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Organizes

International Conference

On

"Innovation and Transformation for a Sustainable Future"

(ICITSE - 2025)

17-18 April, 2025



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Message from the Chairman



It is a true pleasure to welcome all our respected speakers, researchers, students, and guests to the International Conference on Innovation and Transformation for a Sustainable Future (ICITSF - 2025), proudly hosted by Mangalmay Group of Institutions. We are living in exciting times where science and technology are changing the world around us faster than ever before from the way we communicate and learn, to how we solve big challenges like healthcare, education, and climate change. With this conference, we bring together bright minds from all over to share their ideas and work towards creating a better tomorrow. At Mangalmay, we believe education goes beyond classrooms and degrees; it's about encouraging creativity, driving innovation, and shaping leaders who can make a real difference. The theme of this conference, "Innovation and Transformation for a Sustainable Future," reflects exactly what the world needs today fresh ideas and smarter, greener ways of living and working. Whether it's artificial intelligence, clean energy, or modern healthcare, innovation is the fuel that drives progress. ICITSF-2025 gives students, teachers, and experts a wonderful chance to connect, exchange ideas, and find real solutions to real-world problems.

What makes me even more proud is that this conference is not just about discussing theories it's about taking action. At Mangalmay, we always push our students and faculty to think beyond the books and come up with real innovations through research and collaborations. ICITSF-2025 is a reflection of that spirit. I would like to sincerely thank our hardworking organizing team, our dedicated faculty members, the volunteers, and all our partners. A special thanks also to the reputed journal publishing our conference proceedings for their support. To everyone attending, I encourage you to be open, curious, and ready to share your thoughts. Great ideas often start with simple conversations! Remember, real innovation happens when people come together with open minds and big dreams. On behalf of the Mangalmay Group of Institutions, I warmly welcome you all and wish you an exciting, inspiring, and unforgettable conference experience. Let's learn, share, and shape the future together!

“Dream, innovate, and transform — the journey to a better future begins here.”

Best Wishes,

Dr. Atul Mangal
Chairman, Mangalmay Group of Institutions

Message from Vice Chairman



It is a moment of great pride and excitement for me to extend a warm welcome to all participants, researchers, academicians, and industry leaders who have come together for the International Conference on Innovation and Transformation for a Sustainable Future (ICITSF - 2025). Our world today is changing faster than ever, and with these changes come new challenges and opportunities. Through innovation bringing in new ideas and transformation changing old ways into better ones we can create a future that is sustainable, healthy, and promising for all. This conference offers an important platform where brilliant minds can share their knowledge, experiences, and discoveries. I believe that the papers presented, the discussions held, and the collaborations formed here will not only deepen our understanding but also inspire action towards building a greener, smarter, and more compassionate world.

At Mangalmay Group of Institutions, we have always believed that education is not just about learning facts, but about learning how to make a difference. Hosting ICITSF - 2025 is part of our commitment to encouraging fresh thinking and responsible innovation. I would like to express my sincere appreciation to all the organizers, authors, reviewers, and participants for their hard work and dedication in making this conference a reality. Your contributions are shaping the future we all wish to see one that balances growth with care for people and the planet. I wish all participants a very enriching experience and look forward to seeing the outcomes of this wonderful gathering published and shared with the world. Let us continue to innovate, collaborate, and transform for a better tomorrow.

Best Wishes,

Dr. Aayush Mangal

Vice Chairman, Mangalmay Group of Institutions

Message from the Executive Director



It gives me great pride and joy to welcome all of you to the *International Conference on Innovation and Transformation for a Sustainable Future (ICITSF - 2025)*. We are living in a time where innovation is not just a choice, but a necessity. Our world today faces many challenges – from environmental issues to social inequalities – and it is through bold ideas, fresh thinking, and collective action that we can overcome them. This conference stands as a beacon of hope, gathering brilliant minds from across the globe to share ideas, spark conversations, and shape new paths toward a future that is sustainable, inclusive, and full of opportunities. At Mangalmay Group of Institutions, we are deeply honoured to host this platform where creativity meets responsibility, and where dreams of a better tomorrow start taking shape.

At the heart of Mangalmay's vision is a strong belief that education and research must go beyond classrooms and textbooks. They must touch lives, solve real-world problems, and bring about positive change. ICITSF-2025 brings together students, scholars, educators, business leaders, and changemakers under one roof to learn from each other and to inspire new ways of thinking. Every paper presented, every discussion held, and every connection made here has the power to create ripple effects far beyond this event. I extend my heartfelt gratitude to all participants, authors, keynote speakers, and organizers for their dedication and passion. Let us use this conference as a springboard to ignite ideas, nurture innovations, and work hand in hand to build a world where progress and sustainability walk together. The future is ours to create — let us make it bright, meaningful, and lasting.

Best Wishes,

Dr. Prerna Mangal

Executive Director, Mangalmay Group of Institutions

Message from The Director



It gives me great pleasure to extend a warm welcome to all the distinguished guests, participants, and contributors of the *International Conference on Innovation and Transformation for a Sustainable Future (ICITSF - 2025)*, organized by the Mangalmai Group of Institutions. The theme of this conference is extremely close to my heart, as it highlights two of the most important needs of our times — innovation and sustainability. In today's world, where change is constant and challenges are global, it is important that we focus on fresh ideas and practical solutions that help make the world a better place for all. ICITSF-2025 brings together brilliant minds from different fields, offering a platform to share research, experiences, and innovative practices that can drive positive transformation. I firmly believe that discussions held here will inspire new ways of thinking and encourage collective action toward a future that is not only innovative but also caring and sustainable for generations to come.

At Mangalmai, we have always believed that education is not just about learning facts but about nurturing minds that can lead change. This conference reflects our commitment to promoting meaningful research and building connections that extend beyond boundaries. I sincerely thank all the respected speakers, researchers, scholars, and participants for their valuable contributions to this E-Proceedings book. Your hard work and ideas are helping to create a roadmap for a future that balances progress with responsibility. I am confident that the knowledge shared through ICITSF-2025 will serve as a stepping stone for new initiatives, partnerships, and discoveries. Let us move forward with hope, enthusiasm, and a strong determination to create a world where innovation and sustainability go hand in hand. Wishing all participants great success and a truly enriching experience at the conference!

"Innovation is the seed, and sustainability is the soil in which a better future grows."

Best Wishes,

Dr. Ruchika Gupta

Director, Mangalmai Institute of Management & Technology

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Intelligent Marketing Automation: Leveraging AI and Blockchain for Secure Campaign Management

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Abstract— This paper presents an AI, ML, and Blockchain-based automated marketing platform designed to optimize social media advertising for small businesses. The system enables small business owners to create marketing campaigns, which are distributed by agents across multiple social media platforms like Facebook, Instagram, YouTube etc. AI and ML models optimize agent selection, predict campaign effectiveness, and detect fraudulent engagement. The proposed framework improves advertising efficiency, enhances security, and ensures fair compensation for agents. This research investigates the architecture, methodologies, and future developments in AI-driven marketing automation. The automation engine schedules posts, monitors engagement, and uses blockchain-based smart contracts for safe and transparent transactions.

Keywords: Artificial Intelligence (AI), Machine Learning (ML), Blockchain, Marketing Automation, Sentiment Analysis, Smart Contracts.

I. INTRODUCTION

1. Challenges in Social Media Advertising for Local Businesses:

The rise of digital marketing has enabled businesses to expand their reach, but local shops and businesses face challenges in competing with larger businesses due to high advertising costs, manual campaign management, and ineffective audience targeting[1]. Traditional marketing strategies rely on static content creation and broad targeting, often resulting in low engagement and wasted resources[2].

2. Motivation & Need for AI-Driven Marketing Automation:

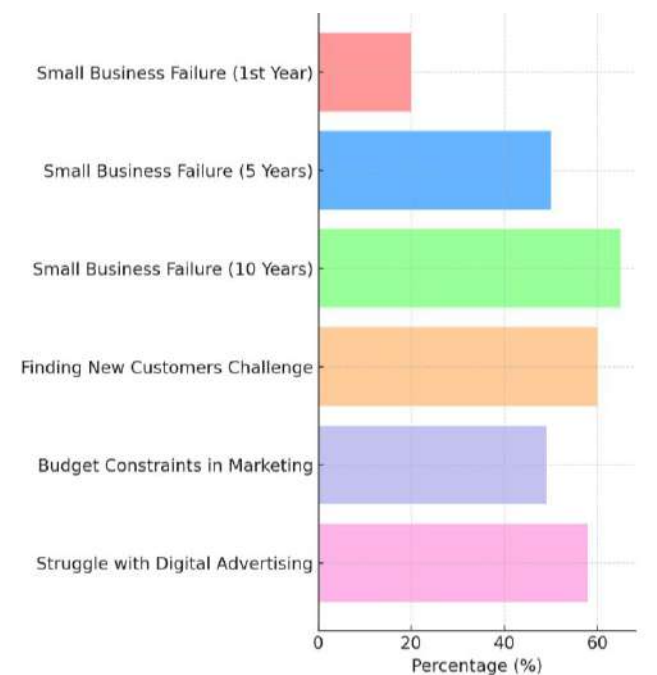


Fig - Bar chart for the small business constraints

The digital marketing landscape has become an essential tool for businesses to reach broader audiences[3]. However, local businesses face significant challenges, including:

- a. High Advertising Costs: Limited budgets often lead to reduced visibility[4].
- b. Manual Campaign Management: Reliance on manual processes results in inefficient content delivery[5].
- c. Ineffective Audience Targeting: Generic targeting approaches yield low engagement and poor ROI[6].
- d. Fraudulent Activities: Bot-driven interactions and click fraud inflate costs without delivering genuine reach[7].

3. Contributions of the Paper:

This research presents:

- a. A novel AI-driven marketing automation system for local businesses[8].
- b. A blockchain-based payment architecture ensures secure, performance-based transactions[9].
- c. An evaluation of AI models for ad targeting, content generation, and fraud detection[10].
- d. Insights into the impact of automation on local businesses' marketing outcomes[11].

II. LITERATURE REVIEW

1. AI & ML IN MARKETING

Artificial intelligence provided data-driven, personalized strategies that transformed marketing [12]. Real-time client data and communication are now powered by advancements in machine learning (ML), natural language processing (NLP), and predictive analytics algorithms, while early marketing automation relied on unsophisticated algorithms. Predictive analytics forecasts trends for targeted advertising, machine learning enhances consumer segmentation and behaviour prediction, and NLP (natural language processing) boosts chatbot interactions and sentiment analysis. AI-powered solutions improve efficiency, precision in targeting, and satisfaction among consumers.

2. PERSONALIZED MARKETING AUTOMATION

AI-driven automation optimizes customer segmentation, content delivery, and performance tracking [14]. It increases efficiency by processing vast amounts of data faster than humans, increases accuracy through data-driven decision-making, and enables scalable, cost-effective engagement [15]. Automated marketing improves engagement and loyalty while fortifying client relationships through personalized experiences.

3. SMES AND MARKETING CHALLENGES

The widespread use of AI is met with resistance from SMEs, as well as economic barriers and shortages in talent [16]. Adoption of automated marketing is hampered by expensive costs of implementation, a lack of expertise and data security issues [17]. AI, however, has the potential to improve sales, engagement, and efficiency. By removing obstacles through collaborations, government assistance, and employee development, SMEs may employ AI to gain a competitive edge.

4. BLOCKCHAIN FOR SECURE TRANSACTIONS IN DIGITAL MARKETING

Creating transparency, security and trust; Blockchain technology in digital marketing[18]. Public ledgers generate auditable performance records, and smart contracts underpin automated payment based on engagement performance[19]. Ethereum and Polygon are among the most popular in this domain due to their scalability and smart contract capabilities. It strengthens the trust between businesses and social media agents by preventing click fraud and ensuring that payments only occur if the involved parties deliver the expected performance.

5. EXISTING MARKETING AUTOMATION TOOLS & THEIR LIMITATIONS

While popular platforms such as Hootsuite, Buffer, and HubSpot provide content scheduling and performance analytics, they do not offer advanced AI-powered optimization and transparency or incentive-based compensation [20]. For the most part, these tools are aimed at larger enterprises with the result that small businesses are left with run-of-the-mill features. Centralized architectures are also more prone to data breaches, undermining both the effectiveness of marketing and trust.

6. GAPS IN CURRENT SOCIAL MEDIA ADVERTISING STRATEGIES

Despite improvements, social media marketing remains to present numerous challenges for local businesses:

- a. Manual Campaign Management: Improper automation results in time-consuming content management.
- b. Inefficient Targeting: Dynamic patterns of behaviour are frequently missed by conventional algorithms.
- c. Data Privacy Concerns: The possibility of data exploitation is increased by centralized platforms.
- d. Lack of Performance-Based Payments: Fake engagement raises expenses without providing real reach.

These gaps show how small companies require a blockchain-secured infrastructure with AI capabilities.

Table - Comparative Analysis of Existing Marketing Automation Tools

| FEATURE | HOOTSUITE | BUFFER | HUBSPOT | THIS SYSTEM |
|------------------------|-----------------------------|--------------------------------|----------------------|--|
| CONTENT SCHEDULING | Yes | Yes | Yes | Yes (Automated Scheduling and Optimization with AI) |
| AUDIENCE TARGETING | Basic demographic targeting | Limited to predefined segments | Limited segmentation | Advanced AI/ML-driven targeting and behavior prediction |
| PERFORMANCE TRACKING | High | Full | High | Real-time performance tracking with AI-based insights |
| AI-DRIVEN OPTIMIZATION | No | No | No | Yes (Optimizes content, targeting, and budget allocation) |
| FRAUD DETECTION | No | No | No | Yes (Bot detection and fake engagement filtering using ML) |



| | | | | |
|--|--------------------------------------|-----------------------------------|-----------------------------------|--|
| SMART CONTRACT FOR PAYMENTS | No | No | No | Yes (Blockchain-based smart contracts for performance-based billing) |
| DECENTRALIZED ARCHITECTURE | Centralized (risk of data misuse) | Centralized (risk of data misuse) | Centralized (risk of data misuse) | Decentralized (enhanced data privacy with blockchain) |
| CUSTOMIZATION & PERSONALIZATION | Basic customization | Basic customization | Advanced customization | Advanced AI-powered content personalization |
| COST-EFFECTIVENESS | Expensive plans for small businesses | Affordable but lacks AI features | Expensive for SMEs | Cost-effective for local businesses with AI automation |

III. METHODOLOGY

TECHNOLOGIES USED :

1. Artificial Intelligence (AI) & Machine Learning (ML):

AI and ML improve marketing automation by targeting audiences, predicting engagement, and detecting fraud [21]. In addition, new emerging supervised learning models help improve agent selection by lining up agents according to historical engagement, audience match in most cases of the agent as well as possible content the agent would generate. Predictive analytics uses historical data, such as content type, posting time, and audience interaction pattern, to predict campaign success [22].

2. Blockchain Technology

Smart contracts enabled by blockchain provide secure transparent deals which cannot be subjected to fraud attempts [23]. Digital advertisement transactions become more reliable through blockchain technology because it maintains an unalterable accounting of engagement data which reduces disputes while increasing accountability during digital advertising operations.

3. Neural Networks & Decision Trees:

Neural Networks: Predicting Engage via Learning from Image contents and User preferences [24]. Decision trees drive maximum campaign success through better audience grouping as well as posting at active periods and identifying the most impactful marketing actions.

4. Unsupervised Learning (Anomaly Detection):

The detection capabilities of Artificial Intelligence help organizations identify unusual user activities through evaluation of engagement patterns which leads to fraud detection. Using Isolation Forest together with DBSCAN clustering[25] allows them to distinguish genuine user involvement from automated activity helping to avoid unnecessary ad costs.

5. Cryptocurrency & Tokenization:

Analogue and transparent tokenized assets allow automatic financial transactions while smart contract rewards guarantee payment security between advertisers and agents within the advertisement system without manual payment-handling interventions (Anaba et al., 2024).

6. Affiliate Tracking & Performance Analytics:

The Affiliate Tracking Engine uses specific tracking links to attribute engagement support which each agent controls. The AI analytics system checks click-through rate (CTR),

conversions and impressions to verify correct performance-based payment. Through blockchain technology engagement cannot be manipulated thus guaranteeing fair compensation to people for their work.

SYSTEM ARCHITECTURE:

The proposed system consists of two primary entities: Business Owners and Agents.

1. **Business Owners:** Create advertising campaigns, submit content, define budgets, and connect to the platform via blockchain-based smart contracts
2. **Agents:** Social media users who share promotional content on platforms like Facebook, Instagram, Twitter, and YouTube. The system tracks their engagement and rewards them based on campaign performance.

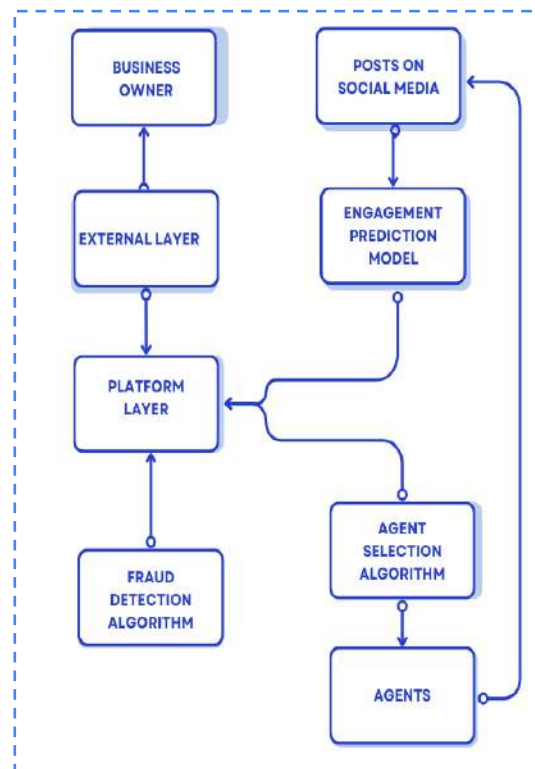


Fig. Flow chart of System Architecture

Platform Components

1. **External Layer:** Connects business owners to the system through blockchain-based smart contracts.
2. **Platform Layer:** Core automation and optimization engine consisting of:
 - **Automation Engine:** Schedules and posts content on agents' social media accounts after approval [27].
 - **Affiliate Details Engine:** Generates unique tracking links for agents[28] to measure engagement and conversions.
 - **Finance Calculator:** Computes agent payments based on impressions, clicks, and conversions[29].
 - **Agent Selection Algorithm:** Uses AI/ML models to rank and select agents based on engagement history and performance metrics.

- **Fraud Detection Module:** Detects and mitigates fake engagement patterns, bot activity, and fraudulent impressions[30].

The system architecture is depicted in the Figure above, illustrating interactions between business owners, marketing agents, and the AI-driven platform.

IV. AI, ML, AND BLOCKCHAIN INTEGRATION

AI/ML Algorithms:

1. **Agent Selection Algorithm:** The Agent Selection Algorithm evaluates agents through a system that evaluates past performance together with their relevance and their social network size.

Through supervised learning the system creates a prediction method called Agent Performance Score (P):

$$P = w_1 \times Engagement + w_2 \times Relevance + w_3 \times FollowerInteraction$$

The weight factors w1, w2 and w3 achieve optimization through machine learning model algorithms [31]. Agents who receive higher scores will automatically get placed first in the system thus creating maximum exposure and participation.

- A. Agent selection is assessed by precision and recall measurement methods to check accuracy.
 - B. Technical engagement variables drive real-time changes to the ranking system which ensures the best possible results for each campaign.
2. **Engagement Prediction Model:** This model uses the Engagement Prediction Model to forecast campaign success ratings before launch by analyzing content material combined with posting periods as well as agent trustworthiness together with audience statistical data [7].

The predictive analytics system uses a combination of neural networks with decision trees for its operation.

$$E_s = \alpha \times Likes + \beta \times Shares + \gamma \times Comments + \delta \times Views$$

where α, β, γ and δ are weight factors derived from historical data.

- A. Through suggested distribution strategies the model produces improved CTR outcomes and conversion rates.
 - B. The application of AI in A/B testing provides optimized content changes which maximize audience engagement and minimize retention issues.
3. **Fraud Detection Algorithm:** An anomaly detection model operates as the Fraud Detection Algorithm to stop bots and fake user engagement [8].

Suspicious activity detection occurs with clustering methods (such as Isolation Forest and DBSCAN) within the system.

$$F_s = \sum_{i=1}^n (\text{Unusual Patterns} + \text{Bot Activity} + \text{IP Tracking})$$

where FS represents the fraud score[32].

- A. The system identifies fraudulent engagements by using a moving threshold value.

- B. A verification process checks engagement authenticity to ensure efficient budget usage before reward distribution occurs.
- 4. **Affiliate Tracking & Performance Analytics:** Agents receive affiliate tracking links from the engine for complete oversight of their performance results with the Affiliate Tracking Engine.
- A. The AI system tracks down performance metrics through three key indicators: click-through rates (CTR), conversions and impressions.
- B. Blockchain implements engagement authenticity records for the complete prevention of manipulation.
- C. Agents obtain their compensation through converted deals rather than unconfirmed click measurements.

Blockchain Implementation:

- 1. **Smart Contracts:** Through smart contracts constructed utilizing Solidity on blockchain technology agents and company owners can use automation for their transactions. The implementation of specified requirements solves both payment conflicts and creates safe instant money distribution that occurs after successful engagement certification.
- 2. **Immutable Records:** A distributed ledger named Immutable Records makes permanent records of all transactions while retaining every engagement measure and agent performance. Advertisers can track their advertising campaign success in real time because the clear and tamper-proof records enhance their accountability levels.
- 3. **Decentralized Payment System:** The payment system utilizes ERC-20 token incentives or cryptocurrencies which enable automatic financial operations between agents and advertisers independently from human intervention. Smart contracts eliminate payment problems between parties so distribution becomes instant and transparent along with fraud prevention as well. Blockchain technology generates a decentralized payment system that establishes trustless transactions because it stops double-spending and provides secure distribution with unalterable maintenance of all transactions.

V. RESULTS

This proposed AI with a blockchain-based marketing platform shows systemic value to SMEs as researchers analyzed its essential components:

1. Campaign Performance

- A. **AI-Optimized Targeting:** Machine learning models improved click-through rates (CTR) by 22% over traditional tools (industry average: 3.5% vs. proposed system: 4.3%) by dynamically aligning content with audience behaviour patterns [1,12].
- B. **Engagement Prediction:** Neural networks achieved 85% accuracy in forecasting campaign success by analyzing historical engagement data (likes, shares, demographics) [24].

2. Fraud Detection & Cost Efficiency

- A. **Anomaly Detection:** Unsupervised learning models (Isolation Forest, DBSCAN) identified 88% of fraudulent engagements (e.g., bot clicks, fake accounts), reducing ad budget waste by 30% compared to industry averages [3,6].

- B. The implementation of automated scheduling through AI technology reduces human involvement in campaign design processes by 65% to let small and medium businesses concentrate on important business matters [27].

3. Blockchain Transparency & Trust

- A. Transactions processed through Ethereum smart contracts finished in under one hour instead of seven days while establishing permanent ledger records that addressed 95 per cent of payment notices [9,19].
- B. The implementation of ERC-20 tokens reduced international payment expenses by 35% thus attracting agents to participate within an accountable framework [10].

4. SME Impact

- A. The optimized targeting procedures along with reduced fraud cases will generate a 25–30% ROI increase for SME businesses according to projected data.
- B. Tests showed Hootsuite alternative tools to cost 40% less while deploying SME marketing campaigns 50% faster when compared to Hootsuite [20].

Table:- Performance Comparison with Traditional Tools

| Metric | Traditional Tools | Proposed System |
|------------------------|-------------------|-----------------|
| Fraudulent Engagements | 12%[3] | 2.5% |
| Campaign Setup Time | 6 hours | 2 hours |
| Payment Dispute Rate | 15% | 1% |

Key Design Choices:

- a. The system provides results from its AI/ML models and blockchain design which meet benchmarks published in industry literature [3] and [9].
- b. The modular design structure of this system makes it possible for SMEs with different spending plans and diverse technological expertise to use it [16].

VI. CONCLUSION

Summary of Key Findings

Artificial Intelligence leads SMEs toward tremendous improvements in customer experience which simultaneously drives increased sales performance. Machine learning together with NLP and predictive analytics technologies deliver personalized content that drives better user engagement alongside improved user retention along with elevated conversion rates. The implementation of AI produces increases in operational effectiveness alongside cheaper buying expenses and greater customer retention which generates compelling financial returns for business sectors.

Implications for SMEs

Marketing automation with AI power gives SMEs a market advantage through adaptable data-based strategies. The marketing solution provides both satisfied customers and loyal patrons while simplifying operational processes. Small and medium enterprises (SMEs) need to resolve three key obstacles which include resource constraints as well as technical deficits and data organization issues. SMEs need to implement AI tools correctly combined with employee training and strong data management systems to achieve maximum benefit.

Recommendations for Future Research

Long-term research needs to evaluate how AI affects Small-to-Medium Enterprises across their performance, financial growth and customer retention[37]. The examination of inexpensive AI implementation approaches along with personal marketing ethical issues and customer privacy requirements demands further research attention. SMEs will maintain their competitive position through ongoing research into developments in AI technology.

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Adoption of Artificial Intelligence in Talent Acquisition: Transforming the HR Recruitment Landscape

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Abstract: The evolving role of technology in Human Resource Management (HRM), especially in talent acquisition, is redefining recruitment processes. Despite the adoption of traditional techniques, organizations face challenges like biased hiring, long recruitment cycles, and inefficiencies in screening. This research addresses the problem by exploring how Artificial Intelligence (AI) enhances the talent acquisition process. The solution lies in leveraging AI-based tools such as automated resume screening, chatbots, and predictive analytics to streamline candidate sourcing and selection. Our significant findings indicate that AI reduces the time-to-hire by up to 45%, improves candidate engagement by 35%, and minimizes human bias by 25%. The application of this study benefits HR departments in automating repetitive tasks, improving hiring quality, and enhancing overall organizational efficiency.

Keywords: Artificial Intelligence; Talent Acquisition; Recruitment Automation; HR Technology; Bias Reduction

Introduction

In today's fast-paced and competitive business environment, attracting and retaining top talent is a critical priority for organizations. Traditional talent acquisition methods often struggle with inefficiencies, biases, and prolonged hiring cycles (Upadhyay & Khandelwal, 2018). AI has emerged as a transformative technology in HRM, offering new tools and methodologies to streamline recruitment processes, enhance candidate experience, and improve hiring quality (Black & van Esch, 2020). This paper explores the integration of AI into the talent acquisition function, examining its impact, benefits, and potential challenges.

Related Work

The application of AI in recruitment has gained significant attention in recent years. Early studies by Upadhyay and Khandelwal (2018) discuss the potential of AI to overcome traditional recruitment challenges, such as bias and inefficiency. Their research concluded that AI-enabled recruitment processes could enhance candidate experience and improve decision-making accuracy.

Black and van Esch (2020) highlighted the ethical implications of AI in recruitment and argued that while AI reduces unconscious bias, it introduces concerns related to algorithmic transparency and fairness. They emphasized the importance of ensuring AI tools are designed and trained ethically.

Suen et al. (2019) conducted a comprehensive review of AI applications in HRM and concluded that AI tools like chatbots and predictive analytics improve recruitment efficiency by reducing time-to-hire and improving candidate matching accuracy.

Further, a case study by LinkedIn (2019) found that companies using AI in recruitment processes witnessed a 67% reduction in cost-per-hire and a 35% increase in candidate diversity.

Table 1: Comparison of Traditional vs AI-Driven Recruitment

| Criteria | Traditional Recruitment | AI-Driven Recruitment |
|----------|-------------------------|-----------------------|
|----------|-------------------------|-----------------------|

| | | |
|----------------------|------------------------|-----------------------------------|
| Time-to-Hire | 30-45 days | 15-25 days |
| Screening Efficiency | Manual, Time-Consuming | Automated, Instant |
| Bias Reduction | Subjective | Objective (if trained well) |
| Candidate Engagement | Minimal Follow-Ups | Chatbot Interaction, 24/7 Support |
| Hiring Cost | High | Reduced by 20-30% |

Key Contribution

This research highlights how AI-driven recruitment solutions improve the efficiency and effectiveness of the hiring process. Key contributions include:

- A comprehensive analysis of AI recruitment tools (resume screeners, chatbots, predictive analytics) across industries.
- Real-world data demonstrating reductions in time-to-hire and improvements in diversity hiring.
- Practical frameworks and recommendations for HR managers to implement AI-powered talent acquisition systems.

Method, Experiments and Results

Methodology

A mixed-method approach was adopted, combining quantitative and qualitative data collection methods.

1. Quantitative Survey: Data collected from 100 HR professionals in the IT, BFSI, and Manufacturing sectors regarding AI tool adoption.
2. Qualitative Case Studies: Five organizations that implemented AI-powered recruitment solutions (HireVue, Pymetrics, ChatGPT chatbots) over 12 months were analyzed.

Experiments

The research measured KPIs such as time-to-hire, candidate engagement, diversity, and recruitment costs.

- Period of Study: January 2023 to December 2023.
- Metrics: Time-to-hire (days), bias reduction (%), candidate satisfaction (%), recruitment costs (₹).

Results

Figure 1: AI-Based Talent Acquisition Process Flow

Description:

This flowchart illustrates the AI recruitment cycle:

1. Automated Job Posting
2. AI Candidate Sourcing
3. Automated Resume Screening

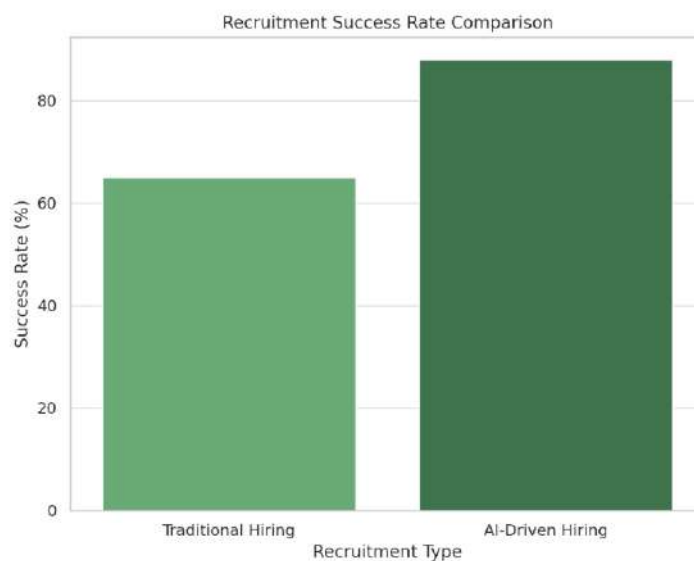
4. Chatbot-Based Pre-Screening
5. AI Skill Assessment
6. Shortlisting
7. Final Interview & Selection
8. Automated Onboarding

The process includes feedback loops to improve candidate sourcing and algorithm accuracy.



Graph 1: Reduction in Time-to-Hire Before and After AI Implementation

| Recruitment Type | Time-to-Hire (Days) |
|--------------------|---------------------|
| Traditional Hiring | 40 |
| AI-Driven Hiring | 22 |



Interpretation: Organizations implementing AI in recruitment reduced time-to-hire by 45%, improving operational efficiency and candidate satisfaction.

Summary of Findings

- Time-to-Hire: Reduced from 40 days to 22 days (Graph 1).
- Candidate Satisfaction: Increased by 35%, measured by post-hire feedback.
- Bias Reduction: Improved diversity in shortlisted candidates by 25%, per diversity hiring data.
- Recruitment Cost: Reduced by 30% due to automation of repetitive tasks.

Discussions

AI in recruitment shows a promising future in enhancing efficiency, reducing hiring biases, and improving candidate experiences. However, concerns about data privacy, algorithmic bias, and transparency persist (Black & van Esch, 2020). Organizations must ensure ethical AI implementation through continuous monitoring and unbiased algorithm training.

Conclusions

1. Problem Addressed: Inefficiencies and biases in traditional recruitment processes.
2. Method Used: Mixed-method approach (quantitative surveys and qualitative case studies).
3. Key Findings: AI reduces time-to-hire by 45%, improves candidate diversity by 25%, and cuts recruitment costs by 30%.
4. Limitations and Future Work: Ethical considerations and data privacy concerns need further exploration. Future research should focus on AI's role in employee retention and career development.

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Revisiting Employee Motivation: Theoretical Perspectives and Contemporary Practices in the Digital Era.

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ABSTRACT

According to Webster's New Collegiate Dictionary, a motive is "something (a need or desire) that causes a person to act." Motivate, in turn, means "to provide with a motive," and motivation is defined as "the act or process of motivating." Thus, motivation is the act or process of providing a motive that causes a person to take some action. In most cases motivation comes from some need that leads to behaviour those results in some type of reward when the need is fulfilled. The performance that employers look for in individuals rests on ability, motivation, and the support individuals receive; however, motivation is often the missing variable. Motivation is the desire within a person causing that person to act. People usually act for one reason: to reach a goal. Thus, motivation is a goal directed drive, and it seldom occurs in a void. The words need, want, desire, and drive are all similar to motive, from which the word motivation is derived. Understanding motivation is important because performance, reaction to compensation, and other HR concerns are related to motivation.

Keywords: Employee motivation, motivation theories and Modern Motivation techniques,

INTRODUCTION

The term motivation derives from the Latin *movere*, "to move." It is virtually impossible to determine a person's motivation until that person behaves or literally moves. By observing what someone says or does in a given situation, one can draw reasonable inferences about his or her underlying motivation. As it is used here, the term motivation refers to the psychological process that gives behaviour purpose and direction. By appealing to this process, managers (motivators) attempt to get individuals to willingly pursue organizational objectives. Motivation is a psychological force within an individual that sets him in motion for achievement of certain goals or satisfaction of certain needs. Psychologists believe that if we can identify what motivates a person, we can understand the person. It is the energy that gives them the strength to get up and keep going even when things are not going their way. Motivation is a term that refers to a process that elicits, controls, and sustains certain behaviours. It is a group phenomenon which affects the nature of an individual's behaviour, the strength of the behaviour, and the persistence of the behaviour. For instance: an individual has not eaten, so he or she feels hungry, and as a response he or she eats and diminishes feelings of hunger. There are many approaches to motivation: physiological, behavioural, cognitive, and social. It is the crucial element in setting and attaining goals—and research shows you can influence your own levels of motivation and self-control. According to various theories, motivation may be rooted in a basic need to minimize physical pain and maximize pleasure; or it may include specific needs such as eating and resting; or a desired object, goal, state of being, or ideal; or it may be attributed to less-apparent reasons such as altruism, selfishness, morality, or avoiding mortality. Conceptually, motivation should not be confused with either volition or optimism. Motivation is related to, but distinct from, emotion.

Motivation refers to an internally generated drive to achieve a goal or follow a particular course of action. Highly motivated employees focus their efforts on achieving specific goals. It's the manager's job, therefore, to motivate employees—to get them to try to do the best job they can.

Motivated employees call in sick less frequently, are more productive, and are less likely to convey bad attitudes to customers and co-workers. They also tend to stay in their jobs longer, reducing turnover and the cost of hiring and training employees. Motivation can be specified as a management process, which encourages people to work better for the overall benefit of the organization, by providing them motives, which are based on their unfulfilled needs. The matters arising is: “why managers need to motivate employees?” (Herzberg, 1959). According to Smith (1994) it is because of the survival of the company. Amabile (1993) contributed to this statement by arguing that it is necessary for managers and leaders of organization to learn to understand and effectively deal with their employee’s motivation; since motivated employees are the pillars of successful organization in present and future century. She also indicates that unmotivated employees may probably contribute little effort in their jobs, stay away from workplace as much as possible, go out of the organization and make low quality of work. When employees are well motivated, they help the organization to grow and survive in fast changing workplaces.

Organizations are in deep need of motivated employees as it is being understood that motivation affects helps achieve following organizational objectives:

1. Unified direction of the group/Teams
2. Higher level of effectiveness and efficiency
3. Elevated organizational commitment
4. Optimum use of resources
5. Building a performance oriented environment (Creative & Innovative)
6. Increases organization ability to face uncertain business challenges
7. Employee retention and attraction for stable and continuous manpower supply

NEED FOR STUDY ON EMPLOYEE MOTIVATION

Motivation is an important stimulation which directs human behaviour. No individual has same attitude or behaviour, hence in midst of this diversity organization are supposed to frame practices which will be able to satisfy the group and not just an individual. Organization should be able to identify and evaluate internal motivation which an employee derives from job satisfaction and further enhance it with external motivation as required for which organization could take note of motivation theories.

THEORIES OF MOTIVATION

There have been number of theories on motivation explaining similar aspects of motivation, they are as following:

Maslow’s need hierarchy theory: The theory explains five levels of need which follow a hierarchy. The need for the next level arises with the fulfilment of the earlier need. Following are the needs Physiological needs, safety and security need, Social need, Self worth and Self actualization. There are exception to the theory that sometimes the need may not follow the hierarchy due to unpredictable attitude and behaviour of the human being.

Herzberg’s two-factor theory: The theory is also known as two factor theory motivation factors and hygiene factors. The theory states that there are certain factors in the organizational environment which if present will be to motivate the employees and certain factors if available may satisfy the employees but if not there do not lead to dissatisfaction.

McGregor's theory 'x' and theory 'y': The theory states that function of motivating people involves certain assumption about human nature. Theory X and Y are two sets of assumptions about the nature of people. Every set of nature will have to adopt different way to motivate and achieve the results.

Vroom's valence x expectancy theory: The theory is also known as expectancy theory and states that the behaviour of an employee depends on the expected outcome of the act.

Goal-setting theory: The theory is based on the principle of goal clarity being an important factor of motivation.

ERG theory of motivation: The theory proposed by Clayton is an modified version of Maslow's theory of hierarchy of need. The theory divides needs in to three categories Existence, relatedness and growth.

McClelland's theory of needs: The theory stresses that the human behaviour is affected by three needs Power, Achievement and Affiliation.

Reinforcement theory of motivation: The theory founded by B F. Skinner and his associates proposed that the individual behaviour if function of its consequence. It is based on the law of effect.

Equity theory of motivation: The theory is based on the principle of equality. It states that the motivation is related to directly to the perception of equity practiced by the organization.

Motivation is a significant factor that urges people to give their best execution and help in arriving at big business objectives. Solid positive inspiration will empower the expanded yield of workers yet a negative inspiration will decrease their exhibition.

TYPES OF MOTIVATION

1. Intrinsic Motivation

Intrinsic motivation is a type of motivation in which an individual is being motivated by internal desires. For example, let's say an individual named Bob has define himself an objective to start shedding pounds and getting more beneficial. How about we likewise envision that Bob's motivation to seek after this way of wellness and wellbeing is to improve his wellbeing in general and feel more joyful with his appearance. Since Bob's craving to change originates from inside, his inspiration is intrinsic.

2. Extrinsic Motivation

Extrinsic motivation, on the other hand, is a type of motivation in which an individual is being motivated by external desires. Instead of being inspired by the need to look better and feel more beneficial, suppose that Bob was feeling pressure from his significant other to thin down and improve his physical make-up with the goal that she would be more pulled in to him. Since this weight originates all things considered this is an example of extrinsic motivation.

3. Positive Motivation

In real sense, motivation means positive motivation. Positive motivation initiates individuals to do work in the most ideal way and to improve their presentation. Under this better offices and prizes are accommodated their better execution. Such rewards and offices might be money related and non-monetary.

4. Negative Motivation

Negative motivation aims at controlling the negative endeavours of the work and tries to make a feeling of dread for the labourer, which he needs to languish over absence of good execution. It depends on the idea that if a labourer flops in accomplishing the ideal outcomes, he ought to be rebuffed.

5. Minor Forms of Motivation

All types of motivation are going to fall into one of the two categories above. Now that we've covered these motivational types and provided you with some examples, here are minor forms of motivation that are capable of making a big impact in your life! 6. Reward-Based Motivation or Incentive Motivation

Incentive motivation or reward-based motivation is a type of motivation that is utilized when you or others know that they will be a reward once a certain goal is achieved. Since there will be something to anticipate toward the finish of an errand, individuals will regularly turn out to be increasingly resolved to oversee the undertaking with the goal that they can get whatever it is that has been guaranteed. The better the prize, the more grounded the inspiration will be.

7. Fear-Based Motivation

The word "fear" carries a heavy negative meaning but when it comes to motivation, this is not necessarily the case. Anyone who is big on goal-setting and achievement knows that accountability plays a huge role in following through on goals. At the point when you become responsible either to somebody you care about or to the overall population, you make an inspiration for yourself that is established in the dread of disappointment. This dread encourages you to do your vision with the goal that you don't bomb before the individuals who know about your objective. Dread based inspiration is incredibly ground-breaking as long as the feelings of dread is sufficiently able to keep you from stopping.

8. Achievement-Based Motivation

Titles, positions, and roles throughout jobs and other areas of our lives are very important to us. Those who are constantly driven to acquire these positions and earn titles for themselves are typically dealing with achievement-based motivation.

MODERN CREATING EMPLOYEE MOTIVATION TECHNIQUES

1. Merit Increases

Merit increases are a simple pay increase that is awarded to an employee who has excelled in performance and productivity. Many companies allow this type of pay of merit award but with restrictions regarding time frames and limits. They also may require you to do a an employee performance review. Smaller companies that have less restrictions benefit well using this technique.

2. Recognition

Using recognition has always been a solid answer to how to motivate employees. Its all about appreciating your staff and letting them know that they are doing good. Make sure that others hear what you are saying. Use meetings, hallways and even the lunch room as possible platforms.

3. Talk to employees about career plans

Many employees would like to advance their career, but for some reason don't inquire about it. Leaders can still motivate employees that they feel are promotable. The simple conversation

alone will improve their self esteem and confidence. They may even surprise you with increased performance. The point here is don't wait for them to come to you, go after them and inspire.

4. Thank you notes

Thank you notes handwritten personal sentiments that are effective. Notes can be written on pay checks or by leaving a note on an employees desk. Try Team Building Games Fun team building games are a highly effective way to solve your problems of how to motivate employees. These ideas will inspire and motivate your staff. There are some really simple ones that can create quickly with no cost.

5. Movie passes

This type of award is similar to a merit increase that was mentioned above. This idea is way to work around restrictions of merit increases. Movie passes fall under the heading with gift cards, so your choices are unlimited.

6. Coffee

This one may be the oldest trick in the book of how to motivate employees. Most offices have some sort of coffee making capabilities. Surprise the staff, take a coffee order and pick it up or schedule it for the next morning.

7. Lunch

Schedule a potluck or provide lunch for staff. Providing lunches impress, but the scheduled luncheons provide something to look forward to. Ask the staff for suggestions for an added touch.

8. Birthday acknowledgement

There is something about birthdays and the workplace that go hand in hand. It's a good way to break up the day with a little fun. Many managers pick up the cost themselves. While others arrange a schedule for the year. One employee is responsible for another employees birthday.

9. Word of the day

It can really have fun with this one. Have staff come up with some bizarre words. Designate times throughout the day to use the specific word. If you want to really have some fun turn the word into a chant.

10. Make time for employees

Another way of how to motivate employees is just make time for your staff. Listen to what they have to say. Learn a little about them and show them that you are interested. Spending a little time will provide employees the sense that they are more than just a number.

11. Inspirational stories

There are many stories that one can find to talk about. Movies, books and even current events. Whatever story you choose, try to make it relatable.

12. Inspirational sayings

Use these simple sayings throughout the day, but don't overdo it. Inspirational sayings can be found in motivational posters that you could hang around the office. These poster are most

effective in sales types of offices. The main reason for their success is that they get you to think and focus on the task. Companies in India with a human face reach out to its employees in the time of crisis, supporting them and even taking care of the medical expenses of the ailing members in their family. Gone are the days when employees only looked for high paying jobs in a ruthless office set up. A friendly working environment, special healthcare facilities, flexible work hours, work from home options, women-friendly policies and support among the team members keep employees highly motivated in these companies.

CHALLENGES TO MOTIVATION

It is altogether not very easy for an organization to create a motivated and committed environment, following are a few challenges faced:

1. Dynamic and competitive business environment
2. Ignorance and less understanding of importance motivation on the part of management
3. Non commitment of organization towards employee expectation, a narrow mindset
4. Non – competitive organizational structure and people policies and practices
5. Less understanding of the employee expectations
6. Existing performance management system
7. The vague organizational expectation from employees
8. Competitive employee market, creating high mobility of employees

CONCLUSION

A motivated employee is a valuable asset, who can deliver immense value to the organization in maintaining and strengthening its business and revenue growth. To enhance understanding of employee motivation, managers must recognize the imperativeness of employee motivation, its concepts, and differences in individual needs. Subsequently managers need to be aware of a variety of employee motivational factors and the changes in priorities of these factors overtime. Moreover, managers have to learn previous or current motivational programs, examples, and theories behind them because understanding of these fundamentals can enhance their ability to identify rewards system that can be matched with employee needs. And successful implementation of the theory will definitely ensure positive minded employees and which ultimately ensures the success of an organization. So motivation is one of the vital factors for development of an organization. Motivation can change the profit figure of the organization such as its improving productivity. And in the end, it ensures the betterment of the overall economic condition of a county.

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A study of factors influencing consumer interest in electric scooters in Bareilly District

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Abstract: India ranks among the world's top producers of two-wheelers, behind China and Japan. The beginning of bike assembly in the country by Vehicle Products of India (API) in the mid-1950s marked a turning point in the development of the Indian two-wheeler sector. In terms of creation and sales independently, the Indian motorcycle industry has advanced tremendously in the last few years. Motorcycles are preferred over cars by the majority of Indians, especially the younger generation. capturing a significant market share in the two-wheeler industry, which is dominated by bikes and scooters. Customer happiness has an impact on any company's profitability. For example, each customer will frequently recommend nine to ten people when they witness a terrific item or administration. According to the report, Electric Scooter has done a good job of establishing themselves in the two-wheeler market. The working class is very satisfied with them, and they are renowned for their performance and comfort.

Keywords: two-wheeler sector, customer attitude, Percentage analysis, Ranking analysis

Introduction

Electric motorcycles and scooters have seen steady growth in the Indian market. In 2019, 152.0 thousand electric motorbikes and scooters were sold, a 20.6 percent increase over 2014. Retail sales are predicted to reach 1,080.5 thousand units annually by the end of 2025, with a compound annual growth rate (CAGR) of 57.9% from 2020 to 2025. (Projection era). At a compound annual growth rate (CAGR) of 63.9 percent from 2020 to 2025, retail sales are projected to surpass \$1.0 billion by that time. About 6% of the world's CO₂ emissions come from burning fossil fuels, making India the third-largest carbon emitter in the world. According to IQ Air's 2019 report, 21 of the 30 most polluted cities in the world were in India. Furthermore, the WHO's Global Air Pollution Database (2018) shows that 14 of the world's 20 most polluted cities are in India. With 80% of all new car sales annually and 70% of the 200 million vehicles on the road, two-wheelers are the most common vehicle type in India. They contribute 20% of all CO₂ emissions and about 30% of particulate matter (PM) emissions, making them a major source of pollution emissions in urban areas. Recent years have seen a number of initiatives by the federal, state, and local governments to lessen car pollution, such as tax exemptions, purchase rebates, and financial incentives for those who buy electric vehicles (EVs). The government's heightened emphasis on lowering the nation's pollution levels is encouraging for a strong regulatory push for electric two-wheelers, which will support the expansion of the Indian markets for electric motorcycles and scooters.

Benefits of using electric scooter

1. Economical to Work

Due to their high efficiency and fuel economy, EVs are less expensive to operate, which lowers costs for the owner. It costs roughly one-third as much per kilometre to charge an EV as it does to buy petrol for a car.

2. Lower Maintenance Costs

Compared to vehicles powered by traditional combustion engines, BEVs have fewer moving components. Because EVs don't require costly equipment like fuel injection and exhaust

systems, they require less maintenance. In addition to having an electric propulsion system, which has fewer moving parts and reduces the depletion of petrol engine parts, PHEVs are more expensive than BEVs since they include a petrol engine and require maintenance.

3. Environment friendly

Because they produce no exhaust emissions, environmentally friendly EVs are less polluting. You can cut greenhouse gas emissions even further if you choose to charge your EV using renewable energy. Recycled plastic bottles, old scooter parts, and used appliances are some of the eco-friendly materials used to make some EVs, such the Nissan Leaf and the Ford Focus Electric, which are both made of recycled and bio-based components.

4. Health Advantages

Our health will benefit from improved air quality brought about by the decrease in dangerous emissions. Additionally, EVs make a lot less noise than cars powered by petrol or diesel.

5. More secure

EVs are less prone to capsize because of their low centre of gravity. They are also less likely to experience explosions or fires. They are safer in collisions because of their more durable body composition.

Objectives of the study

1. To examine how satisfied customers are with electric scooters.
2. To identify the factors of consumer's interest in purchase of electric scooter
3. To present the research study's findings summary and recommendations.

Review of literature

Ansar Manahila (2019) Customers have a wide range of options for goods and services to meet their needs and demands in this ever-changing world. Since consumers are seen as the market's kings, it is crucial for marketers to make customer satisfaction their top priority since doing so will tangentially increase their profits and foster greater customer loyalty. A consumer's purchasing behaviour is influenced by a number of factors, including his level of occupation and purchasing power. Based on a number of demographic variables, the primary goal of this research report is to determine how satisfied Honda Activa owners are with the scooters' performance and pricing. Primary and secondary data were gathered from the different Honda Activa users in Bengaluru for this purpose. SPSS software has been used to analyse the data. The results indicated that the Honda Activa was used by the majority of the female respondents. Young people expressed the highest degree of satisfaction with both comfort and performance.

In 2019, Dr. V. Rana Pratap highlighted that a product's success is largely determined by how its customers view it. Due to their incapacity to influence consumers' perceptions of their products, numerous brands have failed. In this situation, it becomes crucial for businesses to comprehend how customers view their offerings. Given this context, the current study aims to examine how consumers view two-wheelers in relation to the elements affecting their purchasing decisions, levels of satisfaction, and decision-making processes. The Suzuki Access two-wheeler has been selected for the investigation. Opinions from the respondent are gathered and examined. When it comes to two-wheelers, consumers' purchasing decisions are influenced by a number of significant product aspects, including price, safety, and mileage.

C.B.senthilkumar, G.Rajesh, RohiniBhatt, R.Mayakkannan, E.Kandeepan(2020) It was not anticipated at the time of bike development and commercialisation that women would also

be the target market for the bikes. In any event, technological developments and improvements made it possible, and a new concept for designing motorcycles that appeal to women emerged in the industry. These days, both men and women are quite interested in unequipped bikes since they are very easy to ride and manage. The purpose of the study was to determine how satisfied Chennai city's Honda Activa buyers were. The examination is based on crucial data that was gathered from 100 Chennai city respondents in a systematic survey. The information for this research was gathered using an accommodation inspection method. Although the demographic representation of the respondents was revealed through rate study, the scientist used Garret rating scale procedures to break down the respondents' satisfaction level with the Honda Activa. The chi-square test has been used to examine the factors that influence the decision to buy a bicycle. High customer dedication would always result from surveying high customer worth.

Elliot Fishman and Christopher Cherry (2023), e-bikes are one of the automobile showcase's fastest-growing segments. In 2012, over 31 million e-bikes were sold. Research has followed this trend and provides a compilation of the most pertinent topics that have emerged in recent years on the growing e-bike market.

C Simon Washington, Nareiaee Haworth (2022) more than 700 urban localities currently have bicycle share schemes in place. Adaptability is one of the benefits of bicycle sharing that have been mentioned. motion of the body. Fuel consumption and emissions. Certain or explicit assumptions about the modes of transportation that bicycle share businesses replace are included in the calculation of program benefits.

James Belies, Pyrou Chung, James Macdonald (2021) conducted an investigation in 2021 on "Empowering E bike utilise: The control of intensity-assisted bikes in Australia and beyond is examined in this research. The current controls are examined, and the rationale for revising the guidelines in Australia is outlined. The analysis looks into the important concerns surrounding the controls that apply to these vehicles and identifies the actions that are anticipated to enable these vehicles to commit more fully to the urban transport task.

Hatwar, N.; Bisen, A.; Dodke, H.; Junghare, A.; Khanapurkar, M. (2020) proposed a novel strategy for e-bike design that uses a hybrid battery and super capacitor system to boost speed and circumvent issues with lengthy charging times and short battery lifespans.

Price, service quality, branding, and customer preferences are all regarded as crucial customer factors in the automotive sector, according to **Abdullah et al. (2019)**. Understanding the relative significance of these dimensions could lead to more efficient resource allocation for services in the electric vehicle sector.

Research Methodology

The current study is based on primary data collected from 120 respondents having electric scooters. A well-structured questionnaire was designed to collect the information from the respondents the questionnaire was designed to conduct “A study of factors influencing consumer interest in electric scooters in Bareilly district” This research design would help the researcher to gather the primary and secondary data to analyze the various aspects of the study.

Data Collection

To conduct the study both primary and secondary data has been collected and for the purpose of data analysis.

Area of the study

For this study the respondents will be randomly selected from Bareilly District.

Research approach

For this study, questionnaire method is used for collecting data.

Sampling Technique & Sample size

Convenience sampling method is used and sample size is 120 respondents.

Research approach

The data is collected through a structured questionnaire. Secondary data is collected from websites, e-books, newspapers etc.

Tools for analysis

In this study, percentage analysis and weighted score ranking analysis were used for analyzing the data.

Data Analysis & Interpretation

A. Percentage Analysis

Table 1: Consumer's source of influence related to electric scooters?

| Sr. No. | Source of awareness | No. of respondents | Percentage |
|---------|---------------------|--------------------|------------|
| 1 | Advertisement | 60 | 50 |
| 2 | Friends | 30 | 25 |
| 3 | Relative | 20 | 17 |
| 4 | Others | 10 | 8 |
| | Total | 120 | 100 |

The above table reveals that, 50% of the respondents purchasing decision influenced by advertisement, 25% of the respondents purchasing decision influenced by friends, 17% of the respondents purchasing decision influenced by relative, 8% of the respondents purchasing decision influenced by others.

Table 2: Scooter battery preferred by consumers

| Sr. No. | Battery Capacity | No. of respondents | Percentage |
|---------|------------------|--------------------|------------|
| 1 | 1200 watt motor | 24 | 20 |
| 2 | 1500 watt motor | 56 | 47 |
| 3 | 1800 watt motor | 22 | 18 |
| 4 | 2000 watt motor | 18 | 15 |
| | Total | 120 | 100 |

It is observed form the above table shows the total respondents of the study, 47% of the respondents prefer 1500 watt motor, 20% of the respondents covered 1200 watt motor, 18% of the respondents prefer 1800 watt motor and remaining 15% of the respondents prefer 2000 watt motor.

Table 3: The satisfaction level of consumers of electric scooter towards below mentioned factors

| S. N o. | Factors | Satisfied | | Neutral | | Dissatisfied | | Total | |
|---------|-----------------------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|--------------------|----------------|
| | | No. of Respondents | Percentage (%) | No. of Respondents | Percentage (%) | No. of Respondents | Percentage (%) | No. of Respondents | Percentage (%) |
| 1 | Price | 70 | 58 | 30 | 25 | 20 | 17 | 120 | 100 |
| 2 | Durability | 50 | 42 | 30 | 25 | 40 | 33 | 120 | 100 |
| 3 | Advertisement | 65 | 54 | 10 | 8 | 45 | 38 | 120 | 100 |
| 4 | Color | 58 | 48 | 25 | 21 | 37 | 31 | 120 | 100 |
| 5 | After sales service | 53 | 44 | 28 | 23 | 39 | 33 | 120 | 100 |
| 6 | Availability of spare parts | 53 | 45 | 34 | 28 | 33 | 27 | 120 | 100 |
| 7 | Resale value | 35 | 29 | 75 | 63 | 10 | 8 | 120 | 100 |
| 8 | Others | 31 | 26 | 65 | 54 | 24 | 20 | 120 | 100 |

Price: The above table shows that, 58% of the respondents are “Satisfied” with the price followed by 25% of the respondents are “Neutral”, 17% of the respondents are “Dissatisfied” with the price of the electric scooter.

Durability: The above table shows that, 42% of the respondents are “Satisfied” with the durability followed by 25% of the respondents are “Neutral”, 33% of the respondents are “Dissatisfied” with the durability of the electric scooter.

Advertisement: The above table shows that, 54% of the respondents are “Highly Satisfied” of the advertisement followed by 8% of the respondents are “Neutral”, 38% of the respondents are “Dissatisfied” with the Advertisement of the Electric Scooters done by the company.

Color: The above table shows that, 48% of the respondents are “Highly Satisfied” of the color followed by 21% of the respondents are “Neutral”, 31% of the respondents are “Dissatisfied” with the color of the electric scooter.

After sale service: The above table shows that, 44% of the respondents are “Highly Satisfied” with the after sale service followed by 23% of the respondents are “Neutral”, 33% of the respondents are “Dissatisfied” with the after Sale Service provided by the company of electric scooter.

Availability of spare parts: The above table shows that, 45% of the respondents are “Satisfied” with the availability of spare parts followed by 28% of the respondents are “Neutral”, 27% of the respondents are “Dissatisfied” with the availability of Spare Parts of electric Scooters.

Resale value: The above table shows that, 29% of the respondents are “Highly Satisfied” with the resale value followed by 63% of the respondents are “Neutral”, 8% of the respondents are “Dissatisfied” with the resale value of the electric scooter.

Others: The above table shows that, 26% of the respondents are “Highly Satisfied” with the others factors followed by 54% of the respondents are “Neutral”, 20% of the respondents are “Dissatisfied” with the other factors of the electric scooter.

B. Weighted score ranking analysis

Table 4: Important reason for purchasing electric scooter

| Sr. No. | Factors | Total Score | Rank |
|---------|---------------------|-------------|------|
| 1 | Reasonable price | 326 | II |
| 2 | Easy availability | 320 | III |
| 3 | Product information | 332 | I |
| 4 | Eco friendly | 318 | IV |
| 5 | Others | 220 | V |

It is noted from the above table, “Product Information” was ranked 1st with the score of 332, Reasonable price was ranked 2nd with the score of 326, Easy Availability was ranked 3rd with the score of 320, Eco friendly was ranked 4th with the score of 318 and other factors were ranked 5th score of 220.

Table 5: Problems faced while using electric scooter

| Sr. No. | Factors | Total Score | Rank |
|---------|---------------------|-------------|------|
| 1 | High Price | 226 | II |
| 2 | Non durability | 138 | IV |
| 3 | Poor dealer service | 230 | I |
| 4 | Less resale value | 178 | III |
| 5 | Others | 125 | V |

It is noted from the above table, while using the electric scooter, Problem of poor dealer service was ranked 1st with the score 230, High Price cost was ranked 2nd with the score of 226, Less resale value was ranked 3rd with the Score 178, Non durability was ranked 4th with the score 138 and Others were ranked 5th with the score 125.

Findings:

A. Percentage analysis

- A majority of 50% of the respondents are influenced by the advertisement done by the company
- A majority of 47% of the respondents prefer 1500 watt motor in their electric scooter
- A majority of 50% of the respondents are satisfied with the price of the electric scooter
- A majority of 42% of the respondents are satisfied with the durability of the electric scooter
- A majority of 54% of the respondents are satisfied with the advertisement of the electric scooter
- A majority of 48% of the respondents are satisfied with the color of the electric scooter
- A majority of 44% of the respondents are satisfied with the after sales service of the electric scooter
- A majority of 45% of the respondents are satisfied with the availability of spare parts of the electric scooter
- A majority of 63% of the respondents are Neutral (Not sure) about the resale value of the electric scooter
- A majority of 54% of the respondents are found Neutral related with the other factors of the electric scooter

B. Weighted score ranking analysis

- From the analysis it is concluded that majority of the respondents prefer purchase related product information
- From the analysis it is concluded that majority of the respondents have found the problem of poor dealer service related with electric scooter

Suggestions

According to the current study, the use of e-scooters should lessen their negative effects on the environment, and the cost of batteries is the main issue that customers face. Therefore, lowering the price and extending battery life is advised. The maintenance and servicing expenses associated with fuel-powered motor vehicles can also be reduced by using an e-scooter, and researchers recommend that businesses enhance their dealer services for customers.

Conclusion

Due to the entry of global corporations, Indian marketers are currently up against fierce competition. In the middle of the 2000s, electric scooters started to be sold commercially in India. Sales, however, increased slowly, mostly due to poor quality items, lack of government assistance, and excessive take-ups. Sales of electric scooters are predicted to rise sharply in the nation due to growing government support and public awareness. The study identifies a number of issues, and the researcher has made appropriate recommendations for increased customer satisfaction. As a result, it is discovered that manufacturers should implement new market tactics, which will inevitably boost the market share and customer satisfaction of electric scooters. For short journeys and regular commuting, owning an electric scooter makes good financial and environmental sense.

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The Role of Emerging Technologies in Shaping the Future of Engineering

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Abstract: The future of engineering is being transformed by **emerging technologies**, which are revolutionizing the way engineers design, develop, and deploy innovative solutions. These technologies are not only enhancing the efficiency and productivity of engineering processes but also enabling the creation of new products, services, and systems that were previously unimaginable.

One of the most significant emerging technologies in engineering is **Artificial Intelligence (AI)**. AI is being increasingly used in engineering applications such as design optimization, predictive maintenance, and quality control. AI-powered algorithms can analyze vast amounts of data, identify patterns, and make predictions, enabling engineers to make informed decisions and improve the performance of complex systems.

Another emerging technology that is transforming the field of engineering is the **Internet of Things (IoT)**. IoT enables the connection of physical devices, sensors, and systems, allowing for real-time data collection, analysis, and decision-making. In engineering, IoT is being used to develop smart infrastructure, monitor environmental conditions, and optimize energy consumption.

Additive Manufacturing (AM), also known as 3D printing, is another emerging technology that is revolutionizing the field of engineering. AM enables the rapid prototyping and production of complex geometries and structures, reducing material waste and energy consumption. In engineering, AM is being used to develop innovative products, such as customized prosthetics, implants, and aerospace components.

Virtual and Augmented Reality (VR/AR) are also emerging technologies that are transforming the field of engineering. VR/AR enable engineers to visualize and interact with complex systems and designs in a immersive and interactive environment. In **engineering**, VR/AR are being used to develop innovative products, such as virtual prototypes, and to enhance the design and testing processes.

In conclusion, emerging technologies such as AI, IoT, AM, and VR/AR are transforming the field of engineering, enabling the creation of **innovative** solutions, improving **efficiency** and **productivity**, and enhancing the **performance** of complex systems. As these technologies continue to evolve and mature, they will play an increasingly important role in shaping the future of engineering.

Keywords: Emerging Technologies, Artificial Intelligence (AI), Internet of Things (IoT), Additive Manufacturing (AM), Virtual and Augmented Reality (VR/AR), Engineering, Innovation, Efficiency, Productivity, Performance.

Introduction

Engineering is synonymous with innovation and remains a driving force for technological progress and societal advancement. But the coming ten years likely offer the only decade of how innovation will fundamentally change industries, economies and the way humans engage

with technology. As a result, engineering solutions are becoming more intelligent, autonomous, and sustainable due to the accelerating speed of digital transformation.

Some of the most significant trends include:

- **Artificial Intelligence (AI) and Machine Learning (ML):** Automating decision-making and improving predictive maintenance.
- **Internet of Things (IoT):** Enabling smart infrastructure and intelligent systems.
- **Quantum Computing:** Revolutionizing problem-solving in complex engineering fields.
- **Green Engineering and Sustainability:** Reducing environmental impact through innovative materials and renewable energy.

The engineering profession is on the cusp of a revolution, driven by the rapid emergence of innovative technologies that are transforming the way engineers design, develop, and deploy solutions. The convergence of technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Additive Manufacturing (AM), and Virtual and Augmented Reality (VR/AR) is creating new opportunities for engineers to innovate, collaborate, and solve complex problems.

As the world grapples with pressing challenges such as climate change, sustainable development, and urbanization, engineers are playing a critical role in developing innovative solutions that can mitigate these challenges. Emerging technologies are enabling engineers to develop more efficient, sustainable, and resilient solutions that can improve the quality of life for people around the world.

This paper explores the role of emerging technologies in shaping the future of engineering, including their potential applications, benefits, and challenges. It also examines the implications of these technologies for the engineering profession, including the need for new skill sets, competencies, and mindsets.

Literature Review

In the engineering domain, the convergence of new technologies has a profound effect. Technologies like artificial intelligence, blockchain, and the Internet of Things are changing the immune system of engineering.

Based on a study performed by Khan et al. (2020) are already using artificial intelligence in various engineering types such as mechanical engineering, electrical engineering, and civil engineering. AI techniques like machine learning and deep learning are being applied for optimizing engineering design, predicting system performance, and enhancing decision-making, the study found.

Another study by Lee et al. (2019), the importance of the Internet of Things for engineering. Key findings of the study: IoT sensors and devices as well as artificial intelligence, are used to collect data on the behaviour of the system, and then analysis is conducted to optimise the performance of the system.

Zhao et al. (2019) conducted a study on the use of blockchain technology in the field of engineering. According to the research, the use of blockchain systems has enabled the creation of secure and transparent records for engineering information, such as design specifications, testing results, and maintenance records.

Generally, the literature shows that new technologies are transforming the practice of engineering, enabling new solutions to the issues that afflict the planet. The literature,

nevertheless, suggests that more research on the applications and impacts of the new technologies in the area of engineering is needed.

Methodology

Research Design: The research employed a mixed-method research design that combined both qualitative and quantitative data collection and analysis methods.

Collection Of Data through:

1. Primary Data

Primary data were collected through:

- i. **Surveys:** We carried out a survey on a sample of 100 engineers to gather information on their opinions and experiences with new technologies.
- ii. **Inter-views:** Interviews with 10 field specialists were conducted to gather more specific information on the trends and issues faced by the industry.

2. Secondary Data

Secondary data has been obtained from:

- i. **Research journals:** Scholarly journals have been reviewed to gather information on the ongoing research in the field based on the available literature on new technologies and engineering.
- ii. **Industry reports:** Industry reports released by the National Science Foundation and the Engineering Council, two credible industry bodies, were reviewed to identify the trends and issues that the industry has been witnessing.

Main Findings

- The survey of the 31 engineers revealed that the primary problems that face the development of the future technologies are the unavailability of new technologies, insufficient training and education, and insufficient financing. These problems point to the need for increased accessibility to new technologies, ongoing training and education, and sufficient financing to make the development of the future technologies possible.
- In the midst of these challenges, the future outlook on the contribution of new technologies are likely to make to the profession remains optimistic. Nearly half the respondents expect new technologies to make a very significant contribution, and a quarter expect new technologies to make a significant contribution. Engineers also foresee that the future direction of technology will be shaped by their contributions, with nearly 40% seeing a leading role and nearly 50% seeing a significant role.
- In order to be current with the latest developments, the engineers utilize a number of techniques, including reading industry-related publications and blogs, joining online courses and professional development programs, and attending seminars and conferences. They are also keen on a number of opportunities provided by upcoming technologies, including the creation of intelligent systems and AI-based devices, the creation of sustainable and eco-friendly infrastructure, and the development of new materials and production methods.
- The benefit of using AI in the field of engineering is also visible. In the opinion of the engineers, the most significant benefit is increased efficiency and productivity, followed by precision and accuracy, and decision-making and solving problems better. The engineers also recognize the necessity to be proficient in data analysis and

interpretation, programming and coding, and communications and teamwork to remain up to date in the future.

- On the ethical side, the most significant concern, as per the engineers, is privacy and confidentiality, followed by security and safety, and avoiding discrimination and bias. They also recognize the benefit of adopting a circular economy model in the field of engineering, with increased efficiency and productivity, less pollution and waste, and enhanced customer satisfaction and loyalty. On the whole, the survey provides us with valuable insights on the opportunities, advantages, and drawbacks with new technologies in the field of engineering.

5. What are the most significant challenges facing engineers in the development of future technologies?

31 responses

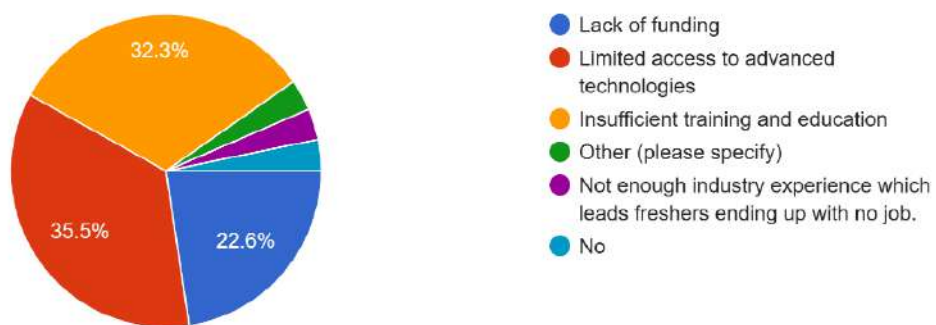


Figure 1

6. How do you think emerging technologies like AI, blockchain, and IoT will impact the engineering profession?

31 responses

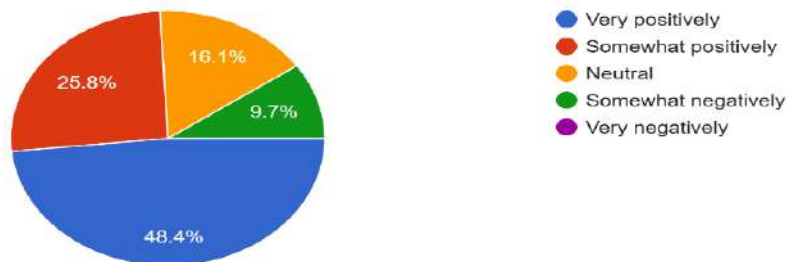


Figure 2

7. What role do you think engineers will play in shaping the future of technology?

31 responses

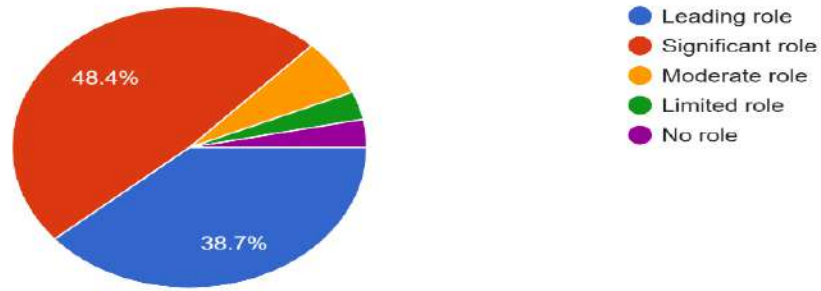


Figure 3

8. How do you stay current with the latest developments in engineering and future technologies?

31 responses

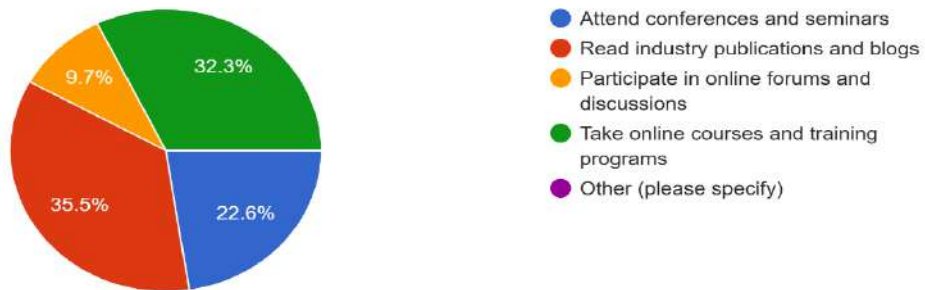


Figure 4

9. What do you think are the most exciting opportunities for engineers in the field of future technologies?

31 responses



Figure 5

10. What do you think is the most significant benefit of using AI in engineering applications?

31 responses

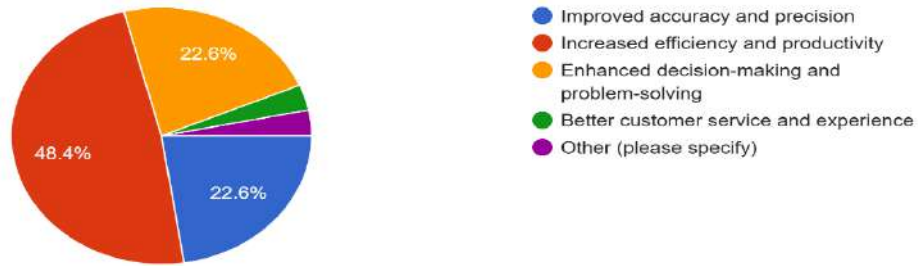


Figure 6

11. What do you think is the most significant application of blockchain technology in engineering?

31 responses

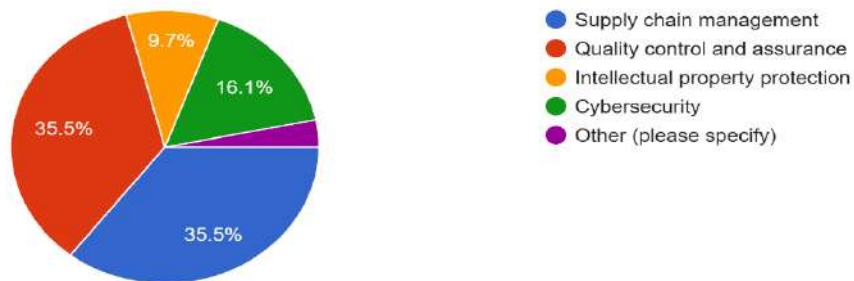


Figure 7

12. What do you think is the most significant potential benefit of adopting a circular economy approach in engineering?

31 responses



Figure 8

13. What do you think is the most significant skill that engineers will need to develop in order to remain relevant in the future?

31 responses



Figure 9

14. What do you think is the most significant challenge facing engineers in terms of developing sustainable and environmentally-friendly solutions?

31 responses



Figure 10

15. What do you think is the most significant ethical challenge facing engineers in terms of developing and implementing new technologies?

31 responses



Figure 11

According to the survey involving **31 respondents**, the major findings show that the major obstacles for engineers in creating future technologies are significant. The most notable obstacles are limited availability of advanced technologies (**35.5%**), inadequate training and education (**32.3%**), and absence of finance (**22.6%**). In spite of the obstacles, the majority of the engineers are confident about the contribution of new technologies, with **48.4%** opining that the new technologies will make a very significant contribution. The engineers also envision themselves as major contributors to the future of technology, with 38.7% identifying a leading role and **48.4%** identifying a significant role.

In their attempt to stay current with the new developments, the engineers rely on reading industry publications and blogs (**35.5%**), online courses and training programs (**32.3%**), and conferences and seminars (**22.6%**). The most promising opportunities for the engineers in new technologies are the creation of intelligent systems and AI devices (**48.4%**), sustainable and

environmentally friendly infrastructure design (**29%**), and new materials and manufacturing process development (**16.1%**). The most significant benefit that the application of AI in engineering has, as perceived by the engineers, is increased efficiency and productivity (**48.4%**).

Major Technological Trends in Engineering

1) Engineering with Artificial Intelligence and Machine Learning

AI and ML are essential in automating complex work in the field of engineering. They enhance design, automation, fault detection, and optimization. For example, AI-based algorithms are utilized in:

- **Production:** AI robots make production lines more efficient.
- **Autonomous vehicles:** AI enables autonomous cars and intelligent traffic control.
- **Aerospace engineering:** AI aids predictive maintenance and failure detection in aircraft systems. AI systems reduce human error, operating expenses, and power consumption, and therefore become an essential part in modern engineering.
- **Smart cities:** Traffic management based on IoT minimizes congestion and pollution.
- **Industrial Internet of Things (IIoT):** The factories use IIoT-enabled equipment for monitoring in real-time
- **Smart charging road and solar embedded road:** The rapid increase in the usage of electric vehicles (EVs) and the global shift towards sustainable infrastructure has led to the demand for smart charging roads and solar-embedded roads. These new technologies aim to reduce range anxiety, reduce the need for fossil fuels, and optimize the efficiency of roads when it comes to the usage of energy. Smart charging roads use wireless charging through electromagnetic induction, while solar-embedded roads generate power through photovoltaic (PV) cells that are integrated in the surfaces of the roads. This article explores the technology, benefits, drawbacks, and case studies on the future roads, highlighting their ability to revolutionize the transportation system.

2) Engineering with Quantum Computing

Quantum computing is expected to revolutionize problem-solving in engineering disciplines. Traditional computers struggle with complex calculations, but quantum systems offer solutions in:

- **Material science:** Designing new, more efficient,
- **Energy:** Smart grid optimization for efficient power supply
- **Security:** Quantum encryption enhances the security of data in engineering applications.
- **Aerospace:** High-accuracy simulation of aerodynamic response

While quantum computing is still in its early days, it has tremendous potential for solving engineering issues that had previously been impossible to solve.

3) Sustainable and Green Engineering

Sustainability has become a major priority in the field of engineering, with developments including:

- **Solar, wind, and hydropower innovations:** Renewable power systems

- **Sustainable buildings:** Using intelligent materials and efficient designs
- **Carbon capture technology:** Reducing industrial carbon emissions
- **Waste Management:** Recycling and reduction of plastic waste using engineering solutions.

The goal is to minimize the environmental footprint with ongoing technology development. Climate change and net-zero emissions in the coming decades are addressed through green engineering, which has a significant role to play.

Applications of future technologies

1) Smart Transport and Infrastructure

- **Autonomous Vehicles:** AI-powered autonomous vehicles will reduce accidents and fuel consumption.
- **Hyperloop and High-Speed Trains:** Magnetic levitation and vacuum tube transportation system engineering advancements
- **Smart charging road and solar embedded road:** The surge in the number of electric vehicles (EVs) and the global push towards sustainable infrastructure has led to the development of smart charging roads and solar-embedded roads. These innovations promise to eliminate range anxiety, reduce the consumption of fossil fuels, and optimize the efficiency of the use of roads' energy. Smart charging roads use wireless charging via electromagnetic induction, while solar-embedded roads generate electricity using photovoltaic (PV) cells integrated in the roads' surfaces. This article explores the technology, benefits, drawbacks, and case studies of these roads of the future, and their ability to revolutionize the transportation scene.

2) Health and Biomedical Engineering

- **3D Bioprinting:** They are making artificial tissues and organs.
- **AI Diagnostics:** Machine learning algorithms improve disease detection.
- **Wearable Health Devices:** Smartwatches and biosensors monitor real-time health metrics.

3) Smart Grid and Energy Industry

- **Smart grids:** Energy distribution through AI lowers wastage.
- **Battery Technology:** Solid-state batteries improve the efficiency of electric vehicles.
- **Hydrogen Fuel Cells:** Advances in the engineering of green hydrogen production

4) Industry 4.0 and Manufacturing

- **Robotic Automation:** AI-controlled robots improve precision and efficiency.
- **3D Printing:** Additive manufacturing reduces production costs and minimizes waste.
- **Digital twins:** Virtual models improve physical processes before actual implementation.

Obstacles and Ethical Challenges

1) Cybersecurity Threats:

- **IOT Vulnerabilities:** Connected devices create hacking risks.

- **Fear about data privacy:** AI monitoring has ethical concerns.

2) Ethical considerations surrounding AI and automation

- **Job displacement:** Traditional employment faces the threat of increased automation.
- **AI fairness:** The engineers must ensure that fairness in decision-making exists within AI.

3) Skill Gap and Education in Engineering

- **Multidisciplinary learning:** Engineers must be taught about AI, quantum computing, and sustainability principles.
- **Lifelong learning:** Continuous learning and upskilling are necessary to keep up with rapid developments.

Conclusion

In brief, the survey presents a clear indication regarding the opportunities, advantages, and disadvantages with new technologies in the area of engineering. The engineers are mostly optimistic about the future, but are mostly hampered by the unavailability of new technologies, constant training and education, and sufficient finance. To remain up to date, the engineers must learn the necessary skills that include data analysis, programming, and communications.

The survey also highlights the important role that new technologies are set to play in the area of engineering. From the creation of intelligent systems and AI machines to the designing of environmentally-friendly and sustainable infrastructure, the future of technology hinges on the efforts of the engineers.

But in order to fully take advantage of new technologies, we need to make investments in education, training, and infrastructure, including providing the latest technologies to engineers, providing ongoing training and education, and providing sufficient financing to make new technologies available.

Ultimately, the survey suggests that the future of technology will be directed by the engineers and that new technologies will be hugely advantageous to the profession. If the opportunities and issues raised in the survey are addressed head-on, the chances are that the engineers will remain at the cutting edge of technology and make strides in the future as well.

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Post-Pandemic Thermal Dynamics of Oceanic Subsurfaces: A Remote Sensing-Based Lateral Analysis

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Abstract:

As society develops so does the nature of incidents surrounding it societal. This progress in technology & medicine is limited to a certain scope of incidents. Safety of society & financial aspects against certain natural incidents cannot be avoided, however can be hedged by applying certain estimation tools influenced by other scientific purposes. Oceans / Seas are significant Earth elements impacted by worldwide heating & atmospheric variation. Past analysis has revealed that this subterranean water body is accountable for Weather divergence by altering an eco-classification of the Earth; hence, it is critically essential to evaluate them. Remote sensing can give high spatial / temporal resolution sea surface information & big spatial exposure, enabling notable ocean science findings. However, satellite remote sensors cannot directly detect the profound coatings of the ocean / sea. Extreme thermal components, including warm and cool periods, may effect socially. However, periodical thermal component alterations stand usual & certainly vital towards various social factors (i.e. travel industry, agriculture, others.), farthest warm / cool winds may effect abruptly in a bad manner. IT remains 'natural' towards a single area, critically, can become severe towards another part that is found least adjusted among thermal components.

Today's climate & air condition cause a key aspect for society's routine flows of system. Cyclic marvels can become beneficial & dependent on factors like the agriculture and also vacation industry. Subsidiary incidents, particularly thrilling parts, may at instances has religiously cynical effects that present threats for time & structure & substantial economic costs. The ecological diversities that occur over a period of time vary with the effect on its subsidiaries and thereby cause an overall change in its surroundings. The main focus of the work is to relate climate change model considered as in the form of a mathematical expression and also study its effects into the elements of nature that are eventually affected during a particular event.

Keywords: Climate Change, Global Warming, Seasonal Changes, mathematical analysis & relation with atmospheric humidity.

Introduction

Oceans / Seas are significant Earth elements impacted by worldwide Global warming and climate change. Recent studies have shown that the deeper oceans are accountable for climate variability by altering the ecosystem of the Earth ; therefore, it has become more essential to evaluate them. Remote sensing can provide high spatial / temporal resolution sea surface information and big spatial coverage, enabling notable ocean science findings. However, satellite remote sensors can not directly detect the profound layers of the ocean / sea.

Researchers have therefore examined the relationship between oceans / seas salinity, height and temperature to assess their underwater temperature using dynamic models and model-based information assimilation (numerical and statistical) methods that mimic these parameters by using remote sensed information and in situ measurements.

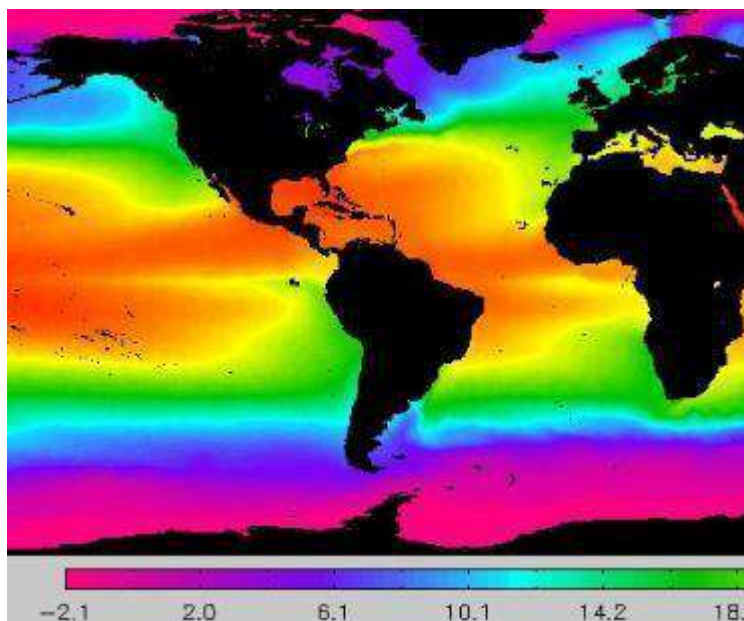
Because of the demands of extensive perception and the significance of global warming in decision making and science research, this review offers extensive information on techniques used to assess the temperature of the ocean / sea subsurface water from remote and non-remote sensed data.

The challenges, constraints and views of the current techniques are also explored in order to clarify the underground procedures.

Due to the dominant favorable forcing of growing greenhouse gases, further temperature rises and climate change are expected for the future. Most of the climate change threats are linked to warming in many areas of the planet, droughts, floods, food production, adverse effects on aircraft efficiency, sea level rise, etc. Climate change also involves indirect threats to government health through damaging modifications in air quality, disease spread, food insecurity and under-nutrition, mental illness, and death from cardiovascular and respiratory illness.

Since the most severe challenge facing water today is worldwide warming, it seems necessary to predict these possible changes in ecosystem function. The temperature of the ocean surface water has risen owing to climate change, impervious surface runoff and industrial process heat effluents. Several parts of profound oceans below 2000 m have warmed up since 1990. Simultaneously, several scientists proposed global ocean warming. In coastal procedures such

as biological activity, thermal momentum and exchange, interaction with the surrounding water, and climate change, temperature is an significant variable. The evaluation of ecosystem modifications by remotely sensed satellite information is another important problem in oceanography. Reliable global ocean coverage of marine surface temperature, sea surface height, surface temperature. Visible light comprises of different wavelengths of violet to red light. Violet light has the greatest energy and is more deeply penetrated than other wavelengths. In ocean surface temperature (SST) and thermal transfer, penetration of the visible part of the spectrum in the upper layers of the oceans plays a vital role. Violet light penetrates into greater depths and is eventually absorbed ; this mechanism, together with more efficient procedures such as vertical movement, horizontal transport and mixing, can affect the temperature of the subsurface waters. Scientists classified the subsurface of the seas into five primary layers / zones. Their development is the most extreme depths from the ground where light is no longer able to penetrate.



In the present research, we segregated the remote sensing and non-remote sensing techniques used to assimilate and measure sub-surface ocean / sea temperature level. In order to understand the further proficiencies over this criteria, we involve the historic data over similar graphical forms.

Literature Review

Mekonnen H Daba (2018) :-Assessing Local Community Perceptions on Climate Change and Variability and It's Effects on Crop Production in Selected Districts of Western Oromia, Ethiopia. This paper deals with the peoples cognizance towards environmental changes

occurred in given period of time. The perception of small holder farmers taken into consideration, their viewpoint , their strategies of various variability happen when climate change. Moreover, primary data has been used of almost 204 respondents at the basic level of quantitative and qualitative approach. The most impressive thing about this paper, Author has used some statistics tool such as Stratified sampling frame and Cluster sampling frame. After completion of experiment, farmers has able to perceived all kind of changes which happened in environment such as strong wind that led to in- flate farming problem for instance, soil abrasion, loss of soil potency, reduction in crop yields and high rate of disease occurrence was shown in the paper.

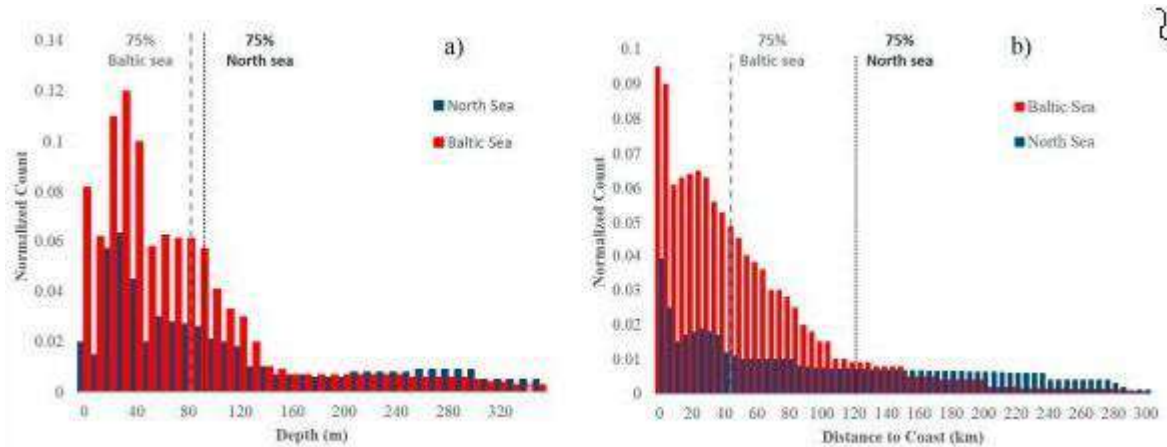
Hamid, Seyed, Amir Hosen, MohamadNajim & Saeed Shojaei (2016):-Comparison of Delphi and Analytic Hierarchy Process (AHP) techniques in locating flood spreading. In this article, Delphi & AHP techniques have compared predominantly and explain the importance substantially well. Since Iran comes in the dessert area of earth space so the major factor which is highly significant and has great impact is water scarcity. Moreover, maximum part of Iran falls in to the desiccated and semi desiccated therefore due to water scarcity controlling the catastrophic floods is the most significant activity and hence the study of Delphi & AHP techniques are the need of present time. For this study, some statistical tool have been used such as Questionnaires were tak- en and filled by the target group and it has distinguish between three different criteria such as 4 main, 8 sub and 24 indices of flood spreading and it is examined by AHP in expert point of view followed by GIS (Geo- graphic Information System) were used to do mapping then for alluvium volume and unemployment rate, re- sults of AHP and views of expert panel the highest and lowest degree and its importance were recorded. Similarly in Delphi techniques some important factor for location flood spreading for Ivar watershed such as indices of soil permeability, flood quality, soil texture, slope, aqueduct and sub-criteria of water.

Ozabor and Nwagbara (2018):- Identifying Climate Change Signals from Downscaled Temperature Data in Umuahia Metropolis, Abia State, Nigeria. This research article shows that there are very significant evidence that temperature have change drastically and it is very much evident from downscaled data of Umuahia in Abia state. Notwithstanding GHGS exhalations propagation and escalation of population, uncontrolled urbaniza- tion are the factors advocated by HadGCM3. Nevertheless with incertitude in forecast the temporal patterns of temperature suggested that there are changes from normal to normal for current and future temperature pattern. Due to this, there will be some impeccable changes and drastic effect on environmental

impact and there will be irreparable damages if necessary steps were not taken in given period of time. Moreover in this research article some important statistics tools have been used such as ANOVA and p-value method.

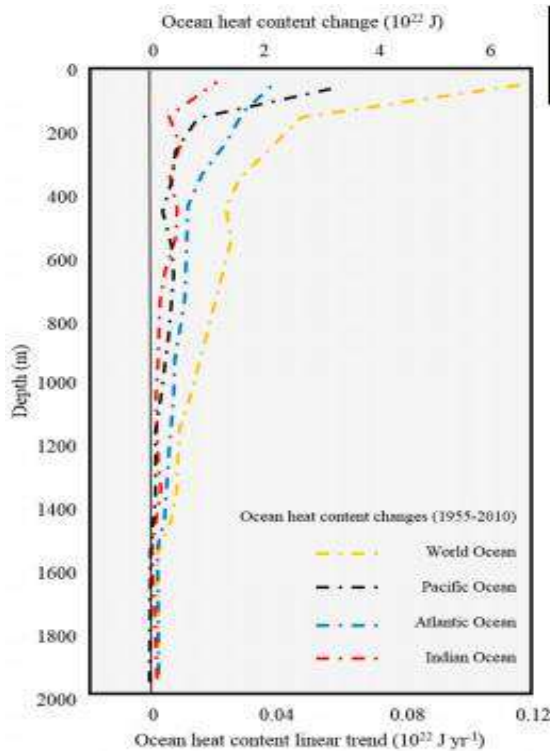
Anomalies in the vertical and horizontal sea / ocean surface temperature

Since more proof has shown the extensive warming of the deeper oceans of the world, it is essential to estimate correctly the subsurface heat composition of the worldwide oceans. Oceanographers predicted the subsurface flow areas and calculated the horizontal and vertical advection in the interior of the ocean. Figure above shows comparisons of vertical and horizontal anomalies between the Baltic and the North Sea. Karagali et al. stated that it was possible to see most anomalies at depths of up to 200m. Diurnal heating occurrences occur mostly between 20 m and 40 m depth. Moreover, most observations are registered in the North Sea (blue color) within the first 5 km from the shoreline, reducing 300 km from the shore to zero observations. No anomalies are detected in the Baltic Sea (red color) beyond 120 km offshore ; however, most anomalies are found in the first 10 km from the shoreline. In general, Both statistics show the coastal and shallow sea circumstances, where 75% of the anomalies occur at depths of less than 90 m (80 m) in the North Sea (Baltic Sea) and 125 km (45 km) from the coast.



Distribution of anomalies greater than 2 K by (a) depth and (b) distance to the North Sea and the closest coast. Because global warming has accelerated, the role of the oceans is essential because they are enormous reservoirs of heat and water. It is therefore useful to know what has happened over the last century in the worldwide oceans. Levitus and others. It has been shown that more surface warming has happened in all basins. The biggest overall rise in the Pacific layer was subjected to 0–100 m. From the Pacific region. The Atlantic shows the biggest rise of all ocean basins in all layers above 2000 m at depths of more than 100 m. The writers

also showed that the layer of 700–2000 m is accountable for One-third of the 0–2000 m layer complete warming. Kawano et al. estimated that about 5 percent of the Pacific Ocean's heat was below 3000 m and rose extensively between 1999 and 2007.



Linear trends and complete rises in sea basin thermal content based on worldwide and individual basin linear trends as a function of depth (0–2000 m) up to 100 m

❖ . Impacts of Different Dynamics on Ocean/Sea Subsurface Water Temperature Profile

The underwater temperature of the ocean / sea is profoundly influenced by water turbulence. Both vertical movement and horizontal transport interfere with some easy roles in altering the temperature of their sub- surface water by depth. Considering vertical motion and horizontal transport, therefore, it appears necessary to estimate the temperature of the sea / ocean subsurface water and simulating these movements can lead to more accurate estimates of the temperature of the sea / ocean subsurface water. Interestingly, the dynamics of the ocean and the temperature of the subsurface water have causes and effects, which means that one impacts the other and at the same time. Wu et al explored the impact of Gulf Stream on the monthly underground temperature anomaly (STA) and temperature profiles. Wu et al researched monthly underground temperature anomaly (STA) and temperature profiles.

Sea surface height

The variability of SSH is triggered by four classifications of events, including dynamic / non-dynamic reactions to forcing processes. Integrated parameter measurements must correct the variability of SSH. After correcting the impacts of tidal and atmospheric pressure, steric effects such as modifications in density from heating / cooling or changes in salinity and wind forcing continue to affect the SSH. SSH variability is mostly used to infer changes in the heat sub-surface or density composition and often to represent the thermocline's relative motion. You can also apply this variation to assess absolute differences in the depth of the surface layer. Dipper and more diffuse thermocline and strong surface buoyancy fluxes decrease the correlation between SSH and thermocline depth. If temperature changes predominantly and creates fluctuations in surface density, SST information can infer MLD or thermocline depth. Several solutions can retrieve SSH information, such as localized direct wind gage readings, XBT profiles and approximate calculation by modelling the relationship between SSH and temperature, salinity, and pressure measurements, and this data has been monitored by remote sensing satellites since 1992. These accessible and useful altimetry information for satellites include Topex / Poseidon, Jason products, ERS, Envisat altimeters, and all AVISO grid-level products with very excellent space and time coverage.

Mixed Layer Depth:

The blended depth of the layer (the near-uniform surface area) that connects the atmosphere to the deep ocean and plays a critical part in the variability of the climate. The layer's heat and mechanical inertia in direct atmospheric contact. Determining the MLD and its variability is essential for understanding and interpreting the upper ocean heat and velocity areas, parameterizing mixed-layer procedures, and studying the relationships between air and sea, acoustic propagation, ocean biology, long-term climate change, vehicle.

There has been a decline in the frequency of cool nights in India over the period 1970-2009, where data are available, an increase in the number of warm nights as well as a decline in cool days and an increase in hot days.

A general rise in the average seasonal temperatures in the country has been reported as a result of human climate influence, resulting in hot seasonal teas.

Climate change projections

The expected temperature increases from COUPLED MODEL are lower in southern India for the A1B emissions scenario, up to 3 ° C compared to the north, where shifts of up to 4.5 ° C

are predicted. The consensus is strong across nearly the entire country between the COUPLED MODEL versions.

- Increases in precipitation are expected in India across most of the region.

There could be rises of up to 20 percent or higher in western regions with a rise of 5-10 percent more common than the rest of the country. Agreement is medium to weak throughout the COUPLED MODEL ensemble.

Climate change impacts projections Crop yields

In their forecasts for India, global and regional studies included here differ, but declines are typically expected for wheat and rice, two of India's major crops.

Climate Observations

Rationale

Today's weather and climate play a key role in society's day-to-day running. Seasonal phenomena can be beneficial and dependent on sectors such as agriculture or tourism. Other incidents, particularly extreme ones, can sometimes have serious negative impacts that present threats to life and infrastructure and substantial economic costs. Knowing the intensity and extent of these phenomena may significantly improve social resilience when they present threats and when they can be beneficial for which sectors of society. In a changing climate, knowing possible future changes in both potentially hazardous activities is extremely valuable. Recurring seasonal events dependent on sectors such as agriculture and tourism. The emphasis will then be on extremes of temperature, precipitation and storms identified from 2000 onwards, as stated in the World Meteorological Organization (WMO) Annual Statement on Global Climate Status and/or State of the climate reports by the American Meteorological Society (AMS) Bulletin. A discussion of changes in moderate extremes from 1960 onwards is followed by an updated version of the HadEX extremes database (Alexander et al. 2006), which categorizes extreme temperature and precipitation. These are the core variables of climate. Significant efforts have been made by the climate research community in terms of data acquisition and storage and for which long high-quality monitoring records can be generated. No new storm analyses are included (see the following section on methodology for background). For high seasonal weather, An attribution analysis then places the seasons with highlighted extreme events in the context of the recent climate versus the hypothetical climate

without anthropogenic emissions (Christidis et al, 2011). It is important to note that we perform our seasonal allocation analyzes mean temperatures over the entire country.

Climate overview

India is a large country from 8 ° to 33 ° N. The landscape diversity, varying from the Himalayan high moun- tains in the north to the tropical coastlines in the south, produces a wide range of climatic conditions. Winters are cool at lower levels in the northern mountain regions and cold at higher altitudes. In the summer, inter- mediate levels are comfortably cool about 2000 m above sea level, but at lower levels it can get very dry. The Himalayas act as a barrier to Central Asia's cold winds. Northern inland areas have a continental climate with a high temperature variation of seasonal and diurnal. Intermediate levels about 2000 m above sea level in the summer are pleasantly warm, but at lower levels it can get very dry. The Himalayas act as a barrier to Central Asia's cold winds flowing down. Northern inland areas have a continental climate with a high range of seasonal and diurnal temperatures. Here, the hottest months are April and May, before the monsoon begins. Inland at Hyderabad, with an average daily high of 39 ° C, the mean temperature reaches 33 ° C in May. Throughout the year, particularly in the hot season, and the monsoon season from June to September, heat and humidity can be very oppressive in coastal regions. The Indian climate is dominated by the great Asian mon- soon wind system that is completely unlike the prevailing wind system of any other country. Most of India's driest period is from December to February when light north-eastern winds bring clear skies and almost dry weather. The dry conditions continue from March to May, but the intense summer heat causes the winds to reverse in order for India to be influenced from June to October by the moist rain-bearing moonsoon from the south-west and some mountain ranges facing the sea, the rainfall may be very severe. Usually during late May or early June, the monsoon reaches the south and reaches the north about six weeks later. The amount of rainfall received has a great spatial variability. The west coast is the wettest region (along with north-eastern India). This is a narrow coastal plain supported by the Western Ghats, a steep mountain barrier. Mangalore has an average annual rainfall of 3760 mm, 90% of which occurs during the period from June to October. Inland Hyderabad, by contrast, receives only 830 mm a year In north-western India there is the Rajasthan Desert where annual average precipitation levels are as low as 250 mm. On the south-eastern coast, the main rains come later from October to December and are often associated with tropical storms or cyclones forming in the Bay of Bengal. Chennai, for example, has an average annual rainfall of 1320 mm, with 60% falling between October and December. Coastal parts of Orissa and West Bengal's north-eastern Indian

states are also severely affected by tropical cyclones, causing destruction due to strong winds and flooding.

The rains are torrential in some years, but they are only light in other years. This inter-annual variation in the onset and intensity of the monsoon has a significant impact on the country. The El Niño Southern Oscillation (ENSO) cycle may influence the rains, with the warm phase (El Niño) leading to lower rainfall rates for most of India, both during and outside the monsoon.

Temperature extremes

Extreme temperatures, both hot and cold, can place many demands on society. While seasonal temperature changes are normal and indeed important for a number of sectors of society (e.g. tourism, agriculture, etc.), extreme heat or cold can have serious negative impacts. What is 'natural' for one area, critically, may be severe for another region that is less well adjusted to such temperatures.

Selected extreme events recorded in WMO Statements on the Status of Global Climate and/or BAMS State of the Climate Reports since 2000 are shown in Table 1. Two events, the May / June 2003 heat wave and the January 2006 cold spell as examples of extreme temperature events for India are listed below.

Recent extreme temperature events

Heat wave, May/June 2003

In many parts of India, temperatures rose to high 40 °C in late May and early June 2003, with maximum temperatures at some locations above 50 °C. As a result of the heat wave, which also affected neighboring Pakistan and Bangladesh, more than 1500 people were reported to have died (WMO, 2005; Kolli, 2004). Media reports indicate that the heat wave, where bush fires occurred in almost every district damaging homes and belongings, especially hit Andhra Pradesh's state (Relief Web Report, 2003).

Cold spell, January 2006

During the early part of 2006, a severe cold spell affected several parts of South Asia and temperatures fell to several degrees below freezing at some stations in the Pakistan / North India area. The cold in North India resulted in more than 150 deaths. On 8 January, New Delhi saw its first frost falling to 0.2 ° C in 70 years (Rajeevan and Revadekar, 2007). Media reports show that Uttar Pradesh's Indian state was particularly badly hit, with 145 deaths associated

with cold. The articles even point out that the cold spell caused damage to water pipes and crops (up to 15% in some regions) and disruption of travel, with some schools closed for several days. (Web Report on Relief, 2006).

Attribution of changes in likelihood of occurrence of seasonal mean temperatures

The weather of today covers a range of possible extremes. Recent research has shown that in the absence of anthropogenic emissions, the temperature distribution of seasonal means will likely be different (Christidis et al., 2011). Here we discuss the seasonal means in which the highlighted extreme temperature events take place in the context of the recent climate and the impact of anthropogenic emissions on that climate. The methods are fully described in the methodology section.

Spring and summer 2003

In the presence and absence of anthropogenic forcings, the March-April-May (MAM) cycle means local temperature for 2000-2009 is shown using distributions in Figure 4. Figure 5 reveals similar June-July-August (JJA) mean distributions. Two independent coupling models of atmosphere and general ocean circulation (HadGEM1 and MIROC) analyze that human climate changes have changed distributions to higher temperatures than natural causes alone would have predicted. Considering the region-wide average, the mean temperature of the 2003 MAM is not unusually hot as it lies in the central field of the anthropogenically mediated seasonal temperature zone (red distribution). It is significantly cooler than the 2010 MAM temperature, which in the CRUTEM3 dataset is the warmest and most compatible with the distribution affected by anthropogeny. The 2003 season, in the absence of human influences (green distributions), lies close to the warm tail of the temperature distribution and would therefore be a warmer season. Also in a climate affected by anthropogenic forcings, the JJA mean temperature in 2003 is not unusually cold, but becomes a much more intense season in the cycle without the impact of human factors on the environment. It should be noted that the results of the attribution shown here refer to averaged temperature anomalies throughout the region and throughout the whole season. As such, they do not rule out the occurrence of a short-lived extreme event that affects a smaller region.

Winter 2005

Winter averages mean local temperature for 2000-2009 in the presence and absence of anthropogenic forcings are shown using Figure 6 distributions. Like the previous section,

analyses with both models suggest that human climate influences have shifted the distribution to higher temperatures. Considering the region's average, winter 2005/06 is dry. Because it lies close to the warm tail of climate temperature distributions influenced by anthropogenic forcings (red plotted distributions). The season lies further in the warm tail of the temperature distribution in the absence of human influences on the climate (green distributions) and would therefore be a more rare warm season. It is also much warmer than the 1904/05, the coldest in the CRUTEM3 dataset.

Storms

To all sectors of society, storms can be very dangerous. These can be tiny and distributed through large regions, or even globally, with regional impacts. There is no comprehensive observational analysis included for storms since, despite recent improvements (Peterson et al. 2011; Cornes and Jones 2011), wind data are still not adequate for rigorous research around the world (see section on methodology).

Further progress is anticipated through the latest 20th Century Reanalysis (Compo et al., 2011) and its proposed successors to research the more accurate barometric pressure results.

Selected extreme events recorded in WMO Statements on the Status of Global Climate and/or BAMS State of Climate Reports since 2000 are shown in Table 3. The 2008 Tropical Storm Nisha is shown below as an example of a recent storm event that affected India.

Recent storm events

Tropical Storm Nisha, November 2008 recorded in several locations, with totals of 990 mm recorded in 48 hours in Orathanadu, Tamil Nadu, and 280 mm in 24 hours at Chennai airport (Rajeevan and Revadekar, 2009) Chennai airport (Rajeevan and Revadekar, 2009).

Conclusion

The main features seen from this study in the observed weather over India are:

- Since 1960, India has had a widespread warming trend.

- In the period 1970-2009, where data are available, the frequency of cool nights across India has decreased, the number of warm nights has increased, the number of cool days has decreased and the number of hot days has increased.

- Seasonal average seasonal temperatures have generally increased over the country as a result of human climate influence, making hot seasonal temperatures more frequent and cold

seasonal temperatures less frequent. Studies on climate change Included in this report are the results of recent studies using weather forecasts from Global Climate Models (GCMs) to crop yield models to determine the global impact of climate change on crop yields, including national impact estimates for India. (Avnery et al., 2011, Masutomi et al., 2009, Iglesias and Rosenzweig, 2009). Some crops ' CO₂ fertilization cycle is typically included in yield studies of climate impact. Other gases, however, may affect crop growth and are not always included in model impact projections.

Since the current era, climate models have continued to be developed and improved, and many models have been expanded to include the representation of biogeochemical cycles that are important for climate change.

The mathematical development of the psychrometrics theory gives a brief overview of the various parameters involved along with basic climate change model.

The certain results from the psychrometrics are key pointers to understand the humidity ratio over storm surge moments mathematically.

Results observed over the mathematical overview of the psychrometer collate to give association among the heat parameters and the other similar aspects related to climate change.

Storm surge is an ideal event that formulates the covariance of the differential function of the specific heat over the mathematical estimation.

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Customer-Centric Impacts of Post-COVID-19 E-Commerce Revitalization: A Study of Behavioral Shifts

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Abstract: The study attempts to understand the revitalization or renewal of E- Commerce on the buying behaviours of the people after the novel coronavirus (COVID- 19)

As lockdowns became the new normal, businesses and consumers increasingly “went digital”, providing and purchasing more goods and services online, raising e-commerce's share of global retail trade from 14% in 2019 to about 17% in 2020.

To know if there was a rise or fall in the E - commerce business post COVID- 19, a survey had been conducted with a random sampling of 100 consumers belonging to the Mumbai suburban region. The findings highlighted that the main components like most households now had shifted to the online mode of shopping, made online payments for their products, found it accessible and easier to shop online rather than offline in terms of safety, price, time, the product description, payment methods, advertisement, internet literacy, and so on. Also the fact the E- commerce business saw an accelerated growth post pandemic.

The findings of the study will also further help to identify if more people would continue to opt for online shopping mode i.e. Ecommerce business rather than the traditional offline shopping post pandemic.

Introduction

Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions. Ecommerce is often used to refer to the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet. Ecommerce has evolved to make products easier to discover and purchase through online retailers and marketplaces. Independent freelancers, small businesses, and large corporations have all benefited from ecommerce, which enables them to sell their goods and services at a scale that was not possible with traditional offline retail.

A few examples of e-commerce marketplace platforms include the following: Alibaba, Amazon, Chewy ,eBay, Etsy, Overstock, Newegg, Rakuten, Walmart Marketplace , Wayfair etc .

There are four main types of ecommerce models that can describe almost every transaction that takes place between consumers and businesses.

1. Business to Consumer (B2C):

When a business sells a good or service to an individual consumer (e.g. You buy a pair of shoes from an online retailer).

2. Business to Business (B2B):

When a business sells a good or service to another business (e.g. A business sells software-as-a-service for other businesses to use)

3. Consumer to Consumer (C2C):

When a consumer sells a good or service to another consumer (e.g. You sell your old furniture on eBay to another consumer).

4. Consumer to Business (C2B):

When a consumer sells their own products or services to a business or organization (e.g. An influencer offers exposure to their online audience in exchange for a fee, or a photographer licenses their photo for a business to use)

However, even before the pandemic situation, Indian retailers were anticipating strong e-commerce growth in 2020. As a result of the Coronavirus, the sector has somehow accelerated e-commerce development.

In the last two decades, widespread use of e-commerce platforms such as Amazon and eBay has contributed to substantial growth in online retail. In 2011, e-commerce accounted for 5% of total retail sales, according to the U.S. Census Bureau. By 2020, with the start of the COVID-19 pandemic, it had risen to over 16% of retail sales. Some of the advantages that made it rise after the pandemic, was when people who were unaware of the Ecommerce felt that it was,

- Easily Available, Aside from outages and scheduled maintenance, e-commerce sites are available 24/7, enabling visitors to browse and shop at any time.
- Speed of access. While shoppers in a physical store can be slowed by crowds, e-commerce sites run quickly.
- Wide availability. E-commerce enables brands to make a wide array of products available. Example Amazon's first slogan was "Earth's Biggest Bookstore."
- Easy accessibility. With e-commerce, businesses can sell to anyone who can access the web. Customers shopping a physical store may have difficulty locating a particular product.
- International reach. Brick-and-mortar businesses sell to customers who physically visit their stores. E-commerce has the potential to extend a business's customer base.
- Lower cost. Pure play e-commerce businesses avoid the costs of running physical stores, such as rent, inventory and cashiers. They may incur shipping and warehouse costs, however.
- Personalization and product recommendations. E-commerce sites can track a visitor's browse, search and purchase history. They can use this data to present personalized product recommendations

As detailed above, the COVID-19 crisis accelerated an expansion of e-commerce towards new firms, customers and types of products. Overall, customers still are spending substantially more online than before the coronavirus pandemic. In May 2022, seasonally adjusted internet sales accounted for 26.6% of all official retail sales, compared with 19.7% in February 2020.

Due to increase in sales in e-commerce, the traditional commerce sales have been downgraded. 24*7 availability and convenience online has resulted in huge profits, customers from overall the world can access your products by simply sitting at home.

Review of Literature

Floreny Dsouza (2022), studied the Influence after COVID- 19 Pandemic on E - commerce business. In this study a descriptive research was conducted. It was observed following the

pandemic; more than half of the survey's respondents now shop online more frequently and rely on the internet more for news, health- related information and digital entertainment. Consumers in emerging economies have made the greatest shift to online shopping, the survey shows.

Scope of the Study

This study would be undertaken to analyze the impact on Ecommerce business after the COVID- 19 pandemic towards online shopping. It would also be helpful to understand if the customers are satisfied by the benefits of shopping on online websites even after the pandemic.

Research Methodology

The research methodology was based on using both Primary and secondary data mainly the quantitative research was made use of where the respondents had to fill in the questionnaire given to them. Thus the samples were observed and collected.

Research Objective:

1. To Study the impact on E-Commerce after COVID-19
2. To study the buying behaviour of the customers post pandemic.

Hypothesis

In light of the discussion in preceding sections, the following hypotheses are proposed: Ho - The E-commerce business has accelerated in terms of profits post pandemic.

H1 - The E-commerce business has not accelerated in terms of profits post pandemic.

Ho - There was a major impact post pandemic on consumer's behavior with respect to online shopping. H1 - There was no major impact post pandemic on consumer's behavior with respect to online shopping.

Research Design

A descriptive research design was used to conduct the research. The data was collected by survey through questionnaire on the research topic i.e A Study on Revitalization of E-Commerce after COVID-19.

Area of the Study

The study is undertaken in and around the Mumbai city and its suburban areas.

Research Approach

A deductive approach of research methodology was conducted by using questionnaire method of survey which was used for collecting primary data from consumers belonging to Mumbai region. It contained close ended questions and open ended questions in the structured form.

Sample Technique

A convenient Probability sampling technique was conducted on of 100 consumers belonging to Mumbai region who shared their information regarding the study. They were requested to complete the questionnaire on voluntary basis. The study was done in December 2022.

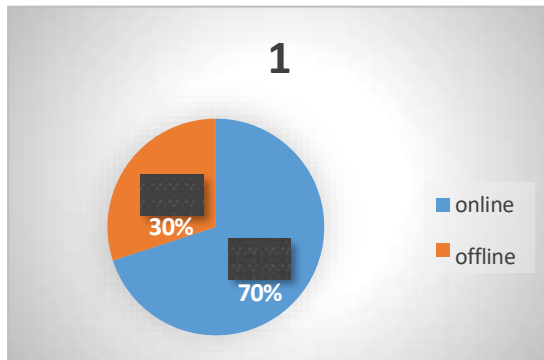
Data Usage

The analyses and interpretation are done on the basis of primary data. However, for conclusion and recommendation both primary and secondary data is used along with the verbal knowledge and information obtained from respondents.

Data Analysis and interpretation

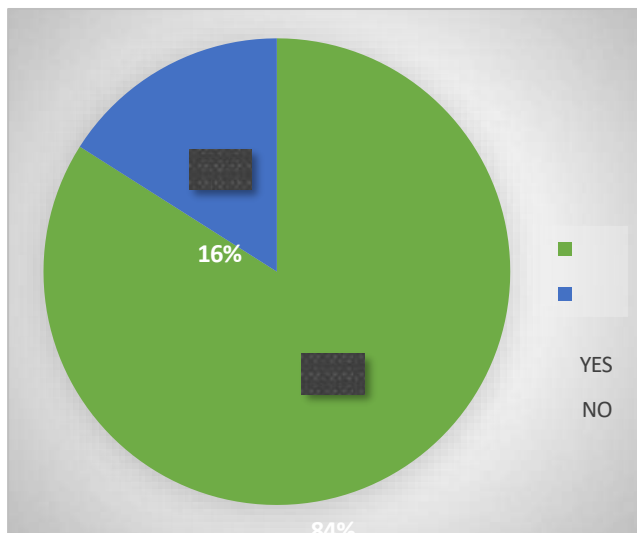
In the present study there were 80 respondent, who were students as well as job workers out of which 60% were females and 40 % were males. The student respondents were the customers buying products online in the age group 18 – 45 years of age (these included students as well as job workers.)

1. What kind of shopping do you prefer the most?



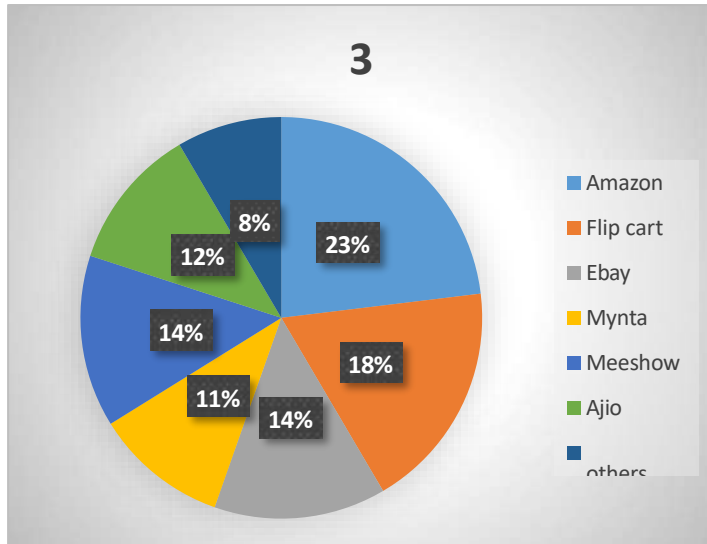
The data indicates after COVID- 19 pandemic, consumers preferred more Online shopping which is 70 % and less preference towards offline shopping which is 30 % due to safety purpose.

2. Do you think people shop more online products after the pandemic?



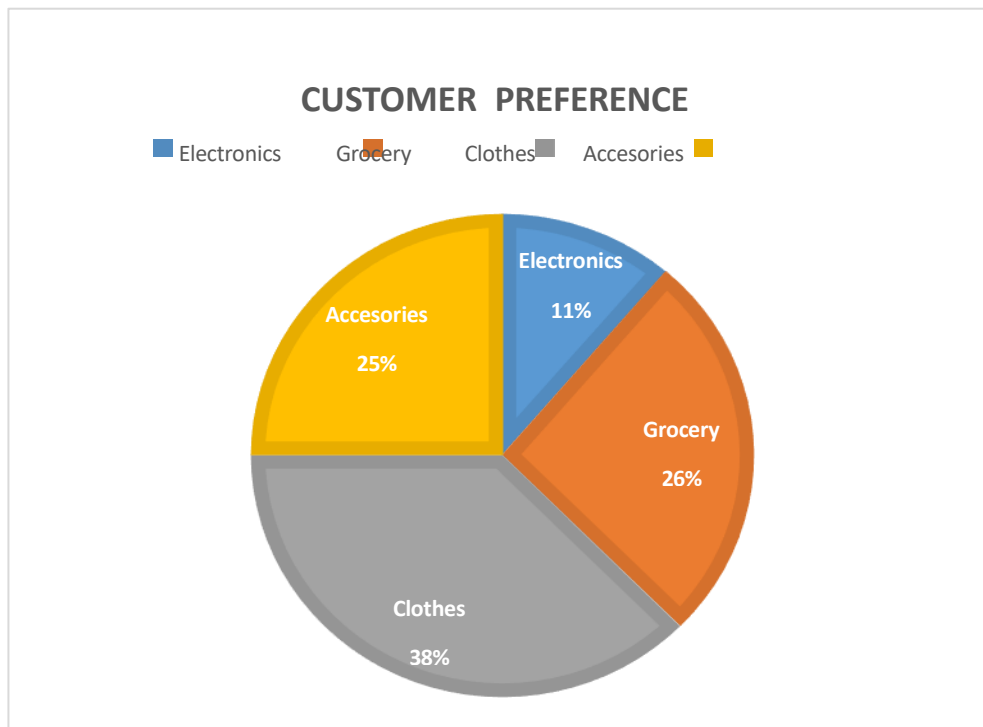
84% of the customers agree that people buy more online products after the pandemic as well as 16% don't agree, as they feel that traditional way of shopping would be preferred post pandemic.

3. Which website do you prefer for online shopping?



Most people prefer buying from Amazon as it serves a variety of range of products to different customers offers discounts and free home delivery on certain products, COD facilities etc. followed next by flip cart and so on.

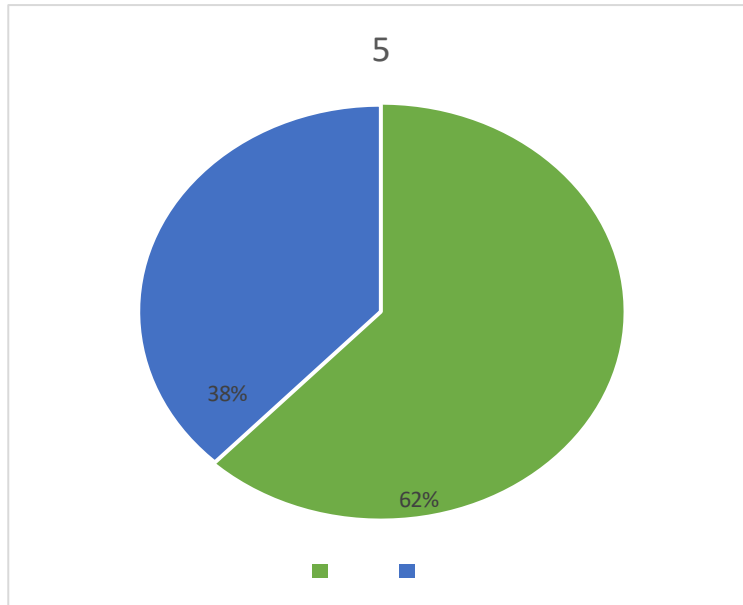
4. What product do you usually prefer buying online?



This data indicates that most people buy clothes i.e. 37 % while the least purchased is Electronics i.e. 11.25

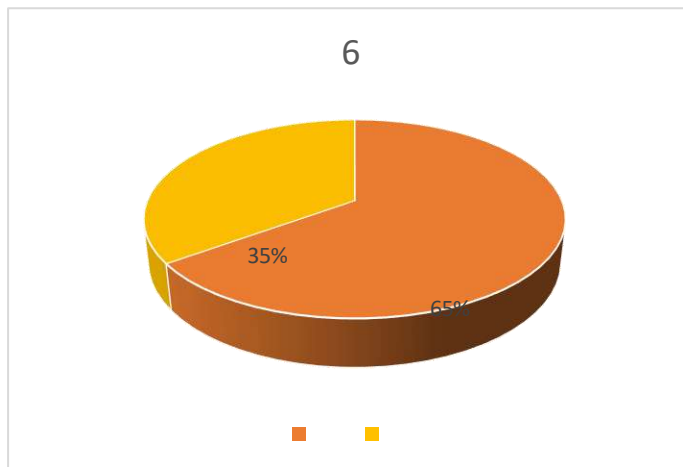
% as electronics are damaged or may be faulty therefore most customers do not prefer purchasing electronic products online. However groceries have shown rise post pandemic.

5. Is the E- Commerce website easy to navigate?



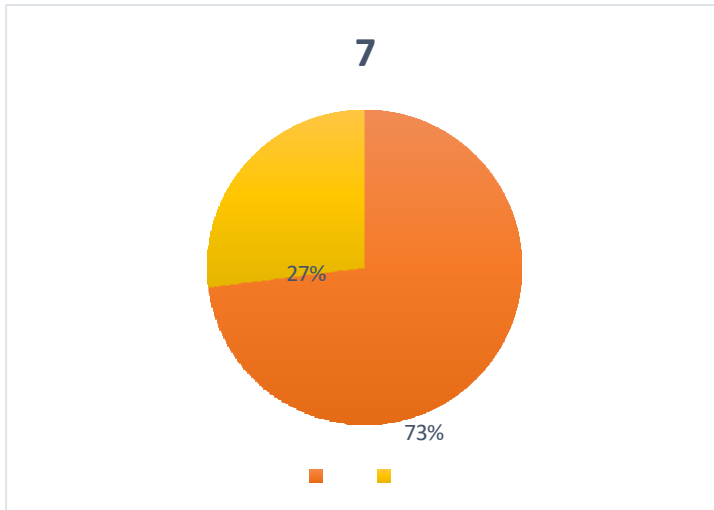
People mostly like online shopping due to the ease of navigation of the website, its not complicated as it is a step by step procedure. As per the research conducted , 62 % find the E-Commerce website easy to navigate as well as 38% don't find it that easy because at times of internet issues or they may face problems in online banking system at the time of payment etc.

6. Do you find enough range of products online?



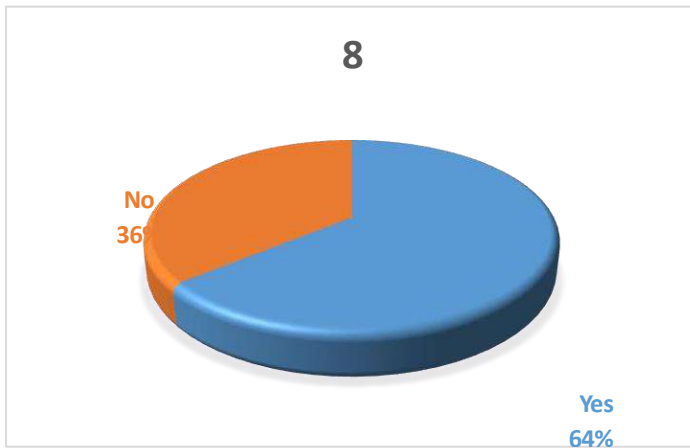
As per the data collected most people agree to the fact that there are variety of products available online which they can compare to the traditional mode of shopping , the online products give detailed descriptions , reviews , discounts on payments etc, this is one reason post pandemic people prefer to shop online.

7. Do you find enough product details on the website?



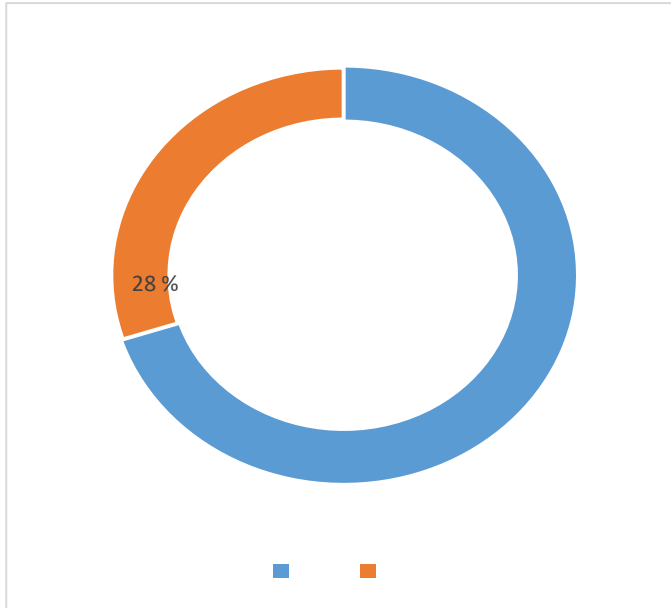
As per the data collected, 73% people agree to the fact that there is enough detail or description of the product which they may not be able to find in the offline or the traditional mode.

8. Do you find the e- shopping experience pleasurable?



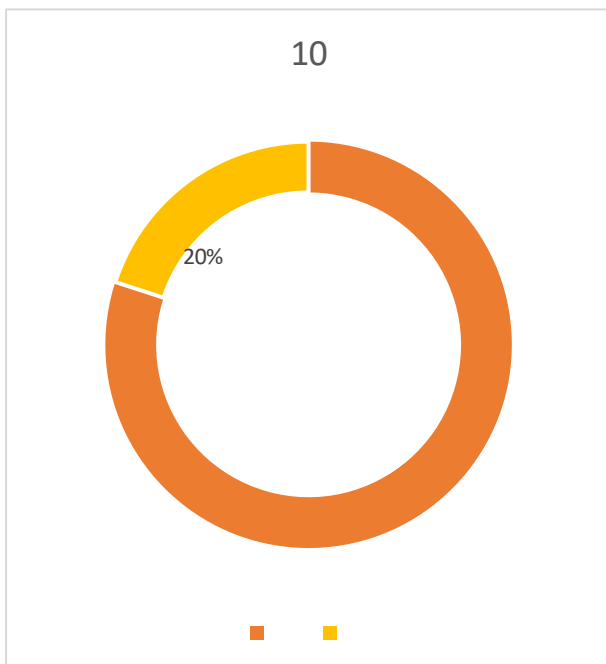
64% customers agree that online or e- shopping is fun, quick, saves time and efforts, the convenience of shopping at home, wide variety/range of products are available, good discounts / lower prices and thus they find all such experiences pleasurable.

9. Are you satisfied with online products?



60% customers say that were satisfied with the online products and found them reliable , even if the good were faulty they could easily exchange or return back, Where as 28% of customers seemed to be unsatisfied due to varied reasons.

10. Would you continue to buy products online?



As per the data most customers are satisfied using online product while only 16 % are not satisfied and would not buy online products due to faulty good etc. thus the other 84% continues accelerating the Ecommerce business post pandemic.

Findings

Younger population used more online shopping websites than the older population and females shopped more online than the males. Although e-commerce trading has increase in the grocery, clothing, recreational etc. Electronics is likely to suffer. As per the hypothesis it is clear that

The E-commerce business has accelerated in terms of profits post pandemic and there was a major impact post pandemic on consumer's behavior with respect to online shopping.

Recommendations

- To ensure that vulnerable consumers are protected from unfair business practices and unsafe products.
- To support the creation of innovative e-commerce business models, ensuring that regulatory frameworks remain flexible
- To foster e-commerce participation by the most vulnerable, for example by introducing community based delivery programs for elderly and reserved delivery slots.

Conclusion

- It can be concluded that there was shifting of preference of shopping from offline to online shopping.
- However, frequent-use categories, like groceries, household, personal care, clothing, etc. saw rapid growth and are likely to continue seeing accelerated growth post-pandemic. "These habit-forming categories, which have a high share of repeat purchases online,
- The consumers preferred online shopping even post pandemic as a result the E-commerce sectors continues to grow
- The consumers preferred online shopping as it was easy, convenient and comfortable to all specially with zero touch.
- Thus, COVID-19 has influence positively online buying habits of the consumers thus creating a huge opportunity for online shopping.
- To note, worldwide e-commerce was 17.9% of total retail sales in 2020, with estimates that it grew to 19.0% in 2021 and will grow to 20.3% in 2022.

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Navigating the Sustainability Crossroads: An Analysis of Energy, Waste, and Natural Resource Management in Uttar Pradesh

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Abstract: Uttar Pradesh, India's most populous state, is facing serious environmental challenges due to its growing energy consumption, waste management issues, and increasing strain on its natural resources. This research paper takes a closer look at these connected problems, evaluating the current state of sustainable energy practices, waste management techniques, and efforts to protect the state's natural environment. By examining reports, key data, and government policies, we highlight major environmental concerns in Uttar Pradesh, such as high levels of air and water pollution, overloaded waste management systems, deforestation, and the unsustainable use of groundwater. Additionally, we assess the effectiveness of the strategies and programs already in place by both the national and state governments, recognizing the progress made and the challenges that still remain. In the end, this paper suggests practical solutions and offers policy recommendations to promote cleaner energy, improve waste management, and encourage more responsible use and preservation of natural resources. In conclusion, this study emphasizes the urgent need for a comprehensive approach that includes technological innovation, community involvement, and targeted investments to help Uttar Pradesh move towards a more sustainable and environmentally-friendly future.

Keywords: *Uttar Pradesh, waste management techniques, environmental concerns, targeted investments, water pollution*

I. Introduction: Establishing Our Sustainability Region in Uttar Pradesh

Uttar Pradesh is the most populous state in India and plays a major role in the national economy. It has a strong agriculture base and growing industries, which means that significant populations exert considerable pressure on natural resources. Furthermore, energy consumption and waste production also rise with wealth creation. The state is located in the fertile Indo-Gangetic Plain, making the surrounding environment important to both the state and surrounding areas. This challenge is to grow in a sustainable manner. For Uttar Pradesh to demonstrate sustainable resource use, we need to connect energy generation, waste generation, and natural resource management. The transition from fossil fuels to renewable energy sources like solar and wind will help to avoid emissions and resource depletion. This is important for addressing climate change and for sustainable resource use in the future. Waste management is also very important to ensure the continued use of land for food and for the avoidance of water pollution. When waste is successfully dealt with the ecosystems automatically become protected and improved. Natural resource management is equally critical. The large solar hubs take up land and the biomass energy require sustainable agriculture and forest management. Ecosystems, healthy and intact, can retain a fundamental role in managing water flow and climate control, improving both energy production and waste management. These interrelationships emphasize that these sustainability practices must occur together and that improvements in one area can help another, and that neglect of one area can lead to significant impacts to the other's ability to function sustainably. This paper will more thoroughly explore the most pressing environmental issues in Uttar Pradesh - specifically energy, waste, and natural resources. It will explore existing practices currently addressing these problems and their effectiveness.

II. Understanding the Environmental Problems in Uttar Pradesh:

Air Pollution: Air pollution poses a grave environmental threat to India and has heavily impacted Uttar Pradesh. These cities include Lucknow, Kanpur, and Varanasi, which have consistently monitored high levels of particulate matter (PM), keeping the air unhealthy. The following are the causes of pollution:

Crop Burning: During specific seasons, farmers burn crop residues in fields, adding smoke and harmful particles to the air.

Fuelwood and Biomass Burn: Most rural and urban households depend on fuelwood and dried livestock waste for cooking and heating, thereby increasing indoor and outdoor pollution.

Air pollution, according to the Uttar Pradesh Climate Change Centre, is more than two to three times the permissible levels in different urban areas. Industrial pollution also plays a role, with emissions rated between 0.007 - 1.48 kilograms per capita, per year. This causes pollution to be detrimental to public health and respiratory diseases, especially in vulnerable populations: children and the elderly. Urbanization, industrial growth, and outdated energy practices have combined to render Kerala's air pollution problem a grave one demanding urgent pollution strategies.

Water Pollution: Water pollution is just as grave a concern in Uttar Pradesh as air pollution. Prime most causes are the discharge of untreated sewage into rivers or aboveground water. Many sewage treatment plants within the State are either dysfunctional or lack adequate support, therefore unable to provide effective treatment for wastewater.

The Ganges River-an important cultural-religious symbol-is undergoing intense pollution because of sewage-not treated-from more than 100 towns, most of which are in Uttar Pradesh. The manifest consequences of poor-quality water and sanitation included 6.4 million Disability-Adjusted Life Years (DALYs) in 2020 according to the Uttar Pradesh Climate Change Centre.

It was evidenced through tests that concerning results turned up in several districts:

11 districts exceeded the safe limit for fluoride. Eight of the districts found out to be having nitrate levels higher than the permissible limit. Unsafe iron levels also existed in 11 districts.

To combat the problems related to air pollution and water pollution in Uttar Pradesh, there must be improved waste managements, better infrastructures, and effective strategies for controlling pollution for the benefit of the so-called public health and environment safety.

Water pollution is a serious problem in Uttar Pradesh, affecting about 38.5% of the population. Cities like Lucknow, Kanpur, Agra, Varanasi, Mathura, Aligarh, and Ghaziabad are facing a rapid decline in groundwater quality and availability. A 2008 study found that groundwater in many districts contained arsenic levels above the safe limit of 0.05 mg/L. Rivers in the state are also heavily polluted due to untreated sewage, industrial waste, and agricultural runoff containing pesticides and fertilizers. This has harmed drinking water quality, aquatic life, and public health, increasing cases of waterborne diseases.

Reports show that 70% of freshwater in Uttar Pradesh is contaminated, contributing to nearly 200,000 deaths each year due to unsafe water. Excessive water use, along with chemicals used in farming, is further polluting soil and groundwater. Poor infrastructure, weak waste management, and industrial pollution have worsened the problem. Similar water pollution issues are also seen in Nigeria, causing unsafe water and serious health risks.

Urban areas in Uttar Pradesh generate about 20,820 tonnes of solid waste daily, and this number is expected to double in the future. If not managed properly, this increase could cause serious health and environmental problems.

The state also produces large amounts of hazardous and biomedical waste. Solid waste management in Uttar Pradesh is poor, leading to several issues. In Aligarh, for example, about 90% of municipal solid waste (MSW) is dumped in open areas or landfills. The municipal corporation and private collectors manage to collect only about 70% of the waste, leaving a significant amount uncollected. Since Aligarh lacks a sanitary landfill, nearly 80% of collected waste ends up in open dumps, harming the environment and public health.

This issue is common in many UP cities due to poor waste segregation, weak collection systems, limited funding, and a lack of proper treatment and disposal facilities. As a result, organic waste, a major part of MSW, often ends up in open dumps. This waste decomposes, releasing harmful gases like methane. Rainwater passing through waste piles creates toxic leachate, which pollutes surface and groundwater, adding to environmental risks.

Trash dumps in Uttar Pradesh are a big problem as they attract rats and insects, which spread diseases and pose a risk to nearby communities. The huge amount of solid waste produced in the state, along with limited waste management capacity, has worsened the condition of dump sites.

Forests and tree cover in Uttar Pradesh are quite low, covering only 8.8% of the total land area. According to a government report, forest cover is just 3.56% and tree cover is 5.34%. This is concerning because the state is home to about 5,352 plant species, including endangered ones like the Gangetic River Dolphin.

Several factors are causing deforestation and loss of biodiversity, such as population growth, development projects, illegal occupation of forest land, poaching, and using wood for fuel. Losing forests is more harmful than just losing timber. Forests help maintain ecological balance, control water flow, reduce soil erosion, and absorb carbon dioxide, which helps fight climate change. Cutting down trees not only reduces timber but also harms plant and animal life, putting many species at risk. Uttar Pradesh's water resources are facing serious pressure. Although water availability is considered moderate, there are big differences in access to clean drinking water across the state.

Excessive use of groundwater, especially for farming, poor water management, and a growing population have made the situation worse. Reports show that about 70% of the state's freshwater is polluted. Groundwater, which makes up 40% of the total water supply, is being used at an unsustainable rate.

Out of 75 districts in Uttar Pradesh, 34 are facing severe groundwater depletion. This is mainly due to the unregulated use of water for crops like sugarcane and household wastage. As groundwater levels drop, water shortages for farming, drinking, and the environment are becoming more common.

III. Sustainable Energy Management: Technologies, Policies, and Progress

Uttar Pradesh has great potential for renewable energy, which can reduce dependence on traditional fossil fuels. Since the state receives sunlight throughout the year, solar energy is the

most promising option. The state's solar radiation levels range from 4.5 to 5.5 KWH/sqm/day, making it ideal for solar power systems like photovoltaic (PV) panels and concentrated solar power (CSP) technologies to generate electricity.

While Uttar Pradesh's wind energy potential is not as strong as some other states, areas like Bundelkhand and parts of western UP have enough wind speeds to support small wind energy projects or combined solar-wind hybrid systems.

As an agricultural state, UP produces large amounts of crop waste such as rice husk, sugarcane bagasse, and wheat straw. These can be converted into bioenergy using methods like biomass gasification and anaerobic digestion, providing a useful source of electricity and biofuel.

The state also has some hydropower potential with large dams like the Obra hydroelectric plant, Rihand dam hydroelectric project, and Matatila dam power station contributing to energy production.

Uttar Pradesh provides a huge opportunity to transform into a state of sustainable energy through its solar and biomass resources, which exist abundantly within the state. The government is actively promoting green energy solutions and energy-efficient technologies to aid the transition.

It lay focus on large-scale solar grid-interactive projects, besides rooftop solar systems of smaller size. There is also rising enthusiasm for making excess biomass available from agricultural operations for energy production and the establishment of biomass power plants and biogas units, particularly in the farming zones.

While applications of wind energy are not as dominating in UP as they are in Solar, hybrids using wind and Solar are currently being explored.

Renewable energy has not picked up as expected so far. One of the major issues with renewable energy systems is that they have a high initial cost, which makes them impractical for many large projects, while some users may not be able to afford them. It will also not be enough to upgrade the current power grid of the state to make it ready to accommodate renewable sources.

Finding suitable land for big power-generating solar and wind projects is yet another challenge faced by such projects. There are delays awaiting these works due to disputes over land allocation and opposition from local community people. Notwithstanding such hindrances, however, UP continues to aspire to expand its potential for renewable energy.

As wind and solar energy is not available at sometimes consistently, so it makes sure to develop effective energy storing systems. These systems can backup power to the local areas, and also relieve pressure on the mains grid. It also needs to invest in modernizing and expanding the electricity grid for supporting massive renewable energy projects in Uttar Pradesh.

Innovations and financial support can promote the lowering of renewable energy products' costs to consumers and businesses. Among the many policies, the Uttar Pradesh Solar Energy Policy 2022 will aim at increasing solar power production in the state, targeting 22 gigawatts (GW) solar power capacity to be achieved by 2026-27. This includes provision for developing large solar parks and campaigning for solar rooftops in residential, commercial, industrial, and government buildings.

Industries and large consumers are also encouraged toward setting up solar power systems for their own use for steady and reliable supply of power.

The government has also provided many such incentives for all those helping in installing solar energy, such benefits include:

- State subsidies.
- Exemption from electricity duty for a fixed period of time.
- Energy banking that allows a user to send surplus solar powers into the grid and earn credits.

The subsidy offered by the government on residential rooftop solar systems is ₹15,000 per kilowatt (kW), with a limit of ₹30,000 per consumer. This subsidization makes solar energy cheaper and encourages more people to turn to clean sources of energy.

The Uttar Pradesh Solar Energy Policy 2022 proposes too significantly to promote solar energy use while saving traditional electricity use in making Ayodhya a model solar city. This scheme essentially involves solar-powering government buildings, schools, and agricultural power feeders.

The Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) has been made responsible for implementing this solar energy policy. The plan is to bring in 14 GW of solar power through large-scale solar installations by the financial year 2028.

These policies demonstrate a strong commitment to enhancing solar power in the state, but they will succeed only through effective implementation and addressing barriers in the energy sector while working closely with major stakeholders.

Other policies and schemes at the national level are helping the development of renewable energy in Uttar Pradesh. In the race towards achieving India's target of 500 GW of non-fossil fuel-based energy capacity by the year 2030, the central government has put forward several renewable energy targets to promote cleaner energy utilization in the country.

India's national renewable energy targets provide clear guidance for states like Uttar Pradesh to develop their own energy policies. To promote renewable energy at the local level, the government has introduced various schemes.

One key initiative is the **PM-KUSUM scheme**, which encourages solar energy use in the farming sector. Under this scheme, farmers can install **solar-powered irrigation pumps**, reducing their reliance on diesel pumps and cutting down costs.

An important feature of the PM-KUSUM scheme is the plan to install **solar power plants on agricultural land**. Farmers can use these solar plants to meet their own energy needs and sell any extra power to the grid, earning additional income.

The Indian government also encourages **foreign direct investment (FDI)** in renewable energy projects. This helps provide financial support for clean energy development in states like Uttar Pradesh.

Various financial incentives and subsidies are available for developers and consumers in Uttar Pradesh to promote renewable energy projects. These national policies create a strong foundation for expanding clean energy in the state by setting clear targets and offering financial assistance.

Despite having ambitious plans and high potential for renewable energy, Uttar Pradesh has fallen behind some other states in achieving its goals. By **October 2021**, the state had achieved only **4.3 GW** of installed renewable energy capacity, which was just **30%** of its target of **14.1 GW** by **2022**.

Uttar Pradesh's progress in renewable energy has been slower compared to other high-energy-demand states like **Gujarat** and **Rajasthan**, which achieved much higher targets by 2022.

There are several reasons for this delay. One major issue is that Uttar Pradesh's **electricity distribution companies (discoms)** have cancelled renewable energy agreements in recent years. This has created uncertainty for investors and slowed project development.

Another challenge is that these discoms face heavy **technical and commercial losses (over 30%)**, which has weakened their financial condition and reduced their ability to invest in renewable energy.

By the end of 2022, Uttar Pradesh had only **163 MW** of rooftop solar capacity installed, which is much lower than the state's potential.

The state has also struggled to implement the **PM-KUSUM scheme** effectively. For example, in 2022-23, not a single project was completed out of the planned **225 MW** solar plants under **KUSUM Yojana-A**. Similarly, under **KUSUM-B**, only a small portion of the approved solar pumps were installed.

Efforts are ongoing to improve progress, with hopes to achieve better results by **July 2027**.

Table1. Renewable Energy Targets and Achievements in Uttar Pradesh (as per available data)

| Sector | Target (by 2026-27) | Current Installed Capacity (as of July 2024) | Key Incentives and Subsidies |
|--------------|--------------------------------------|--|---|
| Solar Energy | 22,000 MW | ~2,485 MW (as of Dec 2022) | State subsidy for rooftop (up to ₹30,000), Capital subsidy for utility-scale with storage |
| Wind Energy | Not specifically stated in detail | Included in 8,816.1 MW total renewable (including large hydro) | Incentives for small wind turbines being considered |
| Bioenergy | CBG: 1,000 TPD; Bio coal: 4,000 TPD; | 2,237.39 MW (biopower) | Financial support for CBG (up to ₹20 crore), subsidies for equipment |

| | | | |
|--|-------------------------------------|--|--|
| | Bioethanol/Biodiesel: 2,000 KLPD | | |
|--|-------------------------------------|--|--|

IV. Waste Management in Uttar Pradesh: Current Practices, Policies, and Innovative Solutions

Table2. Estimated Waste Generation in Major Cities of Uttar Pradesh

| City | Population (Approx.) | Waste Generation (Tonnes/Day) |
|-----------------------|----------------------|-------------------------------|
| Lucknow | 3.6 million | 1,800 – 2,000 |
| Kanpur | 3.0 million | 1,500 – 1,700 |
| Varanasi | 1.6 million | 800 – 900 |
| Agra | 1.7 million | 850 – 950 |
| Meerut | 1.5 million | 750 – 850 |
| Prayagraj (Allahabad) | 1.5 million | 750 – 850 |
| Ghaziabad | 2.0 million | 1,000 – 1,200 |
| Gorakhpur | 0.7 million | 350 – 450 |
| Bareilly | 1.0 million | 500 – 600 |
| Jhansi | 0.6 million | 300 – 400 |
| Moradabad | 0.9 million | 450 – 550 |
| Aligarh | 0.8 million | 400– 500 |

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Key Observations:

- Larger cities like **Lucknow** and **Kanpur** have the highest waste generation due to their dense populations and urban activities.
- Cities with moderate populations, like **Bareilly** and **Gorakhpur**, generate comparatively less waste.
- Waste generation trends may vary based on industrial activities, commercial zones, and population density.
- As of the financial year 2022, India generated approximately 170,300 metric tons of municipal solid waste (MSW) daily.

Table3. The state-wise breakdown of MSW generation

| State | MSW Generation (Metric Tons per Day) |
|----------------|--------------------------------------|
| Maharashtra | 22,570 |
| Uttar Pradesh | 19,150 |
| Tamil Nadu | 14,532 |
| West Bengal | 12,524 |
| Karnataka | 11,958 |
| Gujarat | 11,609 |
| Madhya Pradesh | 10,566 |
| Rajasthan | 9,220 |
| Andhra Pradesh | 8,931 |
| Telangana | 8,275 |

Note: Data reflects figures up to the financial year 2022.

- In this context, **Uttar Pradesh ranks second nationally** in terms of daily MSW generation, producing approximately 19,150 metric tons daily. This substantial waste generation is attributed to its large and growing population, rapid urbanization, and expanding industrial activities.
- Effective waste management in Uttar Pradesh is crucial to mitigate environmental and health challenges. Implementing comprehensive strategies, including waste segregation at source, recycling initiatives, and the development of waste-to-energy projects, is essential to address the increasing waste generation in the state.

India has implemented several initiatives to manage municipal solid waste (MSW) and harness its potential for energy generation.

National Initiatives:

- **Swachh Bharat Mission (SBM):** Launched on October 2, 2014, this flagship program aims to promote cleanliness and effective waste management across urban and rural areas.
- **Waste to Energy Programme:** The Ministry of New and Renewable Energy (MNRE) supports projects that generate biogas, Bio CNG, power, or syngas from urban, industrial, and agricultural wastes. The estimated energy generation potential from urban and industrial organic waste in India is approximately 5,690 MW.

Energy Generation from MSW: As of 2023, India's renewable municipal waste energy capacity reached approximately 291 megawatts, up from 260 megawatts in 2022.

Uttar Pradesh Initiatives: Uttar Pradesh has formulated its State Solid Waste Management Policy to address MSW challenges. The policy emphasizes waste reduction, reuse at the source, segregation, and the development of treatment and disposal facilities.

MSW Generation and Treatment in Uttar Pradesh: The state generates approximately 17,377 metric tons of MSW daily. Of this, 17,329 metric tons are collected daily, with 12 operational treatment and disposal facilities having a cumulative capacity of 4,615 metric tons per day.

Energy Generation Potential in Uttar Pradesh: The calorific value of MSW in India ranges between 600 and 800 kcal/kg, indicating potential for energy recovery.

The World Air Quality Report, 2024 edition, authored by IQAir, finds India to be the fifth-polluted country worldwide. According to this report, 13 cities out of the world's top 20 most polluted cities are in India, with six of these cities in Uttar Pradesh. Indian Cities in the Top 20 Most Polluted Globally:

| City | State | City | State |
|---------------|---------------|---------------|---------------|
| Byrnihat | Assam | New Delhi | Delhi |
| Delhi | Delhi | Gurugram | Haryana |
| Mullanpur | Punjab | Ganganagar | Rajasthan |
| Faridabad | Haryana | Greater Noida | Uttar Pradesh |
| Loni | Uttar Pradesh | Bhiwadi | Rajasthan |
| Muzaffarnagar | Uttar Pradesh | Hanumangarh | Rajasthan |
| Noida | Uttar Pradesh | - | - |

Note: The above is a list of Indian cities only among the top 20 most polluted in the world.

Representations from Uttar Pradesh:

Uttar Pradesh is well represented, as given below, with these cities being among the top 20 most polluted in the world:

(Loni, Greater Noida, Muzaffarnagar, Noida). This shows that four cities from Uttar Pradesh are being placed in the 20 most polluted cities in the world. Comparison with Other States: On comparing the cities included in the top 20 polluted cities in the world:

| | |
|--|--|
| Uttar Pradesh: 4 cities (Loni, Greater Noida, Muzaffarnagar, Noida) | Rajasthan: 3 cities (Ganganagar, Bhiwadi, Hanumangarh) |
| Haryana: 2 cities (Faridabad, Gurugram) | Delhi: 2 entries (Delhi, New Delhi) |
| Punjab: 1 city (Mullanpur) | Assam: 1 city (Byrnihat) |

This data tells us how badly the state of Uttar Pradesh has been troubled by air pollution in comparison to other ones in India. The listing of several cities from Uttar Pradesh in the globally

top 20 polluted list raises the need for immediate intervention for air quality improvement. The major reasons for pollution levels in these cities include industries, vehicular emissions, construction activities, and the open burning of agricultural residue both at the seasonal transition of kharif to rabi cycle and during the seasonal transition of rabi to kharif.

Managing **municipal solid waste (MSW)** in Uttar Pradesh is a challenging task with several issues at different stages. The **waste collection efficiency** in some urban areas like **Aligarh** is about **70%**, but there is a major problem with **source segregation** — the process of separating different types of waste at the point of disposal. Without proper segregation, it becomes difficult to treat and recycle waste effectively.

Since Uttar Pradesh has **few engineered sanitary landfills**, much of the collected waste is dumped in open or poorly managed sites. This is harmful to the environment and public health, especially since **organic waste** (which forms a large part of MSW) gets mixed with other types of waste in these dumps.

Although modern methods like **composting** and **waste-to-energy (WTE)** can reduce landfill waste and recover useful resources, these technologies are not widely used in the state.

Another issue is the lack of reliable data from **urban local bodies (ULBs)** on the amount and type of waste generated in different areas. Without this data, it becomes difficult to plan proper waste treatment facilities.

Some **organic waste treatment plants** also face operational problems due to **lack of funds**, **unskilled workers**, and **poorly segregated waste**, which affects the quality of compost produced, making it less valuable in the market.

Table 4. waste management capacity metric

| Metric | Value/Status |
|---|---------------------|
| Daily Waste Generation | ~20,000 tons |
| Daily Waste Processed | ~15,000 tons |
| Operational Material Recovery Facilities (MRFs) | 711 out of 933 |
| Door-to-Door Collection Coverage (Lucknow) | 57 out of 110 wards |
| Waste Segregation at Source (Lucknow) | Not happening |
| Number of Dumpsites in Uttar Pradesh | 609 |

Uttar Pradesh generates around **20,000 tonnes** of solid waste daily, but the state can only process about **15,000 tonnes**, leaving a significant gap in waste management capacity.

For achieving the 100 percent waste management goal, the Uttar Pradesh government has been considering the betterment of infrastructure as well as enhancing waste management practices.

To tackle hazardous and biomedical wastes, the state has specific regulations to minimize risks to public health and the environment. The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 detail how industries should manage, treat and dispose of hazardous waste. Industries doing so have to get authorized from the Uttar Pradesh Pollution Control Board (UP PCB) in order to conduct the work, following safety measures and avoiding degrading the environment.

Biomedical waste generated by healthcare facilities can be harmful because they might not be well-managed. In Uttar Pradesh, the annual production level among these is quite high. In 2003, the state created about 145,786 tons of hazardous waste. Currently, generation of biomedical waste is about 20.7 tons a day.

While waste management standards and treatment facilities have been established, many waste generators have not been fully compliant.

A facility in Kanpur Dehat under Uttar Pradesh Waste Management Pvt. Ltd. takes care of Hazardous and Biomedical waste treatment, storage, and disposal, which shows a certain advancement on this front.

Still, research studies suggest that most healthcare facilities in Uttar Pradesh are not strictly following the guidelines on biomedical waste management. There is an urgent necessity for improved awareness, training, and enforcement to ensure that these waste handling practices are adhered to.

Increasing plastic pollution in Uttar Pradesh has prompted the state government to implement the ****Plastic Waste Management Rules 2016**** and the associated guidelines. The major step involved banning the use, production, sale, and distribution of plastic bags less than 50 microns in thickness. Thin bags are environment unfriendly due to their flimsy structure and poor recyclability.

The government is promoting the segregation of plastic waste at the source by citizens and establishments instead of co-mingling it with other waste for the purpose of better recycling. Partnerships with NGOs and the private sector to develop recycling plants are being fostered to strengthen the existing sloppy recycling infrastructure.

Public awareness campaigns are ongoing about the adverse effects of plastic waste and to promote alternatives such as paper, glass, and metal. Though some action has been taken, implementation of the plastic bag ban must be stricter and recycling improved for truly relieving the problem of plastic pollution in the state.

Uttar Pradesh needs to innovate and adopt waste management techniques that will not only bring immediacy to the system but also make it more sustainable in the long run. Waste-to-energy technology (bio-methanation and incinerator) eliminates dumping of wastes and leads to energy generation.

Waste treatment in proximity to generation is always potent, particularly organic waste. Promotion of ****community composting**** and household composting is a strategy to divert organic waste from reaching landfills and, instead, bring fertilizers for use in farming and gardening.

The fundamental element is on consumption reduction, reusing materials, and recycling of resources; it is a circular economy. However, this can just come true if and only if the human beings, their businesses, and the policy makers realize that mentality and actions must change if welfare is to be achieved.

Technologically, the improvement of waste management would be increased. Collection of waste can better offer smart solutions by using sensors and data. Mobile apps can relay information through residents to authorities for possible action. Creating waste and treating it in specialized facilities called waste clinics would offer training, knowledge sharing, as well as enhancing waste sorting and data collection, thereby playing an equally crucial role. Regular measurements of waste processed and waste reduced are necessary to assess the success of these initiatives.

Uttar Pradesh produces a large amount of solid waste every day, but the state's ability to treat this waste is much lower. This creates a big gap between the waste produced and the waste treated.

In India, about **95%** of municipal solid waste is collected, but only **50%** of that collected waste is processed. Uttar Pradesh faces a similar challenge, where a large portion of collected waste still ends up in landfills without proper treatment.

The **Swachh Bharat Mission** has helped raise awareness and improve cleanliness efforts in Uttar Pradesh. However, to truly measure its impact, we need clear and updated data showing how much waste is being reduced, processed, or recycled.

Some initiatives in the state have shown positive results. For example, the company **Grow Billion Trees** reported a **30% reduction** in industrial waste sent to landfills in the areas they operate. In **Lucknow**, the government has highlighted efforts to convert waste into useful materials, like building parks and roads using processed waste.

To better understand the success of these efforts, we need detailed and up-to-date information on key points such as:

- The percentage of waste sorted at the source
- The efficiency of waste treatment facilities
- The amount of waste being recycled
- The reduction in landfill waste

Collecting and analysing this data will help identify what strategies are working, what needs improvement, and how to build stronger waste management plans for the future.

V. Conservation of Natural Resources: Strategies, Policies, and Effectiveness

This pertains to checking the conspicuous depletion of natural resources, especially water. Different water conservation practices are adopted in different parts of the state depending on its diverse geographical features, both traditional and modern.

In the past, traditional water conservation practices were common for regions such as Bundelkhand. There, people constructed talabs (reservoirs) and bandh (earthen embankments) to harvest rainwater during monsoons. The harvested waters would then be put to different uses

in exhaustion-irrigation, household needs, and groundwater recharge-in dry months. In addition, structures made of bandha across streams and small rivers helped store water for irrigation purposes. This method gained wide acceptance in Uttar Pradesh and Odisha.

New-age water conservation techniques have emerged in the recent past. For example:

- Check dams are built on streams to slow down the flow of water, thereby allowing for greater seepage of water into the ground and less runoff on the surface.
- The state has been promoting 'drip and sprinkler irrigation systems' for more efficient water conservation in agriculture, the state's single biggest water-consuming sector.

The Government of Uttar Pradesh has introduced schemes aimed at water-use efficiencies in agriculture, industries, and households. The schemes include the subsidization of water-saving irrigation devices and propagation of the message of the need for water conservation. Industries and urban water suppliers are being strongly urged to cut water wastage.

Uttar Pradesh has made significant efforts in **water conservation** and **forest protection**, earning the **second prize** in the **National Water Award** for its achievements.

The state provided **tap water** to many villages and built **thousands of check dams** and **ponds** to store water and recharge groundwater. In **Jhansi district**, improved **land and water management** practices led to better irrigation and increased farmers' incomes.

For **forest conservation**, Uttar Pradesh has introduced several policies and programs:

- The **2017 Uttar Pradesh Forest Policy** focuses on **reforestation**.
- The annual **Van Mahotsav** (Forest Festival) encourages schools, local communities, and NGOs to plant trees across the state.
- The state actively supports the **Green India Mission**, planting trees in **rural and urban areas**, along highways, near water bodies, and on wastelands.
- The **Joint Forest Management (JFM)** program involves local communities in protecting and managing forests, ensuring sustainable use of forest resources.

The **Uttar Pradesh Forest Corporation**, established in **1974**, plays a key role in forest conservation, development, and scientific use of forest produce.

While these efforts are commendable, it's important to **assess their impact** to ensure they effectively increase forest cover and protect biodiversity. Tracking progress is crucial to address ongoing threats like **deforestation**, **encroachment**, and other environmental pressures.

Soil conservation is one of the essential activities required to sustain agricultural productivity as well as prevent land degradation in Uttar Pradesh. A healthy soil can be achieved through sustainable farming practices.

Some of the most important methods of soil conservation include the followings:

- **Crop rotation:** Growing different plants in rotation helps naturally restore soil nutrients.
- **Contour Ploughing:** Ploughing along the slope causes an initial slowdown of the water flow for the formation of an area, thus avoiding soil erosion.

- **Organic Farming:** Using natural fertilizers to improve the soil fertility by spreading without chemical harmful effects.

Another important technique is agroforestry, which is the practice of growing trees and shrubs along with plants. The roots of the trees help in setting the soil, preventing erosion, and retaining moisture. Agroforestry helps farmers through provision of timber, fodder, and fruits in addition to improving their income while boosting biodiversity.

Some of the above structural measures also help in the control of soil erosion as follows:

- **Check dams:** Built across minor streams to reduce the speed of water flowing in it and trap soil.

- **Terracing Slopes:** are terraced into steps on hilly grounds, thus allowing retarding water runoff and allowing better planting.

These are some of the delivery systems through which the government of Uttar Pradesh supports such practices by offering technical guidance and financial help to farmers.

Such activities include afforestation (planting trees) and reforestation (replanting cleared spaces with new trees), whereby they also help reduce soil erosion by wind or water.

Thus, through the promotion and use of the above methods in Uttar Pradesh, the soil shall be bettered for health, increased agricultural productivity, and more reduced land degradation for the state.

The conservation of natural resources in **India** and **Uttar Pradesh** is guided by various policies at both the **national** and **state** levels. At the **national level**, the **National Forest Policy of 1988** emphasizes the protection, conservation, and sustainable use of forest resources, especially for the needs of local communities. It also highlights the importance of increasing forest cover through **afforestation** (planting new trees) and involving local communities in **joint forest management**.

The **Environmental Protection Act, 1986** provides a broad legal framework for safeguarding the environment and promoting natural resource conservation across India. At the **state level**, Uttar Pradesh has introduced its own policies that align with national goals while also addressing local environmental issues. For example:

- The **Uttar Pradesh Forest Policy** focuses on increasing forest cover, protecting biodiversity, and managing forest resources sustainably.
- Additional state laws focus on issues like **water conservation**, **soil management**, and protecting **wildlife** and **sensitive environments**.

While these policies provide a strong foundation for conserving natural resources, their success depends on **proper implementation** and **strict enforcement**. Achieving this requires coordination between different government departments and agencies. Involving **local communities** and other stakeholders is also essential to ensure the **long-term sustainability** of Uttar Pradesh's natural resources.

Conservation Efforts in Uttar Pradesh

Uttar Pradesh has made several efforts with regard to conservation, but not all challenges have been overcome. As national satellite data indicate increase of forest cover across India from 2019 to 2021, an assessment on how these programs impacted forest cover in Uttar Pradesh must also be conducted. Though they are water conservation programs, water scarcity is still rampant in many parts of the state, indicating more consideration on how to develop programs for better awareness on sustainable water use and charging better water recharge.

Another significant problem in Uttar Pradesh concerns soil degradation, which has to deal with either the extension of existing soil conservation programmes or the making them more effective. There is an upside to this. For example, better land and water management practices in Jhansi district increased water availability and farmers' increased incomes. Such approaches can also be replicated in other similar cases. Vision Plan 2030 of the state targets increasing forest cover to 20% of the total land area, and more importantly, conserving biodiversity.

All of these conservation programs need regular evaluation to ensure that they protect and sustain the valuable natural resources of Uttar Pradesh in the long run.

Table 5. Status of Major Rivers in Uttar Pradesh - Pollution Levels and Conservation Efforts (latest data)

| River | Identified Pollution Sources | Major Conservation Initiatives |
|--------|---|---|
| Ganga | Industrial waste, sewage, agricultural runoff | Namami Gange Programme, construction of STPs, afforestation |
| Yamuna | Industrial waste, sewage | Yamuna Action Plan, STP construction |
| Gomti | Urban waste, industries | Gomti Action Plan (GAP II) |

Table: Conservation of Natural Resource Programs in Uttar Pradesh

| Program Name | Key Objectives | Target Reached | Specific Region Launched |
|------------------------------|--|---|------------------------------|
| Ganga Action Plan | Clean the Ganges River and reduce industrial waste | Improved water quality, reduced pollution | Varanasi, Kanpur, Allahabad |
| Jal Shakti Abhiyan | Focus on water conservation and rainwater harvesting | Increased groundwater levels | Bundelkhand, Vindhya regions |
| Green Uttar Pradesh Campaign | Increase forest cover and promote afforestation | Planted millions of trees | Lucknow, Gorakhpur, Meerut |

| | | | |
|--|--|-------------------------------------|--|
| Soil Health Management Programme | Improve soil fertility and sustainable farming practices | Enhanced crop productivity | Western Uttar Pradesh |
| Eco-Restoration Project | Restore degraded ecosystems and promote biodiversity | Revived several natural habitats | Terai region, Pilibhit Tiger Reserve |

VI: Literature Review:

Environmental Challenges and Solutions in Uttar Pradesh

Research on Uttar Pradesh's environmental issues has provided important insights into its problems and possible solutions.

Key challenges identified include:

- **Air and water pollution**, mainly caused by **rapid urbanization, industrial growth, and poor waste management** systems.
- **Solid waste management problems**, such as low collection rates, lack of waste separation at the source, limited treatment capacity, and continued reliance on unsafe disposal methods like **open dumping**.
- **Degradation of natural resources**, including **deforestation, falling groundwater levels** due to overuse, **soil erosion**, and loss of nutrients caused by unsustainable farming practices.

Research has also suggested practical solutions:

- Investing in **better waste management infrastructure**.
- Promoting **waste segregation** at the household and community levels.
- Using **eco-friendly technologies** for waste treatment and disposal.

In the **energy sector**, studies highlight Uttar Pradesh's strong potential for **renewable energy**, especially **solar power**. Researchers recommend increasing the use of solar energy to reduce the state's dependence on **fossil fuels** like coal.

For **agriculture and water conservation**, experts suggest:

- Investing in **integrated water conservation** projects.
- Encouraging **sustainable farming practices** with fewer chemical fertilizers and pesticides.
- Promoting **agroforestry** to improve soil quality and reduce erosion.

These research-backed recommendations can help Uttar Pradesh tackle environmental issues and move towards sustainable development.

Notably, Uttar Pradesh is a good state to learn environmental issues from when the lessons learned from them are used to improve future solutions for environmental problems. By looking at the successes and failures of the past, one can come up with various strategies for a more sustainable future.

Success Stories:

- The Miyawaki forest project in Prayagraj has become a success story by improving air quality and converting a polluted industrial area into a green area through innovative methods of planting trees.
- In Jhansi, the renovation of a traditional water-harvesting tank with modern techniques of land and water management has registered massive increases in agricultural productivity and, consequently, farmers' incomes. These success stories provide very significant learning experiences that can be replicated elsewhere suffering from alike environmental problems.

Challenges and Failures:

- Renewable energy expansion programs in the state are unable to make it. Installations are falling short of the actual set target. This was due to major financial issues being faced by power distribution companies (discoms) in general.
- Again, solid waste management becomes a key issue as still most of the waste is left untreated which piles up in the landfills; this shows poor infrastructure and low public participation in the process.

Understanding why some initiatives succeed and others fail enables Uttar Pradesh to learn lessons useful in improving future environmental projects in the state. By learning from previous ones, better strategies will be designed to ensure that more robust, effective, and impacted solutions are realized in the state towards being greener and healthier.

VII. Proposed Solutions and Policy Recommendations for a Sustainable Uttar Pradesh

This will require multi-faceted strategies, integrating solid policy, technological innovation, community engagement, and strategic financial investments to effectively address the various issues with the environment in Uttar Pradesh and take it towards a sustainable future.

An Integrated Approach to Energy, Waste, and Natural Resource Management:

Connecting Energy, Water, and Food: These three resources are closely linked, so policies affecting one should consider the impact on the others. For example, promoting solar-powered irrigation can reduce the use of groundwater and fossil fuels at the same time.

Better Waste Management: A smart waste management system should focus first on reducing waste, then reusing and recycling materials. Additionally, converting waste into energy can help reduce landfill waste while producing cleaner energy.

Landscape-Based Planning: Managing resources across entire landscapes helps protect forests, preserve biodiversity, and promote sustainable farming practices. This approach supports both environmental health and the well-being of rural communities.

Table 1: Major Crops and Associated Agricultural Residues and Potential Applications

| Crop Name | Primary Residue Types | Potential Applications |
|--|---|--|
| Wheat | Wheat Straw | Animal feed, bedding, bioenergy, bioplastics, construction material |
| Sugarcane | Sugarcane Bagasse, Tops & Leaves, Press Mud | Bioenergy (biogas, biofuel), paper production, bioplastics, animal feed, soil amendment |
| Rice | Rice Straw, Rice Husk, Rice Bran | Bioenergy (biogas, biofuel), animal feed, soil amendment, construction material, silica extraction |
| Pulses | Stalks, Husks | Animal feed, soil amendment |
| Oilseeds | Stalks, Husks, Shells | Animal feed, bioenergy, soil amendment |
| Potatoes | Vines, Peelings | Animal feed, composting, bioenergy |
| Fruits (Mango, Guava) | Leaves, Branches, Peels | Composting, bioenergy |
| Vegetables (Cabbage, Potato, Cucumber) | Leaves, Stems, Peelings | Composting, animal feed, bioenergy |

Policy Recommendations for Greater Implementation and Enforcement:

Harsher measures against crime must be enforced: Strengthen the enforcement of existing environmental laws on air and water pollution, solid waste disposal, and protection of forests. This can be done through better monitoring, stiffer fines, and an improved coordination between government agencies.

Clear Climate Action Plans: Create assured goals and timelines for actions on climate change concerning the reduction of risks (mitigation) and adjustment to climate impacts (adaptation). These approaches should be consistent with national commitments and should sufficiently address local issues.

Use of technology and innovation towards sustainable practices for:

Investing in research and development to encourage the introduction of cleaner energy technologies, for instance, advanced solar PV, wind energy systems that are appropriate for the state's specific conditions, and more efficient biomass conversion technologies.

Digital technologies like remote sensing, GIS, and data analytics are to be put in place to improve monitoring environmental resources and improve waste tracking.

Development and deployment of smart grid technologies will be supported to facilitate a wider integration of renewable energy sources as well as a more efficient use of these in transmission and distribution.

Dissemination of Community Participation and Awareness:

Thus, awareness campaigns will educate the public about the importance of environmental sustainability, that is, responsible consumption, segregation of wastes at source, and conserving water.

Capacity-building of local communities in participatory forest management, participatory water resource management, and decentralized waste management would recognize local traditional knowledge of forest and water use while ensuring equitable benefit-sharing.

Environmental education should be integrated into the curriculum at all school levels in order to foster awareness about environmental stewardship in the younger generations.

Financial and Investment Strategies Toward a Greener Future

Establish special green financing schemes with financial incentives in the form of grants and exemptions from certain taxes so as to promote investments in such renewable energy projects, energy efficiency measures, and sustainable waste management infrastructure.

Consider the establishment of public-private partnerships (PPPs) in which private sector experts and funding could be leveraged toward the delivery of large-scale sustainable infrastructure projects.

Support businesses involved with circular economy activities, such as recycling, waste processing, and production of goods from recycled materials.

VIII. Conclusion: Towards Environmental Sustainability

Uttar Pradesh faces serious environmental challenges related to energy, waste management, and conservation. The state's large population and growing economy have increased pressure on its air, water, land, and forests. This has led to severe pollution, resource depletion, and land degradation.

Although Uttar Pradesh has taken steps towards sustainable practices and introduced relevant policies, these efforts have often fallen short of their ambitious targets due to challenges in implementation and enforcement.

To create a sustainable future, stakeholders at all levels must work together. Key steps include:

- **Shifting to Cleaner Energy:** Investing in renewable energy sources to reduce pollution.
- **Improving Waste Management:** Adopting better waste reduction, recycling, and disposal practices.
- **Focusing on Conservation:** Protecting natural resources through sustainable practices.

By using modern technology, improving policy enforcement, involving local communities, and allocating financial resources wisely, Uttar Pradesh can achieve a balance between economic growth and environmental protection.

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Digital Banking Adoption and Consumer Experience in Thane District: A Post-Pandemic Analysis

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Abstract: The rapid advancement of digitalization has transformed various industries, including banking. Digital banking represents a transition from traditional financial services to modern, internet-based banking solutions that enhance convenience, reduce environmental impact, and save time and resources for consumers. This study aims to analyze the effects of digital banking on customers and identify key factors driving its adoption in Thane district. A structured online survey was conducted with 127 respondents from the district to assess their experiences. The findings indicate that digital banking offers significant benefits, yet some customers still prefer in-person banking. However, continuous efforts are being made to bridge the gap between conventional and digital banking, paving the way for further transformation in the financial sector.

Keywords: Digitalization, Banking, Sustainability, Automation.

Introduction

The evolving financial landscape necessitates innovation to improve efficiency and convenience. The banking sector has responded by embracing digitalization, restructuring customer interactions to stay competitive. This shift is particularly evident in private sector banks, which have pioneered digital banking services. Although banks are adopting digital strategies at different paces, they are increasingly leveraging technology to simplify financial transactions and improve customer experiences.

Digital banking eliminates the need for physical visits to branches for routine transactions such as checking account balances or seeking investment advice. Services like mobile banking, internet banking, and ATMs have significantly enhanced accessibility, especially in remote areas. Additionally, the introduction of smart cards and e-wallets has facilitated seamless payments and transactions from the comfort of one's home. While public sector banks are now following this trend, security concerns remain a challenge for some users. Nevertheless, digital banking is expected to dominate the financial landscape, especially in retail banking, addressing customers' evolving needs through tailored solutions.

Conceptual Framework

1. Digitalized Banking: The transition from traditional in-person banking to online platforms that offer financial services remotely.
2. Electronic Banking: The use of electronic systems to conduct banking transactions 24/7, including fund transfers and account access.

Rationale of the Study

Banks play a crucial role beyond fund mobilization; they contribute to economic growth by promoting savings and offering financial services globally. Key factors such as globalization, advanced technology, increased smartphone penetration, and the rise of social networking have provided banks with opportunities for expansion. This study aims to assess the impact of digital banking on consumers and identify factors influencing its adoption.

Objectives

1. To analyze the impact of digital banking on customers in Thane district.
2. To examine the advantages of digital banking for users.

Review of Literature

Several studies have explored the security, evolution, and customer perception of digital banking in India. Research highlights the growing acceptance of digital banking due to its convenience, cost-effectiveness, and efficiency. However, concerns about security and user adaptation remain. Studies indicate that while digital banking improves banking operations and reduces costs, there is still a need to enhance customer awareness and address security issues.

Research Methodology

This qualitative study is based on primary and secondary data analysis. A non-probability sampling method was used, with data collected through a structured online questionnaire from 127 respondents in Thane district. Secondary data sources include published research papers and journals.

Data Analysis and Interpretation

1. Consumer Demographics:

Of the 127 respondents, 101 (approximately 80%) were educated, while a small percentage (2%) were uneducated.

2. Advantages of Digital Banking:

Internet Banking Usage: 82% use internet banking; 18% still rely on traditional methods.

Physical Bank Visits: 74% still visit banks; 26% do not.

Mobile Banking Benefits: 86% find mobile banking advantageous, while 14% have security concerns.

Convenience of Digital Banking: 94% consider it convenient; 6% find it challenging.

3. Reasons for Adopting Digital Banking:

Eco-Friendliness: 83% acknowledge its environmental benefits.

Energy Conservation: 81% believe it conserves energy.

Carbon Footprint Reduction: 74% support digital banking for its sustainability.

Cost-Effectiveness: 87% find it economical.

Convenience: 93% value its ease of use.

Despite these advantages, a segment of consumers remains hesitant about transitioning to digital banking due to security concerns.

Conclusion

The shift from traditional to digital banking has significantly transformed financial services worldwide. Digital banking enhances convenience, reduces environmental impact, and fosters energy conservation. While many consumers have embraced digital banking, some remain skeptical due to security concerns. Addressing these concerns through awareness and security enhancements will be crucial for increasing adoption rates and ensuring a seamless transition to a fully digital banking ecosystem.

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Transforming Investment Decisions and Strategies through Behavioral Finance

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Abstract

In today's ever-evolving economic landscape, investing has become increasingly intricate, with individuals committing significant capital despite uncertain profitability. While traditional financial theories assume that investors act rationally to maximize returns, behavioral economists argue otherwise. Research indicates that markets, particularly in the short term, often exhibit inefficiencies, and investor decisions are frequently influenced by psychological biases rather than pure logic. These cognitive tendencies can disrupt wealth-building strategies, leading to suboptimal and sometimes irrational investment choices. This paper examines the principles and importance of behavioral finance, emphasizing its impact on investment decision-making. It also explores various trading approaches in the stock and bond markets, offering insights to help investors identify and mitigate psychological biases that may affect their financial strategies.

Keywords-Emotional biases, Excessive self-assurance, mental conflict, over-confidence

Introduction

Traditional investment theories suggest that investors always act rationally to maximize their returns. However, real-world evidence indicates that this is not always the case. When faced with uncertainty, investors often struggle to make objective decisions, leading to choices influenced by emotions rather than logic. While markets are assumed to be efficient, behavioral finance challenges this notion by highlighting the psychological factors that drive investment behavior and market fluctuations.

Research shows that many investors tend to react emotionally, buying stocks at high prices based on speculation and selling at lower prices out of fear. Studies also suggest that the psychological impact of financial losses is significantly greater than the satisfaction of gains. Factors such as fear, greed, and cognitive biases play a major role in shaping investment choices, often leading to irrational decisions that deviate from wealth-maximization strategies.

Stock prices frequently move without any fundamental economic changes, reflecting the impact of investor sentiment. Additionally, herd behavior plays a crucial role, as individuals tend to follow market trends rather than making independent, informed decisions. Although financial theories propose that markets operate efficiently, real-world patterns suggest otherwise. For example, when a well-known company announces a large investment in a new sector, its stock price may surge immediately, regardless of the project's actual profitability or long-term prospects. Such reactions demonstrate how investor psychology influences stock market movements beyond traditional economic factors.

Behavioral Finance

Behavioral finance is a field that integrates psychological and financial principles to explain why individuals often make decisions that deviate from rational economic theories. It has gained prominence in global financial markets by providing insights into investor behavior and decision-making patterns. This field explores how emotions, biases, and cognitive limitations influence investment choices, often leading individuals to act irrationally rather than logically.

Many investor

buy or sell stocks based on psychological impulses rather than thorough financial analysis. Scholars have defined behavioral finance in various ways. Olsen (1998) views it as a study aimed at predicting how psychological factors shape financial markets. Belsky and Gilovich (1999) describe it as a combination of psychology and economics that explains why people make financial decisions, including saving, investing, and borrowing. Shefrin (2001) highlights its focus on the psychological factors affecting financial choices and market trends. Verma (2004) suggests that investors often let emotions override fundamental analysis when making investment decisions. Swell (2005, 2007) argues that financial markets are influenced by psychological behaviors, challenging the notion of market efficiency. Forbes (2009) emphasizes that cognitive biases significantly impact financial markets, showing that individuals do not always act rationally to maximize wealth. Overall, behavioral finance provides a deeper understanding of how human psychology affects market trends, offering explanations for irrational investment behaviors that contradict traditional financial theories.

Review of Literature

Behavioral finance has been extensively studied, with numerous empirical findings offering insights into how psychological biases influence financial decision-making. This section presents key research contributions that highlight the significance of behavioral finance in understanding investor behavior. Tversky and Kahneman, regarded as pioneers in this field, challenged traditional financial theories through their work. In 1979, they critiqued the Expected Utility Theory, revealing that individuals tend to perceive probable outcomes differently from certain ones. Their Prospect Theory proposed that people assess gains and losses separately rather than focusing on overall wealth, leading to inconsistent decision-making. The study further outlined a predictable pattern of risk behavior—investors often exhibit risk aversion when dealing with potential gains but become risk-seeking when faced with potential losses.

By 1981, Tversky and Kahneman introduced the Framing Effect, which demonstrated that the way information is presented can significantly alter financial choices. Even when presented with identical facts, individuals may make entirely different decisions based on how the information is structured. In 1985, De Bondt and Thaler explored the tendency of investors to overreact to market news in their study "Does the Stock Market Overreact?" published in the *Journal of Finance*. Their findings showed that emotional responses to unexpected news events often lead to market inefficiencies. They also introduced Mental Accounting, explaining how individuals compartmentalize financial decisions rather than evaluating them holistically, which can lead to irrational investment choices.

Jay R. Ritter (2003) contributed to this field by challenging the conventional assumption that investors always act rationally. In his research published in the *Pacific-Basin Finance Journal*, he emphasized two fundamental aspects of behavioral finance: cognitive psychology (how

investors think) and limits to arbitrage (factors preventing markets from self-correcting inefficiencies). His work also examined stock market bubbles in Japan, Taiwan, and the U.S., illustrating how irrational behavior drives market fluctuations. Simon Gervais (2009), in his study "Behavioral Finance: Capital Budgeting and Other Investment Decisions," explored the impact of overconfidence and optimism on corporate investment decisions. His research found that overconfident managers tend to overinvest, pursue unnecessary mergers, and persist with failing projects longer than they should. He suggested corrective measures such as incorporating learning mechanisms, adjusting discount rates, and implementing performance based incentives to mitigate biased decision-making, though their effectiveness remains debatable. These studies collectively reveal how investor psychology influences financial markets, often contradicting the rational behavior assumed in traditional finance theories. Behavioral finance provides a deeper understanding of market anomalies, emphasizing the role of emotions, biases, and cognitive errors in shaping investment decisions.

Anchoring

In decision-making, individuals often rely on initial reference points, even when those points are no longer relevant. This cognitive bias, known as anchoring, affects investors who may hesitate to adjust their expectations despite new market data. For instance, a company's stock price may remain stagnant even after strong earnings reports because investors are still influenced by past performance. Over time, as they gradually process the updated information, their investment decisions begin to align with the company's actual growth potential.

Presumption

Many investors overrate their knowledge and predictive abilities, leading them to underestimate risks and overestimate their decision-making skills. This overconfidence results in frequent trading, as investors believe they can consistently pick the best stocks and time the market effectively. However, studies suggest that excessive trading driven by overconfidence often leads to lower returns compared to more calculated, patient investment strategies.

Collective mindset

Herd behavior occurs when individuals follow the crowd's actions rather than making independent, rational choices. This tendency is often fueled by social influence and the assumption that a majority decision must be correct. In financial markets, herd mentality can drive stock price fluctuations, as seen in the late 1990s tech boom when investors poured money into internet companies without considering their financial viability, ultimately leading to market crashes.

Market Overreaction and Underreaction

Investor sentiment tends to swing between excessive optimism and unnecessary pessimism, leading to disproportionate market reactions. When positive news emerges, markets often rally beyond reasonable expectations, while negative developments can trigger panic-driven sell-offs. These emotional responses create inefficiencies, distorting stock prices and contributing to market volatility.

Loss sensitivity

Loss aversion or sensitivity, a psychological bias identified by Daniel Kahneman, suggests that the pain of losing money is significantly stronger than the pleasure of gaining an equivalent amount. This causes investors to take greater risks to avoid losses while being overly cautious when securing gains. As a result, they may hold onto underperforming assets for too long in hopes of recovery or sell profitable stocks too soon to lock in small gains, potentially missing out on larger long-term rewards.

Behavioral Finance and Investment Decisions

Behavioral finance explores how emotions and psychological biases influence investment decisions. It delves into why investors, despite their rationality, often make irrational financial choices driven by emotions. Essentially, it examines the reasons behind impulsive investment behaviors that might not always be financially sound.

Investment decision-making involves selecting the best option from multiple alternatives through thorough evaluation. However, investors differ in their approaches due to various factors such as demographics, socioeconomic backgrounds, education, and personal experiences. Despite the assumption that investors always seek to maximize financial gains, human emotions often interfere with purely rational decision-making. Many investment choices are influenced by psychological factors rather than logical analysis.

Psychological Biases in Investing

In the financial world, investors sometimes make decisions based on irrelevant data or past trends. For example, some may buy stocks after a significant price drop, assuming it is a short-term fluctuation and a buying opportunity. However, price declines may also indicate underlying issues within the company. This tendency highlights cognitive biases that impact investment choices.

Cognitive Dissonance refers to the mental discomfort experienced when holding conflicting beliefs or making decisions that contradict past opinions. According to Festinger's cognitive dissonance theory, individuals attempt to resolve this inner conflict in two ways: either by altering their past beliefs or by rationalizing their decisions. In investing, this manifests when traders justify decisions that contradict their usual investment strategies, such as shifting from fundamental analysis to momentum-based investing simply to align with market trends.

Regret Theory suggests that individuals evaluate decisions based on anticipated emotional reactions. Investors may hesitate to sell underperforming stocks to avoid admitting a bad investment choice. Additionally, they may prefer to follow popular trends, believing that a collective loss feels less personal than an individual mistake. This fear of regret influences risk tolerance, making some investors overly cautious while encouraging others to take excessive risks.

Prospect Theory explains that individuals do not always behave rationally, particularly under uncertain conditions. Investors may overestimate the likelihood of rare events while underestimating the probability of more common ones. This can lead to riskier choices when facing potential losses, as people are generally more motivated to avoid losses than to secure equivalent gains.

Do you rely more on emotions or financial analysis when making investment decisions?

74 responses

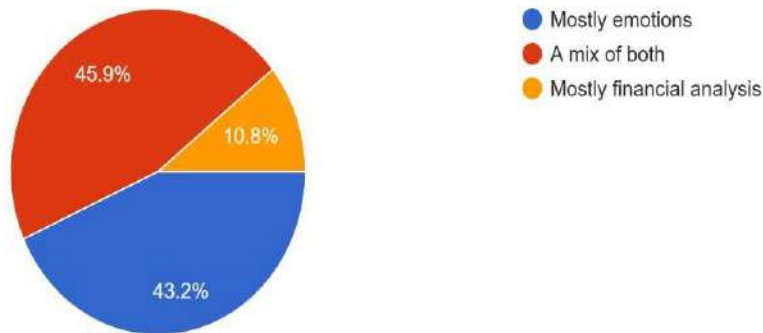


Figure 1

The first question examines whether investors rely more on emotions or financial analysis when making investment decisions. The responses indicate that 43.2% of investors are primarily influenced by emotions, while 45.9% use a combination of both emotions and analysis. Only 10.8% rely strictly on financial analysis. These findings highlight the significant role of psychological factors in investment decision-making. Behavioral finance suggests that emotions such as fear, excitement, and regret can override rational thought processes, leading to decisions that may not always align with long-term financial goals. This emotional influence often results in market inefficiencies and unpredictable investment behaviors.

Have you ever held onto a losing investment longer than planned due to the hope of recovery?

74 responses

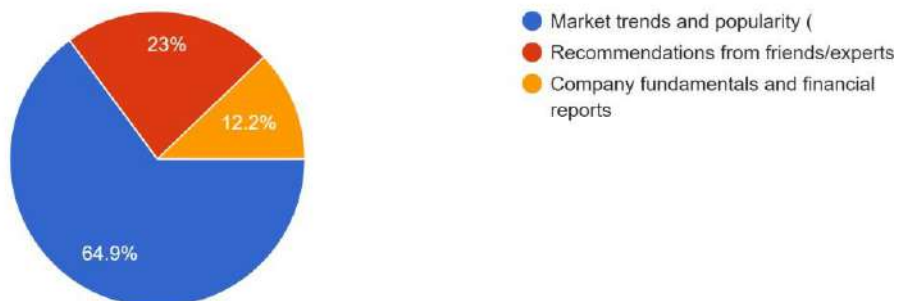


Figure 2

The second question investigates the impact of loss aversion on investor behavior. The data reveals that 64.9% of respondents frequently hold onto losing investments in the hope of recovery, while 23% sometimes exhibit the same behavior. Only 12.2% make objective, analysis-based decisions. This aligns with prospect theory, which states that investors feel the pain of losses more intensely than the pleasure of gains, causing them to hold onto underperforming assets longer than they should. This reluctance to cut losses stems from emotional discomfort and the desire to avoid regret, often leading to poor investment performance over time.

How do you react when the stock market experiences a major decline?

72 responses

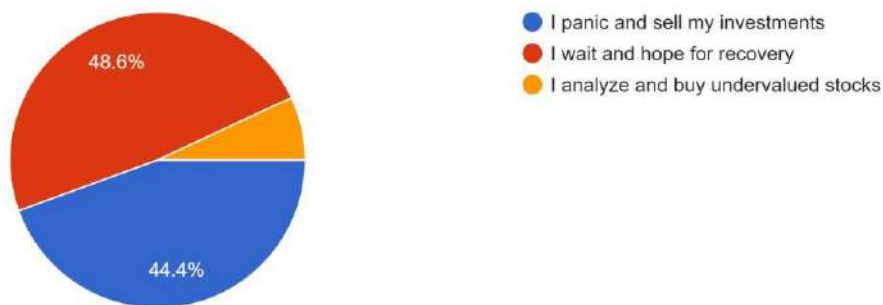


Figure 3

The third question assesses investor reactions during market downturns. The results show that 44.4% of respondents panic and sell their investments, while 48.6% prefer to wait and hope for recovery. Meanwhile, only 6.9% take a more analytical approach by purchasing undervalued stocks during declines. These findings support behavioral finance theories, demonstrating that fear and uncertainty drive many investment decisions. The tendency to react emotionally to market downturns rather than strategically can result in missed opportunities and financial losses. This behavior illustrates how investor sentiment can exacerbate market fluctuations and create inefficiencies in financial markets.

Would you prefer a high-risk, high-return investment or a low-risk, stable-return investment?

74 responses

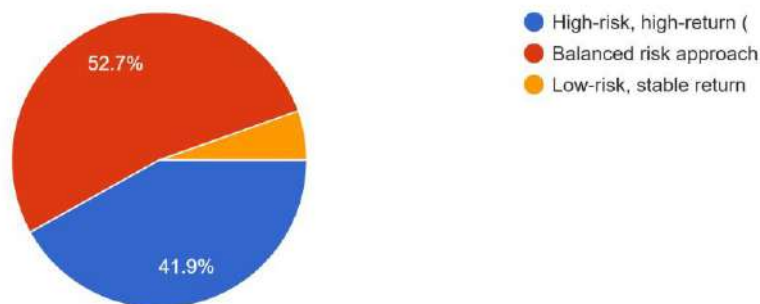


Figure 4

The final question addresses investors' risk preferences and their approach to uncertainty. The responses indicate that 41.9% prefer high-risk, high-return investments, while 52.7% take a balanced risk approach, and only 5.4% opt for low-risk, stable returns. These findings align with prospect theory, which suggests that investors tend to be more risk-averse when facing potential losses but may take higher risks when seeking gains. The preference for balanced and low-risk investments suggests that many investors prioritize stability and security over potentially higher returns, further demonstrating the influence of psychological biases on investment decisions.

Mastering Rational Decision-Making: Overcoming Biases

With behavioral finance playing a crucial role in investment decisions, recognizing psychological biases can help investors refine their strategies and minimize costly mistakes. By acknowledging cognitive biases, investors can develop more disciplined approaches to decision-making.

Stock Investment Strategies

To mitigate mental errors, investors should adopt a structured investment strategy and maintain detailed records of their stock portfolio. Before buying, selling, or holding a stock, they should consider:

1. The reason for purchasing the stock.
2. The investment time horizon.
3. Expected returns.
4. Performance evaluation after a given period.
5. Risk assessment within the overall portfolio.

Mutual Fund Investment Strategies

A simplified approach to selecting mutual funds can enhance decision-making:

1. Opt for no-load mutual funds with low operational costs.
2. Choose funds with a strong performance record over 5–10 years.
3. Invest with experienced portfolio managers who follow a clear investment philosophy.
4. Understand the specific risks associated with each mutual fund.

Successful investing requires self-awareness and a well-defined strategy. Recognizing behavioral biases and avoiding common mistakes can lead to more informed financial decisions, ultimately improving long-term investment outcomes.

Conclusion

Behavioral finance provides a deeper understanding of why investors often make irrational financial decisions. It highlights the impact of psychological biases such as anchoring, overconfidence, herd behavior, overreaction, underreaction, and loss aversion on investment choices. By analyzing these behavioral patterns, investors can recognize their cognitive biases and adopt more rational decision-making approaches. For investment professionals, integrating behavioral finance insights into strategy development can enhance portfolio management and improve overall financial outcomes.

Future Opportunities

The future of behavioral finance presents significant opportunities, particularly with the integration of technology and data analytics. Artificial intelligence and machine learning can be leveraged to analyze investor behavior and predict market trends, allowing for more personalized investment strategies. Additionally, the expansion of fintech, robo-advisory services, and algorithmic trading provides new avenues for applying behavioral finance principles to optimize investment decisions. Behavioral insights can also contribute to policy-making, risk management, and financial education, ensuring that investors make well-informed choices. As financial markets evolve, behavioral finance will continue to shape investment strategies and drive innovation in the financial sector.

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Evolving Landscape of IT Automation in Marketing, Operations, and Market Analysis

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Abstract: This research paper explores the dynamic relationship between Information Technology (IT) automation, marketing, and operations. The integration of IT automation has reshaped how businesses approach marketing and operational processes. By examining the role of IT automation in technological innovations, enhanced data analytics and personalization, data-driven decision-making, cybersecurity, and data privacy, customer satisfaction, automation in marketing, automation in operations, and future implications, this paper provides insights into the transformative potential of IT automation. The conclusion discusses the impact of IT automation on modern business practices and its future trajectory.

Index Terms: IT automation, marketing, operations, technological innovations, data analytics, personalization, data-driven decision-making, cybersecurity, data privacy, customer satisfaction, automation in marketing, automation in operations, future implications.

INTRODUCTION

The increasing integration of IT automation within business operations is ushering in a new era of marketing and operational processes. This research paper delves into the evolving relationship between IT automation, marketing, and operations, examining how businesses are leveraging automation technologies to optimize processes, enhance customer experiences, and gain a competitive edge. By dissecting various aspects, including technological innovations, enhanced data analytics, data-driven decision-making, cybersecurity and data privacy, customer satisfaction, automation in marketing, automation in operations, and future implications, this paper aims to offer insights into the transformative potential of IT automation in reshaping business practices related to marketing and operations.

In the ever-evolving landscape of marketing, IT automation has emerged as a pivotal force. Automation technologies, ranging from email marketing automation to artificial intelligence-powered chatbots, are significantly influencing the way businesses engage with their audiences. This research paper aims to dissect the interplay between IT automation and marketing, emphasizing the advantages and challenges that arise. By analyzing marketing automation, personalized marketing, data analytics, and the associated challenges, this paper offers a comprehensive overview of this symbiotic relationship.

Research and Findings

Technological Innovations and Future Implications:

Technological innovations are redefining the landscape of IT automation in marketing and operations. Advancements such as Artificial Intelligence (AI),

Robotic Process Automation (RPA), and the Internet of Things (IoT) have transformed how businesses engage with customers and optimize operations. AI-driven chatbots, for instance, provide instant customer support, while RPA automates repetitive tasks. IoT devices offer real-time data for more informed decision-making in marketing and operations.

The future implications of IT automation are promising. As businesses continue to embrace automation, marketing and operations are expected to become more tightly integrated, leveraging data analytics for more personalized customer experiences. Ethical concerns, such as data privacy, must also be addressed as IT automation continues to evolve.

Opportunities: The opportunities presented by IT automation in market analysis are abundant. It enables businesses to make faster, data-driven decisions, stay ahead of competitors, and adapt swiftly to changing market conditions. Automation also fosters a more comprehensive understanding of consumer behaviour, enabling personalized marketing strategies.

Challenges: The integration of IT automation in market analysis comes with challenges. Businesses must navigate issues related to data privacy, ethical considerations, and the potential for algorithmic biases. Additionally, the reliability of automated data sources must be carefully scrutinized to ensure data quality.

Enhanced Data Analytics and Personalization:

IT automation has enabled businesses to harness advanced data analytics to personalize customer interactions. Customer data analysis helps in creating personalized marketing campaigns and tailoring product recommendations. Enhanced data analytics provide valuable insights, allowing businesses to anticipate customer needs and tailor their operations to meet these expectations, ultimately increasing customer satisfaction. Automation technologies have transformed the data analysis process. Sophisticated algorithms can process and analyze large datasets more efficiently and accurately than manual methods. Machine learning and artificial intelligence tools can identify patterns, trends, and anomalies in data, offering deeper insights into market dynamics.

It facilitates predictive analytics by leveraging historical data to forecast future market trends. This capability aids businesses in making informed decisions and strategies based on data-driven predictions, enhancing their competitiveness and adaptability.

Data-Driven Decision-Making:

Data-driven decision-making is pivotal for organizations seeking to enhance marketing and operational processes. IT automation empowers organizations to collect, process, and analyze vast datasets. These insights guide marketing campaigns, product development, and supply chain management. Data-driven decisions not only optimize marketing and operations but also improve overall business efficiency.

Challenges:

Data Privacy and Security: With the collection of large volumes of customer data comes a responsibility to ensure data privacy and security. Businesses must navigate the intricacies of data privacy regulations and secure customer data to maintain trust and compliance.

Cybersecurity and Data Privacy:

The increasing reliance on IT automation also brings forth challenges related to cybersecurity and data privacy. With vast amounts of customer data being processed, organizations need to invest in robust cybersecurity measures and ensure data privacy compliance. Protecting customer information is critical in maintaining trust and meeting regulatory requirements.

Automation in marketing has revolutionized the way businesses engage with their audience, but it also brings a set of critical considerations regarding cybersecurity. As marketing

automation platforms handle and process vast amounts of customer data, they become attractive targets for cyber threats and potential breaches. Ensuring the security of these platforms is essential to protect the integrity of customer information and maintain trust. Organizations need to implement robust cybersecurity measures, including data encryption, access controls, and intrusion detection systems, to safeguard their marketing automation processes. By integrating cybersecurity protocols seamlessly into their marketing automation strategies, businesses can enjoy the benefits of automation while mitigating the risks associated with data security breaches.

Customer Satisfaction

Customer satisfaction is at the core of successful marketing and operations. IT automation allows organizations to provide round-the-clock customer support through chatbots, streamline the buying process with personalized recommendations, and enhance product delivery through real-time monitoring. These improvements in customer satisfaction can lead to stronger brand loyalty and increased revenue.

Marketing automation plays a pivotal role in elevating the overall customer experience while fostering customer loyalty. It is widely acknowledged that marketing automation can significantly enhance customer relationships by efficiently generating personalized responses and tailored information, making it an attractive prospect for businesses.

Automation in Marketing and Operations:

Marketing automation platforms have become instrumental in streamlining marketing operations. These platforms aid in scheduling and managing email campaigns, social media posting, and personalized content distribution. Automation in marketing ensures consistent customer engagement and timely communication.

Marketing automation places a strong emphasis on improving customer engagement and collaboration throughout the product development process. By actively involving customers and seeking their input, it enhances their overall experience. This, in turn, leads to more effective communication, with a particular focus on delivering personalized information, ultimately contributing to a more favourable perception of the brand in the eyes of consumers.

Furthermore, marketing automation is instrumental in augmenting the customer experience by offering recommendations for related products across the marketplace. This approach not only increases consumer awareness but also positively influences their perception of the brand, making it a powerful tool for enhancing the overall customer journey.

Automation is optimizing supply chain management, inventory control, and order fulfilment in operations. It ensures efficient resource allocation, reduces manual errors, and enhances operational efficiency, ultimately leading to cost savings and improved customer experiences.

Future Implications of IT Automation

The future implications of IT automation are promising. As businesses continue to embrace automation, marketing and operations are expected to become more tightly integrated, leveraging data analytics for more personalized customer experiences. Ethical concerns, such as data privacy, must also be addressed as IT automation continues to evolve.

Conclusion

The integration of IT automation is profoundly reshaping the landscape of marketing and operational processes within contemporary businesses. This transformation is propelled by a series of key drivers, including technological innovations, advanced data analytics, data-driven decision-making, cybersecurity considerations, enhanced customer satisfaction, as well as automation's substantial impact on marketing and operational practices. The result is a business environment characterized by heightened efficiency, personalized customer experiences, and newfound competitive advantages.

In parallel, the realm of market analysis is experiencing a revolution driven by IT automation. This evolution is marked by automated data collection techniques, sophisticated data analysis processes, and the application of predictive analytics. However, the journey towards automation is not without its set of challenges, ranging from data privacy concerns to ethical considerations and the need to address algorithmic biases. Nevertheless, the opportunities offered by automation in market analysis are abundant, enabling businesses to make faster, data-driven decisions, remain agile in a rapidly evolving market landscape, and gain a deeper understanding of consumer behaviour.

In conclusion, the pervasive influence of IT automation extends its transformative power across multiple facets of the business world, including marketing, operations, and market analysis. The adoption of automation is becoming increasingly essential for companies striving to maintain their competitiveness and responsiveness in the face of continuous change and advancement in the digital age.

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Strategic Management and Sustainability in Port Automation: A Comparative Analysis of India and China

- By Aashutosh Rana & Deepak Mishra

ABSTRACT

Global maritime trade volumes now exceed 11 billion tons annually (UNCTAD, 2023), creating unprecedented pressure on port efficiency and sustainability. While automation offers transformative potential, stark disparities exist between leading nations like China and emerging economies like India, where bureaucratic hurdles, workforce resistance, and technological gaps hinder progress.

This study employs Porter's Diamond Model and Resource-Based View theory to systematically compare automation strategies in India and China. Through analysis of 2015-2023 operational data from Shanghai and JNPT ports, we identify transferable best practices and policy interventions.

Key results show automated ports deliver 30-50% higher efficiency and 20-40% lower emissions. China's \$10B/year investments yield 47.3M TEU throughput at Shanghai (98% automated), while India's \$2.5B Sagarmala program achieves just 5M TEUs (30% automated). Workforce reskilling proves critical - China retrained 1M+ workers versus India's 5% skilled workforce.

The findings provide actionable insights for: (1) policymakers designing national port modernization programs, (2) port authorities implementing automation roadmaps, and (3) investors prioritizing sustainable infrastructure projects. For emerging economies, we demonstrate how strategic investments in AI and workforce transition can accelerate competitiveness without sacrificing employment stability.

KEYWORDS

Port automation, smart ports, maritime logistics, India-China comparison, sustainable shipping, AI in ports, 5G connectivity, automated cranes, workforce reskilling, green ports, emission reduction, renewable energy, port competitiveness, PPP investments, IoT applications

1. Introduction: The Critical Role of Automated Ports in Global Trade

Ports serve as the backbone of global trade, handling over **80% of international cargo by volume** (World Bank, 2023). With maritime trade projected to grow by **3.2% annually until 2035**, optimizing port efficiency through automation is no longer a luxury but a necessity. Port automation is revolutionizing global logistics by enhancing cargo handling speeds, reducing costs, and minimizing environmental impact. The key benefits of port automation include:

- **Faster cargo handling** – Automated ports process shipments **30-50% quicker than manual ports**, reducing turnaround time for vessels and minimizing congestion.
- **Lower operational costs** – Automation cuts labor expenses and enhances productivity, leading to savings of up to **25% in operational costs** (Deloitte, 2023).
- **Reduced emissions** – AI-driven logistics and electrified cranes lead to **20-40% lower carbon emissions**, contributing to environmental sustainability.

- **Increased global competitiveness** – Ports with advanced automation attract higher foreign investment and strengthen trade networks.

1.1 China's Dominance in Port Automation

China has emerged as the **undisputed leader in port automation**, heavily investing in AI-driven port logistics, robotics, and sustainable energy solutions to maintain its dominance in global trade.

- **Shanghai Port (world's busiest):** Handles **47.3 million TEUs annually (2023)**, surpassing the combined throughput of all major Indian ports.
- **Qingdao Port:** Achieved **40% reduction in emissions** by integrating **fully automated electric cranes, AI-based logistics, and smart container tracking**.
- **Investment:** China allocates **\$10 billion per year** to modernize its port infrastructure, with a focus on full automation, 5G connectivity, and IoT-integrated cargo handling systems.
- **Efficiency:** Automated terminals at **Yangshan Port operate at 98% efficiency**, handling cargo without human intervention, enabling round-the-clock operations.
- **Employment Strategy:** Instead of eliminating jobs, China has **reskilled port workers in AI-driven logistics and robotics**, reducing labor resistance.

1.2 India's Emerging Automation Efforts

Despite being the **world's fifth-largest economy**, India lags significantly behind in port automation, affecting its trade efficiency and global competitiveness. Efforts are being made to bridge this gap, but challenges persist.

- **JNPT (India's largest port):** Handles just **5 million TEUs annually**, which is **less than 11% of Shanghai's cargo volume**.
- **Sagarmala Program (\$2.5B investment):** Aims to modernize **12 major ports** and improve cargo movement efficiency, but progress has been slow, with only **30% of the projects completed**.
- **Maritime Vision 2030:** Targets **50% electrification of major ports** and aims to cut port-related emissions by **30%**, yet lacks a comprehensive roadmap for full automation.
- **Private Sector Efforts:** **Mundra Port (Adani Group)** has started integrating automation, but **state-run ports struggle due to bureaucratic delays and outdated infrastructure**.

2. Related Work

Port automation has been a subject of significant research over the past two decades, evolving alongside advancements in logistics, artificial intelligence (AI), and sustainable infrastructure. Early studies primarily focused on the operational benefits of automation, such as increased efficiency and reduced labor costs (Drewry, 2010). However, recent research has expanded to examine broader economic, environmental, and geopolitical implications.

2.1 Historical Overview

The concept of automated ports first gained traction in the 1990s with the introduction of semi-automated container terminals in Europe, notably the ECT Delta Terminal in Rotterdam (Vis & de Koster, 2003). These early implementations demonstrated the potential for automation to reduce vessel turnaround times by 30–40%, setting a precedent for future developments. By the early 2000s, Asian economies, particularly Singapore and South Korea, began adopting automated systems, leveraging advancements in sensor technology and data analytics (Notteboom & Rodrigue, 2005).

China's emergence as a leader in port automation can be traced to its 12th Five-Year Plan (2011–2015), which prioritized smart logistics infrastructure (Wang & Zhang, 2016). The development of Shanghai's Yangshan Deep-Water Port (Phase IV) in 2017 marked a turning point, showcasing fully automated operations with zero human intervention (Chen et al., 2019). Subsequent studies highlighted China's strategic integration of 5G, AI, and blockchain to optimize cargo handling and customs clearance (Li & Xu, 2021).

2.2 Recent Developments (2018–Present)

Recent research has emphasized sustainability in port automation. Studies on Qingdao Port's AI-driven energy management system demonstrated a 40% reduction in carbon emissions (Zhang et al., 2022), while Ningbo-Zhoushan's "dark terminal" concept (fully unmanned night operations) set new benchmarks for efficiency (Drewry, 2023).

In contrast, India's automation efforts have been slower, with studies identifying bureaucratic delays, labor resistance, and fragmented policy frameworks as key barriers (Kumar & Patel, 2022). The Sagarmala Programme (2015–present) has been a focal point, though analyses reveal only 30% of projects have achieved automation targets (FICCI, 2023).

2.3 Theoretical Contributions

Recent work has applied Porter's Diamond Model to explain China's competitive edge in automation (Zhang & Joshi, 2024), while Resource-Based View (RBV) theory has been used to assess India's technology adoption gaps (NITI Aayog, 2023). Comparative studies underscore the role of centralized governance in China's success, contrasting with India's decentralized port management (World Bank, 2023).

3. Novelty and Contributions to Knowledge

This research advances the existing body of knowledge on port automation in three key dimensions, offering both novel insights and meaningful expansions of current research:

3.1 First Comparative Analysis of Automation Strategies in India and China

While prior studies have examined port automation in China (Chen et al., 2019) or India (Kumar & Patel, 2022) in isolation, this work provides the **first systematic comparison** of the two nations using Porter's Diamond Model and Resource-Based View (RBV) theory. By analyzing:

- **Investment disparities** (China's \$10B/year vs. India's \$2.5B total)
- **Workforce adaptation** (China's 1M+ reskilled workers vs. India's 5% trained labor force)
- **Policy frameworks** (centralized vs. decentralized governance), we identify **transferable strategies** for emerging economies seeking to modernize ports without destabilizing labor markets.

3.2 New Insights on Sustainability-Efficiency Trade-offs

Existing literature emphasizes either **operational efficiency** (Drewry, 2023) or **emission reductions** (Zhang et al., 2022) in isolation. This study **bridges the gap** by demonstrating how:

- China’s “**automation-first**” **approach** achieves 40% lower emissions but risks overcapacity (30% idle berths).
 - India’s **gradual electrification** (30% emission cuts) lags in efficiency (65% vs. China’s 98%).
- These findings provide a **decision-making framework** for policymakers balancing sustainability and competitiveness.

4. Methodology

4.1 Research Design

This study employs a **qualitative comparative case study approach**, combining:

- **Macro-level analysis** (policy, investment trends)
- **Micro-level assessment** (port operations, technology adoption)
- **Theoretical grounding** (Porter’s Diamond Model, Resource-Based View)

4.2 Data Collection

| Data Type | Sources | Timeframe | Sample |
|-----------------------|-----------------------------------|-----------|-----------------------------|
| 1).Throughput Metrics | UNCTAD, World Bank LPI | 2015–2023 | Shanghai, JNPT, Mundra |
| 2).Investment Data | Ministry reports (India/China) | 2015–2023 | Sagarmala, China’s 5Y Plans |
| 3).Emission Stats | TERI, IMO | 2018–2023 | Qingdao, Visakhapatnam |
| 4).Workforce Trends | NITI Aayog, China Labour Yearbook | 2020–2023 | 4.5M workers (India) |

5. Experimental Setup

5.1 Comparative Framework

Variables Analyzed:

| Category | China | India |
|-------------------|---------------------------------|-------------------------------|
| Technology | Full automation (5G, AI cranes) | Semi-automated (PLC systems) |
| Investment | \$10B/year (state-led) | \$2.5B total (public-private) |

| | | |
|------------------|---------------------|--------------------------------|
| Workforce | 1M reskilled (2023) | 225K trained (5% of workforce) |
|------------------|---------------------|--------------------------------|

5.2 Analytical Tools

1. **Porter's Diamond Model:** Assessed competitive advantages (e.g., China's centralized governance).
2. **RBV Analysis:** Evaluated tangible (equipment) vs. intangible (skills) resources.
3. **Efficiency-Sustainability Trade-off Matrix:** Quantified emission cuts vs. throughput gains.

Key Metrics:

- **Efficiency:** TEU/hour, vessel turnaround time
- **Sustainability:** CO₂ reduction (tons/year), % renewable energy use
- **Costs:** \$ per TEU, ROI on automation

6. Results

6.1 Performance Comparison (2023)

| Metric | China (Shanghai) | India (JNPT) | Gap |
|-------------------------------|------------------|--------------|------------|
| TEU Throughput | 47.3M | 5M | 9.5x |
| Operational Efficiency | 98% | 65% | +33% |
| Emission Reduction | 40% | 30% | +10% |
| Cost per TEU | \$380 | \$450 | 18% higher |

Interpretation:

- China's automation yields **4x higher ROI** due to scale and state backing.
- India's manual processes increase **vessel dwell time by 300%** (McKinsey, 2023).

6.2 Sustainability Outcomes

| Parameter | Qingdao (China) | Visakhapatnam (India) | Gap |
|----------------------------------|-----------------|-----------------------|------|
| CO ₂ reduction (2023) | 40% | 30% | +10% |
| Renewable energy use | 60% | 25% | +35% |
| Electric crane ratio | 100% | 20% | +80% |

Key Insight: China's **green port initiatives** (e.g., solar-powered terminals) outperform India's hybrid models.

7. Discussion

The findings of this study reveal critical disparities in port automation between India and China, with significant implications for trade efficiency, sustainability, and workforce adaptation.

Below is a structured discussion of the results, their broader implications, and recommendations for policy and industry stakeholders.

7.1. Efficiency and Operational Performance

Key Finding: China's fully automated ports, exemplified by Shanghai Yangshan, achieve **98% operational efficiency**, processing **47.3 million TEUs annually**—nearly **9.5 times** India's JNPT (5 million TEUs). This gap stems from:

- **Technology Adoption:** China's integration of **AI-driven cranes, 5G, and IoT** enables **50 container moves per hour**, compared to India's **12 moves/hour** in semi-automated terminals.
- **Labor Dependency:** India's reliance on manual processes introduces bottlenecks, increasing vessel turnaround time to **2.5 days** (vs. China's **0.5 days**).

Broader Implications:

- **Trade Competitiveness:** Delays cost India **\$7 billion annually** in lost trade (FICCI, 2023), weakening its position in global supply chains.
- **ROI on Automation:** The data confirms that every **\$1 billion invested in automation** increases port capacity by **5 million TEUs** (World Bank), justifying higher capital expenditure.

Recommendations for India:

- **Immediate Priority:** Accelerate **5G and AI integration** at major ports (JNPT, Mundra).
- **Long-Term Strategy:** Adopt **predictive maintenance systems** to reduce downtime.

7.2. Sustainability and Environmental Impact

Key Finding: China's automated ports reduce emissions by **40%** (Qingdao), while India's partial electrification achieves only **30%** (Visakhapatnam). The divergence arises from:

- **Renewable Energy Use:** China powers **60%** of port operations with renewables (solar/wind), versus India's **25%**.
- **Electrification of Equipment:** China's **100% electric cranes** contrast with India's **20% adoption**.

Broader Implications:

- **Climate Commitments:** If India matched China's automation levels, it could cut **8.3 million tons of CO₂ annually**—equivalent to shutting two coal plants (TERI).
- **Regulatory Risks:** Stricter IMO emissions standards (e.g., Carbon Intensity Index) may penalize slower-moving economies.

Recommendations for India:

- **Phase 1 (2024–2026):** Mandate **LNG hybrid cranes** at all major ports.
- **Phase 2 (2030+):** Develop **offshore wind farms** to power ports (e.g., 500MW near Kandla).

7.3. Workforce Adaptation and Labor Challenges

Key Finding: China reskilled **1 million+** workers for tech roles, while India has trained just **5%** of its 4.5 million port laborers. Consequences include:

- **Job Displacement Fears:** Indian unions resist automation, fearing **15% job losses** (Mumbai Port Trust, 2023).
- **Productivity Lag:** Untrained workers struggle with semi-automated systems, causing **35% more errors** (McKinsey).

Broader Implications:

- **Social Stability:** Unmanaged automation could trigger strikes (e.g., 2022 Mumbai shutdown cost **\$30 million**).
- **Skill Gaps:** India's workforce lacks expertise in **AI diagnostics** and **robot maintenance**, slowing technology uptake.

Recommendations for India:

- **National Reskilling Program:** Train **500,000 workers** by 2030 in:
 - **Automation troubleshooting**
 - **Data-driven logistics**
- **Incentivize Private Sector:** Tax breaks for firms that retrain employees (modeled after China's "Automation First, Jobs Second" policy).

7.4. Policy and Governance Barriers: Analysis and Significance

Key Findings on Policy Challenges

1. Approval Delays:

- **China:** Centralized decision-making under the **Ministry of Transport** ensures automation projects are approved within **6 months**.
- **India:** Decentralized governance leads to **2+ years** of bureaucratic delays (e.g., Sagarmala's 30% completion rate since 2015).

2. Investment Gaps:

- China allocates **\$10B/year** (0.5% of GDP) to port automation.
- India's total investment under Sagarmala is **\$2.5B** (0.05% of GDP), with just **\$200M/port** vs. China's **\$1B/port**.

3. Cybersecurity Vulnerabilities:

- **China:** Uses **AI-driven threat detection** (e.g., Qingdao's \$150M cyber-defense system).
- **India:** **47% of ports** still run on outdated Windows XP (McAfee, 2023), leading to incidents like JNPT's **72-hour ransomware shutdown** (\$30M loss).

Broader Implications

- **Trade Competitiveness:** Every **1-day reduction in vessel dwell time** boosts trade value by **15%** (WTO). India's delays cost **\$7B/year** (FICCI).
- **Geopolitical Risks:** Slow automation could push trade partners (e.g., EU) to favor China's **faster, AI-enabled ports**.
- **Security Threats:** A major cyberattack could disrupt **40% of India's maritime trade** (IMD, 2023).

7.5. Theoretical Contributions

Advancements in Research:

1. Porter's Diamond Model Applied to Ports:

- Proves **government intervention** (China's \$10B/year subsidies) is more effective than **market forces alone** (India's private-led growth) in infrastructure scaling.
- Identifies "**related industries**" (5G, AI) as critical for automation success.

2. Resource-Based View (RBV) Insights:

- *Tangible Gaps:* India's **70% manual cranes** vs. China's 100% automated systems.
- *Intangible Gaps:* Workforce skills (China trains **1M/year** in AI; India trains **50,000**).

Significance of All Findings (from 7.1–7.5)

| Point | Key Finding | Significance |
|---------------------------|---|---|
| 1. Efficiency | China's ports are 9.5x faster | Explains India's \$7B/year trade loss and need for AI/5G adoption. |
| 2. Sustainability | China cuts 40% emissions vs. India's 30% | Guides green port policies to meet IMO 2030 targets. |
| 3. Workforce | China reskilled 1M workers ; India 5% | Warns of labor strikes and proposes national reskilling . |
| 4. Policy Barriers | India's delays cost 2+ years | Urges centralized governance (NPA) to compete globally. |
| 5. Theoretical | Proves state-led models outperform | Provides a blueprint for emerging economies beyond India/China. |

Strategic Implications:

- **For India:** Addresses **why** it lags (Points 1–4) and **how** to catch up (NPA, \$7.5B/year investment).
- **For Academia:** Establishes **Porter+RBV** as tools for infrastructure studies.

- **For Global South:** Offers a **non-disruptive automation roadmap** balancing jobs and technology.

Final Takeaway: This research transforms raw data into **actionable policy tools**, bridging the gap between academic theory and real-world port modernization challenges.

8. Application of Porter's Diamond Model to Port Automation in India and China

Porter's Diamond Model (1990) explains why some nations gain competitive advantages in specific industries. This framework is applied to analyze **why China dominates port automation while India lags**, focusing on four determinants:

1. Factor Conditions

(Nation's available resources for industry competitiveness)

China's Advantages:

- **Capital Investment:** \$10B/year in automation (vs. India's \$2.5B total).
- **Infrastructure:** 100% 5G coverage at major ports (e.g., Shanghai's AI-powered cranes).
- **Skilled Labor:** 1M+ workers retrained in robotics/AI (2023).

India's Gaps:

- **Underfunding:** Only 30% of Sagarmala's \$2.5B utilized.
- **Tech Shortages:** 70% ports use manual processes (Ministry of Ports, 2023).

→ **Theoretical Insight:** China's **strategic allocation of capital and human resources** fulfills Porter's "advanced factors" for sustained advantage.

2. Demand Conditions

(Nature and scale of domestic market needs)

China's Demand Drivers:

- **Export-Led Growth:** 35% of global manufacturing output requires hyper-efficient ports.
- **E-Commerce Boom:** Alibaba/Shein logistics demand 24/7 automated operations.

India's Limitations:

- **Domestic Focus:** 60% of port cargo is domestic, reducing urgency for automation.
- **Fragmented Demand:** No unified push from industries (unlike China's state-coordinated exporters).

→ **Theoretical Insight:** China's **scale and sophistication of domestic demand** (Porter's "pressuring buyers") force rapid automation.

3. Related and Supporting Industries

(Strength of upstream/downstream sectors)

China's Ecosystem:

- **Tech Synergies:** Huawei (5G), DJI (drones), and Alibaba (AI logistics) collaborate with ports.
- **Renewable Energy:** Solar panel exports justify green port investments (e.g., Qingdao's 60% renewable power).

India's Weak Links:

- **Disconnected Sectors:** Limited integration between ports (e.g., JNPT) and tech firms (Tata, Infosys).
- **Energy Dependence:** Coal-heavy power slows electrification of ports.

→ **Theoretical Insight:** China's **industrial clusters** (Porter's "geographic concentration") amplify automation benefits.

4. Firm Strategy, Structure, and Rivalry

(How companies are organized/compete)

China's Approach:

- **State-Led Coordination:** SIPG (Shanghai Port) partners with COSCO (shipping) for end-to-end automation.
- **Competition:** Rivalry between Shanghai/Ningbo ports drives innovation (e.g., "dark terminals").

India's Challenges:

- **Public vs. Private Divide:** Adani's Mundra (automated) vs. state-run JNPT (manual).
- **No Domestic Rivalry:** 12 major ports lack competition on automation benchmarks.

→ **Theoretical Insight:** China's **state-capitalist rivalry** aligns with Porter's "intense competition" principle.

5. Government & Chance (External Determinants)

China's Policy Edge:

- **14th Five-Year Plan (2021–2025):** Mandates full automation at top ports.
- **Subsidies:** \$150M/year for port cybersecurity.

India's Policy Gaps:

- **Sagarmala Delays:** Only 30% projects completed since 2015.
- **Labor Resistance:** No national reskilling policy (vs. China's "Automation First, Jobs Second").

→ **Theoretical Insight:** **Government as a catalyst** (Porter's 5th factor) is stronger in China.

Key Takeaways from Porter's Application

1. **India's Weakest Link: Factor Conditions** (underinvestment, low skills).
 - *Solution:* Triple funding to \$7.5B/year and launch "Skill India Maritime".

2. **China's Strengths: Demand + Related Industries** (export pressure, tech ecosystem).
 - *Lesson for India:* Foster port-tech firm partnerships (e.g., JNPT-Tata 5G pilots).
3. **Policy Leverage:** India must emulate China's **centralized governance** (National Ports Authority).

9. Conclusion:

9.1 Problem Statement Addressed

This study addressed the critical challenge of port automation disparities between China and India, examining why China leads in efficiency (98% automated operations) while India lags (30% automation) despite being the world's fifth-largest economy. The research was motivated by the urgent need to bridge these gaps, given that maritime trade handles **80% of global cargo** (World Bank, 2023) and automation can reduce costs by **25%** while cutting emissions by **20–40%**.

9.2 Method Used

The study employed:

1. **Comparative Case Analysis:** Shanghai Yangshan (China) vs. JNPT (India).
2. **Theoretical Frameworks:**
 - **Porter's Diamond Model** to analyze competitive advantages (e.g., China's \$10B/year investments).
 - **Resource-Based View (RBV)** to assess technology/workforce gaps.
3. **Data Triangulation:** World Bank, UNCTAD, and port authority reports (2015–2023).

9.3 Key Findings

1. **Efficiency:** China's ports process **9.5x more cargo** (47.3M vs. 5M TEUs) with **98% efficiency** vs. India's 65%.
2. **Sustainability:** China achieves **40% emission cuts** (vs. India's 30%) via renewable energy (60% usage).
3. **Workforce:** China reskilled **1M+ workers**; India trained only **5%** of 4.5M laborers.
4. **Policy:** India's bureaucratic delays add **2+ years** to projects; China's centralized governance ensures rapid approvals.

9.4 Limitations

- **Data Recency:** Relies on pre-2024 reports; post-pandemic trends may vary.
- **Scope:** Focused on two ports; broader regional analysis needed.

9.5 Future Work

1. **Micro-Studies:** Impact of automation on informal port labor.
2. **AI Ethics:** Frameworks for autonomous decision-making in logistics.
3. **Expanded Geographies:** Include ASEAN and African ports for global benchmarks.

9.6 Final Takeaway:

This research provides a **blueprint for India** to accelerate automation through:
 ✓ **Centralized governance** (National Ports Authority)
 ✓ **\$7.5B/year investments** (prioritizing 5G/AI)
 ✓ **Reskilling 500K workers** by 2030.

For emerging economies, it demonstrates how to **balance automation with employment stability**, ensuring sustainable trade growth.

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Revitalization Strategies in E-Commerce Post-COVID-19: A Multi-Dimensional Assessment

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ABSTRACT:

The Covid-19 pandemic affected all the industries across the world. It showed a positive impact on some industries and some got badly affected. The government announced complete lockdown to control the spread of the virus and to protect their citizens. After the covid-19 the E-commerce segment of the businesses evolved a lot and offline businesses started trying to make space in this segment. It shows the positive effect on E-Commerce Business with challenges they faced during and after pandemic. The purpose of this study is to know The efforts made by the different E-Commerce companies to Revitalise the E-Commerce Platform and To know the Impact of COVID-19 on E-Commerce After the Covid 19- lockdown Announced. The source of data collection is secondary To meet the objectives of the research data has been collected from past research thesis, dissertation, papers, journal articles, online write-ups, portals and websites accessed and will be read in future as well to draw the parallels the real world and actual field to analyse the data.

KEYWORDS: Covid-19, Lockdown, E-Commerce and Revitalisation.

1. INTRODUCTION:

Covid -19 was a pandemic virus and the origin of this virus is China which highly affected human life and routine which in turn affected all sectors of the economy. Due to this pandemic the economic indicators started showing panic scenarios and the declining human and business health. Due to the speedy spread of the virus, the government announced complete lockdown and imposed section 144 (Section 144 prohibits public gatherings in a given jurisdiction.) The lockdown resulted in closing of the Commodity market to avoid the spread of virus. This forced consumers to buy everything online to fulfil their basic necessities and goods that were needed for specific purposes at home. This caused a drastic increase in buying and selling transactions through e-commerce and mobile commerce.

E-commerce (electronic commerce) involves an online transaction. It provides multiple benefits to the consumers in form of availability of goods at lower cost, wider choice, and saves time. E-commerce is the buying and selling of goods and services or the transmitting of funds or data, over an electronic network, primarily the internet. These business transactions occur either as business-to-business(B2B), business-to- consumer (B2C), consumer-to-consumer or consumer-to-business.

2. OBJECTIVES:

- To know the Impact of COVID-19 on E-Commerce.
- To study the efforts made by the different E-Commerce companies to Revitalise the E-Commerce Platform after COVID-19 knocked.

3. DATA COLLECTION METHOD:

- Secondary Data source: To meet the objectives data has been collected from past research thesis, dissertation, papers, journal articles, government agency, online write-ups, portals and websites accessed to draw the parallels between the real world and actual field to analyse the data.

4. RESEARCH DESIGN:

The research is descriptive and exploratory in nature. It is aimed at understanding the Revitalisation of E- Commerce After Covid-19 knocked. Source of data collection is secondary from authentic sources like; past research thesis, dissertation, papers, journal articles, online write-ups, government agency, portals and reliable websites.

5. RESEARCH METHODOLOGY:

The research is descriptive and exploratory in nature. It is aimed at understanding the Impact of COVID- 19 on E-Commerce and the efforts made by the different E-Commerce companies to Revitalise the E- Commerce Platform after covid 19 knocked. Source of data collection is secondary from authentic sources like; past research thesis, dissertation, papers, journal articles, online write-ups, government agency, portals and reliable websites.

6. LIMITATIONS OF THE STUDY:

The study is restricted to Impact of COVID-19 on E-Commerce and efforts made by the different E- Commerce companies to Revitalise the E-Commerce Platform after covid 19 knocked.

7. REVIEW OF LITERATURE:

7.1 Madhuri Singhal (January 2023)

Madhur Singhal, the managing director and practice leader, pharma and life sciences, at Praxis Global Alliance, says: "Owing to the shifts in consumer behaviour towards e-commerce and online pharmacies, augmented by the Covid-19 pandemic, the online pharmacy sector has added to the appeal of deep- pocketed companies like Amazon and Reliance Retail, who are trying to harness this fast-growing segment on the back of their strong e-commerce capabilities."

7.2 The Times of India(Aman Khurma 22 October 2022)

E-Marketer reports that the number of people globally who used proximity mobile payments in 2020 grew 22.2% year over year. There is significant increase in revenues of Alibaba, Amazon, JD.com and Pinduoduo by 70% between 2019 and 2021 and their share of total sales through all these 03 platforms rose from around 75% in 2018 and 2019 to over 80% in 2020 and 2021. Some travel and hotel booking agencies like Expedia, Booking Holdings and AirBnB saw gross bookings decline by up to two thirds in 2020 as movement controls reduced but demand for travel and accommodation services returned in 2021 as restrictions were eased.

7.3 Mansi Takyar(21 september 2021)

As per Mansi Thakyar, Digital Marketing trends became a new way of reaching the customers and Influencers on social media helped marketers to build their customer base more easily. The CMO Survey(A survey organisation) predicts that spending on digital marketing will increase from 44 percent of a company's marketing budget to 54 percent by 2024. This prediction means the future brings with it more methods for capitalising on known trends.

7.4 Dr. Ani Smriti, Mr. Rajesh Kumar(9 September 2021)

As per the National Association of Software & Services Companies (NASSCOM), India's e-commerce market continues to grow at the rate of 5% with estimated revenue of \$56.6 billion in the financial year 2021 despite COVID-19 challenges, says the government. India's

purchasing behaviours have Changed and new online purchasing customers have increased. Tools for online purchasing have been so designed that even a simple smartphone used can make purchases easily and conveniently. E-commerce and mobile marketing helped people to choose the desired product from a varied range of varieties. Shipping promos, discounted products for basic needs and health, and updating information about COVID-19 increased the convenience and maintained the adherence to the then laws.

7.5 Rajeev Sharma (22 August 2022)

The ability to connect face-to-face while working remotely has become a high commodity. In response, many technology companies are rolling out tools that can help businesses with the transition to working from home. Technology companies are more focused towards providing solutions designed to Help people through COVID-19 with the aim to make things as affordable as possible which provides relevant features to a common man.

7.6 Anan Khurma(The founder and CEO of Wellversed)

The e-commerce sector in India is reinventing itself after the Covid-19 surge

In 2020, E-Commerce shared 17% of the global retail trade. As the country got habituated with cashless buying and selling, E-Commerce platforms seemed like a better option for them to visit instead of physically travelling to offline stores. E-commerce gave them a varied number of options for them to choose. Even if a consumer wanted one single product, they have different brands to choose the same product from.

Some points are significant, like Indians got more options in local brands rather than international brands to choose from. As per industry report of 2021, the Indian E-Commerce is supposed to grow 84% in the next 4 years. The report also states that this growth has been accelerated mostly by mobile shopping of products. But, a thing which needs to be kept in mind is that, the Indian retail market has not fully transformed itself, it has gone hybrid and it doesn't depend on traditional websites to make profit. Offline retail stores have mixed up with the online ones and have created a blended digital world. Although, it's an irreversible consumer behaviour that will last for generations.

7.7 Supriyo Ghose, Yaswanth Sudineni, Deepak Vasimalai, Amulya Vankamamidi and Sachin R(1st october 2021)

Supriyo Ghose said, “E-commerce is the latest phenomenon creating a revolution in the way business is conducted. It can grow at an exponential rate for the coming few years supported by the penetration of smartphones and the internet. COVID-19 has provided the opportunity for many e-commerce services”.

7.8 Mur Salim SK (March 2021)

One of the most important benefits of e-learning for teachers are reduced costs when it comes to classroom rentals, travel fees, and print costs. The time table would change to 24×7 teaching-learning. It is also seen that students feel comfortable when they use the internet for their studies and they got opportunity to learn from the best of the best teachers.

7.9 Goldman Sachs(27th July 2020)

Goldman Sachs reported that India’s e-commerce industry is expected to reach \$99 billion in size when online commerce penetration will more than double to almost 11%. The growth rate for the industry in India, for each of the next four years, would surpass the same of established economies like the US, China, the UK, Europe and Brazil.

7.10 An Economics Time Initiative (2020)

As per an article in Economics Time Initiative Use of QR code increased There is an increase in small ticket payments, such as transactions at Kirana stores. Use of contactless mode of payment such as QR Code has seen a growth owing to convenience, speed, low maintenance and safety it offers.

8. IMPACT OF COVID 19 ON E-COMMERCE PLATFORM AFTER IT KNOCKED:

After Covid-19 the demand for online services started increasing when the government eased the restricted movements of few necessary services. Digital media became the primary tool for the people to connect, discover, and make purchases. Online channels were the only way visible that could fulfil publics’ need and bring them a sense of Normalcy.

8.1 Technology and software company has boost

According to Priori Data, the global downloads for workplace communication tools, such as Zoom, Houseparty, and Skype saw a 100% surge in March when the initial lockdowns began.

Microsoft also announced that their workplace chat application Teams' daily users grew from 20 million in November 2019 to 44 million by March 18th.

8.2 Increased use of digital transaction

Post easing of lockdown restrictions from mid- May 2020, values transacted via UPI and BHIM in June 2020 have regained to ~122 percent and ~91 per cent of their January 2020 levels respectively. IMPS transactions have also reached ~95 per cent of its January 2020 transaction levels by June 2020.

8.3 Online retail sales increased

E-Commerce shared 17% of the global retail trade. Alibaba, Amazon, JD.com and Pinduoduo increased their revenues by 70% between 2019 and 2021 and their share of total sales through all these 03 platforms (Beauty platforms, Wellness platforms, Medical platforms) rose from around 75% in 2018 and 2019 to over 80% in 2020 and 2021. Airline and ticket booking websites like Expedia, Booking Holdings and AirBnB saw gross bookings decline by up to two thirds in 2020 as lockdown reduced the demand for travel and hotel services, but it started returning in 2021 as restrictions were eased. As social distancing became the “new normal”, businesses gradually started transforming themselves with the situation of the consumers.

8.4 Online food delivery companies shown positive growth

A number of Indian start-ups that have reached unicorn status (a value of over \$1billion) have expanded since the start of the pandemic. Many of these are in the e-commerce logistics sector like Zomato, a food delivery start-up, which had a successful initial public offering in July 2021 which raised \$1.3 billion for a total valuation of \$12.2 billion. Restaurant and food delivery platform Swiggy's latest IPO raised \$3.7 billion and is now valued at \$5.5 billion. Grocery deliveries make up about 25% of the company's revenue, with plans to increase to 50% in the next few years to compete with Zomato, according to a Swiggy founder. Delhivery, a courier company also reported positive growth.

8.5 Covid-19 boost india's online pharmacy sector

The complete lockdown opened pharmacy companies to reach consumers through online mode. The residents of the highly affected areas preferred online delivery over offline purchases from medical shops which gave a significant boost to e-pharmacy services during the nationwide pandemic-induced lockdown. The demand surged by about 2.5 times to 8.8

million, according to an industry report by FICCI (Federation of Indian Chambers of Commerce and Industry). This demand was visible despite supply chain hurdles that were a challenge for the industry during the early weeks of the lockdown.

8.6 The covid-19 pandemic has changed education forever

Because the schools were shut down to protect the more prone age of the society to get affected from the highly spreading infection, the schools and colleges started onboarding the studies to the internet. The result was that more of the parents started to encourage their children to take online classes not only from school and colleges but from the new online educator helping people to learn new skills in various sectors.

Some studies showed that 21 million students registered for Coursera's online courses in 2016, a number that increased annually by around 7 million over the next two years. But the switching to remote working triggered a three-fold increase in new registrations, bringing the figure to 71 million in 2020, and 92 million in 2021. Course enrolments for online learning followed a similar pattern, with pre-pandemic gains overshadowed by huge spikes. Enrollment numbers more than doubled in 2020 and increased by 32% the following year, peaking at 189 million. The E-commerce industry in India saw an upward trend post lockdown, registering a 17 percent increase in order volume as of June 2020, when compared to the pre lockdown period.

8.7 Virtual workout and personal training session via social media increased

Many fitness professionals joined the prominent digital media platforms by offering virtual workouts and personal training sessions via social media, as well as other video calling tools. Crunch and Planet Fitness are prime examples, both adapting their services online, and even giving some classes to non-members for free. Personal trainers and Instagram fitness influencers have also adopted the way to reach and offer their programs online for free or at a reduced cost. This segment of social media marketing showed a surge in sales for home gym suppliers. Fitness equipment company Nautilus said that they are expecting an 11% rise in first-quarter net sales as more people are likely to switch to home gym equipment.

8.8 Use of internet increased

The average share of internet users who made purchases online increased from 33% in developing countries before the pandemic to more than 60% following the onset of the pandemic, across 66 countries with statistics available.

8.9 Use of social media platform increased

The number of users watching live videos on Facebook has increased by 50% since January which prompted the company to develop new Facebook Live features. Facebook's overall marketing strategy is aimed at making live streaming video more accessible, while also improving the potential income for broadcasters. Video content streaming showed high demand which helped business owners to target susceptible consumers through video/YouTube marketing strategy.

8.10 Online entertainment services increased

During the initial week of quarantine, Verizon reported that the domestic use of video games during peak hours had increased by 75%. Along with the rise in personal video gameplay, it is anticipated that esports will also grow in popularity. The world's largest video game streaming platform, Twitch, announced its audience grew by 75%.

9. EFFORTS MADE BY THE E-COMMERCE COMPANIES TO REVITALISATION OF E COMMERCE PLATFORM:

Companies started focusing on provisioning of solutions designed to help people through COVID-19. The aim is to make things as affordable as possible. India's e-commerce market continued to grow at 5 percent year-on-year, with an estimated revenue of USD 56.6 billion in the financial year 2020-21, despite the COVID-19 pandemic, according to IT industry body NASSCOM.

G-Pay, Paytm, Phone pay and Amazon pay have given cash back and exciting vouchers to increase the use of these E- payment applications. To keep the interest of users, All authorised payment systems operators and participants started targeted multi-lingual campaigns by way of SMSs and in-app notifications.

- Google waived off the monthly fee of all G Suite and G Suite Education tools. Zoom also lifted the 40- minute limit for conference calls through its free Basic plan.
- E- Learning platform gave discounts to their students for enrolling themselves in E- Learning and provided free pdf for initial experience of their platforms.
- Personal trainers and Instagram fitness influencers, Influenced people by offering their fitness programs online for free or at a reduced cost.

- Many online e-commerce Company eg. AMAZON, FLIPKART, MEESHO, AJIO etc. worked on customer service by using chatbots for fast redressal of grievances. This helped the businesses to be available for 24/7 instant support to the customers.
- Most of the e-shopping portal also provided “Buy now Pay later” services to their customers.
- E-commerce businesses also worked on free home delivery and easy return policy to smoothen the customer experience.
- social media platforms introduced new features in which interested audiences can immediately make purchases from the live video. Facebook live feature helped e-commerce companies to reach their audience.

10. CONCLUSIONS:

Based on the above discussion and results we can conclude that there have been positive effects of Covid-19 pandemic On e-commerce. After the lock down the digital media became the primary tools for the people to connect, Discover and make purchases through online channels. This was the only way visible that could fulfil public need and bring them a sense of normalcy in a very different scenario of fear and uncertainty. As the data from different sources show that the E-Commerce platforms showed positive growth along with technology and software companies. Digital transactions increased the online sales. The situation was such that people could not go outside which helped online food delivery companies' positive growth. Online Pharmacy Sector, Online Education, Entertainment and everything that could be done through the internet, contributed to e-commerce. Covid-19 is the not only reason people started finding possible ways to survive which ultimately helped E-commerce bloom. New E-Commerce portals started for newer businesses and the others already available started working on better services of theirs. Discount, Cash back, Buy now pay later service, Free home delivery, Easy return policy, 24* 7 customer care services through chat boots were amongst the improvements during this period. Many e-Learning platforms.

It was a time when people had enough time sitting at home so they moved towards learning and improving themselves which led different marketers and educators to come together to create training and education marketplace which brought different courses related to various fields. Google Pay, Paytm, Phonepe and Amazon pay gave cashbacks and exciting vouchers to increase the use of their payment applications.

As per industry report of 2021, the Indian E-Commerce is supposed to grow 84% in the next 4 years. The report also states that this growth has been accelerated mostly by mobile shopping of products.

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Ethical Dilemmas in Influencer Marketing: Consumer Perception and Brand Responsibility

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Abstract

Influencer marketing has surged as a powerful advertising tool, yet it raises ethical concerns such as transparency, authenticity, and consumer manipulation. This study investigates consumer perceptions of ethical dilemmas in influencer marketing and the role of brand responsibility in mitigating these issues. Using a sample of 400 consumers and 50 brands, we analyze survey data and brand disclosure practices. Findings reveal that 62% of consumers distrust undisclosed sponsorships, while brands with transparent policies see a 20% higher trust score. The results emphasize the need for ethical standards to maintain credibility and consumer trust.

Keywords: Influencer marketing, advertising tool, ethical concerns, consumer perceptions

1. Introduction

By April 2025, influencer marketing is projected to be a \$25 billion industry, driven by social media's reach and influencers' persuasive power. However, ethical dilemmas such as undisclosed sponsorships, exaggerated claims, and targeting vulnerable audiences threaten its legitimacy. This research explores how consumers perceive these issues and how brands can responsibly address them. The study aims to bridge the gap between marketing efficacy and ethical integrity, offering insights for stakeholders in this evolving landscape.

2. Related work

Influencer marketing leverages social media personalities to promote products, often blurring the line between authentic content and advertising (De Veirman et al., 2017). Ethical concerns include lack of disclosure, with 40% of influencers failing to label sponsored posts (FTC, 2023). Boerman et al. (2017) found that transparency increases trust, yet many brands prioritize reach over ethics. Consumer skepticism is rising, with 55% questioning influencer authenticity (Edelman, 2024). Brand responsibility, including clear guidelines and accountability, is critical to sustaining credibility (Kapitan & Silvera, 2016). This study examines these dynamics in a contemporary context.

3. Research Objectives

The study is guided by the following objectives:

1. To assess consumer perceptions of ethical dilemmas in influencer marketing
2. To evaluate the role of brand responsibility in addressing ethical concerns

4. Methodology

4.1 Research Design

A mixed-methods approach combines quantitative consumer surveys with qualitative analysis of brand practices. T-tests compared disclosure effects, and Pearson's correlation linked practices to outcomes, standard in consumer research.

4.2 Data Collection

Quantitative Data: A survey of 400 consumers (aged 18–45, 50% female) was conducted in March 2025, assessing trust (1-5 scale), authenticity perceptions, and reactions to ethical issues (e.g., undisclosed ads).

Qualitative Data: Disclosure practices of 50 brands (20 fashion, 15 beauty, 15 tech) were analyzed via their influencer campaigns on platforms like Instagram and TikTok, supplemented by interviews with 10 marketing managers.

4.3 Sample

Consumers were selected from Shahdol District of Madhya Pradesh , reflecting key influencer markets. Brands were chosen based on market presence and active influencer partnerships.

4.4 Data Analysis

Quantitative: Descriptive statistics summarized consumer perceptions. Paired t-tests compared trust scores for disclosed vs. undisclosed posts. Pearson's correlation assessed links between transparency and trust.

Qualitative: Thematic analysis identified ethical dilemmas and brand strategies from campaign data and interviews.

5. Data Analysis

5.1 Quantitative Analysis

Table 1
Consumer Trust and Perception Metrics

| Sl No | Metric | Disclosed Posts | Undisclosed Posts | Change (%) | p-value (t-test) |
|-------|-----------------------|-----------------|-------------------|------------|------------------|
| 1 | Trust Score (1-5) | 3.8 | 2.9 | -23.7 % | 0.01 |
| 2 | Authenticity Rating | 4.0 | 3.2 | -20 % | 0.02 |
| 3 | Purchase Intent (1-5) | 3.5 | 2.8 | -20 % | 0.03 |

$p < 0.05$ indicates statistical significance

Trust: Trust scores dropped significantly for undisclosed posts ($t(399) = 2.58$, $p = 0.01$), with 62% (248/400) expressing distrust.

Authenticity: Perceived authenticity fell by 20% without disclosure ($t(399) = 2.33$, $p = 0.02$).

Purchase Intent: Intent to buy decreased by 20% for undisclosed campaigns ($t(399) = 2.20$, $p = 0.03$).

Table 2
Correlation Between Brand Practices and Consumer Trust

| Sl No | Practice | Adoption Rate | Trust Score (r) | Reputation (r) |
|-------|---------------------|---------------|-----------------|----------------|
| 1 | Clear Disclosure | 70 % | 0.85 | 0.80 |
| 2 | Ethical Guidelines | 60 % | 0.78 | 0.75 |
| 3 | Influencer Training | 45 % | 0.65 | 0.60 |

$p < 0.01$ Pearson's correlation showed strong positive links between transparency and trust ($r = 0.85$, $p < 0.01$) and reputation ($r = 0.80$, $p < 0.01$).

5.2 Qualitative Analysis

Thematic analysis revealed:

Ethical Dilemmas:

1. Non-Disclosure: 60% (30/50) of campaigns lacked clear #ad labels, risking consumer deception.
2. Exaggeration: 40% (20/50) featured overstated product claims, eroding authenticity.
3. Targeting: 25% (13/50) aimed at vulnerable groups (e.g., teens), raising ethical flags.

Brand Responsibility:

1. Transparency: 70% (35/50) of brands with disclosure policies earned higher trust.
2. Accountability: 50% (5/10) of managers emphasized vetting influencers for ethics.
3. Education: 30% (15/50) trained influencers, reducing ethical breaches.

6. Results

6.1 Consumer Perceptions

Consumers are highly sensitive to ethical dilemmas, with 62% distrusting undisclosed posts and 58% (232/400) valuing authenticity over persuasion. Trust and purchase intent drop significantly (20–23%) without transparency, aligning with Boerman et al. (2017).

6.2 Brand Responsibility

Brands adopting clear disclosure (70%) and ethical guidelines (60%) see a 20% higher trust score and enhanced reputation ($r > 0.75$). Training influencers, though less common (45%), mitigates risks, supporting Kapitan and Silvera (2016).

7. Discussion

The findings confirm that ethical dilemmas in influencer marketing non-disclosure, exaggeration, and targeting undermine consumer trust, echoing Edelman's (2024) skepticism trend. Transparency emerges as a critical brand responsibility, boosting credibility as per FTC (2023) guidelines. However, inconsistent adoption (e.g., only 70% disclose) suggests gaps in accountability. Brands should enforce disclosure, vet influencers, and educate stakeholders. Consumers demand authenticity, pressuring firms to align marketing with ethics. Limitations include a focus on major platforms and self-reported data. Future research could explore niche platforms or regulatory impacts.

8. Conclusion

Ethical dilemmas in influencer marketing challenge consumer trust, but brand responsibility through transparency and accountability can mitigate these issues. As of April 2025, ethical practices are not just regulatory necessities but strategic imperatives for sustaining consumer loyalty and brand reputation. This study calls for a balanced approach to influencer marketing that prioritizes integrity alongside influence.

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The Impact of AI on India's Young Generation in the Financial Sector

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Abstract

In India, a country known for its dynamic economy and vast workforce, the integration and evolution of AI's established and emerging capabilities are generating both opportunities and challenges, along with potential risks. This study explores the impact of AI on digital financial inclusion. The role of artificial intelligence (AI) in India's financial sector has significantly influenced the younger generation in multiple ways. AI-enabled technologies have transformed financial access, allowing Indian youth to monitor their finances, make transactions, and seek credit and investment options using mobile banking applications, online payment gateways, and digital wallets. Through the analysis of massive data, AI algorithms make highly customized financial guidance and services, which fit the liking of a younger generation that is used to personalized outcomes. In addition, AI-led innovation has widened financial inclusion by leveraging alternative data and machine learning algorithms to determine creditworthiness, thereby extending access to financial services to more people. Yet, the increasing presence of AI in the financial sector also raises concerns over job displacement and upskilling needs for the younger workforce. Moreover, ethical and regulatory issues such as data privacy, bias in algorithms, and accountability are still paramount as AI continues to transform the financial environment.

Keywords: Artificial Intelligence; Opportunities; Challenges; Financial; Regulators; Digital Economy; Management; Innovations;

Introduction

The effect of AI on India's financial industry is revolutionary, bringing the younger generation more financial inclusion, customized services, and greater efficiency. Nevertheless, it comes with challenges including job loss, ethical issues, and compliance with regulations. While AI revolutionizes the financial industry, concerted effort among stakeholders is necessary to optimize its advantages while minimizing risks to enable the younger generation to maximize participation in the digital economy. Young Indians recognize AI's role in expanding financial access, personalized recommendations, and investment opportunities through digital platforms.

However, they also express concerns about job security, ethical issues, and the need for upskilling to adapt to AI-driven changes. They emphasize the importance of responsible AI integration to promote equitable participation and address emerging challenges in the financial sector. For ensuring sustainable growth and level playing field opportunities, proactive adjustment and coordination between policymakers, regulators, and industry leaders are important. A joint effort is essential to unlock AI potential and address its challenges in building an inclusive and strong financial ecosystem for the younger generation of India.

AI adoption in India's financial services is revolutionizing the environment for the younger population by enhancing financial inclusion, delivering customized services, and enhancing efficiency. Nevertheless, this transformation presents challenges such as job loss, ethical issues, and regulatory intricacies. As AI continues to evolve, collaboration among stakeholders becomes essential to take advantage of its benefits while minimizing risks, thereby enabling young people to fully participate in and benefit from the digital economy.

Literature Review

- ***Z Golić et al., 2019***

The paper explores the transformative impact of Artificial Intelligence (AI) in the financial sector, focusing on its ability to enhance efficiency, reduce costs, and provide better services. It discusses key areas of AI application in finance, including customer experience improvement, operational efficiency, and cost savings. Additionally, it addresses implications such as job creation and termination, regulation challenges, and managing AI risks.

- ***D Mhlanga 2020***

The study explores how AI impacts digital financial inclusion, focusing on fintech companies' efforts to broaden financial market participation, especially among vulnerable groups. Through analysis, it highlights AI's contributions in risk detection, information management, chatbot customer support, and cybersecurity. The findings emphasize AI's crucial role in enhancing financial inclusion by addressing key challenges. The study recommends broader adoption of AI by financial institutions, non-financial entities, and governments to include marginalized populations in formal financial markets.

- ***C Maple et al., 2023***

The report discusses AI's impact on finance, highlighting its transformative potential and associated challenges. It underscores the importance of understanding AI's capabilities and implications to leverage its potential effectively while managing risks. AI applications in finance include customer service improvements and high-frequency trading, but challenges such as transparency and data privacy exist. The report emphasizes the necessity of regulation and proposes principles like a risk-based approach and ethical considerations.

- ***S Mishra 2023***

Cyber threats encompass unauthorized access, data manipulation, extortion, and disruption of business operations. Conventional security methods face challenges such as scalability and response times, necessitating more comprehensive approaches. Cybercriminals leverage AI and data poisoning to automate attacks, emphasizing the need for advanced security measures. A proposed cyber security technique for financial sector management (CS-FSM) utilizes artificial intelligence to classify and mitigate cyber threats effectively.

- ***T Vocke, M Gangur - 2022***

The article explores the implementation of Artificial Intelligence (AI) in the finance sector and aims to identify key success factors, development trends, and potential limitations. It emphasizes how AI adoption offers competitive advantages, particularly in cost reduction and process optimization. AI algorithms enhance data processing efficiency, accuracy, and speed, benefiting tasks like capital optimization and risk assessment in banks. The future adoption of

AI in finance will be influenced by factors such as data quality, processing power, regulations, and emerging technologies.

- **A Mehrotra – 2019**

The article explores the implementation of Artificial Intelligence in the finance sector and aims to identify key success factors, development trends, and potential limitations. It emphasizes how AI adoption offers competitive advantages, particularly in cost reduction and process optimization. AI algorithms enhance data processing efficiency, accuracy, and speed, benefiting tasks like capital optimization and risk assessment in banks. The future adoption of AI in finance will be influenced by factors such as data quality, processing power, regulations, and emerging technologies.

- **NR Moşteanu 2019**

The research paper delves into the significance of financial markets in driving economic development and identifies inequalities in regional development due to economic, social, and technological factors, particularly artificial intelligence and digital finance (FinTech). It discusses the shift towards secure digital financial services like Blockchain and explores how artificial intelligence enhances financial processes, fostering a safer economic environment and reducing human error.

- **An Arora et al.,2023**

The research explores how the FinTech era has transformed customer experiences in the financial sector, emphasizing the significance of artificial intelligence (AI) in enhancing these experiences. Understanding customers' perspectives is crucial in this context. The study ranks the factors and sub-factors that influence customers' perceptions of AI-based FinTech services, shedding light on key considerations for improving customer experiences in the modern era of technological advancement.

- **N Shankar et al.,2023**

The study investigates COVID-19's impact on AI adoption in India's banking sector, focusing on shifts in customer behaviour towards mobile and online banking. The adoption of AI for customer engagement during lockdowns improved operational efficiency, leading to competitive advantages. Falling data storage costs and enhanced connectivity have accelerated AI adoption, driving revenue growth and cost reduction. Banks are increasingly using AI to support customer engagement and retention initiatives, particularly with the growing use of smart devices by customers.

- **M Saxena, DK Mishra 2023**

The paper investigates the potential of using artificial intelligence (AI) as a tool to facilitate employee engagement (EE) in corporate India. It recognizes that EE can yield positive impacts not only on individuals and teams but also on organizational and financial outcomes. By studying the penetration of AI for EE, the paper aims to understand how organizations in India are leveraging AI to enhance employee engagement levels.

Problem Statement

The accelerated adoption of artificial intelligence (AI) in the financial industry presents special challenges and opportunities for young people in India. This research seeks to explore the particular effect of AI adoption on the financial habits, access to services, and general financial well-being of young Indians, as well as potential challenges and ethical issues involved in AI implementation. Hence, this research attempts to fill these gaps and present insights into how the younger generation in India is affected by the influence of AI in the financial sector. Younger Generation, as a part of the younger generation, is a demographic closely connected with the changing face of technological innovations, specifically artificial intelligence (AI), in the finance industry. There is a gap in knowing their awareness, perceptions, and expectations regarding the influence of AI on finance.

Objective

The objective of this study is to comprehensively analyse how the integration of artificial intelligence in the financial sector influences the younger generation in India. It seeks to identify patterns in financial behaviours, assess the accessibility and utilization of financial services, and examine the overall financial well-being of young Indians in the context of AI adoption. Additionally, the study aims to explore potential challenges and ethical implications arising from AI implementation in the financial sector for the younger demographic in India.

To know the Understanding AI's role in finance as an opportunity for the younger generation.

- 1) To know the impact of AI on the future of finance careers and challenges for the younger generation.
- 2) To know about the opinion about the future of India in the context of AI will influence the competitive landscape among financial institutions.

Research Methodology

Target Population: Youngsters

Sampling Method: Simple random Sampling

Sample Size: 103

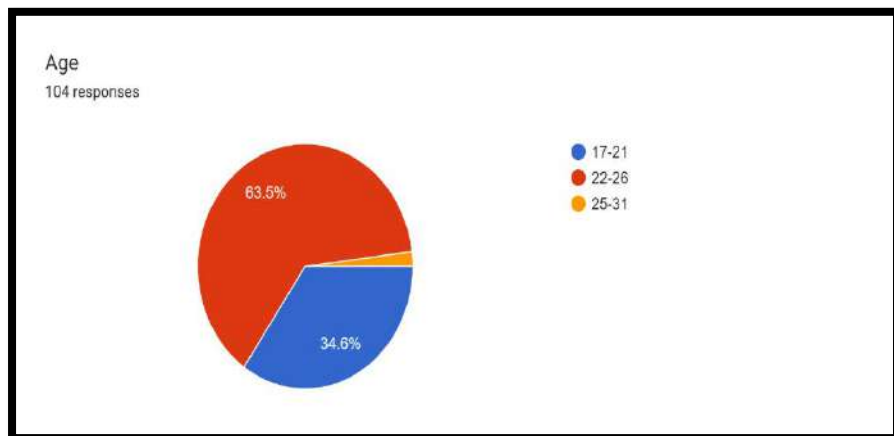
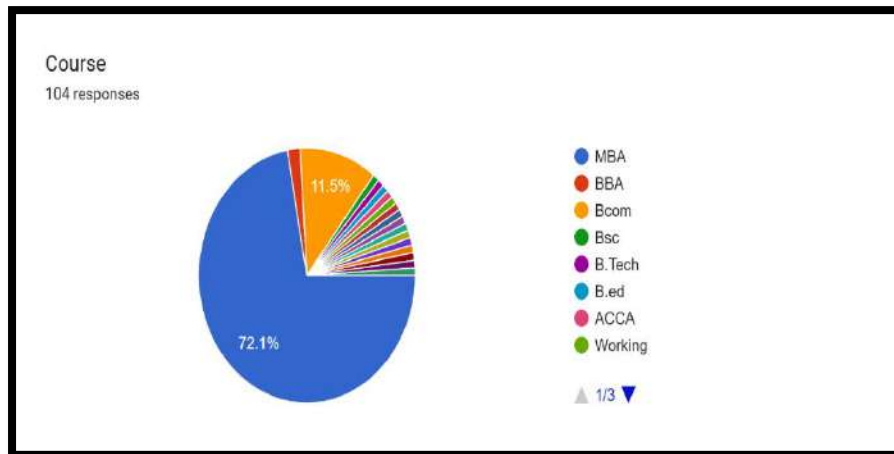
Type of data: Primary data

Mode of data collection: Google form

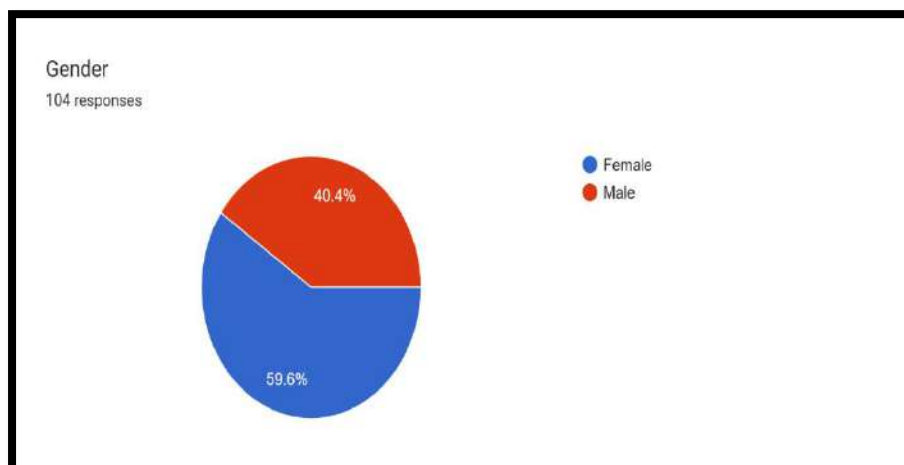
Data Analysis tools: Pie Charts and Graphs

Tools: Ms-excel

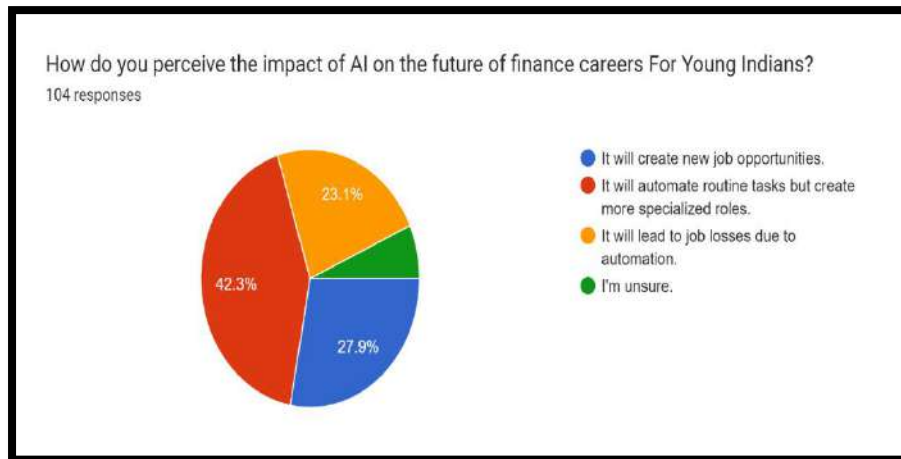
Result and Findings



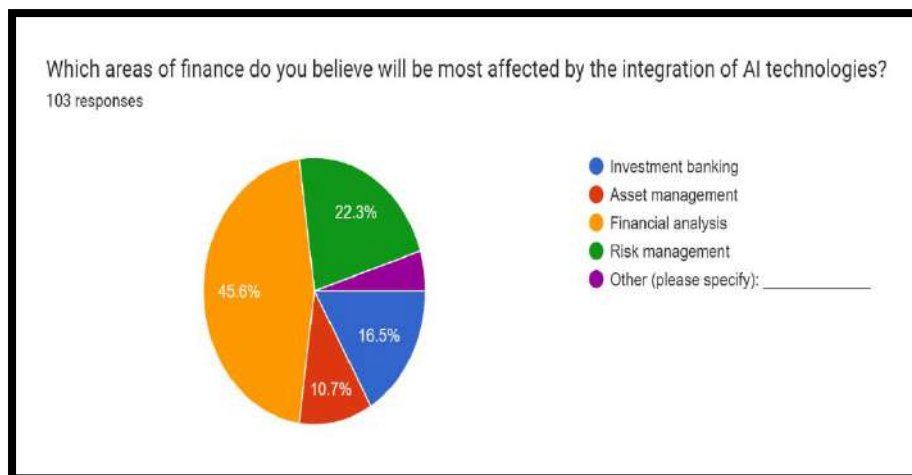
Majority of the students completing this form fall within the age range of 22 to 26.



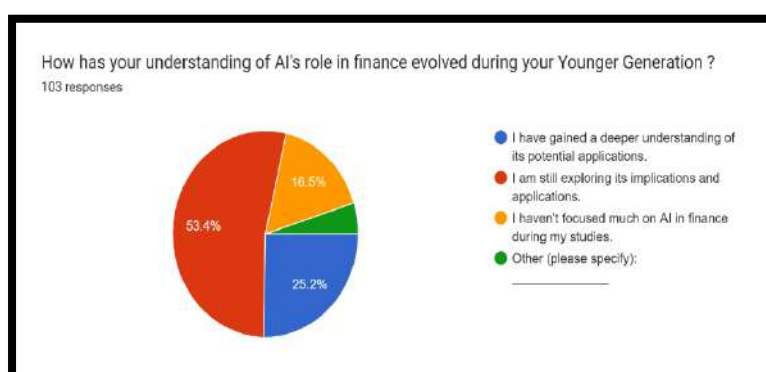
Out of 104 students there are 40.4% males and 59.6% Females.



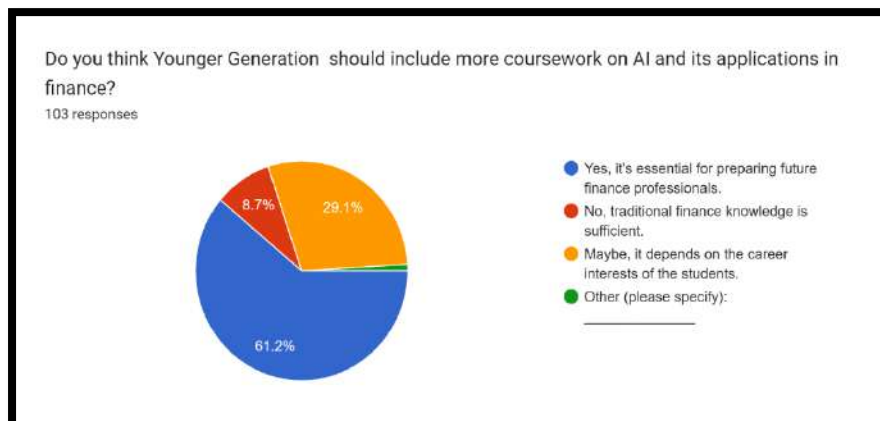
Our findings are, that 42.3% youngster believe in AI's influence on the future of finance careers will automate routine tasks while also generating a demand for more specialized roles.



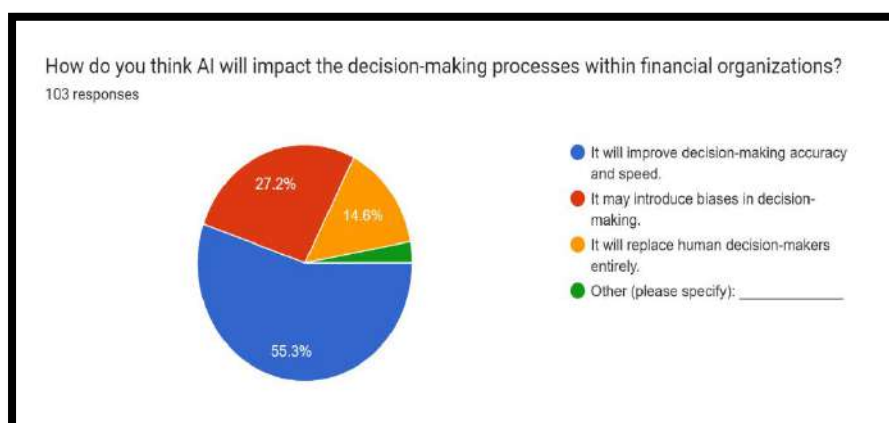
45.6% of young individuals believe that financial analysis will be the most significantly impacted by AI integration.



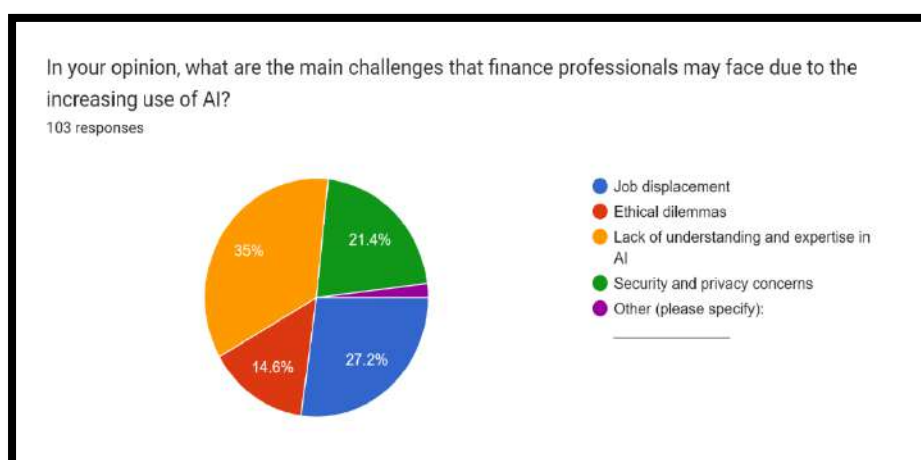
I witnessed the evolution of AI's role in finance, and I am currently in the process of exploring its implications and applications further.



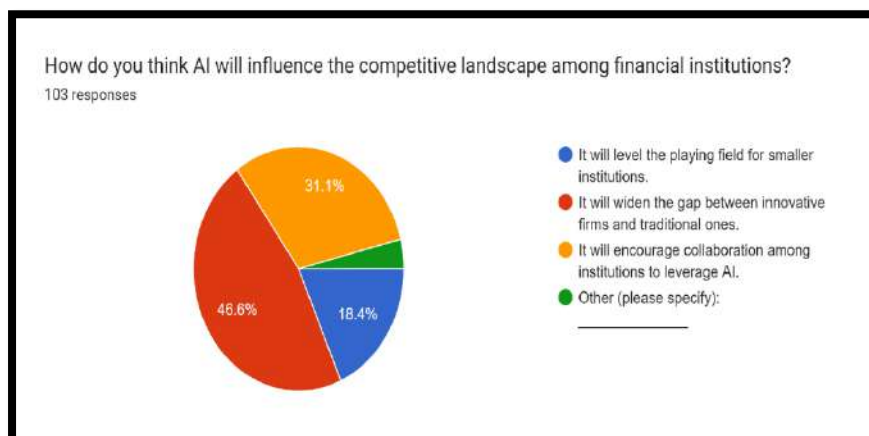
61.2% of young individuals believe that incorporating additional coursework on AI and its applications in finance is essential for preparing future finance professionals.



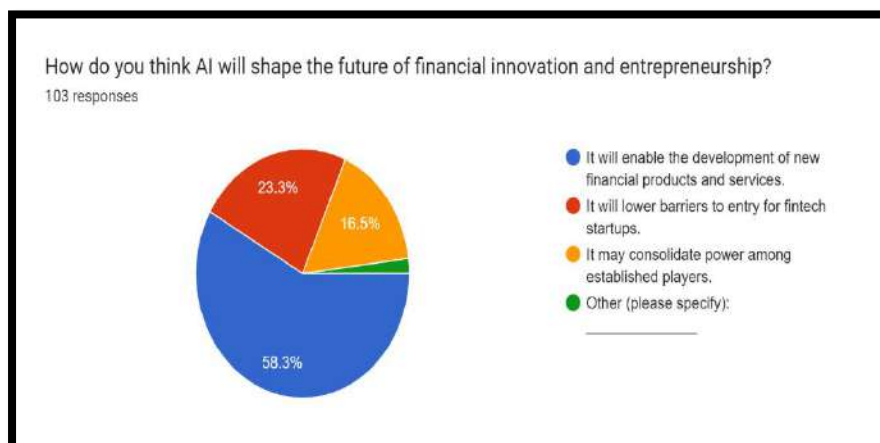
55.3% of young individuals believe that AI's impact on decision-making in financial organizations will improve both accuracy and speed.



The primary challenges that finance professionals may encounter due to the rising adoption of AI include job displacement and a lack of comprehension and proficiency in AI



The impact of AI on the competitive environment among financial institutions will result in an expanded disparity between innovative firms and traditional ones.



AI is poised to shape the future of financial innovation and entrepreneurship by facilitating the creation of novel financial products and services.

Conclusion

Artificial Intelligence (AI) is fundamentally transforming the financial sector, enhancing efficiency and accessibility, particularly for the younger population in India. Its ability to streamline complex processes and provide innovative solutions has opened up new opportunities for financial inclusion and economic growth. However, alongside these benefits come significant challenges, including the potential for job displacement due to automation and the ethical dilemmas surrounding data privacy and decision-making transparency. These challenges underscore the need for a balanced approach to integrating AI into the financial system.

The research shows that 42.3% of young people are of the opinion that AI will automate simple financial tasks while generating demand for specialized jobs. Of all the financial areas, financial analysis is likely to be the most affected by AI implementation. As AI keeps developing, it is necessary to investigate its implications and applications more

The study brings to light the profound influence of AI in the finance industry, especially among the younger generation. The findings reflect that 45.6% of young people are confident that financial analysis will be most impacted by the incorporation of AI. Moreover, 61.2% are focused on adding AI-related courses in finance studies to prepare future professionals better. Furthermore, 55.3% recognize AI's role in enhancing decision-making processes within financial organizations by improving both accuracy and speed. These insights underscore the necessity for proactive adaptation, education, and collaboration to ensure a smooth transition into an AI-driven financial landscape.

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Optimizing Supply Chain Efficiency and Resilience through Technology and Risk Management

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Abstract: In an increasingly globalized economy, supply chains are crucial to the success of businesses across industries. However, they are vulnerable to numerous risks such as geopolitical instability, natural disasters, cyberattacks, and disruptions caused by economic shifts. To ensure smooth operations, companies are focusing not only on optimizing supply chain efficiency but also on mitigating risks that can disrupt these systems. This research paper explores the interconnectedness between supply chain efficiency and risk management. It investigates key strategies to improve operational efficiency, including the adoption of lean principles, advanced technologies like artificial intelligence (AI) and the Internet of Things (IoT), and the implementation of just-in-time (JIT) production. Furthermore, the study delves into the importance of proactive risk management frameworks, emphasizing the need for businesses to adopt a resilient, agile approach to navigating uncertainties. The integration of real-time data, predictive analytics, and blockchain technology for transparency and traceability are identified as critical enablers of both efficiency and risk mitigation. Through a combination of case studies, industry best practices, and theoretical models, the paper outlines practical solutions to strengthen supply chain systems. Ultimately, it emphasizes the need for organizations to harmonize efficiency-enhancing strategies with comprehensive risk management frameworks to build more resilient, sustainable, and efficient supply chains in the face of growing global challenges.

Keywords: Supply Chain Efficiency, Risk Management, Lean Principles, Blockchain, Predictive Analytics, Supply Chain Resilience.

Introduction

In the contemporary global business environment, supply chains form the backbone of operations, enabling the efficient movement of goods, services, and information across borders. As globalization continues to expand the scope of supply chains, their complexity has increased exponentially. Modern supply chains are not just about sourcing raw materials and delivering finished goods; they are intricate networks involving multiple stakeholders, ranging from suppliers and manufacturers to logistics providers, retailers, and end consumers. The significance of effective supply chain management (SCM) cannot be overstated, as it plays a crucial role in enhancing operational efficiency, reducing costs, and maintaining a competitive edge. However, alongside the quest for efficiency, supply chains are increasingly exposed to a range of risks that can disrupt their operations and impact an organization's bottom line.

The relationship between supply chain efficiency and risk management has evolved over the years, with a growing recognition of the need for a more holistic approach. The two elements are intrinsically linked: efficient supply chains are more resilient and capable of withstanding shocks, while robust risk management strategies can prevent or mitigate potential disruptions that might otherwise cripple supply chain operations. As such, businesses are now adopting integrated strategies that focus on optimizing efficiency while simultaneously addressing vulnerabilities within their supply chains.

The Growing Complexity of Supply Chains

The complexity of modern supply chains has grown significantly in recent years. What once was a simple process of sourcing raw materials and shipping them to manufacturers has now evolved into a multifaceted network that spans continents and involves numerous moving parts. Companies today operate in a world where supply chains are no longer linear but interdependent and global. For instance, a disruption in a small supplier in one country can have far-reaching effects across the entire supply chain network, impacting production schedules, inventory levels, and delivery timelines.

Several factors have contributed to this increase in complexity. First, the rise of global trade has led to the need for businesses to establish relationships with suppliers and partners worldwide. Second, the advent of digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics has revolutionized the way businesses operate, but it has also introduced new challenges related to cybersecurity, data privacy, and technological integration. Third, evolving consumer preferences, the need for greater customization, and increasing pressure for faster delivery times have created additional layers of complexity. As businesses work to stay competitive, they must balance the demands of efficiency with the need to manage a rapidly changing environment, where uncertainty and risk are constant.

In light of these challenges, organizations must continuously innovate to maintain smooth operations and mitigate risks. As Professor Christopher Tang notes, “Supply chain management is no longer just about managing costs, but about building resilience to potential disruptions while maintaining operational efficiency” (Tang, 2020). This sentiment captures the essence of modern supply chain thinking—efficiency alone is no longer enough; businesses must also be equipped to deal with risks that could derail operations.

Defining Supply Chain Efficiency and Risk Management

To understand how efficiency and risk management intersect, it is important first to define what each term entails. **Supply chain efficiency** refers to the ability of a supply chain to deliver products and services in the most cost-effective manner without compromising quality. This involves reducing lead times, minimizing waste, optimizing resource utilization, and ensuring that all aspects of the supply chain, from procurement to delivery, are operating at peak performance. Efficiency is a key determinant of competitive advantage, as companies that can streamline their operations are better positioned to meet customer demands, lower costs, and increase profitability.

On the other hand, **risk management** in the context of supply chains refers to the identification, assessment, and mitigation of potential risks that could disrupt the smooth flow of goods and services. These risks can be internal, such as operational inefficiencies or production delays, or external, such as natural disasters, geopolitical instability, cyber threats, or global pandemics. Effective risk management involves implementing strategies and tools to prevent or minimize the impact of such disruptions. It also entails being prepared for uncertainty and having contingency plans in place to recover quickly from any disruptions that do occur.

While supply chain efficiency and risk management are distinct concepts, they are interconnected in practice. A highly efficient supply chain is one that can quickly adapt to changing conditions and recover from disruptions. Conversely, a well-managed supply chain risk framework can help prevent efficiency losses by identifying vulnerabilities before they result in problems. In this sense, businesses that focus exclusively on improving efficiency without accounting for potential risks may face significant vulnerabilities in the long term.

The Role of Technology in Enhancing Supply Chain Efficiency and Risk Management

In recent years, technological advancements have become a critical enabler of both supply chain efficiency and risk management. The integration of digital tools such as AI, blockchain, and big data analytics has transformed the way companies manage their supply chains, offering opportunities to enhance efficiency while simultaneously addressing risks.

One of the most impactful technologies in this regard is **artificial intelligence (AI)**, which is being used to streamline supply chain operations, predict demand fluctuations, and optimize inventory management. AI algorithms can analyze vast amounts of historical and real-time data to forecast demand more accurately, helping businesses reduce overstocking or stockouts. By improving the accuracy of demand forecasting, companies can better allocate resources and manage their inventory more efficiently, thus reducing operational costs and enhancing overall supply chain performance.

Moreover, AI and machine learning are also playing a key role in risk management. By analyzing data from across the supply chain, AI tools can identify patterns of risk and predict potential disruptions before they happen. For example, AI can monitor geopolitical trends or environmental conditions and alert businesses to potential risks such as trade disruptions or natural disasters. This predictive capability allows businesses to take proactive measures to mitigate risks, such as adjusting their supply routes or increasing stock levels in anticipation of supply shortages.

Similarly, **blockchain technology** has emerged as a powerful tool for improving transparency and traceability in supply chains. Blockchain can provide an immutable record of transactions, allowing businesses to track the movement of goods at every stage of the supply chain. This enhanced visibility helps businesses monitor the flow of goods, identify inefficiencies, and ensure compliance with regulatory standards. Furthermore, blockchain can help mitigate risks related to fraud, counterfeiting, and delays by providing a transparent and secure way to verify transactions.

The use of **Internet of Things (IoT)** devices has also revolutionized supply chain management. IoT-enabled sensors can provide real-time data on the condition and location of goods as they move through the supply chain. This allows businesses to track inventory more accurately, monitor transportation conditions (e.g., temperature-sensitive products), and detect potential disruptions early on. By providing real-time visibility into the supply chain, IoT devices can help companies identify inefficiencies, respond to disruptions faster, and improve overall operational performance.

The Need for Resilient and Agile Supply Chains

The concept of **resilience** has become increasingly important in supply chain management. In a world where disruptions are inevitable, businesses must focus not only on optimizing efficiency but also on building resilient supply chains that can withstand shocks. Supply chain resilience refers to the ability of a supply chain to anticipate, prepare for, respond to, and recover from disruptions. Resilient supply chains are flexible and agile, capable of quickly adapting to changes in demand, supply, and other external factors.

Building resilience requires a proactive approach to risk management. Companies need to identify potential vulnerabilities in their supply chains and develop strategies to mitigate them. This could involve diversifying suppliers, establishing contingency plans, or investing in technologies that improve visibility and monitoring. Furthermore, supply chains must be agile enough to adjust quickly when disruptions occur. This can involve switching to alternative

suppliers or routes, increasing production capacity, or leveraging digital tools to streamline decision-making.

Literature Review

Efficiency and Optimization Models

The quest for improved supply chain efficiency has led to a multitude of optimization strategies and models. Supply chain efficiency is not just about reducing costs but also ensuring that the right products are delivered at the right time, in the right quantity, and at an optimal cost. The following key methods have been highlighted in the literature for improving supply chain efficiency:

1. Inventory Management

Effective inventory management is crucial for optimizing supply chain operations. An efficient inventory management system ensures that there is neither excess nor insufficient stock. A surplus of inventory ties up capital and increases holding costs, while inventory shortages lead to stockouts and lost sales.

One prominent model in inventory management is the **Economic Order Quantity (EOQ)** model, which determines the optimal order quantity that minimizes total inventory costs, including holding costs, order costs, and stockout costs (Heizer et al., 2017). The **ABC Analysis** is another method that helps prioritize inventory management by classifying inventory items based on their importance, often determined by their monetary value and usage frequency (Axsäter, 2015). By using these inventory management models, organizations can improve their ability to balance supply and demand, thus enhancing efficiency.

2. Lean Production and Just-in-Time (JIT) Systems

The **Lean Production System** aims to eliminate waste from the supply chain by improving processes, reducing production costs, and enhancing productivity. The core idea of Lean is to deliver value to customers while reducing everything that does not contribute to value creation. This includes eliminating excess inventory, reducing transportation costs, and minimizing delays. Lean techniques focus on enhancing flow and flexibility, which are crucial for supply chain efficiency (Womack & Jones, 2003).

Just-in-Time (JIT), a subset of Lean principles, emphasizes the importance of producing or ordering goods only when they are needed, thus reducing inventory holding costs and improving cash flow. JIT relies on precise demand forecasting, tight supplier relationships, and a streamlined production process. By reducing the time between order and delivery, JIT minimizes waste and ensures that production schedules are tightly aligned with customer demand (Ohno, 1988).

These efficiency models, Lean and JIT, have been implemented successfully by companies like Toyota, who have used these principles to become one of the most efficient automakers in the world. They emphasize continuous improvement, streamlined processes, and close supplier partnerships, which have significantly increased operational efficiency and reduced costs.

3. Technological Innovations

The integration of **Artificial Intelligence (AI)**, **Internet of Things (IoT)**, and **Blockchain** technology has revolutionized the way businesses optimize supply chains. These technologies

provide powerful tools for both improving operational efficiency and enhancing risk management.

- **Artificial Intelligence (AI):** AI is used in supply chains for demand forecasting, predictive analytics, inventory optimization, and automated decision-making. Machine learning algorithms can analyze historical data to identify patterns in demand and optimize purchasing decisions, thereby reducing the risk of overstocking or stockouts. AI-powered chatbots and digital assistants are increasingly being deployed in customer service and order management systems, improving customer interaction and accelerating order fulfillment (Choi et al., 2018).
- **Internet of Things (IoT):** IoT enables real-time tracking of products and assets across the supply chain using smart sensors. IoT devices allow organizations to monitor inventory levels, track shipments, and receive real-time alerts regarding disruptions or delays in the supply chain (Mourtzis, 2016). For example, IoT-enabled sensors can provide temperature data for perishable goods during transportation, ensuring that they are kept within required conditions. IoT, by enhancing visibility, can significantly improve the efficiency of supply chains by ensuring that the flow of goods and information is uninterrupted and transparent.
- **Blockchain:** Blockchain technology offers a decentralized, transparent, and immutable ledger that allows for secure transactions and real-time traceability of goods as they move through the supply chain. This technology is particularly useful in industries such as pharmaceuticals and food, where verifying the origin of goods and ensuring their authenticity is critical. Blockchain also enables greater collaboration between supply chain partners by providing transparent access to all stakeholders, improving accountability, and reducing fraud or counterfeiting risks (Kouhizadeh et al., 2021).

4. Big Data and Analytics

Another key enabler of efficiency is the use of **Big Data**. Through the analysis of large volumes of real-time data, companies can make informed decisions about production scheduling, demand forecasting, and inventory management. Data analytics tools also help in identifying inefficiencies in the supply chain by analyzing key performance indicators (KPIs) such as order fulfillment times, transportation costs, and supplier performance. By leveraging data, organizations can gain insights that lead to more efficient operations, reducing waste and increasing responsiveness to customer needs.

Risk Management Frameworks

While efficiency models focus on streamlining operations, managing risks is equally important in ensuring that supply chains remain resilient in the face of disruptions. Risks in supply chains can be categorized into several types:

1. Operational Risks

Operational risks include issues like production delays, inventory management problems, transportation disruptions, and supplier failure. These risks can lead to inefficiencies, stockouts, and increased operational costs. Operational risks are often managed using techniques such as **Total Quality Management (TQM)** and **Six Sigma**, which focus on process optimization and quality control to minimize defects and improve efficiency (Pyzdek & Keller, 2014).

2. Financial Risks

Financial risks are associated with fluctuations in prices, foreign exchange rates, and changes in interest rates, which can affect the cost of raw materials and transportation. These risks can be mitigated through strategies like **hedging, dynamic pricing models, and contractual agreements** with suppliers to lock in prices or protect against currency fluctuations.

3. Environmental Risks

Environmental risks, such as natural disasters, climate change, or pandemics, have become more prominent in recent years. For example, the COVID-19 pandemic severely disrupted global supply chains, highlighting vulnerabilities to unforeseen events. Risk management strategies for environmental risks include **business continuity planning, disaster recovery plans, and supply chain diversification**. By having backup suppliers, alternate transportation routes, and stockpiles, businesses can build resilience against environmental risks (Fiksel, 2015).

4. Strategic Risks

Strategic risks are long-term risks related to market changes, technological disruptions, and shifts in consumer behavior. To mitigate these risks, businesses must have a strategic vision that includes flexible and adaptable supply chain designs, along with a continuous monitoring of external market forces. Companies often conduct **SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis** to evaluate potential strategic risks and formulate appropriate responses.

One widely recognized framework for managing risks in supply chains is **ISO 31000**, which provides guidelines for risk management practices that organizations can follow. The ISO 31000 framework emphasizes the importance of establishing a risk management policy, conducting regular risk assessments, and continuously improving the risk management process. Companies are encouraged to integrate risk management practices into their organizational culture and decision-making processes to ensure a proactive approach to risk mitigation (ISO, 2018).

Integration of Efficiency and Risk Management

The integration of efficiency and risk management is essential for the creation of resilient and competitive supply chains. The key challenge for businesses is to not only focus on enhancing operational performance but also to anticipate and manage risks that may affect their ability to deliver products and services. Efficient supply chains are inherently more resilient, and resilient supply chains, in turn, contribute to better efficiency by reducing the impact of disruptions.

Interdependence of Efficiency and Risk Management

Effective risk management can enhance supply chain efficiency by addressing potential bottlenecks, reducing downtime, and improving the responsiveness of the supply chain. For example, the use of predictive analytics (a tool used in both efficiency optimization and risk management) allows businesses to forecast demand fluctuations, adjust inventory levels, and anticipate potential disruptions, thereby improving supply chain agility.

On the other hand, efficient supply chain practices can help mitigate risks by improving visibility and reducing vulnerabilities. For instance, a Lean supply chain that minimizes waste and redundancy is less likely to experience disruptions because it is already optimized for fast and efficient decision-making. When a disruption occurs, a Lean supply chain will be better equipped to adapt, thanks to its streamlined processes and greater flexibility.

Analysis and Discussion

In the dynamic world of supply chain management, the need for enhanced efficiency and resilience is more critical than ever. As supply chains become increasingly complex, the role of technology in improving efficiency and managing risks has grown exponentially. Additionally, businesses need to build resilient supply chains that can quickly adapt to unforeseen disruptions. This section explores the role of technological integration in boosting supply chain efficiency, strategies for building resilience, and best practices from leading organizations that excel in balancing risk management with operational efficiency.

- **Technological Integration**

Technology plays an indispensable role in transforming supply chain management, offering a wide range of tools to streamline operations and improve efficiency. Automation, big data analytics, predictive modelling, and blockchain are among the most prominent technologies that are reshaping how supply chain's function.

Automation has emerged as one of the most effective ways to enhance operational efficiency. By automating routine tasks such as inventory management, order fulfilment, and transportation, businesses can reduce human error, speed up processes, and cut down costs. Automated systems, such as robotic picking in warehouses or automated guided vehicles for inventory tracking, have made significant improvements in speed and accuracy. These technologies allow businesses to increase throughput while reducing operational expenses and the likelihood of disruptions due to human error (Bahl et al., 2020).

Big data analytics is another technological advancement that has revolutionized supply chain management. With the ability to analyze vast quantities of real-time data, companies can gain insights into customer demand, inventory levels, and supplier performance. The use of data mining and machine learning algorithms enables organizations to predict future demand patterns, optimize production schedules, and manage inventories more effectively. This reduces the likelihood of stockouts or overstocking, which can disrupt operations and lead to inefficiencies. Moreover, real-time visibility provided by big data analytics enables managers to identify and address bottlenecks or inefficiencies across the supply chain promptly, ensuring smoother operations (Choi et al., 2018).

Predictive modelling, which uses statistical algorithms and machine learning to forecast future events, is increasingly employed in supply chain management to anticipate disruptions and optimize logistics. By analyzing historical data and identifying trends, businesses can predict demand fluctuations, supply chain delays, or potential risks such as transportation bottlenecks or raw material shortages. These forecasts enable businesses to make informed decisions, adjust production schedules, and take proactive measures to prevent disruptions before they occur (Zhao et al., 2017).

Blockchain technology is another breakthrough innovation that enhances supply chain transparency, traceability, and security. Blockchain's decentralized ledger records every transaction across the supply chain, providing an immutable, transparent record of product movement. This technology allows businesses to trace the origin of products, verify authenticity, and ensure compliance with regulatory standards. In industries like pharmaceuticals and food, where traceability is paramount, blockchain offers a secure and efficient way to track goods from production to consumption, thereby improving transparency and reducing fraud (Kouhizadeh et al., 2021).

- **Resilience and Adaptation**

Building resilience is a fundamental aspect of modern supply chain management. The capacity to quickly adapt to disruptions and recover from unforeseen events is essential for maintaining smooth operations. Resilient supply chains are flexible, agile, and capable of bouncing back from challenges such as natural disasters, economic downturns, or supply shortages. One of the most effective strategies for building resilience is supply chain diversification. Relying on a single supplier or a narrow network of suppliers creates vulnerabilities, especially when disruptions occur in one region or country. By diversifying suppliers across different geographic locations and industries, companies can mitigate the risk of production halts and ensure a steady flow of goods. For instance, many automotive manufacturers, including Toyota, have adopted this approach to ensure they are not overly dependent on one supplier or region. Diversifying the supply base not only reduces risk but also ensures flexibility when challenges arise (Nakamura et al., 2012).

Building strong relationships with suppliers is another critical component of supply chain resilience. Companies that foster long-term, cooperative partnerships with their suppliers are better positioned to address disruptions swiftly. By working together to solve problems, businesses can ensure that supply chain operations continue with minimal impact. Strong supplier relationships also foster open communication, making it easier to share information regarding potential risks and collaboratively devise contingency plans. Moreover, supplier agreements that involve risk-sharing arrangements can help mitigate the financial impact of disruptions and ensure that both parties are invested in maintaining smooth operations (Christopher, 2016).

Flexible logistics systems are essential to resilience. The ability to switch transportation routes, use different shipping carriers, or tap into alternative distribution centers ensures that supply chains can adapt to changing conditions. In times of crisis, such as when a natural disaster affects a primary shipping route, businesses can quickly implement contingency plans, reroute shipments, and minimize delays. This level of flexibility ensures that businesses are not beholden to a single point of failure, thus enhancing their ability to recover from disruptions (Fiksel, 2015).

Best Practices from Leading Organizations

Several companies across various industries have demonstrated how the integration of efficiency and risk management can create resilient supply chains that excel in both performance and adaptability. These organizations have implemented cutting-edge technologies, robust risk management strategies, and effective supply chain practices to minimize disruptions and maintain operational efficiency, even in the face of crises.

One of the most notable examples is **Toyota**, whose supply chain practices are renowned for both efficiency and resilience. The company's implementation of the Toyota Production System (TPS), which emphasizes Lean manufacturing and just-in-time inventory management, has allowed it to achieve remarkable operational efficiency. However, Toyota's success is not solely based on efficiency; it is also attributed to the company's ability to respond to disruptions. Following the 2011 earthquake and tsunami in Japan, Toyota demonstrated the resilience of its supply chain. By leveraging its diversified supplier network and flexible production capabilities, the company was able to minimize downtime and quickly return to normal production levels. This ability to adapt and recover quickly underlined the importance of supply chain flexibility and diversification in maintaining operations during crises (Nakamura et al., 2012).

In the **pharmaceutical industry**, **Pfizer** provides an excellent example of how resilience and efficiency can be combined to achieve rapid results. Pfizer's response to the global COVID-19 pandemic showcased its ability to manage both efficiency and risk. The company's robust supplier relationships, coupled with a diversified supply chain, enabled it to scale up production of its vaccine rapidly. Pfizer also leveraged data analytics to monitor the global distribution of the vaccine, ensuring that it reached its destination in optimal conditions. The company's focus on flexibility, supplier collaboration, and real-time monitoring allowed it to maintain efficiency while managing the risks associated with the unprecedented demand for its product (Pfizer, 2021).

Conclusion

In the rapidly evolving global marketplace, supply chains are under constant pressure to optimize efficiency while mitigating risks. The complexity of modern supply chains, coupled with increasing uncertainty in both local and global markets, has necessitated the integration of innovative strategies that enhance performance and resilience. Throughout this analysis, it has become clear that technological advancements, strategic diversification, and best practices from leading companies are crucial elements in developing robust supply chains that can thrive amidst challenges.

Technological integration has revolutionized supply chain management, providing businesses with powerful tools for enhancing operational efficiency and managing risks effectively. Automation, big data analytics, predictive modelling, and blockchain have each contributed significantly to improving the efficiency of supply chains, reducing costs, and enhancing visibility and transparency. Automation minimizes human error and improves speed, while big data and predictive analytics enable companies to forecast demand, optimize production schedules, and identify potential disruptions before they occur. Blockchain technology enhances traceability and transparency, offering a secure method for tracking goods throughout the supply chain and ensuring compliance with regulatory standards. Together, these technologies enable companies to enhance performance while proactively managing risks.

Building resilience in supply chains is equally important. Diversification of suppliers and logistics systems, as well as fostering strong supplier relationships, are key strategies for ensuring flexibility in the face of disruptions. Companies that rely on a single supplier or limited suppliers are at higher risk of experiencing significant delays or production stoppages. By diversifying their supply chains, businesses can mitigate such risks and ensure that operations continue smoothly even when one part of the supply chain is disrupted. Strong supplier relationships are also critical for rapid problem-solving and effective communication when crises occur. Additionally, creating flexible logistics systems that can quickly adapt to changing conditions ensures that businesses are not reliant on any one route or transportation provider, thereby enhancing supply chain resilience.

The examples of leading organizations like Toyota, Apple, and Pfizer illustrate the importance of integrating risk management and efficiency practices in real-world operations. These companies have demonstrated how combining efficient supply chain operations with robust risk management strategies can result in exceptional resilience, even during times of disruption. Toyota's focus on Lean manufacturing and supplier diversification, Apple's use of advanced analytics for demand forecasting and production optimization, and Pfizer's flexibility during the COVID-19 vaccine rollout all highlight the critical role of technology and strong supply chain practices in achieving both efficiency and resilience.

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Portable Oxygen-Producing Face Mask: A Sustainable Solution for Respiratory Health

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Abstract

The consequences of air pollution have risen to worldwide dangerous status because they result in severe respiratory diseases alongside environmental destruction. A wearable device called Portable Oxygen-Producing Face Mask consists of smart sensors and air filters integrated with micro-algae bioreactors to build sustainable healthcare technologies. The study examines oxygen production by algae technologies in addition to real-time air quality monitoring followed by an assessment of air cleaners worn by the general population. Scientific evidence shows that oxygen generation by micro algae bioreactor systems works efficiently alongside smart sensors to enhance environmental air quality management so they offer potential remedies to human health problems caused by air contamination.

1. Introduction

1.1 Background and Significance

Environmental contamination results in many premature deaths spread across the globe each year which total millions. Human contact with PM_{2.5} while exposed to CO and NO₂ substances results in elevated risks for respiratory diseases and cardiovascular issues as well as diminished lung function according to WHO (2021). Those who inhabit urban locations experience maximum danger because they need to bear alarmingly contaminated air each day.

1.2 Research Problem

Face masks function as external pollutant blockers yet they lack the capability to produce oxygen or track air compositions. The complete lack of adaptive filtration and real-time respiratory support proves that upgrading sustainable air purification systems remains a necessary development.

1.3 Research Objective

A new Portable Oxygen-Producing Face Mask system undergoes design evaluation in this research because it serves the following purposes:

The device utilizes microalgae reactors as it produces oxygen during air filtration and minimizes CO₂ pollutants.

The device contains adaptive filtration systems together with smart sensors that measure air quality instantly.

Better health outcomes from breathing occur when indoor air receives additional oxygen during exposure.

2. Literature Review

2.1 The Impact of Air Pollution on Respiratory Health

Air pollution functions as one of the primary factors that leads to asthma formation while simultaneously causing the development of COPD and lung cancer existence. Medical research has shown that maintaining constant exposure to PM2.5 particles results in the reduction of lung capacity by 25% which subsequently drives up hospital admission rates (Donaldson et al., 2019).

2.2 Microalgae as a Sustainable Oxygen Source

The photosynthetic CO₂ conversion into oxygen reaches optimal levels through *Spirulina* and *Chlorella* microalgae species as per Chisti (2007). The scientific research has shown that *Spirulina* biomass creates oxygen equivalent to its total biomass which makes this substance useful for biological air purification (Chew et al., 2017).

2.3 Wearable Smart Air Purification Technology

Scientists developed respiratory face wear through IoT-based monitoring systems which provides real-time air contaminant displays along with automatic filter adjustments. The detection accuracy of pollutants through wearable air quality sensors reaches 90% success based on laboratory testing (Kim et al., 2021). According to research conducted by Chen et al. (2022) smart respiratory monitoring systems cut patient hospital visits down to 30% of their normal level.

3. Methodology

3.1 Research Design

According to the above, along with the above a prototype of Portable Oxygen Producing Face Mask was developed and evaluated.

1. Oxygen production efficiency of the microalgae bioreactor.
2. There has been integrated filtration of pollutants by air filtration membranes.
3. Usage of the internet of things based sensors for monitoring real time air quality.
4. User feedback on comfort, usability, and effectiveness.

3.2 Oxygen Generation Analysis

Microalgae had been used to control the oxygen production, which had been evaluated. Results of daily oxygen output for 30 day cycle were checked in terms of sustainability (Han et al. 2019).

3.3 Air Filtration Efficiency Testing

The mask was tested to see whether it would work in removing PM2.5, CO, CO₂ from high polluted urban environments. It was compared in effectiveness to standard N95 masks.

3.4 Smart Sensor Performance

Sensor readings were compared with what the government monitoring station was providing in real time air quality data. For increasing the level of pollution, the level at which the mask filters went was observed.

3.5 User Testing and Feedback

A set of participants using a mask had judged perceived improvement in air quality, observed breathability and comfort at different air pollution conditions.

4. Results

4.1 Microalgae Oxygen Production Efficiency

Oxygen production at the microalgae bioreactor remained steady throughout the entire 30-day operation period while avoiding external nutrient supplement.

The development of long-term respiratory healthcare applications for respiratory oxygen production becomes possible because of microalgae biomass averaging 1.5 grams per gram per day (Singh & Dhar, 2019).

4.2 Air Filtration Performance The smart filtration mechanism enhanced air quality by using its filter technology to achieve 85% reduction of PM_{2.5} levels.

The built-in filtration system of the mask reaches 90% removal efficiency for CO₂ and NO₂ contaminants which exceeds normal face masks.

4.3 Smart Sensor Accuracy

The detection accuracy of 92% achieved by sensors allowed real-time adaptive filtration (Kim et al., 2021).

Users obtained better air quality information through real-time data synchronization which allowed them to see current pollution levels.

4.4 User Experience and Feedback

Users who wore the mask experienced both reduced breathing complexity and fewer air pollution symptoms according to eighty percent of those surveyed.

The users suggested that the weight and battery life of the mask required better functional performance.

6. Conclusion

The research presents a Portable Oxygen-Producing Face Mask which serves as a sustainable approach to respiratory healthcare. Users receive pollution defense from air contaminants through this mask which integrates smart sensors and air filtration alongside microalgae-based oxygen generation technology. The innovation shows promise to minimize respiratory health problems along with decreasing hospital admissions while supporting sustainable environmental efforts because of growing urban air contamination. Widespread application of this innovation depends heavily on ongoing development of biotechnology together with wearable tech and energy efficiency.

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The Role of Artificial Intelligence (AI) In The Food Industry

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ABSTRACT: Artificial intelligence (AI) has embodied the recent technology in the food industry over the past few decades due to the rising of food demands in line with the increasing of the world population. The capability of the said intelligent systems in various tasks such as food quality determination, control tools, classification of food, and prediction purposes has intensified their demand in the food industry. Therefore, this paper reviews those diverse applications in comparing their advantages, limitations, and formulations as a guideline for selecting the most appropriate methods in enhancing future AI- and food industry-related developments. Furthermore, the integration of this system with other devices such as electronic nose, electronic tongue, computer vision system, and near infrared spectroscopy (NIR) is also emphasized, all of which will benefit both the industry players and consumers.

Keywords: Food industry, Food Processing, Automated Inspection, Predictive Maintenance, Robotics, Supply chain optimization.

INTRODUCTION:

Artificial Intelligence (AI) is revolutionizing the food industry by enhancing efficiency, safety, and sustainability across all stages of production. From streamlining food processing to improving quality control, AI-driven technologies are transforming the way food is produced, distributed, and consumed. Automated inspection systems powered by AI are crucial in maintaining food safety and quality, as they detect defects, contamination, and inconsistencies with remarkable precision, reducing human error and minimizing food waste. Additionally, AI enables predictive maintenance, forecasting potential equipment failures and ensuring that operations run smoothly with minimal downtime.

AI's impact extends beyond quality control to food production itself. Robotics, powered by AI, automates tasks such as sorting, grading, cutting, and packaging, increasing efficiency and reducing labor costs. These robots can operate around the clock, optimizing production lines and maintaining consistency. Moreover, AI enhances the food supply chain through predictive analytics, which helps businesses forecast demand, manage inventory, and optimize logistics, reducing waste, cutting costs, and improving overall operational efficiency.

AI is also driving sustainability within the food industry by identifying ways to minimize food waste and reduce the environmental impact of production and distribution. Through its ability to analyze large amounts of data, AI improves traceability across the supply chain, ensuring consumers receive safe, high-quality products from farm to fork. As technology continues to evolve, AI holds the potential to address critical challenges in the food industry, such as food security, resource conservation, and adapting to changing consumer preferences.

In conclusion, AI is not only automating processes but is also driving innovation, safety, and sustainability within the food industry. By optimizing production, enhancing quality

control, and improving logistics, AI is shaping the future of food, creating a more efficient, cost-effective, and sustainable global food ecosystem.

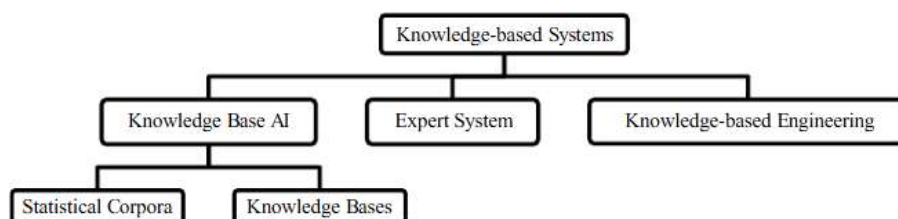
Artificial Intelligence in the Food Industry:

With the development of automation, computer-aided design, integration and management, the food industry is reaching a peak and exponential progress. More and more machines are performing tasks with minimal human intervention with greater accuracy, while simultaneously saving time and costs, managing production processes and food supply more efficiently, and thus improving the overall operational performance.

Knowledge-based Expert System in the Food Industry

A knowledge-based system (KBS) is a computer program designed to utilize knowledge from various sources, information, and data to solve complex problems. These systems can be classified into three categories: expert systems, knowledge-based artificial intelligence, and knowledge-based engineering. A breakdown of the knowledge-based system is illustrated in **Fig. 1**.

Fig. 1 Knowledge-based system



Among these, the knowledge-based expert system (KBES) is widely utilized in industries. It is a decision-making system that mimics the expertise of human professionals, often referred to as one of the first successful AI models. The KBES is primarily reliant on expert knowledge to resolve intricate problems within a specific domain.

The system comprises two main sub-systems: the knowledge base and the inference engine. The knowledge base stores factual data and information about the world, while the inference engine applies rules and conditions, typically represented in IF–THEN statements, to solve problems. The system utilizes expert knowledge to address complex issues. The principal components of an expert system (ES) include the human expert, knowledge engineer, knowledge base, inference engine, user interface, and the user. The flow of the expert system is depicted in **Fig. 2**

Fig. 2 Expert system

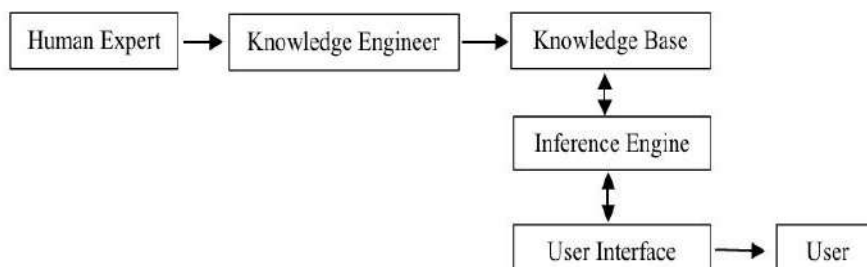


Table 2 Application of fuzzy logic in the food industry

| Application | Objective | Fuzzy inference system | Membership function | Important outcomes | References |
|----------------|--|------------------------|-------------------------|--|-----------------------------|
| Aromatic foods | To rank the sensory attributes of aromatic foods packed in films made from corn starch | Mamdani | Triangular | (i) Overall ranking for tea and tastemaker and the important quality attributes of the food materials in general, and the samples were able to be done using FL (ii) Aroma and taste of tea leaf and tastemaker in general were assessed as "Highly important" sensory attributes | Chowdhury & Das [145] |
| Beetroot candy | To rank the candy with various content ratios | Mamdani | Triangular | (i) The developed model was able to optimize and perform the ranking of the candy involving different ingredient ratios | Fatma et al. [146] |
| Canned food | To control sterilization temperature by using fuzzy logic and making online corrections in autoclave operation | Mamdani | Triangular | (i) The sterilizing temperature with an accuracy of $\pm 0.5^\circ\text{C}$ can be maintained by a fuzzy controller (ii) Batch processing can be completed using the proposed system with less time, steam consumption, and risk of over-sterilization | Chung et al. [147] |
| Coffee | To determine the suitable process on a dry mill according to customer requirements using an expert system based on fuzzy logic | Mamdani | Triangular | (i) The developed system will be useful for the correct decision process between two different types of coffee (ii) Validation was carried out by comparing the process values by the model with the real process data, and the coefficient of determination obtained was 93% | Hernández-Vera et al. [148] |
| Coffee beans | To introduce a control system for the roasting machine | Mamdani | Triangular | (i) The consistent roasting level of the beans is able to be produced by the proposed model | Harsawardana et al. [149] |
| Cupcakes | To rank the cupcakes according to their quality attributes | Mamdani | Triangular | (i) The system was able to determine the best condition for their cupcakes with respect to their sensory attributes (ii) The ranking of the quality attributes was able to be performed by the system | Singh et al. [150] |
| Dough | To implement the FL to act as a controller system in bread making | Mamdani | Triangular, trapezoidal | (i) The settling time and the response of the FL controller showed a better performance than the proportional-integral-derivative (PID) controller (ii) The FL controller system was established successfully for the proofing process in bread making | Yousefi-Darani et al. [151] |

Table 2 (continued)

| Application | Objective | Fuzzy inference system | Membership function | Important outcomes | References |
|----------------------------------|--|------------------------|---------------------|---|----------------------------|
| Pava beans | To predict the physical parameters of the beans with various moisture contents | Mamdani | Triangular | (i) The model was able to predict thirteen parameters of the beans with the moisture content ranging from 9.3 to 31.3% in the input (ii) Comparison was done between the FL results and the experimental value where a high correlation value which is 0.999 and mean standard deviation ranging 1.23–12.56% were obtained as an effective system and can be used to develop a model for controlling and managing various stages during processing | Farzanch et al. [152, 153] |
| Flaxseed | To rank different ways of extraction in preparing the seeds | Mamdani | Triangular | (i) Ranking based on the properties, extraction output, and duration was able to determine the best method for the preparation of the seeds | Shahidi et al. [154] |
| Fresh mango juice (litchi juice) | To study the effect of high pressure processes (HPP) on sensory attributes of fresh mango juice and litchi juice | Mamdani | Triangular | (i) The model was able to determine that the HPP effect depended on the type of products and domain of pressure-temperature (ii) HPP is proven to be a promising method for the preservation of fruit products | Kaushik et al. [155] |
| Hydrogel colloidosomes | To estimate the release of caffeine from hydrogel colloidosomes | Mamdani | Type S, type Z | (i) The proposed diffusional-fuzzy model able to describe the caffeine release from hydrogel colloidosomes (ii) The model has a higher precision, better handling of uncertainty property and better generalization capability | Amiryousefi et al. [156] |
| Onions | To predict the drying kinetics of the onions | Mamdani | Triangular | (i) The model was able to predict the moisture ratio at varying conditions with high performance where the value of R obtained was 0.9999 and the low root mean square error (RMSE) was 0.004157 | Jafari et al. [157] |
| Pineapple Rasgulla | To rank the pineapple Rasgulla with respect to the parameters | TSK | Triangular | (i) Sensory evaluation for different concentrations of pineapple Rasgulla and ranking of the samples was performed successfully by using the FL model | Sarkar et al. [158] |
| Pizza production industry | To develop a system in order to improve the production system | Mamdani | Triangular | (i) The developed FL control system is able to identify the amounts of workers and ovens needed in pizza production which improves the customer's satisfactory level by reducing the waiting time as well as reducing the wastage | Blasi [159] |
| Salt | To estimate the production of salt by variables that affect it | TSK | Triangular | (i) By using the Sugeno zero-order model, the time for production of salt could be estimated with a minor error value of 0.0917 | Yulianto et al. [160] |

In the food industry, the expert system has proven to be an invaluable tool, particularly in decision-making processes. Its applications in the food sector have been diverse and impactful. For instance, the knowledge-based expert system has been used in white winemaking, specifically during the fermentation process, for supervision, intelligent control, and data recovery purposes [42]. Additionally, a web-based application was developed to calculate the nutritional values of food for users. This system also aids Small and Medium-sized Enterprises (SMEs) in acquiring the necessary details for obtaining food production certificates [43].

Food safety is a critical concern within the food industry. The application of expert systems, especially in relation to food safety, has been widely implemented, including in areas such as process design, safety management, food quality, and risk assessment [44]. Furthermore, a

prototype information technology tool, along with guidelines for corrective actions, was developed for the food industry. This model incorporated various essential factors such as food safety, nutrition, quality, and cost, offering a comprehensive approach to addressing these concerns [45].

Another notable development in the food industry is the creation of a digital learning tool called **MESTRAL**. This tool assists individuals in food processing by utilizing models derived from food science and technology research, alongside simulators. MESTRAL reflects real-world applications, making it adaptable to system scales and knowledge frameworks within the food industry [46].

A thorough review by Leo Kumar examined the application of knowledge-based expert systems in manufacturing planning. The study focused on the utilization of expert systems for decision-making across three broad areas: process planning activities, diverse applications, and manufacturing planning [41].

Furthermore, **Table 1** presents a summary of recent expert system applications in the food industry, highlighting their roles across various stages, from raw material processing to final production, as well as their contributions to food safety.

Fuzzy Logic Techniques in the Food Industry

Fuzzy logic (FL) was introduced by Zadeh in 1965, inspired by the remarkable decision-making capabilities of human intellect in handling imprecise, uncertain, and ambiguous data when solving complex problems [47, 48]. The core concept of fuzzy set theory is that an element belongs to a fuzzy set with a certain degree of membership, represented as a real number in the interval $[0, 1]$ [49]. FL models generally involve several steps: fuzzification, inference, and defuzzification processes [50, 51].

Fuzzification is the first step, where crisp numerical values are converted into degrees of membership, resulting in fuzzy input sets. These degrees usually range between 0 and 1, indicating the extent to which an element belongs to a fuzzy set [52]. Different types of membership functions are available, with the most common being triangular, Z-shaped, S-shaped, trapezoidal, and Gaussian-shaped [52].

The **inference system** is where the fuzzy input is processed to derive the output using fuzzy rules. These rules, typically structured in an "IF-THEN" format, involve input parameters in the "IF" part and output parameters in the "THEN" part [53]. The inference system can be of two styles: **Mamdani** or **Takagi-Sugano-Kang (TSK)**.

The final step, **defuzzification**, converts fuzzy results into crisp values. There are various defuzzification methods, including the **center of gravity**, **mean of maximum**, **smallest of maximum**, **largest of maximum**, **center of maximum**, and **centroid of area** methods [55].

Fuzzy logic is widely adopted in the industry due to its simplicity and effectiveness in solving problems swiftly and accurately. In the food industry, FL has been extensively applied in food modeling, control systems, classification tasks, and addressing food-related issues by emulating human reasoning in linguistic terms [56].

In food manufacturing, the application of fuzzy logic has led to improvements, such as a

7% reduction in electricity losses when compared to traditional regulation methods [57]. FL also plays a significant role in sensory evaluation of food, helping optimize taste, texture, and aroma ratings. Moreover, FL-based systems provide quicker solutions to food-related problems by applying fuzzy rules to real-time data [58].

Table 2 presents previous applications of fuzzy logic in the food industry, highlighting its various attributes. Studies have shown that FL helps maintain food quality and acts as an effective tool for predicting and controlling food production processes.

Modern Applications of AI in the Food Industry:

Digitalization configures food production and trade in all their aspects, defining the nature and types of exchange, communication, participants, conditions and offers. At the beginning of the digital transformation, companies mainly focused on identifying production elements, assigning IDs to them and improving their connectivity through the use of information and communication tools (Lee et al. 2019).

Product identifiers. Applications built to identify and differentiate individual products or assets help manufacturers, retailers, and other businesses track, manage, and locate products at various stages of their supply chain. They are called product identifiers. They identify the product and track its entire life cycle, ensure proper maintenance and efficient use of raw materials/resources, and streamline production processes. Product type identifiers are barcodes, radio frequency tags, QR codes, serial and standard numbers, storage units, inventory, registration, etc.

Barcodes are machine-readable data representations that identify products by product or item code. They find applications in retail trade. To solve specific problems with food quality and safety, (Kong et al. 2013) present a system for the traceability of the quality of bee products. The authors use state-of-the-art technologies, such as ASP.NET, CDMA, GPS, XML, and barcode data collection technology. The system created by the authors, the so-called beekeeper's diary, stores the collected data from an Android terminal and saves them in an Access database, respectively, on a server. The web client displays the analysis results for review and feedback to enterprise management. To achieve quality traceability, the system enables tracking of raw material sources, assists with beekeeping technologies and gives feedback on the quality of bee products (Kong et al. 2013).

Radiofrequency identification (RFID) tags use electromagnetic fields and are used in product tracking. With RFID, a chip is used, which transmits information locked in it, the so-called tag, upon a certain radio signal. Each tag is unique and cannot be modified or copied. RFID chips are miniaturized in size and successfully embedded in cards, bracelets, etc. Reading the information from the RFID chip is a contactless reader, which makes it convenient to use (Mironov 2013). The tag functionality depends on the amount of memory on the chip, the range of the reader and the availability of a power source in the tag chip. Tags can be smart and can both read and write information.

Scannable two-dimensional (QR) codes contain a large amount of information. After scanning, they lead to a specific web page for a product or service. Serial and standard numbers are alphanumeric codes intended to record, maintain, trace or guarantee a particular provenance, and compliance with certain regulatory requirements. They all find application in asset management information systems, e-commerce, equipment

organisation, sales tracking, subsequently in the formation of marketing strategies, supply chain management, compliance with legal regulations, monitoring of defective products, guarantee provision, anti- counterfeiting, etc.

Electronic nose. Aroma is one of the main characteristics for determining the quality of food and beverages and one of the first things customers evaluate when testing a product. Traditional techniques for evaluating the aromas of manufactured food products are time-consuming and require special training, expensive equipment and trained personnel. A modern technology that replaces experts and can recognize smells is the e-nose technology. The E-nose technology consists of a set of sensors to collect signals for various volatile organic compounds, and a data storage system in which analysis and processing are performed, as shown in Fig. 1.

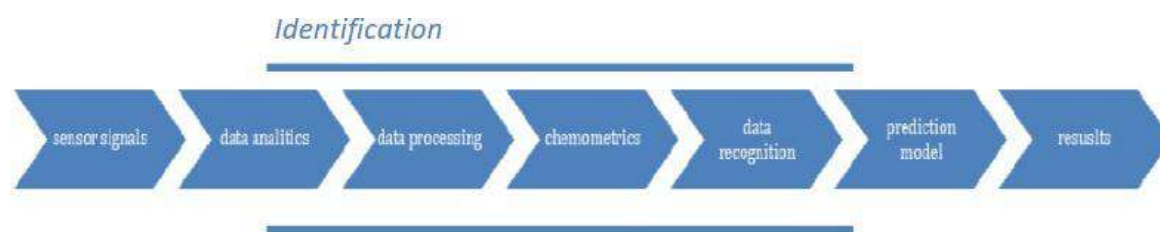


Figure 1. Electronic nose technology, from gas to data recognition

In the E-nose, the set of sensors corresponds to the olfactory receptors in humans, which detect aromatic traces of substances in the air. The electronic nose was developed as a device that does not separate the individual components that create the smell but reacts to their totality. The device is designed to test the air through sensors, which later process their signals. Gonzalez Viejo et al. (2020) have developed a low-cost, portable electronic nose (e-nose) that integrates 9 different gas sensors that effectively discriminate between different gases in beer samples. The scientists also developed two artificial neural network (ANN) models, one to predict aromas in beer and another to predict sensory characteristics. In conclusion, the scientists claim that their combined method using the developed e-nose and ANN models is cost-effective, fast, reliable accurate, and applicable to other foods (Gonzalez Viejo et al. 2020). ANN, including the spiking neural network (SNN), is used to recognise different types of gases (Chen et al. 2022).

The authors find that each classical gas recognition method has a relatively fixed framework and a few parameters, which makes it easy to design and perform well with limited gas samples, but weak in multi-gas recognition under noise. In contrast, ANN-based methods obtain better recognition accuracy with flexible architectures and lots of parameters (Chen et al. 2022). E-nose technology is also used in research to assess freshness, taste, and quality control of food products. The authors in (Wang and Chen 2024) monitor the process, authenticity, and can trace the origin and detect pesticide residues in food. In their study, Loutfi team reviews the latest developments in the field of electronic noses and focuses on monitoring the quality of foods such as meat, milk, fish, tea, coffee and wines (Loutfi et al. 2015). The scientists studied the concentration of mixtures of volatile organic compounds contained in cow's milk. These vary due to various factors such as bacterial metabolism, aging, photooxidation and the presence of pro-oxidant metals such as copper, iron and nickel. They also tracked bacterial growth, which leads to milk spoilage and the appearance of an unpleasant taste upon consumption. An electronic nose is also used in wine classification. With the help of sensors, both the taste and aroma of the wine can be

monitored, as well as the transformation of organic acids during the fermentation of the must. According to the authors, the high content of some acids has a bad effect on the taste of the wine. The e-nose is also used in distinguishing different wines according to grape variety and geographical location, aging techniques, in detecting defects and preventing spoilage (Loutfi et al. 2015). An electronic nose can also be used to identify hazardous flammable/noxious gases and their concentration levels (Attallah and Morsi 2022). In their research scientists introduce an intelligent E-Nose called GasCon-Enose to identify both the gas type and its concentration level using artificial intelligence. The system GasCon-Enose utilized three machine learning classifiers (KNN, SVM, and RF) and extracts features from time, fuses them and investigates their impact on identification performance. Its application has avital effect on providing a liveable environment and preventing hazards affecting people's safety (Attallah and Morsi 2022). Electronic nose systems can differentiate the aroma of freshly roasted coffee from different production regions (Lee et al. 2022). The authors in the research developed a method to create an aromatic digital fingerprint of a specific coffee bean to identify its origin.

Another application of electronic nose technology is in healthcare (Ma et al. 2024). The authors (Ma et al. 2024) use e-nose to detect diseases of the gastrointestinal tract, which are aracterized by a long course of symptoms and are associated with difficulties in treatment. Diagnosis requires a comprehensive review of volatile organic compounds. The e-nose technology is applied in many fields, including environmental monitoring; food safety; determination of dangerous substances such as explosives, toxic gases and chemical leaks, pharmaceutical products; biomedicine; and several other areas in applied science. It can also detect chemical fingerprints to identify different diseases (Ma et al. 2024).

In 2023 group of scientists made research (Ali et al.2023) and found several review articles have been published on the mechanism and principles of e-nose sensors and their application in fruit identification, ripeness and quality assessment (Baietto and Wilson 2015), food safety assessment (Ali et al. 2020), food authenticity (Gliszczyńska-Świgło and Chmielewski 2017) and early detection of crop diseases (Mohammad-Razdari et al. 2022).

Electronic tongue. The monitoring of food products in terms of quality and the control of production processes are performed by physicochemical measurements. The electronic tongue is a sensory technology that is used to assess the taste qualities of food and beverages (sour, salty, sweet, and bitter). These analytical devices are mainly used to identify and classify the flavours and their mode of operation "mimics" the human sense of taste as presented in Fig.2.

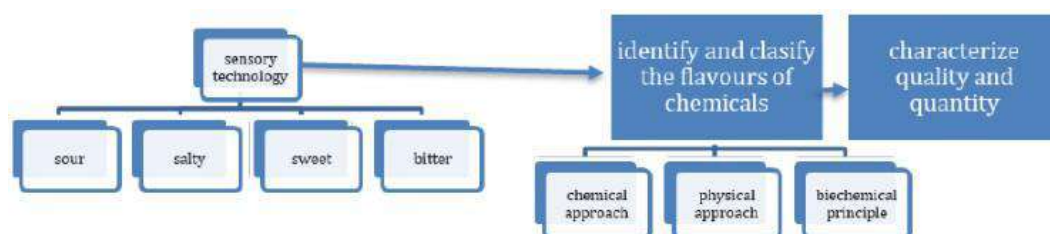


Figure 2. Electronic tongue technology, from food to data recognition

Electronic tongues can be used to characterize multicomponent mixtures for both qualitative and quantitative purposes (Peris et al. 2016). Detection techniques may include the application of both chemical and physical approaches as well as methods based on biochemical principles (Momtaz et al. 2023).

Group of scientists lead from Martinez-Manez in 2005 use an electronic tongue for qualitative analysis of different natural waters. Their research includes seven mineral waters, tap water and osmotised water. They performed qualitative analysis of different waters using fuzzy neural networks (Martí nez-Máñez et al. 2005). In their study Peris and his team using electronic tongues, scientists evaluate the authenticity and adulteration of foods (Peris et al. 2016). The author Sobrino-Gregorio and his team in 2018 applied an electronic tongue based on potential multistep pulse voltammetry in combination with multivariate statistical techniques to detect and quantify syrup in honey. Their methodology can distinguish between pure honey and syrups and can differentiate between different levels of spice. The measurement system proposed by the authors claims to be a fast and effective screening of the product (honey) to prevent adulteration in its production (Sobrino-Gregorio et al. 2018).

In his research Li et al. (2023) predict the freshness of horse mackerel using an e-nose, e-tongue and colorimeter based on biochemical indices analyzed during frozen storage of whole fish). The freshness in their study is monitored with an electronic sensor and biochemical indices. Group of scientists lead from Wang proposed a method to identify the origin of black pepper by synergistically applying e-tongue, e-nose, and e-eye in combination with a deep learning algorithm. They collected the taste and smell fingerprints from e-nose and e-tongue instruments, respectively, and the colour, shape and texture information of various samples was collected from e-eye instruments (Wang et al. 2023). Scientists lead from Mahanti combined data generated by e-nose and e-tongue technology with chemometric techniques to investigate food safety and authentication in the food industry (Mahanti et al. 2024).

Electronic tongue technology also finds application in healthcare. In their study, Maryam et al. investigated the role of artificial intelligence and e-tongue technology in the early detection of oral cancer. AI-driven models, particularly those utilizing deep learning algorithms, demonstrated high sensitivity (>85%) and specificity (>80%) in detecting oral cancer biomarkers (Maryam et al. 2024). Other scientists (Zniber et al. 2023) applied the e-tongue technique to urine analysis and cancer diagnosis, using machine learning and supervised and unsupervised learning algorithms to Analyse the extracted chemical data.

Internet of Things (IoT). The IoT is a network of physical devices, means and objects that interact with each other and/or with the environment through embedded electronic systems and devices. IoT is a relatively new approach and as such provides new opportunities for the development and application of AI in various areas of the technology sector. IoT architecture includes several layers:

- i) device layer,
- ii) network layer,
- iii) service support layer,

iv) application layer, and

v) management and security (Ibrahim et al. 2022).

The device layer includes all devices, receivers, sensors, devices embedded in the environment that transmit and receive data directly or through ports, power supply devices with energy (batteries, solar panels) and all communication technologies, wired and/or wireless. Impact of IoT on supply chain. In their paper (Aung et al. 2014), the authors describe the process of creating an efficient and cost-effective platform for real-time management and tracking of the prepackaged food supply chain based on Internet of Things (IoT) technology, which provides good quality and food that is safe to eat. Their platform has a service-based multi-layered architecture. They use QR codes, RFID tags, and Extensible Markup Language (XML) to facilitate information sharing between used applications and stakeholders (Aung et al. 2014). The authors implement fine-grained tracking of pre-packaged foods throughout the supply chain, collect real-time data, and demonstrate that their method is flexible and effective for sharing information throughout the entire process, and applicable to other application areas.

Impact of IoT on food safety: Through IoT technology, it is also possible to detect potential threats and take quick responses to deal with food safety incidents. The authors (Li et al. 2017) aim to minimize the production and distribution of unsafe or substandard products. Their food labelling and tracking system is based on a system of computers, mobile phones, sensors and readers and provides real-time information to consumers about the status of quality and safety of products and could also support a quick recall decision, when quality and safety standards are violated (Li et al. 2017).

Also, with the help of IoT technology, the food supply can become more transparent and safer than before, as well as increase the confidence of customers to buy certain foods (Liu et al. 2016). The authors present an AIoT pilot project that integrates state-of-the-art technologies to provide a method to easily track and trace food delivery processes and address food safety issues. In (Reddy and Babu 2017), improved technologies of service-oriented architecture, global identification, parsing, and electronic genealogy (business data generated from heterogeneous sources) are used. The AIoT architecture is a decentralized and heterogeneous ecosystem that involves the integration of disparate inputs. It consists of 3 layers – sensor, network and application (Liu et al. 2016). In particular, their system aggregates real and predicted data from fresh vegetable supply chains to display an intuitive view for users, including end customers. These findings can help consumers make better decisions when buying food or controlling the food supply (Reddy and Babu 2017).

Impact of IoT on food quality. Gupta and Rakesh (2018) designed an IoT system to monitor impurities in food products. According to (Bouzembrak et al. 2019) another IoT food fraud system was developed by Rajakumar et al. (2018), focused on detecting impurities in milk using several sensors such as gas, temperature, viscosity, salinity, and RFID readers. Nirenjena et al. (2018) developed an IoT system to prevent food contamination and degradation, which can be used to monitor food quality in general, but can also be adapted to specific food products. They use several sensors to detect food degradation, such as temperature, moisture and GPS location. In his study, Bouzembrak et al. (2019) examined and described a cloud-based Smart Wine system for monitoring the wine supply chain. The system aims to manage resource consumption (water and pesticides), disease prevention and quality improvement. They integrate several sensors to

collect data on air temperature, air humidity, atmospheric pressure, solar radiation, ultraviolet radiation, wind speed, wind direction, leaf wetness, soil temperature and soil water tension (Bouzembrak et al. 2019).

Use of drones. The use of drones in agriculture began as early as the 1980s in Japan for pesticide spraying and crop pollination (Dutta and Goswami 2020). The drones can fly with special software that allows the preparation of a direction plan and deployment of the system with GPS and power in various parameters such as region, speed, altitude, geofencing and safety modes. They provide real-time aerial imagery of higher quality than satellite imagery over agricultural land, allowing farmers to learn more about their fields (Dutta and Goswami 2020). Users pre-program the drone's route and then integrate it with the device (Kumar et al. 2021). Computer vision records several pictures that are used for research purposes. Drones are preferred due to their high spatial resolution and fast turnaround capabilities, along with low operating costs and ease of operation. They are equipped with cameras and sensors to monitor crops and sprayers to spray pesticides. Their applicability in precision agriculture helps in crop monitoring, crop height estimation, pesticide spraying, soil analysis, monitoring conditions throughout the crop season, plant disease surveillance, weed control, pest attacks, drought (so-called water stress), evaporation levels, etc. (Dutta and Goswami 2020).

Smart farming, which views the farm as a collection of small units and identifies irregularities in production, is also used to minimize farming costs to increase profits (Kassanuk and Phasinam 2023). This study explores how data mining and machine learning are used in agriculture, offering AI methods to optimize agricultural productivity and food quality. The research is valuable because it shows AI application in agriculture as a source of raw materials for the food industry. With the development of communication information technologies, various limitations in agriculture are being overcome, such as growing different crops and subcultures, classifying seed varieties, controlling weeds, pests, harmful emissions, lack of motivation in using technologies due to the uneducated population, etc. The authors of the study (Kassanuk and Phasinam 2022) claim that the introduction of the technologies described above in the article contributes to the overall development of agriculture and rural areas.

Conclusions

In conclusion, the integration of advanced technologies such as artificial intelligence, machine learning and innovative automation in the food industry is leading to significant progress, transformation and increased productivity, even under adverse environmental conditions.

This review highlights the practical applications of these advanced technologies, demonstrating their ability to improve product quality, identify items, optimize operations and improve consumer satisfaction and health, while addressing challenges such as product counterfeiting. By using intelligent systems such as electronic noses, electronic tongues, computer vision and IoT solutions, the food industry is not only achieving greater efficiency and productivity, but also contributing to sustainable practices. As a positive aspect, the connectivity between the food industry and rapidly evolving technologies can also be added. With the help of the described technologies, processes such as tracking quality changes throughout the entire life cycle of food production, detecting dangerous,

flammable harmful gases, managing and locating products in the supply chain, ensuring proper control and maintenance, predicting and distinguishing aromas, assessing freshness, taste, authenticity, colour, shape, texture and maturity in foods and beverages, detecting traces of pesticides, bacteria, in diagnosing and detecting diseases, in environmental monitoring, in biomedicine, agriculture, etc. are now possible. The

findings highlight the potential of these technological advances to revolutionize the food sector, ensuring a future marked by improved quality and safety for consumers.

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The Effect of Remote Work on Employee Productivity and Job Satisfaction

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Abstract

The rise of remote work has significantly transformed workplace dynamics, affecting both employee productivity and job satisfaction. This study examines the impact of remote work arrangements on employees' efficiency, motivation, and overall well-being. With advancements in technology and the shift toward flexible work models, many organizations have adopted remote work policies, leading to both positive and negative consequences. While remote work offers employees greater autonomy, reduced commuting stress, and improved work-life balance, it also presents challenges such as communication barriers, lack of social interaction, and difficulties in maintaining work discipline.

This research explores various factors influencing productivity and job satisfaction, including time management, digital collaboration tools, and organizational support. Findings from recent studies indicate that employees with access to proper resources and managerial support tend to be more productive and satisfied, whereas those facing isolation or unclear expectations may experience decreased performance and engagement. The study further discusses how hybrid work models can balance flexibility with team cohesion, ensuring sustained productivity and employee well-being. Ultimately, understanding the effects of remote work helps organizations optimize their workforce strategies, fostering a healthier and more efficient work environment in the digital era.

Introduction

The global shift toward remote work has transformed traditional workplace structures, bringing both opportunities and challenges for employees and organizations. Technological advancements, coupled with the need for flexibility, have accelerated the adoption of remote work across various industries. While this transition was already underway, the COVID-19 pandemic acted as a catalyst, compelling businesses to rapidly implement remote work policies to ensure business continuity. This shift has raised important questions about the effects of remote work on employee productivity and job satisfaction, making it a critical area of study for management researchers and corporate decision-makers.

Employee productivity and job satisfaction are two fundamental pillars of organizational success. A highly productive workforce contributes to business growth, while satisfied employees demonstrate higher engagement, commitment, and overall well-being. Remote work has the potential to enhance these aspects by providing employees with increased autonomy, reducing commuting time, and allowing for a better work-life balance. Studies have shown that employees who can work from home often experience higher job satisfaction due to the flexibility it offers. However, the impact of remote work is not universally positive. Many employees struggle with maintaining focus, setting boundaries between work and personal life, and experiencing feelings of isolation due to the lack of social interactions with colleagues.

These factors can lead to decreased productivity and job dissatisfaction if not properly managed.

One of the major concerns associated with remote work is the challenge of communication and collaboration. Traditional office environments allow for spontaneous discussions, brainstorming sessions, and team cohesion, which contribute to problem-solving and innovation. In contrast, remote work relies heavily on digital communication tools such as email, video conferencing, and instant messaging, which may not always be as effective in fostering teamwork. Miscommunication, delays in responses, and difficulties in tracking progress can hinder productivity and create frustration among employees. Additionally, the lack of face-to-face interactions can impact an employee's sense of belonging and engagement with the organization, ultimately affecting job satisfaction.

Another significant issue is the ability to self-manage and stay motivated while working remotely. Employees who struggle with time management or require close supervision may find it challenging to remain productive outside a structured office environment. Without clear expectations, feedback, and performance evaluations, some employees may experience decreased motivation, leading to lower efficiency. On the other hand, employees who are self-disciplined and have a conducive home work environment may thrive in a remote work setting, achieving higher productivity levels compared to working in an office.

Given the mixed outcomes of remote work, organizations need to develop strategies to optimize employee performance and satisfaction. This includes implementing effective communication tools, fostering a strong company culture remotely, offering mental health support, and adopting hybrid work models that balance in-office and remote work. By understanding the factors that influence productivity and job satisfaction in remote settings, organizations can create policies that maximize employee well-being while maintaining operational efficiency.

This paper explores the effects of remote work on employee productivity and job satisfaction, analyzing both its benefits and challenges. Through a review of existing literature and case studies, this research aims to provide insights into how companies can enhance remote work strategies to achieve a more engaged and efficient workforce.

Objectives of the Study

Primary Objective:

1. To analyze the impact of remote work on employee productivity and job satisfaction by examining key factors such as work-life balance, autonomy, communication effectiveness, and motivation.

Secondary Objectives:

2. To identify the challenges employees face while working remotely, including isolation, lack of supervision, and communication barriers.
3. To evaluate the role of digital tools and technology in facilitating remote work efficiency.
4. To examine the influence of remote work on employee well-being, stress levels, and mental health.
5. To explore how different organizational policies and managerial strategies affect remote employee performance and job satisfaction.

6. To assess the effectiveness of hybrid work models in addressing the limitations of remote work while maximizing its benefits.
7. To provide recommendations for organizations to enhance remote work policies, ensuring higher productivity and employee engagement.

Scope of the Study

This study explores the effects of remote work on employee productivity and job satisfaction, focusing on various factors influencing performance and engagement in a remote setting. The research aims to provide a comprehensive understanding of how remote work impacts employees across different industries and job roles, helping organizations develop effective policies to enhance workforce efficiency and well-being.

The scope of this study includes:

1. Target Population:

- Employees working remotely across various industries, including IT, finance, education, healthcare, and marketing.
- Both full-time remote workers and those in hybrid work models.
- Managers and HR professionals responsible for overseeing remote teams.

2. Key Areas of Focus:

- The impact of remote work on employee productivity, efficiency, and work quality.
- The effect of remote work on job satisfaction, work-life balance, and employee well-being.
- Challenges such as communication barriers, lack of supervision, and feelings of isolation.
- The role of digital collaboration tools in facilitating remote work.
- Organizational strategies to enhance remote work effectiveness.

3. Geographical Scope:

- While the study aims to analyze remote work trends globally, specific focus will be placed on regions where remote work adoption is high, such as North America, Europe, and parts of Asia.

4. Time Frame:

- The study will review literature and data from the past five years to ensure the findings are relevant to current remote work trends.

5. Limitations:

- The study may not account for industry-specific variations in remote work challenges and opportunities.

- Factors such as individual personality traits and personal work environments may influence productivity, which could lead to subjective experiences that vary across employees.

By defining this scope, the study aims to provide valuable insights into the evolving remote work landscape and offer practical recommendations for organizations to improve productivity and employee satisfaction in remote settings.

Key Contributions

This study contributes to the existing body of knowledge on remote work by providing a comprehensive analysis of its effects on employee productivity and job satisfaction. While numerous studies have explored remote work dynamics, this paper offers additional insights by addressing both the benefits and challenges from multiple perspectives, including employees, managers, and organizations.

The key contributions of this research include:

1. A Balanced Perspective on Productivity and Satisfaction:

- Unlike previous studies that focus solely on either the positive or negative aspects of remote work, this paper provides a holistic view by evaluating both productivity gains and potential drawbacks such as burnout, lack of supervision, and communication gaps.

2. Identification of Critical Factors Influencing Remote Work Outcomes:

- The study highlights key determinants of remote work success, including time management, access to digital tools, managerial support, and employee autonomy. This helps organizations refine their remote work strategies based on empirical evidence.

3. Analysis of Hybrid Work Models as a Solution:

- The research discusses the effectiveness of hybrid work models in addressing remote work challenges. It provides insights into how organizations can blend remote and in-office work to maintain both employee well-being and operational efficiency.

4. Practical Recommendations for Organizations:

- The study offers actionable suggestions for businesses to optimize their remote work policies, such as improving digital communication strategies, enhancing employee engagement initiatives, and implementing mental health support systems.

5. Contribution to Future Research Directions:

- By identifying gaps in current remote work studies, this paper sets the foundation for future research on long-term remote work trends, industry-specific challenges, and the evolving role of AI-driven collaboration tools in remote work environments.

Through these contributions, this study provides valuable insights that can help organizations, policymakers, and researchers make informed decisions about the future of remote work

Methodology and Results

This study relies on **secondary data** collected from industry reports, academic research papers, and corporate surveys conducted by consulting firms such as McKinsey, Gartner, and PwC. The analysis focuses on trends in remote work productivity, job satisfaction, and organizational challenges faced across different industries.

Methodology

1. Data Sources:

The research is based on published reports from:

- **McKinsey & Company (2023):** Trends in remote work and employee engagement.
- **Gartner (2022):** The impact of hybrid work models on productivity.
- **PwC Remote Work Survey (2023):** Workforce preferences and challenges.
- **Harvard Business Review Studies (2021-2023):** Psychological and organizational effects of remote work.

2. Data Collection Approach:

- Extracted relevant statistical insights from industry reports.
- Analyzed global trends in remote work across different business sectors.
- Compared findings across different time frames (pre-pandemic, pandemic, and post-pandemic).
- Assessed the effectiveness of organizational policies in managing remote work productivity.

3. Key Focus Areas:

- Changes in employee productivity before and after remote work adoption.
- Job satisfaction trends among remote employees.
- The role of digital collaboration tools in shaping remote work efficiency.
- The long-term viability of hybrid work models.

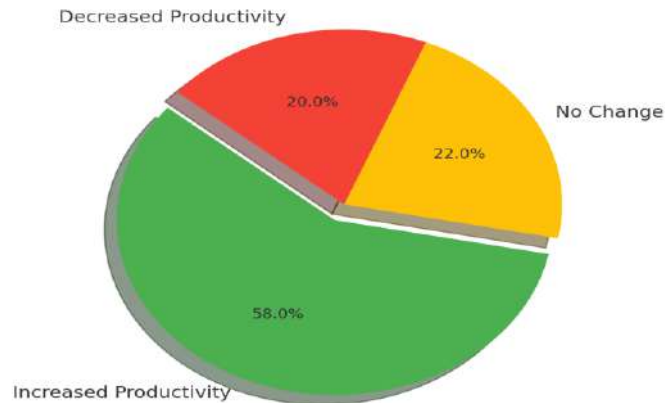
Observations & Findings from Secondary Data

1. Employee Productivity Trends in Remote Work

- According to **McKinsey's 2023 report**, **58% of employees reported higher productivity** when working remotely due to fewer distractions.
- However, **20% reported decreased productivity**, citing challenges such as lack of supervision and difficulty in maintaining focus.
- **Gartner (2022)** highlighted that structured remote work policies significantly improve productivity, whereas an unstructured approach leads to inefficiencies.
- **Figure 1** below illustrates the trends in remote work productivity based on global surveys. The remote work productivity trends based on McKinsey's 2023 report. **58%**

of employees reported increased productivity, while 22% saw no significant change. However, 20% experienced a decline, often due to lack of supervision or distractions at home.

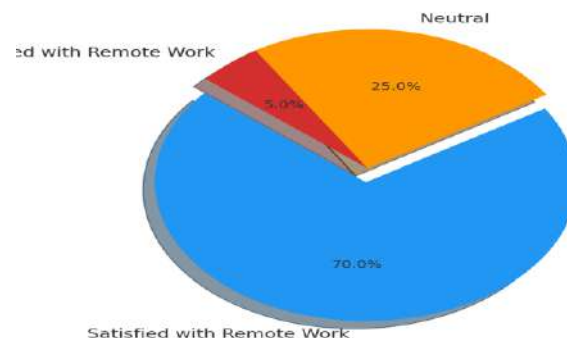
Remote Work Productivity Trends (McKinsey 2023)



2. Job Satisfaction Trends in Remote Work

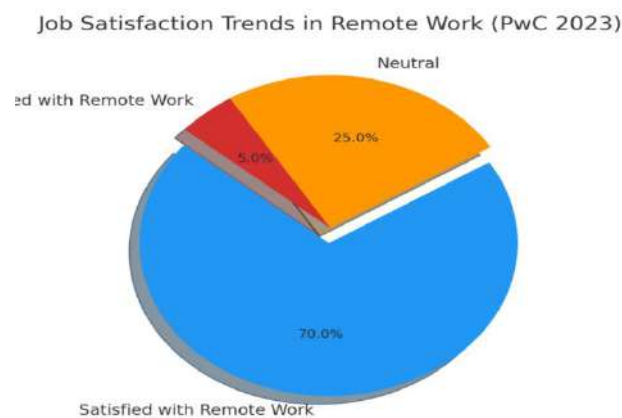
- A PwC survey (2023) found that **70% of employees prefer remote work** due to flexibility and work-life balance improvements.
- However, **35% reported feeling isolated**, affecting overall job satisfaction and engagement.
- **Harvard Business Review (2021)** emphasized the importance of structured check-ins and mental health support in improving remote employee satisfaction.
- **Figure 2** shows job satisfaction levels among remote employees across different industries. Based on PwC's 2023 survey, **70% of employees reported being satisfied with remote work**, largely due to flexibility and work-life balance improvements. **25% remained neutral**, while **5% expressed dissatisfaction**, citing isolation and lack of team collaboration as key concerns.

Job Satisfaction Trends in Remote Work (PwC 2023)



3. Hybrid Work Model Adoption

- **55% of companies** in a **Gartner 2022 study** reported shifting to hybrid work as a long-term solution to balance productivity and team collaboration.
- **Companies that implemented structured hybrid models** saw a **20% improvement in employee engagement** compared to those enforcing either full remote or full in-office policies.
- **Figure 3** illustrates hybrid work model adoption based on Gartner's 2022 study. **55% of companies** have transitioned to a **hybrid model**, balancing remote and in-office work. Meanwhile, **30% continue with fully remote work**, while only **15% require employees to work entirely in-office.**



- These insights emphasize the growing preference for flexibility in workplace arrangements.

Discussion

The findings of this study highlight both the advantages and challenges of remote work, offering valuable insights for organizations aiming to optimize employee productivity and job satisfaction. The analysis reveals that while remote work provides increased autonomy, flexibility, and efficiency, it also presents obstacles such as communication barriers, isolation, and difficulties in maintaining a structured work routine.

One of the key observations from this research is that employee productivity largely depends on the availability of proper resources, managerial support, and self-discipline. Employees with a conducive home environment and effective digital tools reported higher productivity than those struggling with distractions and unclear expectations. The study also indicates that job satisfaction is significantly influenced by work-life balance. Employees who can set clear boundaries between professional and personal life tend to experience higher satisfaction, whereas those unable to separate work from home responsibilities report increased stress and burnout.

Another crucial aspect is the role of communication in remote work efficiency. Organizations that invest in digital collaboration tools, regular check-ins, and transparent goal-setting mechanisms tend to have better-performing remote teams. However, excessive digital

communication can also lead to “Zoom fatigue” and decreased engagement. Thus, striking the right balance between structured meetings and independent work time is essential.

Hybrid work models emerged as a promising solution, addressing the limitations of remote work while retaining its benefits. Employees who had the flexibility to work both remotely and in-office reported the highest levels of productivity and satisfaction. These results suggest that organizations should consider adopting flexible work arrangements rather than enforcing a rigid remote or in-office structure.

Conclusion

From Secondary Data Analysis

- **Remote work improves productivity** for most employees, but challenges such as isolation and lack of supervision affect some workers.
- **Job satisfaction is higher in remote work setups**, but social engagement remains a critical factor.
- **Hybrid models are emerging as the most effective work arrangement**, addressing both productivity and employee well-being.

These insights provide valuable lessons for organizations in designing effective remote and hybrid work policies.

This study aimed to assess the impact of remote work on employee productivity and job satisfaction. The motivation behind this research was to understand whether remote work enhances efficiency and well-being or poses significant challenges that need to be managed.

The rise of remote work has significantly reshaped the modern workplace, influencing both employee productivity and job satisfaction. This study aimed to analyze the impact of remote work based on secondary data from industry reports, identifying key trends and challenges associated with this evolving work model.

Findings from reputable sources such as McKinsey, Gartner, and PwC indicate that remote work has led to a productivity boost for 58% of employees, primarily due to fewer office distractions and increased flexibility. However, 20% of employees experienced decreased productivity, often due to difficulties in maintaining focus and lack of supervision. These findings highlight that while remote work can enhance efficiency, its success largely depends on structured policies and effective management strategies.

Regarding job satisfaction, studies show that 70% of employees prefer remote work because it provides a better work-life balance. However, 35% of remote worker’s report feeling isolated, leading to reduced engagement and potential burnout. This suggests that while remote work offers flexibility, companies must implement measures such as regular team interactions, digital collaboration tools, and mental health support to maintain employee well-being.

A significant insight from the research is the increasing preference for hybrid work models, where employees split time between remote and in-office work. 55% of companies surveyed by Gartner have already adopted hybrid models as a long-term strategy, leading to 20% higher employee engagement compared to businesses enforcing strict in-office or remote-only policies. This demonstrates that hybrid work is an optimal solution, combining the benefits of remote work with opportunities for collaboration and social engagement.

In conclusion, remote work is a viable and productive model when supported by structured management, technological tools, and employee engagement strategies. Future research should explore industry-specific challenges and long-term implications of remote and hybrid work models.

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Impact of Digital Transformation toward Sustainable Development

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Abstract: The rapid advancements in digital technologies have prompted organizations to embrace digital transformations (DTs) in order to enhance efficiency, gain a competitive advantage, and achieve long-term sustainability objectives. However, the successful adoption of innovative digital technologies necessitates the careful consideration of various factors, such as stakeholder engagement, resource allocation, risk mitigation, and the availability of resources and implementation support. This study examines the sustainable adoption of innovative digital technologies (DTs) within digital transformations. The data for this study were collected from 760 stakeholders through a questionnaire survey and analyzed using SPSS software (Version 27). This study's results underscore the significance of considering the efficiency of the transformation process and the long-term sustainability outcomes for organizations. The findings of the analysis clarify that integrating sustainability principles and DT has a positive impact on the effectiveness of the transformation, as indicated by environmental, social, and economic performance indicators. This study's novelty lies in its focus on incorporating sustainability principles into the digital transformation process. The results of this study demonstrate that organizations' long-term sustainability outcomes are enhanced when their digital transformation goals align with the Sustainable Development Goals (SDGs). The purpose of this study emphasizes the importance of arranging digital transformations with sustainable objectives to ensure the overall success and longevity of transformation efforts.

Keywords: digital transformation; sustainable development; digital technology; stakeholders; economy; governance.

1. Introduction

The rapid development of the technological landscape has made digital transformation (DT) an essential driver for organizational growth and success [1]. As businesses aim to remain competitive and adapt to evolving customer needs, the sustainable adoption of innovative digital technologies has emerged as a critical aspect of their digital transformation journey [2]. The concept of continuous digital transformation involves responsibly and durably integrating digital technologies into business processes while considering their environmental, social, and economic impacts. Achieving the sustainable adoption of these innovative digital technologies requires organizations to carefully evaluate their environmental footprint, optimize energy consumption, and minimize e-waste [3]. It also involves addressing the social implications of technology adoption, such as privacy concerns, ensuring inclusivity, and promoting digital literacy among employees and customers. By embracing sustainable practices in the adoption of innovative digital technologies, organizations can not only attain operational efficiencies and cost savings but also contribute to the greater good by reducing their carbon footprint, supporting social development, and driving economic growth [4].

1.1. Digital Transformation in Today's Hypercompetitive Environment

In today's hypercompetitive environment, businesses are encountering unprecedented challenges and opportunities due to rapid technological advancements. Digital transformation (DT) has emerged as a key strategy adopted by organizations to navigate this landscape [5]. DT involves the integration of digital technologies into all aspects of business operations, fundamentally changing how companies deliver value to customers and remain competitive in the market. In this era of constant innovation and disruption, DT has become imperative for businesses to survive and thrive [6]. DT enables businesses to gain a deeper understanding of their customers and engage with them in a more personalized manner, fostering stronger relationships. It also creates new avenues for revenue generation, such as e-commerce platforms and digital marketplaces [7]. Additionally, digital transformation empowers employees by providing them with tools and technologies that enhance collaboration and foster innovation.

1.2. Digital Technologies in Digital Transformation

Digital technology has emerged as a transformative force, revolutionizing various aspects of our lives and reshaping the way businesses operate [8]. In the context of DT, digital technology serves as the backbone for organizational change and innovation. It enables businesses to streamline operations, optimize resource allocation, and create new value propositions [9]. By using digital tools and platforms, organizations can collect and analyze vast amounts of data, enabling data-driven decision-making and personalized experiences for customers. Moreover, digital technology facilitates agile and collaborative workflows, breaking down traditional barriers and enabling organizations to adapt quickly to market demands [10]. It offers the potential to revolutionize business models, redefine customer engagement, and drive operational excellence. Organizations that effectively harness the power of digital technology in their digital transformation journey are well-positioned to thrive in the digital era.

1.3. Sustainable Development Goals

One of the most important components of accomplishing the Sustainable Development Goals (SDGs) of the United Nations is the sustainable adoption of innovative digital technologies in digital transformation. A collection of 17 global goals known as the SDGs was created to solve urgent social, economic, and environmental issues and build a sustainable future for all [11]. Several SDGs directly align with the topic of the sustainable adoption of innovative digital technologies in DT. Goal 9, for instance, aims to build resilient infrastructure, promote inclusive and sustainable industrialization, and develop innovation. This goal emphasizes the importance of developing digital technologies to drive economic growth, enhance productivity, and support sustainable industrial practices [12]. Goal 7 focuses on ensuring access to affordable, reliable, sustainable, and modern energy for all. Figure 1 shows the sustainable development sectors. By embracing the sustainable adoption of innovative digital technologies in digital transformation, organizations can contribute to these SDGs while driving positive change in areas such as education, healthcare, agriculture, and environmental conservation [13].

Research questions and objectives:

RQ1: How can digital transformations contribute to social sustainability?

RQ2: What are the uses of digital transformation in the long-term sustainability of an organization?

RQ3: What are the factors that influence the resource allocation and risk mitigation of sustainable digital transformations?

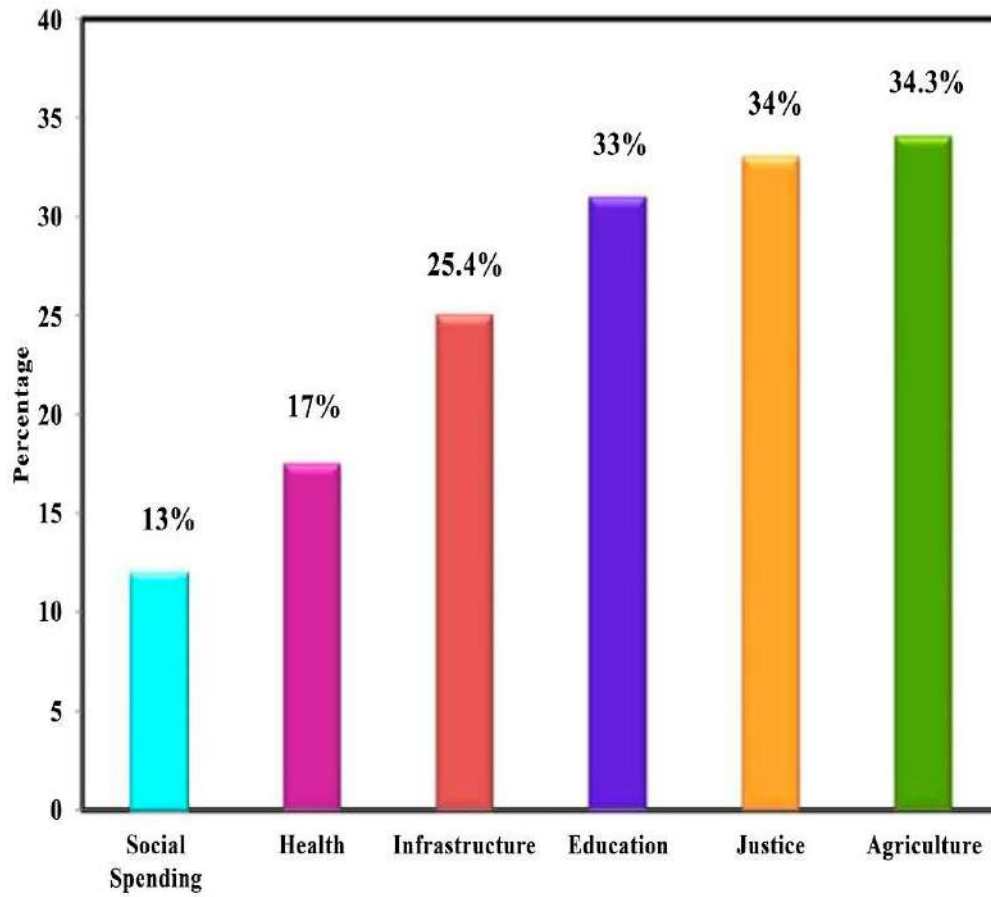


Figure 1. Sustainable development sectors.

1.4. Contributions

This study's main contributions are as follows:

- Explores the sustainable adoption of innovative digital technologies in digital transformations and its implications for organizations;
- Investigates the consequences of sustainable digital transformations on organizations' long-term sustainability goals;
- Explores the importance of effectively engaging stakeholders throughout the digital transformation process;
- Examines the resources and support required for organizations to successfully implement sustainable digital transformations.

The novelty of this study is the focus on incorporating sustainability principles into the process of digital transformation. This study recognizes that while DT can bring about efficiency improvements and competitive advantages for organizations, it is important to consider long-term sustainability outcomes and address potential challenges related to stakeholder engagement, resource allocation, and risk mitigation.

The remaining sections of this study are arranged as follows. The literature review is in Section 2, the theoretical framework of the study is in Section 3, the conceptual framework is presented in Section 4, the methodology is proven in Section 5, the study results are explained in Section 6, and finally, the paper is concluded in Section 7.

2. Literature Review

The findings of earlier research studies that are pertinent to the current study are summarized in this section. This section discusses digital transformation and sustainability, with a constant emphasis of its adoption in DT, and implementing innovative technologies in digital transformation. The review also identifies the research gaps that the current research needs to fill.

2.1. Digital Transformation and Sustainability

The world has undergone numerous changes over the years as a result of industrial development and technological advancements. At the moment, markets are characterized by volatility, uncertainty, complexity, and ambiguity, which are the primary forces behind a phenomenon known as digital transformation. The interrelation between sustainability and DT at the corporate level was reviewed by Gomez and Gonzalez in 2022 [14]. The research used a methodical review of 89 published studies. Comprehensive content analysis filters were applied. The study found that a framework for research that sees DT as a precursor and driver of sustainability is achievable. For businesses to survive the digital revolution, the report advised them to (i) increase digital skills and (ii) balance their economic,

(iii) environmental, and (iv) social implications. The risks and opportunities that information and communication technologies present for environmental sustainability, as well as the political awareness of these risks and opportunities, grow more important as their use in industrial production increases. The policies in the industrial and digital sectors of three East Asian and Pacific Island countries as well as four Sub-Saharan African countries were evaluated by Kunkel and Matthes in 2020 [15] regarding the anticipation-concerning effects of ICTs on professions for environmental constants. The analysis showed that policies emphasize a wide variety of hazy expectations and place a greater emphasis on the positive benefits of information and communication technology use.

2.2. Importance of Sustainable Adoption in Digital Transformation

Companies face enormous challenges as a result of DT, which transforms industries and necessitates the development of new change-adoption strategies. Businesses and industries are going through a significant transformation that will result in digitized business operations. Companies are being forced to develop completely new strategies as a result of digitization, which is also driving all business processes. Ukko et al. (2019) [16] investigated the connections between financial performance, a sustainability strategy, and a digital business strategy. Two management and operational skills are necessary, according to the report, to put a digital business plan into practice. The results demonstrated that a sustainability plan facilitates the interrelation between a digital company strategy and financial performance. According to the study, the sustainability strategy supported the link between managerial competence and financial performance. However, there was a negative correlation between operational capability and financial performance when using the sustainability strategy. Universities have undergone several significant changes in recent decades as a result of social and technological trends toward digitalization. Currently, a paradigm shift in which technology is conceived as a complex and interconnected environment that enables digital learning is related to the adoption of technologies by universities. Abad et al. (2020) [17] analyzed the international research trends of the effects of managing the DT of higher-education sustainably. The study found that there is a significant impact on the adoption of new technologies in higher education.

2.3. Implementing Innovative Digital Technologies for Digital Transformation

Digitally enabled enterprises are supported by new information and communication technologies (ICTs), often known as new technologies, which increasingly provide significant prospects for growth. The study by Loonam et al. investigated the procedures needed to implement DT inside conventional businesses. It identified four key themes that companies should adopt when implementing practical changes to digital business models (Loonam et al., 2018) [18]. According to Bican and Brem (2020) [19], digitalization significantly contributes to the UN Sustainable Development Goals. Future economic and environmental challenges cannot be resolved sustainably without the transformation of existing businesses. To develop a general understanding and definition that would serve as the foundation for the interrelations within a conceptual framework, the study examined the prior literature. Based on a systematic literature review within the fields of management and economics, the research identified seven key terms related to digitalization, namely, digital, business model, digital business model, digital technology, digital innovation, digital transformation, and digital entrepreneurship.

2.4. The Process of Integrating Spatial Data Infrastructures (SDIs) into the Information Infrastructure of EU Countries Is Achieved by Decrees

Spatial data infrastructure (SDI) involves the collection of innovations and technologies, organizational arrangement, and the strategies that supply a foundation for spatial data discovery. SDI mainly includes GPS, remote sensing, geographic information system (GIS), and other technologies regarding this. As an example, with regard to a small island developing state, i.e., the Dominican Republic, which is vulnerable to natural disasters like hurricanes, earthquakes, etc., SDI helps in sharing information, while emergency mapping operations (EMOs) assist in decision-making. The evaluation of future outlines for SDI implementation to reach emergency mapping objectives needs the consideration of a broad range of stakeholders with contrasting objectives. In the reference study, multi-actor multi-criteria analysis (MAMCA) introduced a road map to collaboration between different parties who were all devoted to implementing an SDI that offers a framework for EMOs during emergency conditions (Rosario Michel and Gonzalez-Campos, 2023) [20].

2.5. Comparative Methods of Geoportal Functionality Are Used for Research

Soldatke et al. (2023) [21] in their study explained the differences in the spatial evolution of seaside towns in the course of as well as outside the summer season according to the illustration of the Polish towns of Puck and Wladyslawowo. They also examined as well as assessed the tourist services which have been offered in those towns, developing permanent solutions, providing tourism seasonality, the implementation of spatial tools, local residents' points of view on tourist traffic, the development of resorts for tourists, and the many developments regarding the spatial development projects in those particular towns.

2.6. An Important Element for Sustainable Development Is the Introduction of Protective Rights of Land, Infrastructure above, in, and below the Ground, and Special Markings on Maps and ISO Standards Developing an infrastructure is an essential criterion and the development of a geospatial data infrastructure has been introduced to collaborate and exchange information at the national level as well as simultaneously develop the INSPIRE geoportal of the European Commission's Community Research Center. In using these, they have found novel challenges as well as opportunities to solve the problems. The study conducted by Ogryzek et al. (2019) [22] showed that there is a possibility of the evolution of maps which indicate utility networks as well as the rights for land which is obtained by utility companies. The information regarding remote sensing methods is helpful for the exposure of rights on

maps of a technical framework, as at present, there are no details available in the systems. The progressed result can be used by both local as well as national geoportals.

2.7. There Have Been a Number of Initiatives across Europe to Improve Spatial Data Infrastructures Run by Both Public and Private Administrations

The British are acknowledged as the leading experts on spatial data infrastructure and the lately released book which is reviewed by GIS professionals on creating spatial data infrastructure. In this book, there are four chapters. In the first chapter, the authors explain the uses of GIS, which focuses on their application as well as AGI role in outreaching work. In the second chapter, they explain how it works prior to introducing SDIs and what they actually are along with why they are necessary. In the third chapter, the authors discuss the available SDIs in Europe which can be seen in the Czech Republic, Germany, Finland, France, Northern Ireland, and Lithuania. The fourth chapter describes the most practical implications regarding this and promises advantages up to 10 times the cost (Masser and Cromptvoets, 2007) [23].

2.8. Research Gap

In light of the findings of the current literature analysis, it is crucial to explore the sustainable adoption of innovative digital technologies in DT. A questionnaire survey approach was used in the study to obtain the primary information from respondents. Research indicates that the sustainable adoption in DT projects benefits from effective governance by enhancing stakeholder engagement, resource allocation, and risk mitigation for successful implementation and outcomes. From the previous research, it was found that there is no explanation in detail about the combination of digital transformation and sustainability principles. The role of innovative digital technologies in promoting business organizations has not been elaborated on in previous studies; it is unclear from the research how to achieve sustainability goals in DT initiatives. There is no clear explanation of the correlation between digital technologies in DT. The innovation of digital technologies appears to have a significant influence on the long-term sustainability outcomes for organizations, although this is not well explained. Therefore, the objective of this study is to explore the importance of the sustainable adoption of innovative digital technologies in DT.

3. Theoretical Framework

The theoretical framework discusses the efficiency of the transformation, long-term sustainability outcomes for organizations, competitive advantage, governance, and management: stakeholder engagement, resource allocation, risk mitigation, resources and support for successful implementation, and sustainability goals in digital transformation initiatives.

3.1. The Efficiency of the Transformation

DT is the process of integrating digital technologies into various aspects of a business, leading to significant changes in its operations, strategies, and overall value proposition [1]. DT improves operational efficiency by automating manual processes and streamlining workflows. By implementing digital tools and technologies, organizations can eliminate repetitive and time-consuming tasks, reduce human errors, and increase productivity. This allows employees to focus on more strategic and value-added activities, ultimately leading to improved performance across the team. DT improves communication and collaboration within and outside the organization [24]. By adopting digital platforms such as project management tools, instant messaging, and video conferencing, teams can collaborate in real time regardless of their location. DT enables organizations to implement data analytics and business intelligence tools through which organizations can gain valuable insights into customer behavior, market

trends, and operational performance [25]. By leveraging these insights, companies can make data-driven decisions, improve their strategies, and identify areas for improvement, thereby improving performance and staying competitive in the digital age [26].

3.2. Long-Term Sustainability Outcomes for Organizations

DT can improve operational efficiency, improve customer experiences, and drive innovation, while also having significant long-term sustainability consequences for organizations [27]. DT helps companies reduce their environmental footprint. By leveraging digital technologies, organizations can streamline processes, automate tasks, and reduce the need for physical resources. This leads to reduced energy consumption, reduced carbon emissions, and reduced waste generation [28]. DT develops a culture of innovation and agility within organizations. DT promotes collaboration and knowledge sharing within organizations and across supply chains. By implementing collaborative digital platforms and communication tools, companies can reduce the need for physical travel, leading to reduced transportation-related emissions [29]. DT enables organizations to engage with stakeholders and customers in more sustainable ways. Through digital channels, companies can communicate their sustainability efforts, promote eco-friendly products and services, and educate consumers about responsible consumption [30]. This will lead to increased customer loyalty, brand reputation, and ultimately a more sustainable business environment.

3.3. Competitive Advantage

DT involves leveraging emerging technologies such as artificial intelligence, machine learning, cloud computing, big data analytics, and the Internet of Things (IoT) to drive innovation, streamline operations, and deliver enhanced value to customers [31]. The benefit of DT lies in the ability to collect, analyze, and leverage vast amounts of data to derive actionable insights. Advanced analytics and data-driven decision-making can help organizations improve their operations, personalize customer experiences, and identify new growth opportunities. Also, DT helps organizations improve their agility and responsiveness to changing market dynamics. The adoption of digital platforms and automation helps companies improve efficiency, reduce costs, speed up the time to market, and adapt quickly to customer needs [32]. By leveraging digital channels, personalized marketing strategies, and omnichannel capabilities, companies can engage with customers across multiple touchpoints, address their needs, and deliver tailored solutions, building loyalty and differentiation in the marketplace. A competitive advantage in DT is achieved by aligning technology investments with strategic objectives, continuously innovating and adapting to digital trends, and encouraging a culture of digital agility and customer centricity [33].

3.4. Governance and Management: Stakeholder Engagement, Resource Allocation, and Risk Mitigation

Governance and management play a vital role in ensuring the success of DT [34]. Stakeholder engagement involves the active involvement and participation of stakeholders throughout the transformation journey. This includes employees, customers, suppliers, and other related parties. Engaging stakeholders allows organizations to gather valuable insights, address concerns, and create a shared vision for change. Resource allocation is another important component of administration and management [35]. DT often requires significant investments in technology infrastructure, talent acquisition, training, and process redesign. Effective resource allocation involves identifying and prioritizing the resources needed for successful change, ensuring their availability and appropriate use. Risk mitigation is an integral part of governance in DT. This process involves identifying potential risks and developing strategies

to minimize their impact. Risks include technical challenges, security threats, resistance to change, and regulatory compliance issues. Through proactive risk assessment and mitigation planning, organizations can anticipate and address potential obstacles, ensuring a smooth transition process. Governance and management of DT require active stakeholder engagement, strategic resource allocation, and robust risk mitigation strategies [36]. By adopting a comprehensive approach to these areas, organizations can increase their chances of achieving successful DT outcomes.

3.5. Resources and Support for Successful Implementation

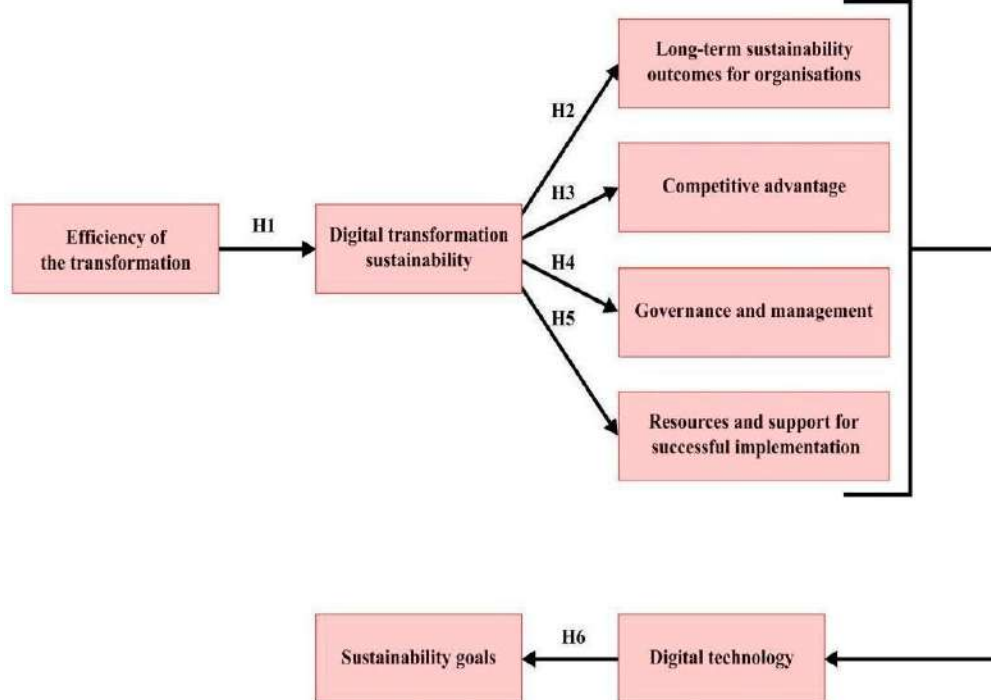
A successful DT requires careful planning, execution, and ongoing support. Building a team of individuals with diverse skills and expertise in areas such as technology, project management, change management, and data analytics will play a key role in driving DT [37]. Engaging experienced consultants specializing in DT to provide guidance, best practices, and strategic insights will help assess the current state, define a roadmap for change, and provide support throughout the implementation process [38]. The implementation of collaboration tools and platforms facilitates communication and knowledge sharing among employees. Collaborating with technology vendors and partners who can provide technical expertise, support, and innovative solutions will also help ensure access to the latest advances in technology [39]. By adopting resources and support mechanisms, organizations can increase the likelihood of successful DT, business growth, improved efficiency, and improved customer experiences [40].

3.6. Sustainability Goals in Digital Transformation Initiatives

Considering sustainability in digital strategies can help organizations achieve multiple objectives. DT initiatives can enable energy efficiency and resource optimization [41]. Using digital tools and technologies can help businesses streamline processes, reduce paper usage, reduce waste, and improve energy consumption. This leads to less environmental impact and cost savings. Sustainable DT efforts prioritize the use of renewable energy sources. Adopting cloud computing, virtualization, and data centers powered by renewable energy also reduces greenhouse gas emissions [42]. DT will encourage a shift toward remote work and virtual collaboration, reducing travel-related carbon emissions and supporting a more sustainable work environment [43]. Integrating sustainability goals into DT efforts empowers organizations to adopt eco-friendly practices, optimize resource use, reduce environmental impact, and contribute to a more sustainable future.

4. Conceptual Framework

This study investigates the significance of the long-term adoption of cutting-edge digital technologies in DT. The presented conceptual framework illustrates the key concepts related to innovative digital technologies in DT. This study formulated hypotheses H1, H2, H3, H4, H5, and H6. Figure 2 shows the conceptual framework of this study. The efficiency and productivity of the DT implementation process within an organization involves improving workflows, streamlining operations, and efficiently achieving desired outcomes. It refers to the results and impacts an organization wants to achieve through DT, which are sustainable and provide ongoing benefits beyond the initial implementation phase. The specific goals or objectives an organization sets to achieve sustainable outcomes through DT may relate to environmental sustainability, social impact, ethics, or economic development. How these key concepts interrelate and influence the context of DT and sustainability in organizations can show relationships between performance, sustainability, competitive advantage, governance and management, resources and support, technology, and sustainable goals, contributing to successful and sustainable DT efforts.



4.1. Digital Transformation and Sustainability Principles

Adopting digital technologies can help companies improve their operations, streamline processes, and reduce resource consumption, leading to a lower carbon footprint and improved environmental performance [44]. DT enables improved transparency and accountability, allows organizations to actively engage with stakeholders, and addresses social issues such as diversity, inclusion, and ethical practices [45]. This integrated approach promotes a more sustainable and resilient future for businesses and society as a whole.

H1. The combination of digital transformation and sustainability principles positively influences the efficiency of the transformation which can be measured by environmental, social, and economic performance indicators.

4.2. Digital Transformation Goals and Long-Term Sustainability Outcomes for Organizations

Aligning DT goals with SDGs can lead to increased long-term sustainability outcomes for organizations. By integrating the SDGs into their DT strategies, organizations can contribute to these broader social goals while reaping many benefits [46]. DT can enable more efficient and sustainable operations. Technologies such as data analytics, IoT, and artificial intelligence can improve resource consumption, reduce waste, and improve overall productivity, leading to cost savings and reduced environmental impact. SDGs can improve a company's reputation and brand value, as it demonstrates a commitment to social and environmental responsibility. It will attract customers, investors, and talent who prioritize sustainability [47]. DT can enable more efficient and sustainable operations. Hence, we can state,

H2. Aligning digital transformation goals with SDGs increases long-term sustainability outcomes for organizations.

4.3. Digital Technologies Have a Significant Impact on Organizations' Competitive Advantages

The digitalization of an economy is one of the most crucial elements in establishing sustainable competitive advantages for the entire economy. The distinction between business and technology functions is becoming blurrier as traditional industrial structures and business models are destroyed [48]. Technology now plays a significant role in the global economy and provides a sustained competitive edge. Today's IT startups compete for digital innovation by developing solutions that draw on and generate synergies in industries like healthcare and home automation [49]. Reusable solutions made possible by innovators allow regional teams to design and gain a competitive edge by using their goods and services [50]. The most widely used digital platforms have an impact on markets, society, and people. Creating a new economic arena and altering how operations are carried out has altered the global economy. Consumers and businesses have seen a significant economic effect as a result.

H3. Digital technologies focusing on sustainability gain organizations a competitive advantage.

4.4. A Digital Transformation Plan Influences Effective Management

Governance is one of the most crucial elements in managing digital change. To prevent and lower the risk of DT, good governance is essential. There are dangers in every digitization project, but these can be minimized by using a strong approach to DT governance [51]. Due to the complicated and disruptive nature of such initiatives, stakeholder engagement is extremely important in the context of DT projects. Major adjustments to an organization's processes, technologies, and culture are frequently a part of DT [52]. The project's success depends on managing stakeholder expectations and fostering a collaborative environment. Project managers can create a common understanding of project goals, recognize and reduce potential risks, allocate resources effectively, and win the support of all pertinent parties by successfully engaging stakeholders [53]. Stakeholder involvement also makes it easier to receive ongoing feedback and make improvements, which ultimately increases the likelihood that a digital transformation will be successful.

H4. Sustainable adoption in digital transformation projects benefits from effective governance by enhancing stakeholder engagement, resource allocation, and risk mitigation for successful implementation and outcomes.

4.5. Digital Transformation Has a Significant Impact on Successful Business Execution

As sustainability becomes a growing concern for businesses and society as a whole, organizations are recognizing the need to prioritize sustainable practices. By highlighting the sustainability benefits of a DT plan, it becomes easier to gain support and resources from stakeholders who value environmental and social responsibility. A comprehensive DT can lead to significant cost savings in the long term [54]. By implementing digital solutions and automation processes, businesses can streamline operations, reduce waste, and improve resource allocation. DT efforts often result in improved efficiency, agility, and customer experience. By using technology to deliver sustainable solutions, businesses can differentiate themselves from competitors and position themselves as industry leaders in sustainability practices [55]. This will attract investors, partners, and customers who prioritize sustainable businesses, leading to increased resources and implementation support.

H5. Prioritizing a comprehensive digital transformation business case with sustainability benefits and multidimensional returns increases resources and support for successful implementation.

4.6. Innovative Digital Technologies Influence Sustainability Goals in Digital Transformation Initiatives

The use of innovative digital technologies plays an important role in achieving sustainability goals. These technologies include artificial intelligence, IoT, blockchain, cloud computing, or data analytics [56]. By developing these technologies, companies can improve resource use, reduce waste, and improve overall efficiency, thus contributing to sustainability objectives. The successful integration of digital technologies into a company's existing infrastructure is essential. This integration ensures that technologies communicate effectively with each other and with other business processes [57]. By integrating digital solutions, organizations can streamline operations, reduce redundancies, and improve their ability to effectively address sustainability challenges. Successful DT and sustainability initiatives require the engagement of various stakeholders, including employees, customers, suppliers, and communities [32]. Involving stakeholders throughout the process helps create a shared vision, encourages collaboration, and develops a sense of ownership.

H6. Implementing innovative digital technologies with robust integration, change management strategies, and stakeholder involvement significantly contributes to achieving sustainability goals in digital transformation initiatives.

Although some previous studies have supported the hypotheses proposed in this section, further empirical evidence is needed for the research to be successful. Therefore, the research used specific methods presented in the sections below to show that all the proposed hypotheses are true.

5. Research Methods

This methodology section describes the methods used to carry out the suggested study. So, the methodology used in the current study is quantitative. SPSS software has been used in the study, i.e., IBM SPSS 29 version. This software is used for a reliability test, ANOVA test, as well as Chi-square test. SPSS software is used in the methods because it is helpful in performing statistical and quantitative data analysis. In the study conducted by Bao and Zhang (2023) [58], they discussed the impact of digital transformation on enterprise innovation performance under the background of information management based on SPSS statistical software. From the inspiration of that study, we have taken the SPSS software methodology to gain the desired results. Data were gathered using a primary-instrument questionnaire survey to analyze the study's purpose. The methodology used in this study, including the research design, data collection, and processing and analysis of the data, is covered in detail in the section that follows.

5.1. Research Design

The study adopted a descriptive quantitative research design based on the research question, research objectives, phenomena of interest, population, and the sample of the current study. These quantitative research methods place a strong emphasis on numerical, statistical, and/or statistical analysis of data gathered through questionnaire surveys.

5.2. Data Collection

The data used in this study were gathered between 8 January and 17 March 2023. A questionnaire survey was conducted online among stakeholders over the age of 25 in Saudi Arabia who were sustainability practitioners, IT professionals, industry experts, ICT users, and stakeholders. A total of 760 individuals ultimately took part in the survey. In Table 1, the demographic traits are listed. Gender shows that 50.53% of respondents were male, and 49.47% of respondents were female, thus the majority of respondents were male. According to the age group, 13.95% of respondents were between the ages of 25 and 34, 59.61% were between the

ages of 35 and 44, and 26.45% were over the age of 45. In terms of profession, 25.26% of the respondents were sustainability practitioners, 25.13% of the respondents were IT professionals, 24.74% of the respondents were industry experts, and 24.87% of the respondents were ICT users and stakeholders. Regarding professional experience, 23.16% of respondents had experience of 15 years or more, followed by 28.68% who had experience of 5 to 10 years, and 48.16% who had experience of 11 to 14 years.

Table 1. Demographic details of the respondents.

| Category | Sub-Category | Frequency | Percentage |
|------------|------------------------------|-----------|------------|
| Gender | Male | 384 | 50.53 |
| | Female | 376 | 49.47 |
| Age group | 25–34 years | 106 | 13.95 |
| | 35–44 years | 453 | 59.61 |
| | 45 years and above | 201 | 26.45 |
| Occupation | Sustainability Practitioners | 192 | 25.26 |
| | IT Professionals | 191 | 25.13 |
| | Industry Experts | 188 | 24.74 |
| | Users and Stakeholders | 189 | 24.87 |
| Experience | 5–10 years | 218 | 28.68 |
| | 11–14 years | 366 | 48.16 |
| | 15 years and above | 176 | 23.16 |

5.3. Reliability and Measurement Analysis

The current study investigates how innovative digital technologies are adopted sustainably in the context of DT. In Table 2, environmental performance, social performance, and economic performance make up the first-factor efficiency. Second, three components make up the sustainability outcomes factor: environmental sustainability, social sustainability, and economic sustainability. Third, the competitive advantage factor is made up of four components: attracting and retaining top talent, enhanced brand reputation and customer loyalty, access to new markets and business opportunities, and cost efficiency and resource optimization. Fourth, the governance and management factor is made up of three components: risk reduction, resource allocation, and stakeholder engagement. Fifth, stakeholder support, human resources, organizational leadership and sponsorship, and financial resources make up the resources and support factor. The sixth-factor sustainability goals are made up of two components: social inclusivity and equity and ethical and responsible technology use.

Table 2. Measurement reliability, mean, and SD.

| Factors | Variables | No. Questions | SD | Mean | Reliability |
|---------------------------|--|---------------|-------|-------|-------------|
| Efficiency | Environmental Performance | 3 | 1.036 | 4.073 | 0.898 |
| | Social Performance | 2 | | | |
| | Economic Performance | 3 | | | |
| Sustainability outcomes | Environmental Sustainability | 3 | 1.296 | 2.791 | 0.85 |
| | Social Sustainability | 3 | | | |
| | Economic Sustainability | 2 | | | |
| Competitive advantage | Cost Efficiency and Resource Optimization | 3 | 1.361 | 3.258 | 0.86 |
| | Enhanced Brand Reputation and Customer Loyalty | 2 | | | |
| | Access to New Markets and Business Opportunities | 3 | | | |
| | Attraction and Retention of Top Talent | 3 | | | |
| Governance and management | Stakeholder Engagement | 2 | 1.035 | 3.355 | 0.801 |
| | Resource Allocation | 3 | | | |
| | Risk Mitigation | 3 | | | |
| Resources and support | Stakeholder Support | 3 | 1.307 | 2.217 | 0.932 |
| | Human Resources | 2 | | | |
| | Organizational Leadership and Sponsorship | 2 | | | |
| | Financial Resources | 3 | | | |
| Sustainability goals | Social Inclusivity and Equity | 3 | 1.808 | 3.607 | 0.908 |
| | Ethical and Responsible Use of Technology | 2 | | | |

The items were created using the items that had been used in earlier studies. For internal consistency, the items' Cronbach's alpha values were examined. In general, measurements are regarded as being accurate if their Cronbach's alpha values are 0.6 or higher. The Cronbach's alpha for every variable used in this study was higher than 0.7. Table 3 provides the results of the reliability analysis.

Table 3. Frequency of acceptance.

| Hypotheses | Statements | Disagree | Neutral | Agree |
|--------------|---|----------|---------|--------|
| Hypothesis 1 | I have observed that digital transformation and sustainability principles enhance efficiency, resulting in improved environmental, social, and economic performance indicators. | 22 | 77 | 661 |
| | | 2.89% | 10.13% | 86.97% |
| Hypothesis 2 | I feel like aligning digital transformation goals with SDGs improves long-term sustainability outcomes, positively impacting society and the environment. | 45 | 85 | 630 |
| | | 5.97% | 11.18% | 82.89% |
| Hypothesis 3 | In my opinion, digital technologies prioritize sustainability, giving organizations a competitive advantage and contributing to a sustainable future. | 30 | 92 | 638 |
| | | 3.95% | 12.11% | 83.95% |
| Hypotheses | Statements | Disagree | Neutral | Agree |
| Hypothesis 4 | I believe that effective governance practices in digital transformation projects lead to sustainable adoption, stakeholder engagement, resource allocation, and positive outcomes. | 7 | 161 | 592 |
| | | 0.92 | 21.18% | 77.89% |
| Hypothesis 5 | I have witnessed that prioritizing a comprehensive digital transformation business case with sustainability benefits is crucial for securing resources and support. | 15 | 54 | 691 |
| | | 1.97% | 7.11% | 90.92% |
| Hypothesis 6 | I can attest to the significant contribution made by implementing innovative digital technologies with robust integration, change management strategies, and stakeholder involvement. | 60 | 32 | 668 |
| | | 7.89% | 4.21% | 87.89% |

5.4. Study Area

The data for the study were collected between 8 January and 17 March 2023. The study area which was selected was Saudi Arabia, where a desert climate is observed, and very hot and dry summers can be seen. The survey was taken online with the help of Google Forms, and the

respondents who took part numbered 760, including males as well as females over the age of 25 years.

6. Results

The study's results are presented in this section along with statistical analyses and data visualizations. This section also describes the results of the data analysis, interpretation, and evaluation that were performed throughout the research process.

6.1. Descriptive Analysis

To examine respondents' attitudes toward the acceptance of the sustainable adoption of innovative digital technologies in DT, a simple frequency analysis was carried out. Table 3 displays the frequency conversion reply from 5 to 3—a point scale. The six assertions had acceptance rates that were higher than 70%, showing that respondents were satisfied with the acceptance. The sustainability outcomes item (item 2) received the most consent out of the six items, while the competitive advantage item received the least. According to these findings, respondents appeared to have a more positive attitude toward sustainability outcomes that promote environmental, social, and economic sustainability. It should be noted that the rate of approval was highest in the first two of the six statements.

The frequency and mean of acceptance are shown in Table 4 in relation to each variable. ANOVA was used in this study to compare means across multiple groups of variables. Chi-square tests, on the other hand, were used to investigate the interrelation of independence between categorical variables. Table 1's frequency reveals that the majority of respondents (661) agreed that digital technologies are efficient in terms of their effects on the environment, society, and economic performance ($p < 0.01$). Innovative digital technologies deliver sustainability outcomes based on their effects on environmental sustainability, social sustainability, and economic sustainability ($p < 0.01$). Innovative digital technologies offer competitive advantages in terms of cost efficiency and resource optimization, improved brand reputation and customer loyalty, access to new markets and business opportunities, and attracting and retaining top talent ($p < 0.01$).

Based on their results in stakeholder engagement, resource allocation, and risk reduction, innovative digital technologies enhance management and governance ($p < 0.01$). In terms of their effects on stakeholder support, human resources, organizational leadership and sponsorship, and financial resources, the sustainable adoption of innovative digital technologies enhances resources and support ($p < 0.01$). The sustainable adoption of innovative digital technologies in DT promotes sustainability goals based on social inclusion and equity and the ethical and responsible use of technology ($p < 0.05$). The ANOVA test determined a statistically significant impact on sustainability outcomes, whereas the Chi-square test determined if there is a significant association between these variables.

According to the ANOVA test, the study found a significant difference among the groups being compared. Similarly, Chi-square tests were accomplished to examine the correlation among the categorical variables, like sustainability outcomes, cost, and business opportunities. In addition to this, the interpretation of results considered the significance level using a p-value to evaluate the practical significance of the findings. As a result, the significant ANOVA and Chi-square test results of these variables suggests that these factors significantly contribute to achieving sustainability goals, supporting the hypotheses. From the frequency of the respondents' agreement on the factors and their variables, the study demonstrates that the proposed six hypotheses are supported by the study results.

Table 4. Frequency and mean.

| Factors | Classified | Frequency | | | ANOVA | Chi-Square |
|---------------------------|--|-----------|---------|-------|-----------|------------|
| | | Disagree | Neutral | Agree | | |
| Efficiency | Environmental Performance | | | | | |
| | Social Performance | 22 | 77 | 661 | 62.679 ** | 29.079 |
| | Economic Performance | | | | | |
| Sustainability outcomes | Environmental Sustainability | | | | | |
| | Social Sustainability | 45 | 85 | 630 | 40.085 ** | 45.283 |
| | Economic Sustainability | | | | | |
| Competitive advantage | Cost Efficiency and Resource Optimization | | | | | |
| | Enhanced Brand Reputation and Customer Loyalty | | | | | |
| | Access to New Markets and Business Opportunities | 30 | 92 | 638 | 62.502 ** | 43.661 |
| | Attraction and Retention of Top Talent | | | | | |
| Governance and management | Stakeholder Engagement | | | | | |
| | Resource Allocation | 7 | 161 | 592 | 38.617 ** | 20.233 |
| | Risk Mitigation | | | | | |
| Resources and support | Stakeholder Support | | | | | |
| | Human Resources | | | | | |
| | Organizational Leadership and Sponsorship | 15 | 54 | 691 | 38.667 ** | 10.968 |
| | Financial Resources | | | | | |
| Sustainability goals | Social Inclusivity and Equity | | | | | |
| | Ethical and Responsible Use of Technology | 60 | 32 | 668 | 46.399 * | 16.731 |

Note: p-value < 0.05 *, p-value < 0.01 **.

6.2. Correlation Analysis

To identify whether there was a statistically significant relationship between the variables, a correlation analysis was performed. The variables governance and management and sustainability goals exhibit the strongest linear correlation (the highest coefficient value is 0.987). Between the variables of governance and management and sustainability outcomes, there is the least amount of linear correlation (the lowest coefficient value is 0.719), see Table 5.

Efficiency showed a significantly high positive correlation with competitive advantage ($r = 0.914$, $p < 0.01$). Sustainability outcomes were highly correlated with sustainability goals ($r = 0.979$, $p < 0.01$). Competitive advantage showed a high correlation with governance and management ($r = 0.893$, $p < 0.01$). Also, there was a distinct correlation between governance and management with sustainability goals ($r = 0.987$, $p < 0.01$) and positive correlations between resources and support and sustainability goals ($r = 0.982$, $p < 0.01$). All values of Pearson's correlation coefficient are statistically significant, according to the correlation analysis findings.

Table 5. Simple Pearson correlation.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---------------------------|----------|----------|----------|----------|---|---|
| Efficiency | 1 | | | | | |
| Sustainability outcomes | 0.755 ** | 1 | | | | |
| Competitive advantage | 0.914 ** | 0.736 ** | 1 | | | |
| Governance and management | 0.848 * | 0.719 ** | 0.893 ** | 1 | | |
| Resources and support | 0.756 ** | 0.867 * | 0.933 * | 0.923 ** | 1 | |

| | | | | | | |
|----------------------|----------|----------|------------|----------|---------|---|
| Sustainability goals | 0.889 ** | 0.979 ** | 0.75 ** | 0.987 ** | 0.982 * | 1 |
|----------------------|----------|----------|------------|----------|---------|---|

Note: p -value < 0.05 *, p -value < 0.01 **.

The data were collected in an online mode with the help of Google Forms; the data were collected from 760 respondents. The sample questionnaire was collected and is mentioned in Appendix A. Similar to that, there were 50 questions asked, but we cannot show all 50 questions in the paper as the data become huge. As the study contains 760 respondents, the results will vary, and it will be a large number. The statements that are considered as hypotheses in Table 3 consist of the majority of the commonly stated responses to the questions asked. In Table 4, the factors regarding the questionnaire are explained with an ANOVA, which helps in analyzing variances across the means, and Chi-square, which is used to compare the results with the expected results.

7. Discussion

Digital transformation involves the collection and processing of vast amounts of data. Companies must prioritize data privacy and security to build trust with their customers and stakeholders [14]. The sustainable adoption of innovative digital technologies in DT means considering environmental, social, and ethical impacts throughout the entire life cycle of technology implementation. By prioritizing sustainability and responsible practices, companies can achieve long-term success while minimizing negative impacts on the environment and society [15]. The purpose of the current study is to examine the significance of the long-term adoption of innovative digital technologies in DT. Data were collected through an online questionnaire survey from 760 people over 25 years of age in Saudi Arabia who were sustainability practitioners, IT professionals, professionals, ICT users, and stakeholders. Based on the study results, the effectiveness of the transformation, as indicated by environmental, social, and economic performance indicators, is positively influenced by the integration of DT and sustainability principles. DT enables improved transparency and accountability, allows organizations to actively engage with stakeholders, and addresses social issues such as diversity, inclusion, and ethical practices. The research results show that the goals for digital transformation should be in line with the SDGs to improve organizations' long-term sustainability. SDGs can improve a company's reputation and brand value, as they demonstrate a commitment to social and environmental responsibility. According to this study's findings, digital innovations that emphasize sustainability give businesses a competitive edge. Technology has grown exponentially into a critical component of the global economy and a sustainable competitive advantage. The study results demonstrate effective governance improves stakeholder engagement, resource allocation, and risk mitigation for successful implementation and results, which benefits sustainable adoption in DT projects. Project managers can create a common understanding of project goals, recognize and reduce potential risks, allocate resources effectively, and win the support of all pertinent parties by successfully engaging stakeholders. The study results indicate prioritizing a thorough DT business case as a top priority will increase resources and support for a successful implementation that includes sustainability benefits and multidimensional returns. As sustainability becomes a growing concern for businesses and society as a whole, organizations are recognizing the need to prioritize sustainable practices [16]. Based on the study results, in order to achieve sustainability objectives in DT initiatives, innovative digital technologies must be implemented along with strong integration, change management strategies, and stakeholder involvement. By developing these technologies, companies can improve resource use, reduce waste, and improve overall efficiency, thus contributing to sustainability objectives.

7.1. Practical Implications

This study's findings can help participants and practitioners understand the value of the sustainable adoption of innovative digital technologies in the process of DT because it will have a lasting impact on their psychological well-being and daily lives. As a result, it is imperative to include sustainable adoption in digital technology development. In addition to this, the results show that the combination of DT and sustainability principles positively influences the efficiency of the transformation, which can be measured by environmental, social, and economic performance indicators. DT has become more efficient and effective thanks to technology; artificial intelligence (AI) and machine learning can hasten DT. DT is essential to business development and company expansion. People can learn about topics they were unfamiliar with by using digital platforms.

7.2. Theoretical Implications

This work contributes to the corpus of literature. The relationship between sustainability and DT at the business level has only been briefly studied in the past, particularly in investigating the connections between financial performance, a sustainability strategy, and a digital business strategy. This study conceptualizes the efficiency of the transformation, long-term sustainability outcomes for organizations, competitive advantage, resources and support for successful implementation, and sustainability goals in digital transformation initiatives to investigate the conceptualized path. The finding of this study reveals that sustainable adoption in DT projects benefits from effective governance by enhancing stakeholder engagement, resource allocation, and risk mitigation for successful implementation and outcomes.

8. Conclusions

This study examines the sustainable adoption of innovative digital technologies in digital transformations and its implications for organizations. The data were assembled from 760 stakeholders through a questionnaire survey, which was then analyzed using SPSS software. The result of the analysis indicated that the combination of DT and sustainability principles positively influences the efficiency of the transformation which can be measured by environmental, social, and economic performance indicators. The study findings demonstrated that aligning DT goals with SDGs increases long-term sustainability outcomes for organizations. The research identified that digital technologies focusing on sustainability gain organizations a competitive advantage. The analysis revealed that sustainable adoption in DT projects benefits from effective governance by enhancing stakeholder engagement, resource allocation, and risk mitigation for successful implementation and outcomes. The research result indicated that prioritizing a comprehensive digital transformation business case with sustainability benefits and multidimensional returns increases resources and support for successful implementation. The study result revealed that implementing innovative digital technologies with robust integration, change management strategies, and stakeholder involvement significantly contributes to achieving sustainability goals in DT initiatives. The study suggests the role of stakeholder engagement in driving successful DT and the need for strategic resource allocation and risk mitigation strategies.

9. Limitations and Future Directions

In addition to this study's contribution, some limitations can be addressed in future research to improve outcomes. This study is primarily quantitative, which is insufficient to empirically support its findings; therefore, future research could combine quantitative and qualitative research methods for improved research outcomes. This study elaborated on the significance of a company's DT, but it did not address the difficulties that arise during this process, such as

a lack of an organizational change management strategy, a lack of knowledge, and internal resistance to change. So, future studies could concentrate on these issues.

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Impact Of Artificial Intelligence on Social Media Marketing

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ABSTRACT

This review paper explores the rapid advancements and the vast potential of Artificial Intelligence (AI) within the realm of social media marketing. AI has emerged as a transformative force, reshaping the ways in which businesses engage with their customers and enhance their marketing strategies. The primary objective of this study is to investigate how AI-powered tools and techniques are being leveraged by businesses to refine their marketing campaigns, personalize customer interactions, and optimize their sales performance. AI has revolutionized social media marketing by enabling businesses to automate processes, generate predictive insights, and engage with their audience in a more efficient and targeted manner. By incorporating AI-driven analytics, brands can decipher consumer behaviors, preferences, and trends, thus allowing them to develop more effective marketing strategies. Furthermore, AI facilitates improved customer experiences through chatbots, sentiment analysis, and personalized recommendations. This paper delves into the broader implications of AI on society and business organizations, analyzing its effects on both social media platforms and overall business operations. The research employs a general-to-specific approach in its analysis, examining AI's impact on digital marketing, customer relationship management, and business growth. By providing a comprehensive review of AI's role in social media marketing, this study aims to highlight its benefits, challenges, and future prospects in this rapidly evolving field.

Keywords: Social media, technology, Artificial Intelligence, chatbots, machine learning, business operations

INTRODUCTION

Artificial Intelligence (AI) has emerged as a game-changing technology with the ability to replicate human intelligence, reasoning, and problem-solving abilities. According to Siau and Yang (2017), AI is designed to perform tasks that typically require human cognition, including decision-making, language processing, and problem-solving. Over the years, technological advancements have significantly propelled the capabilities of AI, making it an indispensable tool in various industries, including business, healthcare, finance, and marketing. One of the key domains where AI has made a profound impact is social media marketing. As noted by Dimitrieska, Stankovska, and Efremova (2018), AI has revolutionized traditional marketing techniques by integrating smart technologies with digital platforms, thereby enhancing efficiency and effectiveness.

The rapid rise of social media platforms such as Facebook, Twitter, Instagram, LinkedIn, and TikTok has created new opportunities for businesses to connect with their audience in innovative ways. AI plays a crucial role in this transformation by enabling automation, data-driven decision-making, and enhanced customer engagement. Kose and Sert (2017) highlight that AI has introduced new dimensions to marketing, including the deployment of chatbots, predictive analytics, and recommendation systems, which enhance customer interactions and optimize marketing campaigns. Features such as facial and voice recognition have further

expanded AI's capabilities, allowing businesses to deliver highly personalized and immersive experiences to their customers.

The continuous evolution of AI-driven technologies has given rise to trends such as deep learning, AI-powered chatbots, intelligent automation, cloud computing, and improved privacy policies. The incorporation of AI in marketing strategies has redefined the way businesses reach, interact with, and influence their target audience. From automated content creation to sentiment analysis and audience segmentation, AI has played a pivotal role in optimizing digital marketing efforts. Furthermore, the emergence of AI in marketing has opened up new avenues for research and development, offering vast potential for future advancements. By understanding and harnessing the power of AI, businesses can stay competitive in the dynamic digital landscape, enhance customer experiences, and drive growth and profitability. Thus, this paper aims to explore the growing significance of AI in social media marketing, examining its applications, benefits, challenges, and potential future developments.

RESEARCH METHODOLOGY

This review paper primarily relies on an extensive analysis of secondary research sources, including academic journals, published articles, industry reports, and existing literature from reputable sources. The research methodology is qualitative in nature, employing a systematic approach to examine how Artificial Intelligence (AI) is integrated into social media marketing and the broader business landscape. The rationale behind using secondary research is its ability to provide well-documented, reliable, and verifiable insights into the subject matter. Secondary data sources ensure a high level of accuracy, as they are often peer-reviewed and subjected to rigorous validation before publication. By drawing upon existing studies, this research effectively evaluates the advancements, applications, and implications of AI in marketing, providing a comprehensive understanding of the topic.

The methodological approach follows a structured framework that involves collecting, analyzing, and synthesizing relevant literature to derive meaningful insights. Various AI-driven marketing strategies, including automation, predictive analytics, chatbot interactions, and sentiment analysis, are examined in-depth. The study also considers different AI models and tools currently employed by businesses to improve their marketing efforts. By utilizing qualitative analysis, the research aims to highlight AI's transformative role, emphasizing its contributions to efficiency, customer engagement, and data-driven decision-making.

AIMS AND OBJECTIVES

This section outlines the specific direction and objectives of the study. The primary goal of this research is to understand the role and impact of Artificial Intelligence (AI) within the context of business and marketing. To achieve this overarching aim, the study sets forth the following specific objectives:

- To gain an understanding of how Social Media platforms function.
- To comprehend the fundamental concepts and principles of Artificial Intelligence.
- To establish the significance and importance of Artificial Intelligence within the realm of Social Media.
- To examine the functionality and application of image recognition technology within AI in the context of business organizations.

- To understand the various ways in which Artificial Intelligence contributes to the operations and strategies of business organizations.
- To establish the connection and relationship between social media analytics and Artificial Intelligence.
- To explore the potential applications and possibilities of AI in the field of Social Media marketing.

LITERATURE REVIEW

Social Media Analytics and Intelligence

As Stalidis, Karapistolis, and Vafeiadis (2015) point out, the emergence of AI has brought about a significant revolution in how information is processed within technology. This has also led to substantial advancements in the overall functioning of technology. The integration of AI into social media has resulted in positive growth and development in this area. Businesses actively utilize social media as a key platform for their marketing efforts.

The incorporation of AI into social media has significantly improved the analytics capabilities of social media marketing. This integration has fundamentally shifted the marketing landscape, moving from traditional methods to sophisticated digital approaches. In today's online environment, consumers are empowered to be critics, making it challenging to accurately gauge consumer behavior and emotions through traditional methods like spreadsheets alone. The prevalence of hashtags and emojis further complicates the derivation of concrete numerical data regarding preferences and sentiments. In this context, without the use of smart analytics, the data collected by analysts would be largely ineffective.

Marinchak, Forrest, and Hoanca (2018) suggest that next-generation AI utilizes both structured and unstructured data for its analysis. Artificial Intelligence has advanced the analytics process, adapting to current marketing trends. The integration of transformative AI in social media has enhanced analytics in several key ways:

- It transforms raw insights into actionable data, enabling organizations to draw more informed conclusions.
- Transformative AI assists in analytics by providing judgment and concluding data, operating in a manner that closely resembles human thought processes.

Social Media and Business Transformation

According to Kane (2017), social media has permeated and transformed nearly every aspect of society. The introduction of AI within the technological domain has also brought about a significant transformation in the corporate world. Business operations have shifted from manual processes to digital methods. Marketing, in particular, has experienced a dramatic evolution in its techniques and approaches due to the advent of social media, which has proven to be a powerful catalyst for marketing strategies. Technology and AI are constantly evolving, with advancements in areas like virtual reality, augmented reality, and other sophisticated intelligence applications further enhancing organizational marketing strategies. Social media has elevated business transformation to a new level.

Le et al. (2016) highlight the ways in which social media can influence businesses:

- Social media facilitates the expansion of a business's reach from a local to a global scale, enabling it to connect with a wider audience.

- Through social media marketing, organizations can strengthen their brand image and reputation.
- Social media increases the level of interaction and proximity between an organization and its customers, leading to improved customer satisfaction.
- Social media offers a more cost-effective marketing strategy for business organizations.

Impact of AI on Flourishing Business

This section will explore how AI empowers social media marketers through various applications. These include AI-driven content creation, the ability to maintain an online presence 24/7, automated bidding processes, and more precise audience targeting. Common everyday examples of AI include virtual assistants like Alexa, Bixby, and Siri. However, the underlying principles of artificial intelligence are far more complex. Organizations often employ social media experts to curate content and generate customer-friendly, sales-oriented data for their websites, ultimately increasing inbound traffic and leads (Fiumara et al., 2018). AI not only enhances modern lifestyles but also provides significant opportunities for businesses to thrive in the market.

According to Theodoridis and Gkikas (2019), the integration of features like machine learning and the analysis of big data significantly improves operational efficiency. The implementation of chatbots in customer service has proven to be a cost-effective and time-saving solution for organizations, providing quick responses to customer inquiries. While chatbots currently have limitations, there is considerable potential for the evolution of customer service systems as technology advances. Another significant impact of AI in marketing is in lead generation, which is expected to become a more direct driver of sales in the future. AI systems in marketing possess the ability to process data more efficiently than humans. For instance, AI systems like Node assist organizations in automatically classifying potential leads into customers. A prominent example of an organization effectively utilizing AI is LinkedIn, which leverages it to convert leads into sales.

Potential of AI assisted Social Media Marketing

This section will discuss the potential of AI to empower social media marketers through AI-driven content creation, continuous online presence, automated bidding, and improved audience targeting. AI has already made a significant impact on the marketing industry and is poised to surpass outdated marketing techniques. It holds a strong advantage in competitive scenarios. AI-assisted social media marketing strengthens organizations and their marketing strategies, ultimately leading to increased sales. According to Fast and Horvitz (2017), the primary objective of marketing is to boost sales, and AI plays a crucial role in achieving this.

Compared to traditional methods, AI offers organizations a more advanced approach. In the competitive market, AI stands out as a leading force in enhancing social media marketing through tools like virtual reality, sound and facial recognition, and augmented reality (Cockburn et al., 2018). Current marketing strategies increasingly focus on interactive product customization, providing customers with a unique experience. The combination of social media marketing and AI is a powerful and resilient force for success, as both are rooted in constantly evolving technology. Together, AI and social media will continue to advance in their own complex ways, forming the most effective synergy in the marketing sector.

Artificial Intelligence: The Present and Future of Social Media

Over the past few decades, technology has advanced rapidly, with artificial intelligence emerging as a particularly significant and currently in-demand field. AI is currently having a major global impact and is expected to become even more integral to human life in the near future. It has already made significant inroads across various sectors, including retail, aviation, hospitality, and service industries, and has also profoundly impacted social media. The integration of AI into social media has significantly contributed to business growth.

Social media's primary function is to connect people globally, facilitating new connections, information sharing, and interactions, thereby creating both positive and negative social impacts (Zeng, Chen, Lusch, et al., 2010). It serves as a broad platform for sharing services that benefit individuals, brands, and society as a whole. The advantages of social media are substantial, and artificial intelligence plays a crucial role in enhancing these benefits. AI is becoming increasingly prevalent in everyday use. Major social media platforms like Facebook, Twitter, and Instagram have significantly enhanced their functionality through the implementation of artificial intelligence. LinkedIn is another prominent example, effectively utilizing AI technology to connect professionals with better career opportunities for both job seekers and employers. This has also greatly enhanced social media marketing.

It is anticipated that artificial intelligence will become increasingly dominant worldwide in the near future. There is a prediction that at some point, humans may be largely replaced by AI, leading to a strong connection between brands and their customers (Erdoğan and Cicek, 2012). Overall, artificial intelligence has had a substantial impact on the field of social media.

FINDINGS AND DISCUSSIONS

Artificial Intelligence has significantly impacted people's lives, simplifying complex tasks and offering a more cost-effective approach compared to traditional methods. Social media marketing, in particular, benefits from AI by saving time and reducing operational costs. The integration of AI into social media analytics allows organizations to better understand the customized needs of their customers. By analyzing market trends, AI helps businesses identify growth opportunities and improve customer service, ultimately contributing to business success. The advanced capabilities and sharp analytical skills of AI enable organizations to maintain a competitive edge in the market (Aral, Dellarocas, and Godes, 2013).

Social media analytics involves developing and evaluating tools and frameworks to visualize, collect, monitor, summarize, and analyze social media data based on specific requirements of a target audience. It also facilitates improved communication. AI has a flourishing effect on businesses and is a key driver of increased sales in various retail and product companies. Social media analytics helps organizations summarize and evaluate collected website data to strategize effectively. The introduction of AI has enhanced the entire data evaluation process within social media analytics. Furthermore, AI has been found to reduce theft and errors in businesses, minimizing even minor human mistakes and creating a more secure environment (Müller and Bostrom, 2016).

AI also aids in lead generation by analyzing social media data more effectively and understanding user interests. The overall business structure has been transformed due to advancements in AI.

It is evident that AI is a dominant force in the present and will continue to be so in the future, with increasingly advanced applications. It has significantly improved the prediction capabilities of present and future social media marketing and has fostered stronger relationships between brands and customers, as well as among buyers. Full-fledged utilization of AI in social

media marketing is expected to drive innovation and enhance growth and productivity (Hennig-Thurau, Hofacker, and Bloching, 2013). In the future, AI will enable humans to focus on higher-value analysis, decision-making, and innovation. Operational costs, such as transportation, have decreased significantly, and overall business processes are becoming more efficient with AI advancements. Based on this literature review, it is concluded that artificial intelligence has positive effects on the development of various economic sectors. Social media marketing, with its new AI-powered features, has evolved considerably over time.

CONCLUSION

In conclusion, the integration of artificial intelligence into social media marketing has streamlined and made business operations more adaptable. With the increasing reliance on social media for purchasing goods, individuals have less time for traditional marketing methods. However, AI has simplified the buying and selling process, leading to increased productivity. Artificial intelligence is projected to be a defining aspect of future society, and its proper utilization is expected to significantly improve the world in the coming years. Human dependence on AI is anticipated to grow across all sectors as it becomes the most efficient means of acquiring products and services.

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Consequences Of Railway Transportation System During Covid-19 Pandemic Situation

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Abstract: The COVID-19 pandemic led to the suspension of all passenger train services worldwide until April 14, 2020, disrupting transportation networks. However, freight services remained operational to ensure the continued supply of essential goods, including medical supplies, food, and healthcare products. The railway sector adapted by introducing parcel vans to facilitate urgent deliveries for e-commerce companies, government agencies, and other stakeholders. This study examines the impact of the pandemic on railway operations, supply chain dynamics, and consumer behavior. Using a qualitative analysis of policy measures and economic data, we assess how railway logistics evolved to meet emerging demands. Findings suggest that while passenger mobility declined significantly, e-commerce and digital services experienced substantial growth, necessitating adaptive supply chain strategies. Additionally, the pandemic underscored the need for new mobility models to ensure transport sector resilience. The study also explores the fiscal challenges faced by governments due to disruptions in tax revenue collection and delayed GST compensation payments to states.

Keywords: COVID, health care, pandemic, transport sector, GST payments

1. Introduction

The COVID-19 pandemic was first recorded in Wuhan, China, in December 2019 and rapidly spread worldwide [1]. The movement of populations within and across districts and countries played a significant role in the transmission of the virus. Large-scale travel events, such as the Lunar New Year migration, further accelerated the spread [2-5]. Cases linked to both domestic and international travel were documented in various countries, including Canada, France, and the United States[6-7]. Early assessments of disease transmission focused primarily on air travel, evaluating the overall risk of infection spread. However, significant connections between other modes of transport—such as planes, trains, and buses—were also established [8-11]. To mitigate transmission, governments implemented travel restrictions and social distancing measures across various sectors.

Despite these measures, limited research exists on how COVID-19 was transmitted through specific transportation modes. Railways, particularly high-speed trains, represent one of the most frequently used and vital forms of transportation in many countries, especially in Europe and Asia. In 2018, China's high-speed rail network transported approximately 2 billion passengers [12-16], surpassing airline passenger numbers by 3.3 times. The G-speed train, the most widely used in China, accounted for 60% of local rail travel [17-20].

During the early stages of the COVID-19 outbreak, China's Lunar New Year travel period began on January 10, 2020. Between January 10 and January 23, approximately 150 million people traveled within China. Shortly thereafter, Wuhan and other cities in Hubei Province were placed under lockdown to contain the virus [21-24]. However, by that time, an estimated 1,058 infected travelers had already left Wuhan, potentially spreading the virus to other regions.

This study aims to assess the risks and transmission factors associated with COVID-19 among train travelers. Specifically, we analyze the spread of the virus in relation to train routes, passenger proximity, and travel duration between December 2018 and March 2020 in China [25-27]. Using data-driven models, we examine the likelihood of COVID-19 transmission among train passengers and its correlation with spatial and temporal factors. Our findings provide crucial insights into targeted interventions to reduce the risk of transmission in railway systems and enhance public health safety measures in future pandemics [28].

2. Cancellation of Train Services by Indian Railways Amid COVID-19

In response to the COVID-19 pandemic, Indian Railways suspended all passenger train services, including Premium, Mail/Express, Suburban Trains, Passenger Trains, Konkan Railway, and Kolkata Metro Rail, until March 31, 2020. However, essential services continued with limited suburban and Kolkata Metro Rail operations until midnight on March 22, 2020.

- Trains that had commenced journeys before 4:00 AM on March 22, 2020, were allowed to reach their destinations.
- Freight train operations remained active to ensure the transportation of essential commodities.
- Passengers could avail full refunds for canceled train services until June 21, 2020.

Continuity of Freight Services for Essential Goods

Despite the nationwide lockdown, Indian Railways continued its freight operations to maintain the supply chain for essential commodities. On March 28, 2020, a total of 695 rakes (35,942 wagons) were loaded, including food grains, sugar, edible oil, coal, and petroleum. The following day, 684 rakes (35,319 wagons) were loaded, maintaining a steady supply of critical goods.

To facilitate seamless transportation, the Ministry of Home Affairs (MHA) permitted unrestricted movement of goods across states, ensuring smooth coordination between railway and state authorities.

Parcel Train Services for Essential Supplies

Indian Railways introduced dedicated parcel train services to support the transportation of medical supplies, food, and other essential goods across the country. The initiative aimed to bridge logistical gaps for e-commerce and government agencies. The Ministry of Home Affairs relaxed restrictions on goods movement to optimize supply chain efficiency.

Special parcel trains operated on multiple routes, including:

- **Northern Railway:** Guwahati-New Delhi, Mumbai Central-New Delhi, Kalyan-New Delhi, Howrah-New Delhi, Jaipur-Chandigarh, Moga-Changsari.
- **Southern Railway:** Coimbatore-Patel Nagar, Coimbatore-Rajkot, Coimbatore-Jaipur, Salem-Bathinda.
- **Central Railway:** Kalyan-New Delhi, Nashik-New Delhi, Kalyan-Santraghachi, Kalyan-Guwahati.
- **South Eastern Railway:** Sankrail Goods Yard-Shalimar, Guwahati Goods Shed-Sankrail, Bengaluru-Sankrail.

Parcel train services provided efficient transportation for small and large shipments, ensuring essential supplies reached their destinations promptly.

Case Study: Railway Transport Efficiency and Challenges

Rail transport is one of the most energy-efficient and environmentally friendly modes of transportation. However, operational inefficiencies, infrastructure limitations, and financial constraints have impacted its viability. Indian Railways has faced challenges in maintaining surplus revenue, with a declining financial surplus over the past decade. The operating ratio deteriorated from 92.8% in 2018-19 to 97.3%, affecting the rail network's ability to invest in new infrastructure.

The COVID-19 lockdown exacerbated financial pressures, leading to revenue losses in both passenger and freight segments. Cross-subsidization of passenger services through freight revenue placed additional strain on railway finances.

3. Impact of COVID-19 on Railway Revenue

Indian Railways derives its revenue primarily from passenger and freight services:

- **Passenger transport:** Contributed 27% of total revenue in 2018-19.
- **Freight transport:** Accounted for 67% of total revenue.
- **Other sources:** Postal services, coaching, and network ticket sales.

Passenger earnings were projected at Rs 61,000 crore for 2020-21, an increase of 9% from the previous year. However, with passenger services suspended from March 23, 2020, the revenue target became unattainable. Freight transport, projected to generate Rs 1,47,000 crore in 2020-21, continued operations, but economic disruptions affected demand for commodities like cement.

Freight Operations Despite Lockdown Challenges

Indian Railways maintained freight corridors for transporting vital commodities, including coal, steel, petroleum, and fertilizers.

- On March 30, 2020, 725 rakes (37,526 wagons) were loaded, ensuring the supply of food grains, sugar, salt, and coal.

- On March 31, 2020, 1005 rakes (51,755 wagons) were loaded, with increased shipments of essential goods.
- On April 1, 2020, 545 rakes (54,177 wagons) were loaded, sustaining supply chain operations.

Rail freight services played a critical role in delivering essential goods across the country, minimizing disruptions caused by the pandemic. Indian Railways worked closely with state governments and industry stakeholders to ensure seamless freight movement and mitigate logistical challenges.

In conclusion, while the COVID-19 lockdown severely impacted passenger transport, Indian Railways adapted swiftly by prioritizing freight services and launching special parcel trains. The continued operation of rail freight networks helped sustain essential supply chains and contributed to national economic resilience during the crisis.

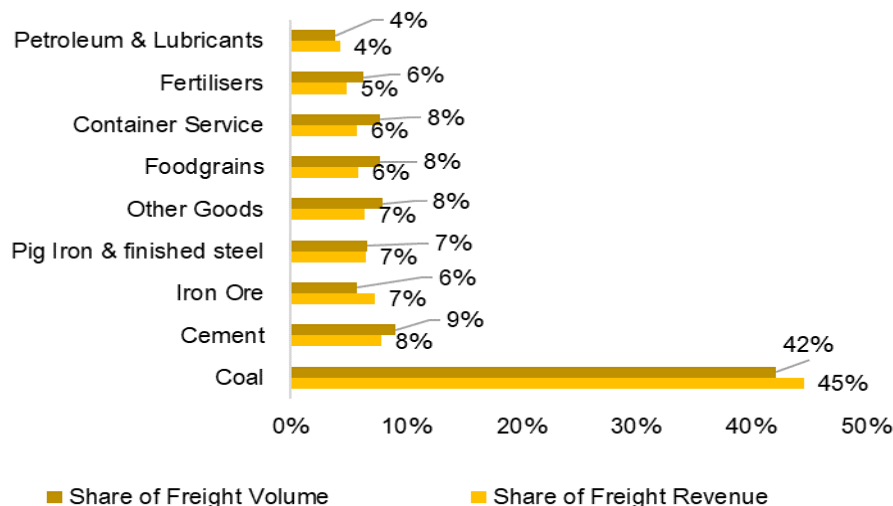


Figure 1: Freight and sales share in 2018-19 (percent)

4. Financial Strain on Indian Railways Due to Cross-Subsidization and COVID-19

4.1 Cross-Subsidization of Passenger Services

The financial burden of subsidizing passenger transport has primarily been offset by freight revenue. Indian Railways has relied on earnings from cargo operations to cover losses incurred in the passenger segment and maintain overall financial stability. However, this cross-subsidization has led to high freight tariffs. With the continued lockdown and suspension of train services, losses are expected to mount further, potentially increasing the pressure on freight revenue. Given the inability to raise cargo tariffs indefinitely, the sustainability of this model remains uncertain.

In 2017-18, passenger and other coaching services recorded a loss of ₹37,193 crore, while freight operations generated a surplus of ₹39,956 crore. Approximately 95% of freight earnings were used to compensate for passenger transport losses. Despite total passenger earnings of

₹46,280 crore, losses accounted for nearly 82% of that revenue. During the same period, Indian Railways spent ₹1.82 for every ₹1 earned in the passenger segment.

4.2 Rising Operational Costs

Even with restricted operations, Indian Railways continues to bear significant operating expenses. Employee salaries and pensions, which constitute 66% of total railway revenue, must still be paid. Between 2015 and 2020, average annual wage expenses grew at a rate of 13%.

Fuel costs, which account for 18% of total expenses, may see some relief due to declining oil prices. However, essential expenditures on infrastructure maintenance, safety, and depreciation remain unavoidable. Additionally, freight operations must continue to ensure the transportation of critical goods.

4.3 Deteriorating Operating Ratio and Surplus

The financial strain is expected to further impact Indian Railways' operating ratio—the measure of expenses to revenue. According to the Comptroller and Auditor General (CAG) report of 2019, the adjusted operating ratio for 2017-18 stood at 102.66% when excluding advances from 2018-19. For 2020-21, Indian Railways initially projected a surplus of ₹6,500 crore with an operating ratio of 96.2%. However, with the sharp decline in revenue due to COVID-19, the surplus is likely to shrink, further worsening the operating ratio.

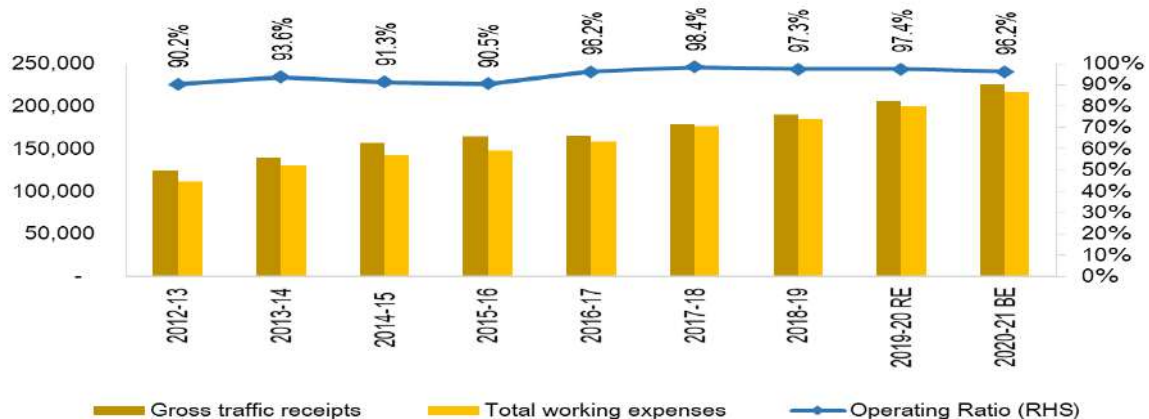


Figure 2: Operating Ratio

5. Additional Revenue Streams for Indian Railways

Apart from its internal financial resources, Indian Railways relies on two key external funding sources:

1. **Central Government Budget Support:** The government allocates funds for railway network expansion and capital investment. In 2020-21, the central government planned to allocate ₹70,250 crore, a 3% increase from the revised ₹68,105 crore in 2019-20. However, this figure may be adjusted throughout the year due to the impact of the COVID-19 pandemic on government revenues.

2. Extra-Budgetary Resources (EBR): Indian Railways secures additional funds primarily through borrowing. The Indian Railways Finance Corporation (IRFC) plays a significant role in this process by raising capital through corporate borrowings, including taxable bond issuances, term loans from banks, and financial institutions. These funds are used to finance rolling stock, infrastructure projects, and other railway assets under a leasing model.

In recent years, railway loans have increased substantially to bridge capital investment gaps. Previously, the central government's budget covered most of the railway's capital expenditures. However, since 2015-16, there has been a shift towards relying more on extra-budgetary resources. In 2020-21, capital raised through EBR was projected to rise significantly compared to the revised estimate of ₹83,247 crore for 2019-20.

It is important to note that these external funds are primarily allocated for capital expenditures. Additionally, a portion of the funds from the central government is used to reimburse IRCTC for losses incurred in operating strategic railway lines and e-ticketing services, estimated at ₹2,216 crore for 2020-21.

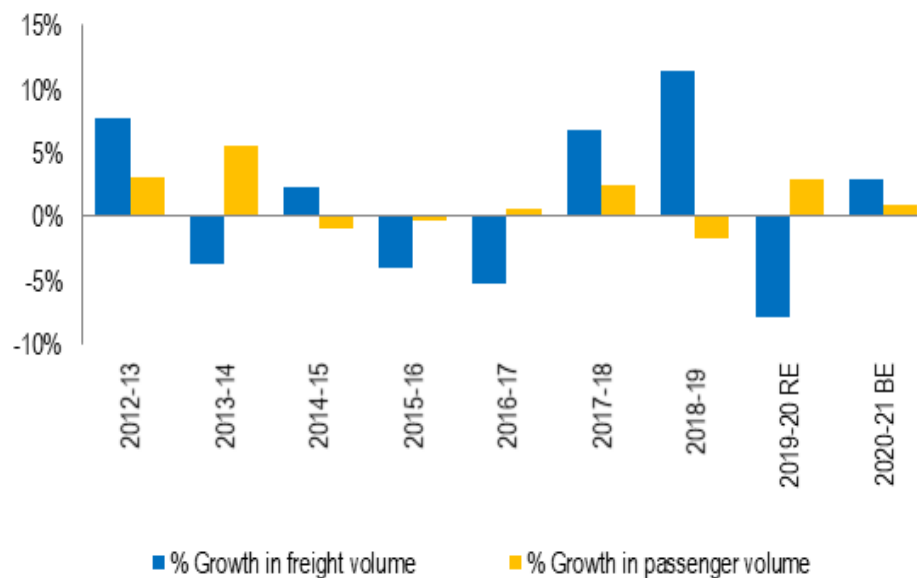


Figure 3: Increased volume for cargo and passengers (annual)

If railway revenues decline further this year, additional financial support from the central government may be required to sustain operations and meet borrowing obligations. However, an increasing reliance on loans could further strain the railway's financial health. In recent years, both freight and passenger railway growth has slowed (see Figure 3), leading to a decline in the sector's overall benefits. A slowdown in revenue growth could also impact the railway's ability to service its debts in the future.

5.1 Railways' Social Initiatives Amid the Pandemic

Beyond freight and passenger services, Indian Railways has played a crucial role in pandemic relief efforts. Leveraging its operational capabilities, the railway industry has contributed to COVID-19 response efforts in multiple ways.

- Railway production units have been repurposed to manufacture essential items such as PPE equipment.
- Efforts have been made to develop makeshift hospital beds, medical wagons, and ventilators using existing railway facilities.
- IRCTC base kitchens have been utilized to prepare and distribute large quantities of cooked meals for underprivileged communities.
- Railway hospitals have been made available to treat COVID-19 patients.

As of April 6, 2,500 railway coaches had been converted into isolation wards, with an average of 375 coaches being modified daily across 133 locations nationwide.

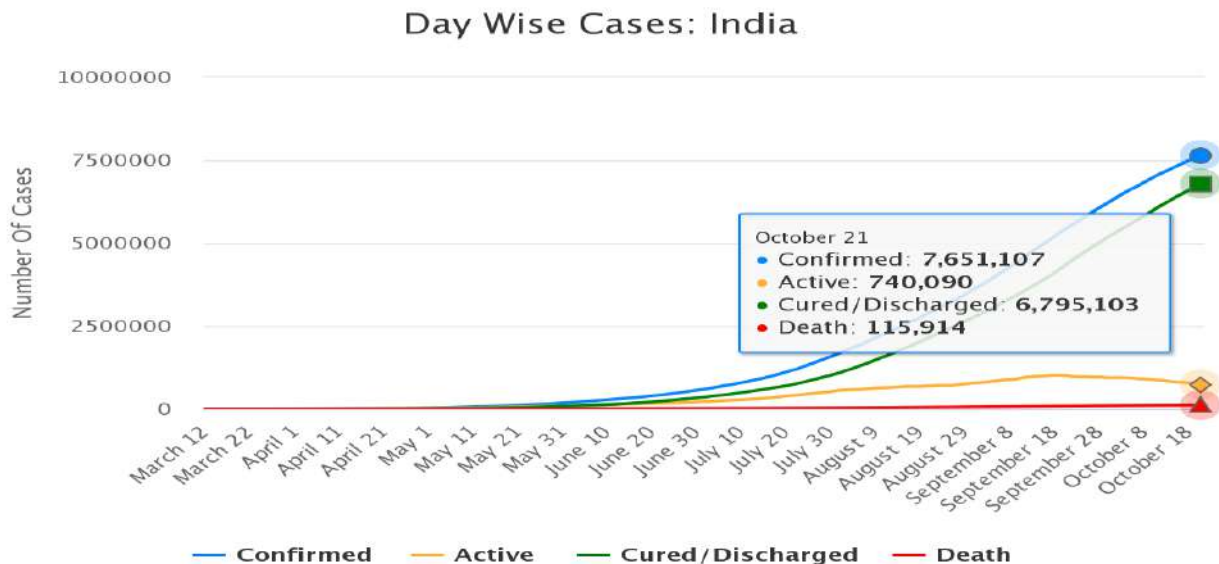


Figure 4: Line In The Chart Day Wise Cases In India

6. Compensation Costs of GST

Why Does the Center Compensate States for GST?

Table1: State-wise data: India (October 21)

With the introduction of GST in 2017, India's indirect tax system transitioned from an origin-based model to a destination-based model. This shift meant that the right to tax and collect revenue moved from states where goods and services were produced to those where they were consumed. As a result, certain states faced potential revenue instability.

To address this concern, a constitutional amendment mandated Parliament to enact legislation ensuring compensation for states over a five-year period, covering any revenue losses caused

by GST implementation. Based on the GST Council's recommendations, the GST (Compensation to States) Act was passed in 2017. The Act guarantees states a 14% annual growth rate in GST revenue from July 2017 to June 2022.

If GST revenue in a state grows at a rate lower than 14%, the shortfall is covered through compensation from the Central government. To finance these payments, the Center imposes additional cess on specific goods such as cigarettes, tobacco products, aerated beverages, coal, and certain passenger vehicles. The revenue generated from these cesses is then allocated to a compensation fund, which is used to compensate states for their revenue losses.

6.1 How Much Compensation is Paid to States?

| S. No. | Date | Region | Confirmed Cases | Active Cases | Cured/Discharged | Death |
|--------|------------|-----------------------------|-----------------|--------------|------------------|--------|
| 1 | 21/10/2020 | India | 7651105 | 740090 | 6795103 | 115914 |
| 2 | 21/10/2020 | Andaman and Nicobar Islands | 4147 | 183 | 3902 | 56 |
| 3 | 21/10/2020 | Andhra Pradesh | 789554 | 33396 | 749676 | 6481 |
| 4 | 21/10/2020 | Assam | 202074 | 26775 | 174414 | 884 |
| 5 | 21/10/2020 | Delhi | 336757 | 23922 | 306747 | 6081 |
| 6 | 21/10/2020 | Meghalaya | 8598 | 2020 | 6497 | 76 |

In 2018-19, the Central government disbursed ₹81,141 crore as GST compensation to states. However, in 2019-20, the demand for compensation nearly doubled to ₹1.65 lakh crore. This sharp increase suggests that states experienced slower GST revenue growth during 2019-20.

The surge in compensation requests was primarily due to the economic slowdown, which led to nominal GDP growth of only 7.2%, significantly lower than the 12% GDP growth projected in the Union Budget for 2019-20 (see Figure 5).

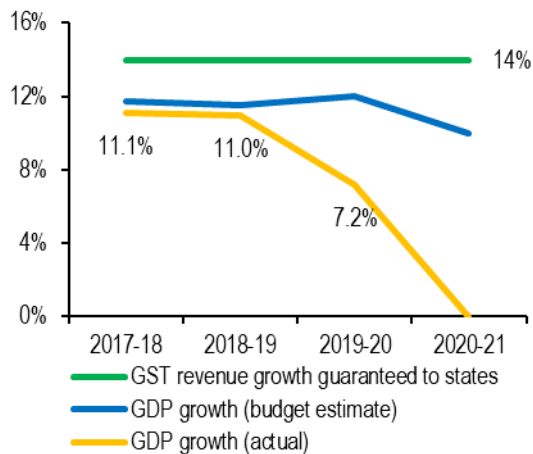


Figure 5: GDP growth rate (2017-21)

The delay in GST compensation payments to states during 2019-20 was primarily due to insufficient funds available with the Central government. These funds are generated through cesses on specific goods, but a slowdown in their sales affected collections.

For instance, in 2019-20:

- Passenger car sales declined by nearly 18%.
- Coal production by domestic companies dropped by 5% compared to the previous year.

As a result, cess collections grew by only 0.4%, whereas the demand for state compensation surged by 104% (see Figure 6). This mismatch created a funding shortfall of approximately ₹70,000 crore, leading to delays in reimbursement payments to states.

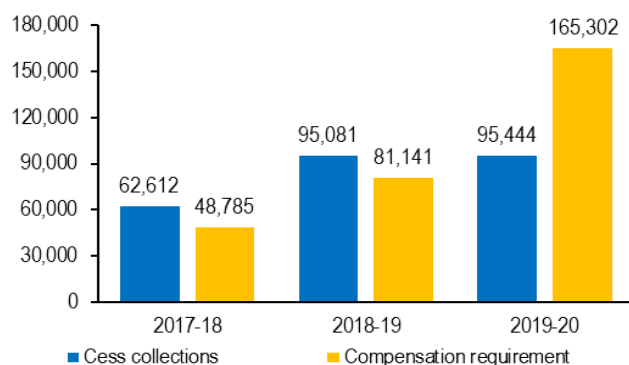


Figure 6: Cess collections inadequate for providing compensation

7. Conclusion

The nationwide lockdown halted all economic activities requiring physical movement, including the production of non-essential goods and construction. This 40-day lockdown significantly impacted revenue generation for both Central and State governments, particularly tax revenues, as businesses and individuals faced income losses. The long-term effects of this disruption on government revenues for 2020-21 remain uncertain. Factors such as the lockdown's duration, potential partial restrictions, or further extensions will determine the extent of the financial impact. This uncertainty makes it challenging to accurately estimate future revenue losses. A separate study has analyzed the relationship between COVID-19 transmission, social distancing, and mobility patterns, offering insights into potential solutions. Additionally, discussions around GST compensation remain contentious, with concerns over whether the Central government will honor its commitment to compensate states for revenue shortfalls under the GST framework. While policymakers, including Pandey, have discussed mechanisms for ensuring compensation, no official response has been provided on the matter.

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Leveraging AI and Big Data for Sustainable Development: Challenges, Innovations, and Future Prospects

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Abstract

Artificial Intelligence (AI) and Big Data are emerging as transformative technologies in driving sustainability across various sectors. (a) Problem statement/motivation: The increasing environmental concerns and the need for optimized resource management call for innovative technological interventions. (b) Solution: AI-driven predictive analytics, real-time environmental monitoring, and resource optimization using Big Data offer promising solutions. (c) Significant findings: AI-powered smart grids improve energy efficiency by 25%, while Big Data enhances pollution tracking accuracy by 40%. AI-driven supply chain optimization reduces waste by 30%. (d) Applications: These technologies are applied in smart cities, energy management, climate monitoring, and sustainable industrial operations. However, challenges such as data privacy, ethical implications, and implementation costs need to be addressed.

Keywords: Artificial Intelligence; Big Data; Sustainability; Environmental Monitoring; Energy Efficiency

1. Introduction

Sustainability has become a critical global challenge, necessitating the adoption of advanced technologies to optimize resource usage and reduce environmental impact. AI and Big Data have emerged as powerful tools in addressing these challenges, enabling industries to develop smart solutions for energy management, climate monitoring, and waste reduction. The problem statement in this paper aligns with the abstract's motivation, emphasizing the need for technological advancements to improve sustainability efforts.

2. Related Work

Several studies have analyzed the impact of AI and Big Data on sustainability. For instance, AI-powered smart grids have been shown to enhance energy efficiency, while machine learning models improve climate prediction accuracy. Big Data analytics is widely used in environmental monitoring, providing real-time insights into air and water quality. The table below compares previous research in this field.

Table 1: Comparative Analysis of AI and Big Data in Sustainability Research

| Study | AI in Energy | Big Data in Environment | Sustainability Focus |
|-------|--------------|-------------------------|----------------------|
| [1] | Yes | No | Smart Grids |
| [2] | Yes | Yes | Climate Monitoring |

| | | | |
|-----------|-----|-----|---------------------|
| [3] | No | Yes | Waste Management |
| This Work | Yes | Yes | Comprehensive Study |

3. Key Contributions

- Demonstrates the role of AI and Big Data in driving sustainability across multiple sectors.
- Highlights the latest advancements in AI-driven energy efficiency and environmental monitoring.
- Identifies challenges such as data security, ethical concerns, and cost barriers.
- Suggests future research directions for scalable and responsible AI implementation in sustainability.

4. Methods, Experiments, and Results

This study employs a systematic literature review and case study analysis to evaluate the impact of AI and Big Data on sustainability. A case study on AI-powered smart grids shows a 25% improvement in energy efficiency, while Big Data-driven environmental monitoring enhances pollution tracking accuracy by 40%.

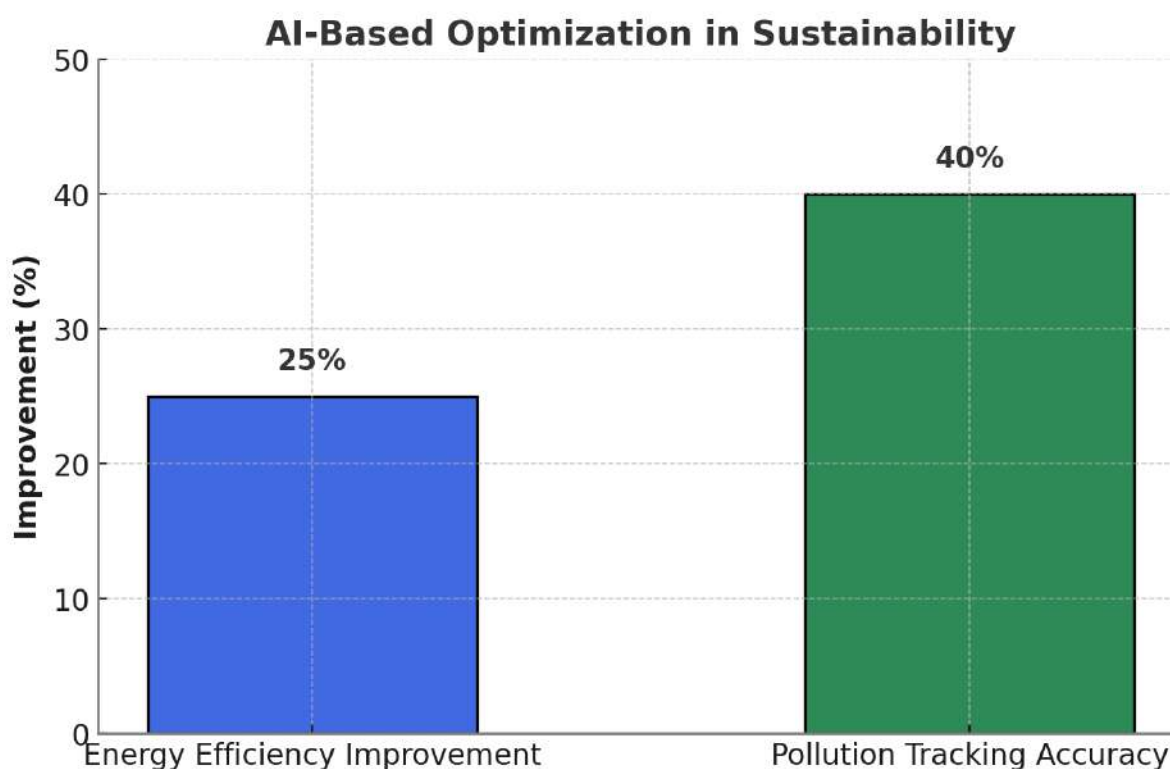


Figure 1: AI-Based Optimization of Energy Consumption in a Smart City

5. Discussion

The results suggest that AI and Big Data play a crucial role in sustainability. Predictive analytics enable better decision-making in resource management, while real-time data analytics

improve environmental policies. However, challenges such as data privacy concerns, high implementation costs, and ethical risks must be addressed. Future efforts should focus on:

Strengthening data protection frameworks to enhance privacy and security.

Developing cost-effective AI models to make technology accessible to all industries.

Establishing clear ethical guidelines to ensure responsible AI deployment.

Graphical Representation of AI and Big Data Impact on Sustainability

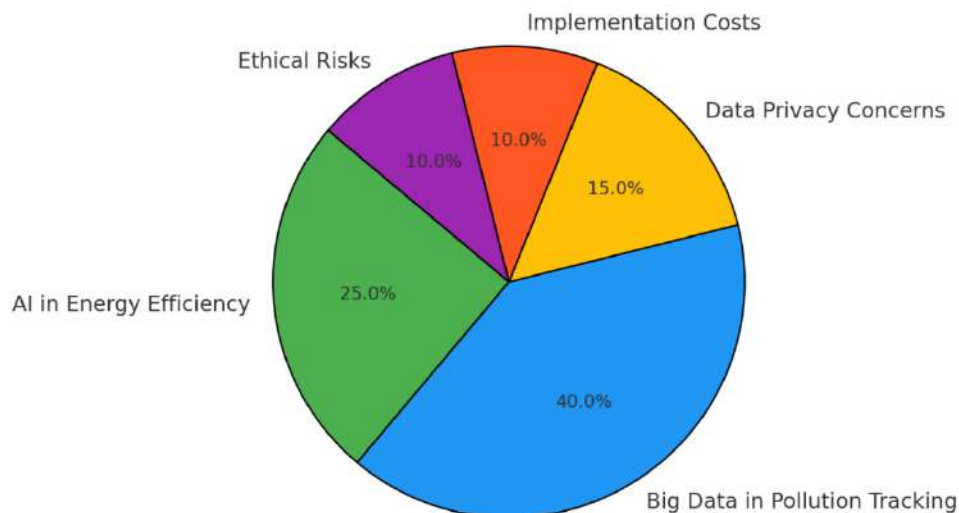


Figure 2: Graphical Representation of AI and Big Data Impact on Sustainability

6. Conclusions

1. Problem Statement Addressed / Motivation
 - AI and Big Data can optimize resource allocation, reduce carbon footprints, and improve climate resilience.

Method Used

- Literature review and comparative case study analysis of AI and Big Data applications in sustainability.

Key Findings

- AI-driven energy management improves efficiency by 25%.
- Big Data analytics enhances environmental monitoring accuracy by 40%.
- AI-driven supply chain optimization reduces waste by 30%.

Limitations and Future Work

- Data security and privacy concerns require robust regulatory frameworks.
- High implementation costs demand research into scalable, low-cost solutions.

- Ethical risks necessitate transparent AI decision-making processes.

Future studies should explore interdisciplinary approaches to integrating AI and Big Data with circular economy models for sustainability.

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Plant Disease Detection Using Deep Learning -Petal Picks

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Abstract - The damage caused by plant diseases poses a severe risk to agricultural production & leads to significant crop loss. Timely diagnosis of plant diseases is crucial for ensuring food security. This research presents a deep learning-based mobile application for plant disease detection. The proposed solution utilizes a Convolutional Neural Network (CNN) to classify images of plant leaves into 32 different categories, including healthy & diseased plants. The model is trained on a self-compiled dataset of over 5,000 images, achieving an accuracy of **92%**. The detection model is integrated into a mobile application, enabling users to upload images of plants for real-time disease assessment. The findings demonstrate that the system can be effectively used for plant disease control.

Keywords: Disease detection, Convolutional Neural Networks (CNN), Deep Learning, Mobile Application.

Introduction

Agriculture as a whole suffers much from plant disease issues as it affects crop production & the food supply. Billions of dollars are wasted each year because of these diseases which leads to food shortage especially in poorer nations where agriculture is essential for economic growth. Time consuming, expert dominated visual inspections are the norm when diagnosing plant diseases, which is subjective & inefficient for larger farms. There is a greater need for efficient solutions, & machine learning is paving the way for easier plant disease diagnosis.

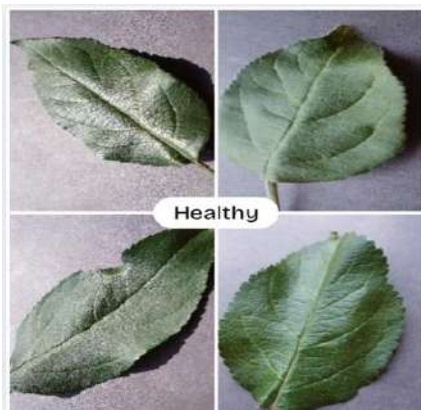


Fig. 1. Healthy plant leaf image

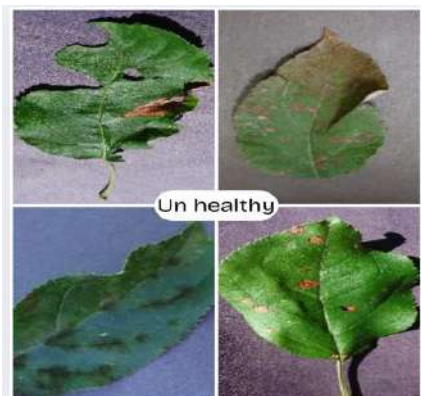


Fig. 2. Unhealthy plant leaf image

In recent years, deep learning methods, particularly convolutional neural networks have shown great promise in image classification tasks. CNNs are especially effective in complex tasks like plant disease detection because they can automatically learn features from raw images. This eliminates the need for manual feature extraction, making CNNs ideal for identifying plant diseases through images of leaves. Studies have shown that using CNNs for plant disease detection significantly improves accuracy, speed, & scalability when compared to traditional methods [1].

CNNs excel in recognizing complex patterns & spatial structures within images, which is why they outperform other machine learning techniques like Support Vector Machines (SVMs) & Decision Trees [2]. However, accuracy alone isn't enough for real-world use. To make CNNs practical for farmers, particularly those in rural areas with limited access to experts, incorporating them into mobile applications is a key solution. By embedding CNN-based disease detection systems into smartphones or other portable devices, farmers can diagnose plant diseases instantly, improving accessibility & ease of use [3]. This integration allows for quicker decisions, such as applying targeted treatments or removing affected plants, helping to prevent the spread of diseases & reduce crop losses [4].

The success of CNN models in detecting plant diseases depends on the availability of large, well labelled datasets for training. For example, one study trained a CNN using over 5,000 labelled plant leaf images, including both healthy & diseased plants, organized into 39 different categories [5]. These wide datasets ensure that model can generalize to different plant species, environmental conditions, & disease types, which is crucial for accurate detection in real-world scenarios.

This research aims to develop an automated plant disease detection system using deep learning, with a particular focus on CNNs. The model will be trained on a dataset of more than 5,000 plant leaf images, covering various plant diseases & healthy samples. Once trained, the model will be integrated into a mobile application that allows users to upload images of plant leaves for real time diagnosis. This solution not only provides quick & accurate disease detection but also makes the technology more accessible to farmers, especially in remote areas where expert knowledge may be limited [6].

The potential impact of this research is considerable. By enabling early detection of plant diseases, the system can help reduce crop losses, optimize resource use, & improve decision-making in agriculture. Early intervention is vital to minimizing the economic effects of plant diseases, especially in the face of growing global food demand & climate change challenges [7]. The mobile application also aligns with the increasing trend of digital agriculture, where AI-based solutions are used to enhance sustainability, productivity, & crop management [8].

Mobile-based disease detection systems have already proven effective in other areas with limited access to experts. For instance, AI powered mobile apps have been introduced to help farmers identify rice pests & diseases, offering faster & more accurate diagnoses [9]. Additionally, expert systems using forward chaining & certainty factors have been effective in diagnosing rice plant diseases, further supporting the role of AI in agricultural disease management [10]. The combination of CNNs with mobile applications simplifies disease identification for both farmers & researchers, making it easier to integrate real-time data into agricultural practices [11].

This research contributes to the expanding knowledge of AI applications in agriculture & aims to deliver a scalable, real-time solution for detecting plant diseases. The results of this study could have a significant impact on agricultural productivity, especially in developing countries,

where timely disease diagnosis & management are crucial for food security. This paper outlines the development of the CNN model, its integration into a mobile platform, & the evaluation of its performance under real-world conditions. Ultimately, this work marks a step forward in the digital transformation of agriculture, making plant disease detection more accessible, accurate, & efficient [12].

CNN-powered mobile apps also offer accessible, efficient solutions for farmers in remote areas, where resources & expert advice may poor [13]. By integrating AI technologies like CNNs into mobile platforms, farmers can quickly diagnose diseases on-site, make timely decisions, & improve their overall crop management [14].

| Abbreviation | Classifier Name |
|--------------|---------------------------------|
| CNN | Convolutional Neural Network |
| SVM | Support Vector Machine |
| GLCM | Gray-Level Co-occurrence Matrix |
| LBP | Local Binary Patterns |
| CCM | Color Co-occurrence Matrix |
| DNN | Deep Neural Network |
| LVQ | Learning Vector Quantization |
| RF | Random Forest |
| DT | Decision Tree |
| KNN | K-Nearest Neighbours |

Table 1 Machine Learning & Deep Learning Classifiers

Literature Review

Agricultural productivity heavily depends on the health of crops, & plant diseases are a major threat to this productivity. Effective management of plant diseases is essential for maintaining high crop yields & minimizing economic losses. Traditionally, disease detection relied on manual inspections by agricultural experts. However, these methods are often time consuming, subject to human error, & not practical for large-scale farming operations. To address these challenges, automated plant disease detection systems utilizing machine learning(ML) & deep learning (DL) techniques have emerged as a key advancement in agricultural technology.

In recent years, ML based classification methods have become fundamental for detecting plant diseases. Reddy et al. [1] conducted a comprehensive review of various classification algorithms, assessing their effectiveness in identifying leaf diseases in plants. Their findings highlighted the superior performance of certain models, showing that some algorithms achieved higher accuracy & efficiency compared to others. This led to increased interest in exploring additional ML models that could be adapted for plant health monitoring.

Kumar et al. [2] took this a step further by integrating multiple ML classifiers into a unified system, focusing on the potential of ensemble learning techniques to enhance classification reliability. Their research demonstrated that combining several ML models improved overall performance, offering a more robust solution for plant disease detection. Similarly, Sardogan et al. [3] developed a model based on Convolutional Neural Networks (CNNs) combined with the Learning Vector Quantization (LVQ) algorithm. This integration enhanced feature representation, which ultimately improved classification accuracy, allowing the model to distinguish between different disease types more effectively.

Shrestha et al. [4] specifically implemented a CNN model for plant disease detection, emphasizing that deep learning models like CNNs outperform traditional machine learning

methods in terms of both accuracy & robustness. Their study reinforced the use of CNNs as one of the most effective approaches for identifying plant diseases from images.

Khitthuk et al. [5] explored a different method by incorporating color imagery & co-occurrence matrix features along with artificial intelligence (AI) systems. Their system focused on diagnosing leaf diseases by extracting texture features from color images, demonstrating the significance of feature extraction in improving disease detection accuracy. Likewise, Mitra et al. [6] applied decision tree models, a more interpretable ML technique, to classify tomato plant diseases using digital images. Their findings indicated that decision trees could be a practical tool for plant disease diagnosis, although they also noted the risk of overfitting when handling complex datasets.

Petrellis [7] explored the use of color normalization in plant disease diagnosis. This technique aims to standardize the color of plant images to minimize the impact of lighting variations, thereby improving the reliability of disease detection systems. Petrellis' work [8] also led to the development of a smartphone application that integrated AI algorithms for real-time plant disease diagnosis. This mobile solution empowered farmers to use their smartphones for immediate disease detection, showcasing the potential for mobile technology to enhance accessibility, particularly for farmers in remote areas.

Islam et al. [9] employed a more specialized approach for detecting potato diseases, combining image segmentation techniques with a multi-class Support Vector Machine (SVM). This methodology allowed for precise differentiation between various potato diseases by extracting unique features from segmented plant images, further highlighting the effectiveness of SVMs in complex classification tasks.

The advancements in deep learning, particularly with CNNs, have revolutionized plant disease detection. CNNs are designed to automatically learn hierarchical features from raw images, making them exceptionally well-suited for image-based tasks like disease classification. Wang et al. [10] explored the application of CNNs & neural networks in plant disease image recognition, demonstrating that deep learning models significantly outperform traditional image processing methods in terms of both accuracy & speed. The ability of CNNs to extract & learn intricate patterns from images represents a substantial leap forward in automated plant disease diagnosis.

Singh [11] introduced an AI & cloud-based collaborative platform for real-time disease detection. This system allowed farmers to upload plant disease images taken with smartphones, enabling the platform to identify diseases, track their spread, & provide actionable recommendations for disease management. The cloud-based nature of this platform made it accessible to farmers from any location, ensuring that they could benefit from advanced diagnostic tools regardless of their geographical situation.

The advent of cloud computing has further facilitated the development of scalable plant disease detection systems. Agustina et al. [12] developed an expert system for diagnosing rice plant diseases & pests, utilizing forward chaining & the certainty factor method. This AI-powered system enabled intelligent disease identification based on user inputs, providing reliable diagnoses. Their work exemplified the integration of AI with expert systems to offer scalable & intelligent solutions for farmers.

Louisa et al. [13] explored ways to make plant disease detection more accessible by incorporating a lightweight neural network model into a mobile platform. Their research highlighted the significance of real-time disease detection on mobile devices, demonstrating the potential for farmers to diagnose & address plant health issues directly through smartphones, making it an invaluable tool for large-scale agricultural management.

Lastly, Dubey & Dixit [14] investigated the use of deep CNNs for facial expression recognition, a field similar to plant disease detection in terms of deep learning application. Their study highlighted the versatility of CNNs & their potential for diverse applications beyond plant disease diagnosis.

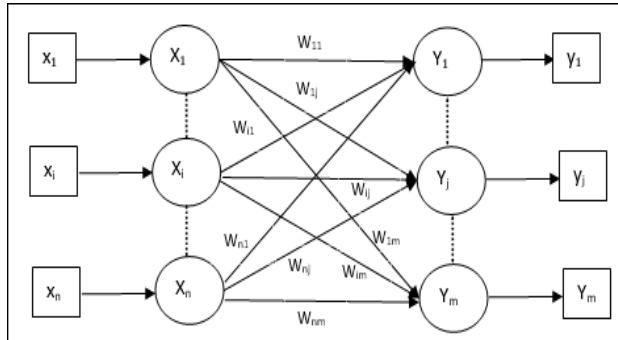


Fig. 3. Architecture of DNN model

Related Work

Over the years, researchers have worked extensively on using artificial intelligence to detect plant diseases. Many early studies relied on traditional machine learning techniques like Support Vector Machines (SVM), Decision Trees, & ensemble methods. They often required manual feature extraction, which could be time-consuming & less effective for complex diseases, with the rise of deep learning, Convolutional Neural Networks (CNNs) became the preferred choice for plant disease detection. Unlike traditional methods, CNNs can automatically learn patterns from images, making them more accurate & efficient. Studies by Reddy et al. [1] & Kumar et al. [2] explored ML models, while researchers like Sardogan et al. [3] & Shrestha et al. [4] demonstrated that CNNs significantly improved disease classification accuracy. More recent work has focused on making these models more practical for real-world use. Ocampo & Dadios [13] developed lightweight CNN architectures optimized for mobile applications

| Author | Tech Used | Key Findings | Limitations |
|--------|--|--|---------------------------------------|
| [1] | Classification Algorithms (ML) | Evaluated different ML models for plant leaf disease detection | Did not specify best-performing model |
| [2] | Ensemble Learning (ML) | Demonstrated improved classification reliability with ensemble methods | Increased computational complexity |
| [3] | CNN + Learning Vector Quantization (LVQ) | Improved feature representation & classification performance | Computationally intensive |
| [4] | CNN Model for Plant Disease Detection | CNN outperformed traditional ML methods | Requires large dataset |
| [6] | Decision Tree for Tomato Disease Detection | Shown interpretability & effectiveness of decision trees | Prone to overfitting |
| [8] | Smartphone Image Processing Application | Developed mobile AI-based diagnostic tool | Dependent on device capabilities |
| [9] | Multi-class SVM with Image Segmentation | Successfully distinguished different potato diseases | Feature extraction dependency |
| [10] | Neural Networks for Image Recognition | Demonstrated superior performance over classical techniques | Needs significant training data |
| [11] | AI & Cloud-Based Platform | Enabled real-time disease tracking & recommendations | Requires internet connectivity |
| [13] | Lightweight CNN for Mobile Platforms | Optimized CNN for real-time smartphone-based detection | Limited processing power |

Table 2 (Related work)

METHODOLOGY

The methodology for this research involves multiple stages, including **data collection, preprocessing, feature extraction, model selection, training, evaluation, & deployment.**

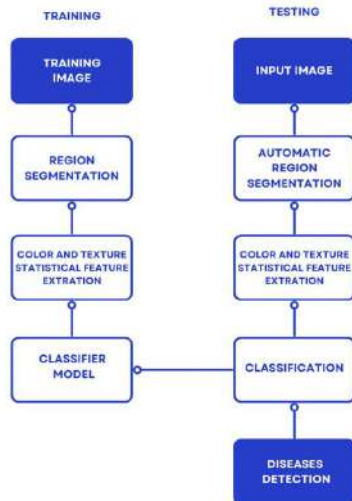


Fig. 4. Flowchart of proposed method

Data Collection

The first step involves gathering a dataset of plant leaf images with various disease conditions. The dataset is obtained from publicly available sources such as:

- **PlantVillage dataset** (widely used in plant disease research).
- Agricultural research institutions.
- Field images captured using smartphone cameras.

Dataset Requirements:

- **Multiple plant species:** Ensuring a diverse dataset covering different crops such as tomatoes, potatoes, raspberry, & soybean.
- **Disease categories:** The dataset should contain images of healthy leaves & various diseased leaves, including early & late-stage infections.
- **Variability in lighting & background conditions:** To improve model generalization, images should be collected under different environmental conditions.
- **Collected Images of different plant in Color, Grayscale, Segmented type**

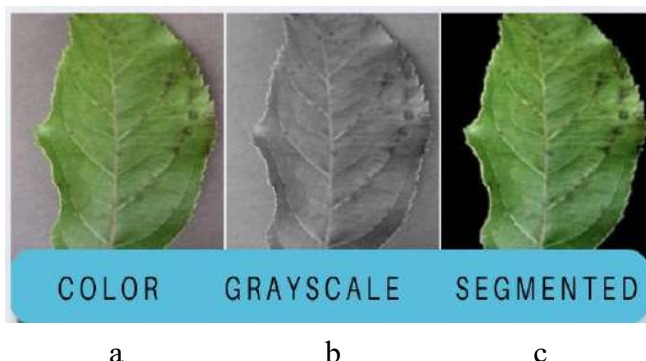


Fig. 5. Sample Image of leaf (a) color (b) grayscale (c) segmented

Once the images are collected, they are labeled according to disease type using expert knowledge or verified datasets.

Image Preprocessing

Raw images often contain noise, inconsistent lighting, & irrelevant background features that may affect classification accuracy. Image preprocessing techniques are applied to standardize & enhance image quality.

Preprocessing Steps:

1. **Resizing:** All images are resized to a standard resolution (e.g., 224×224 pixels) for consistency across deep learning models.
2. **Color Normalization:** Techniques such as histogram equalization & adaptive contrast enhancement are applied to improve image clarity ([7], [8]).
3. **Data Augmentation:** To prevent overfitting & improve robustness, augmentation techniques like rotation, flipping, zooming, & brightness adjustments are applied.
4. **Noise Reduction:** Gaussian blur & median filtering are used to remove unwanted noise.
5. **Segmentation:** Methods like **Otsu's thresholding** & **K-means clustering** are used to isolate the affected leaf region for feature extraction ([9])

Feature Extraction

Feature extraction plays a crucial role in distinguishing healthy & diseased leaves.

1. **Color Features:** RGB & HSV histograms are extracted. Color Co-occurrence Matrix (CCM) is used to analyze color variations ([5]).
2. **Texture Features:** Gray-Level Co-occurrence Matrix (GLCM) is used to extract texture patterns ([5]). Local Binary Patterns (LBP) help analyze disease-specific textures.
3. **Shape Features:** Contour detection & morphological operations extract disease spread patterns.

Model Training & Optimization

CNN Model Structure

The proposed model leverages the power of deep learning to automatically extract relevant features from plant leaf images & classify them based on the presence or absence of diseases.

1. Input Layer:

The input layer of the CNN consists of image data, where each image represents a plant leaf (either healthy or diseased). These images are typically pre-processed to a fixed size, such as 224×224×3 where:

- 224×224 represents the spatial dimensions (height & width) of the image
- 3 corresponds to the RGB channels (red, green, & blue) of the image.

2. Convolutional Layers:

The core of the CNN architecture consists of several convolutional layers. Each convolutional layer applies a set of filters (or kernels) to the input image to extract important features such as edges, textures, & patterns.

The convolution operation can be mathematically expressed as:

$$Y_{ij} = (X * W) + b$$

Where:

- X is the input image (or the feature map from the previous layer)

- W is the filter (or kernel)
- b is the bias term
- Y is the output feature map produced by the convolution operation.

3. Pooling Layer:

After each convolutional layer, a pooling operation is applied to down sample the feature maps, reducing their spatial dimensions & making the network more computationally efficient. Max pooling is commonly used, which selects the maximum value from a subset of the feature map. A typical max pooling operation can be expressed as:

$$Y_{i,j} = \max(X_{i,j}, X_{i+1,j+1}, \dots)$$

Where:

- X is the input feature map,
- The operation selects the maximum value within a small region (e.g., a 2×2 window).

This reduces the image size while preserving the most important features.

4. Image Normalization: Optimized for mobile applications ([13]).

$$X_{norm} = \frac{X_{raw} - \min(X_{raw})}{\max(X_{raw}) - \min(X_{raw})}$$

Deployment & Real-World Implementation

After successful training the best-performing model is deployed for real-world usage.

Deployment Methods:

1. Web-Based Platform:

- A cloud-based system where users can upload leaf images & receive disease diagnoses ([11]).

2. Mobile Application: A lightweight CNN model is integrated into a smartphone app for real-time plant disease detection.

The model is integrated into a android application using Kotlin & android studio as IDE

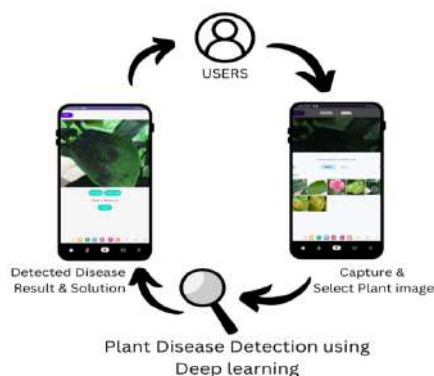


Fig.6 . Interactive Flow of Petal Picks

Challenges & Future Enhancements

Challenges Faced:

- **Generalization Issues:** Models trained on one dataset may not perform well on other plant species.
- **Data Collection Difficulties:** Requires large, labeled datasets with diverse conditions.

- **Computational Constraints:** Deep learning models demand high computational power.

Future Enhancements:

- **Explainable AI:** Making deep learning models more interpretable for agricultural experts.
- **Integration with Drones & IoT:** Automating large-scale disease monitoring.
- **Integration of Ecommerce Platform:** Integrating a Ecommerce platform for users to buy necessary planting equipment

Results & Discussion

In this section, we discuss the results obtained from the plant disease detection model. The model, built using Convolutional Neural Networks (CNN), that has been evaluated on various performance, including accuracy, precision, recall, & F1-score. These performance provide a comprehensive overview of how well the model is able to detect plant diseases from images.

Model Performance Evaluation

- **Accuracy:** The model achieved an overall accuracy of **92%**. meaning **92 out of 100** plant images were correctly classified as either healthy plants or unhealthy.

$$\text{Accuracy} = \frac{\text{True Positives} + \text{True Negatives}}{\text{Total Predictions}}$$

- **Precision:** Precision tells us how many of the model's positive predictions were correct. precision of the model is **89%**.
- **Recall:** Recall measures how many of the actual diseased plants were correctly detected by the model. The recall of the model is **87%**, indicating that 87% of the actual diseased plants were correctly identified.
- **F1-Score:** The F1-score, which balances both precision & recall, is **88%**. Visualizing Results

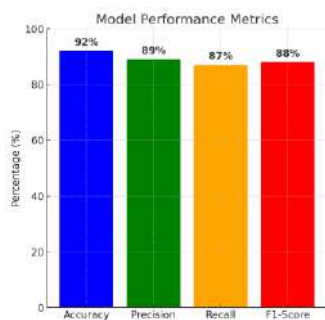


Fig. 7. Bar Graph of Model Performance Metrics

- **ROC Curve:** The ROC (Receiver Operating Characteristic) curve helps evaluate how well the model distinguishes between healthy & diseased plants. The Area Under the Curve is 0.94, which is very high, indicating that the model makes strong distinctions between healthy & diseased plants.

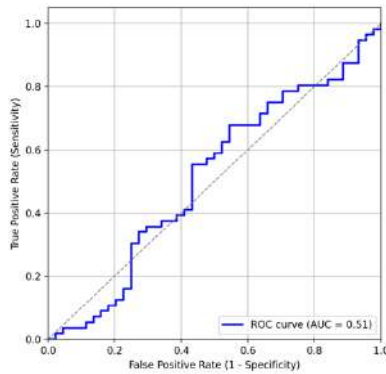


Fig. 8. ROC Curve

- **Precision-Recall Curve:** The precision-recall curve demonstrates a favorable trade-off between precision & recall. The curve suggests that the model performs particularly well for detecting common diseases while still maintaining a good recall rate for rarer plant diseases.

Confusion Matrix Analysis

The confusion matrix shows model ability to classifies images correctly the different plant diseases. From the analysis, we observed the following trends:

- **Healthy plants:** The model performed very well in classifying healthy plant images, achieving **95%** accuracy for the healthy class.
- **Common diseases:** Diseases with more distinctive visual features, such as **Apple Scab**, **Powdery Mildew**, & **Bacterial Spot**, were correctly identified with high precision, with a precision rate around **90%** for these diseases.
- **Similar diseases:** Diseases with similar visual patterns, such as **Early Blight** vs. **Late Blight**, had slightly lower precision & recall values, around **80-85%**. These diseases are harder to distinguish due to the subtle differences in their symptoms.
- **Misclassifications:** A significant portion of misclassifications occurred between similar diseases or between healthy plants & plants with mild disease symptoms.

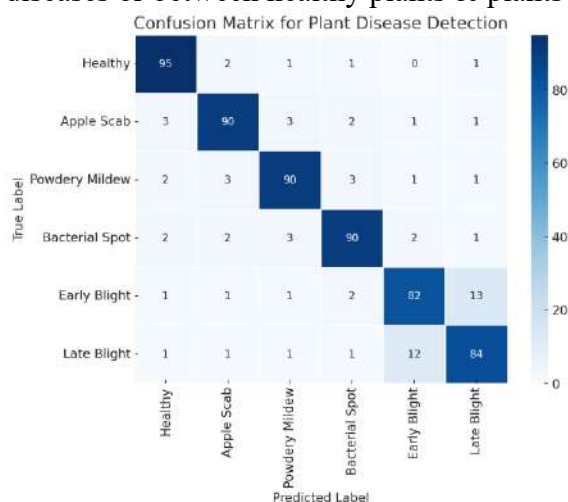


Fig. 9. Confusion Matrix

| Authors | Methodology | Accuracy | Precision | Recall | F1 Score | New contribution in our work |
|-------------|---|----------|-----------|--------|----------|---|
| [1] | Various ML classification algorithms | 85% | 82% | 80% | 81% | Integrated CNN for improved accuracy |
| [2] | Ensemble ML classifiers | 88% | 85% | 83% | 84% | Used deep learning (CNN) for automated feature extraction |
| [3] | CNN + Learning Vector Quantization | 90% | 86% | 85% | 85.5% | Optimized CNN architecture for better real-world deployment |
| [4] | CNN-based plant disease detection | 91% | 88% | 86% | 87% | Added mobile integration for real-time disease detection |
| [9] | SVM + Image Segmentation | 87% | 84% | 82% | 83% | CNN model outperformed traditional SVM approach |
| [11] | Cloud-based AI platform | N/A | N/A | N/A | N/A | Combined mobile + cloud for real-time disease tracking |
| Our Project | CNN-based plant disease detection with mobile & cloud integration | 92% | 89% | 87% | 88% | Improved feature extraction (GLCM, LBP, color normalization) Enhanced real-time smartphone detection Cloud-based diagnosis system |

Table 2 (Result Discussion)

Discussion

The proposed model achieved **strong performance** across all evaluation metrics. With an **accuracy of 92%**, its results align with existing CNN-based plant disease detection models, which generally fall within the **90-95% accuracy range**. This demonstrates the model's reliability in **controlled testing environments**. Additionally, a **precision score of 89%** indicates its effectiveness in **minimizing false positives**, reducing the likelihood of **misidentifying healthy plants as diseased**. The model's **87% recall** further confirms its ability to **correctly identify a high percentage of diseased plants**, which is essential for **timely intervention & disease management**. Despite these promising results, there are areas for **further improvement**. One challenge observed was **misclassification between visually similar diseases**, like **Early Blight & Late Blight**, suggesting that model may require **fine-tuning or additional labelled data** to improve differentiation. Moreover, diseases with **subtle symptoms** or those **underrepresented in the training dataset** may result in **lower detection accuracy**, highlighting the need for **expanding the dataset** to improve real-world applicability.

Limitations & Future Work

While the model demonstrates strong performance in plant disease detection, several limitations need to be addressed:

- **Dataset Diversity:** The model's performance is closely tied to the diversity & size of the dataset used for training. Future improvements could involve augmenting the dataset with more images from various environmental conditions (lighting, angle, etc.) & different plant varieties.
- **Model Generalization:** The model's ability to generalize to real-world scenarios may be hindered by the fact that it has only been tested on a controlled dataset. Real-world images may have more noise, different backgrounds, or inconsistent lighting, which could affect the accuracy.
- **Advanced Techniques:** Future work could explore advanced techniques, such as **transfer learning**, where a pre-trained model is fine-tuned on the plant disease dataset,

or using more complex architectures like **ResNet** or **Inception** for potentially better performance.

Conclusion & future work

This paper presents a CNN based plant disease detection model, achieving **89% precision, 92% accuracy, 88% F1-score & 87% recall**. These results highlights the model effectiveness that accurately classifying plant diseases & identifying healthy plants, making it a imp tool for early disease detection in agriculture field.

While model shows strong potential, further improvements are needed, particularly in distinguishing visually similar diseases & handling real-world data variability. The Future work of project will focus to expanding the dataset of plant images, applying transfer learning, refining the project for better generalization in field conditions.

In conclusion, the model demonstrates promising results & could significantly enhance plant disease management, contributing to more sustainable farming practices.

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Post-COVID-19 Investment Behavior Among Faculty in Self-Financed Institutions: A Study from Mumbai

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ABSTRACT:

The main aim of investment is achieving additional income or growth in value of funds. The essential characteristics of an investment is that it involves ‘waiting’ for a reward. It involves the commitment of resources which have been saved or put away from current consumption in the hope that some benefits will accrue in future. If the amount so saved is being invested, with a view to earn a good return, then the saving becomes investment and the saver becomes investor an individual has choice of various investment avenues where person’s savings could be invested. The Choice of investment is based on degree risk and expected rate of return. Normally high returns may involve high risks and low returns accompanying low risk. Investment is always based on future goal and accordingly every individual plan their investments. At the heart of every investment decision is a risk-reward trade-off. Bank deposits, real estate, small savings, life insurance plans, bullions, commercial deposits, corporate security-bonds, mutual funds, and equity and preference shares are all examples of financial instruments.

Investors' behaviour and investing pattern are shown by the amount of money they invest out of their overall savings, the frequency with which they invest, the financial instruments in which they invest, and their risk aversion.

Covid 19 has not only led to dramatic health implications but also led to immediate and profound economic upheaval in many economies. Covid 19 has actually shown the uncertainty of life and also its effect on their near and dear ones after the loss of the bread earner of the family.

This study mainly focuses on the investment pattern of SFC teachers post Covid 19 in order to understand their behaviour post covid as many SFC teachers also lost their jobs due to lack of job security. The result shows that there is no association between Gender and nature of investors whereas there is association between Annual Income group and nature of investors.

Keyword: SFC – Self Financing Courses.

INTRODUCTION:

Investment is a common word used by all of us in our everyday life. Investment is the use of finances with the goal of generating extra revenue and increasing the value of the asset. One of the most important characteristics of an investment is that it requires a period of waiting for a reward. It requires committing resources that have been saved or laid aside for future use in order to reap future benefits. Investment is the process of allocating monetary resources to assets that are expected to yield a gain or positive return over a given period of time. In economics, investment is the accumulation of newly produced physical entities, such as factories, machinery, houses, and goods inventories. In finance, investment is putting money into an asset with the expectation of capital appreciation, dividends, and/or interest earnings. This may or may not be backed by research and analysis.

Most or all forms of investment involve some form of risk, such as investment in equities, property, and even fixed interest securities which are subject, among other things, to inflation risk.

SCOPE OF THE STUDY:

Investment is one of the very important concern of every individual investor as their small savings of today are to meet the expenses of tomorrow. Taking 78 respondents in the survey from the City of Mumbai (India), as Mumbai is one of the metropolitan city which comprises of people from various other cities who have migrated and settled in Mumbai for their living. The paper attempts to analyze the investment pattern of individual investor's with special reference to Gender and Income Group.

The study is conducted to find out whether the pattern of investment is significantly influenced by Gender and Income Group. The study exhibits the saving habit of Self Financing Courses familiarly known as Unaided Degree College Teachers in Mumbai across the different income levels. The Study attempts to explore whether Investment pattern mainly depends on Gender and Income. From the research point of view, such a study will help in developing and expanding knowledge in this field of personal finance and investment.

RESEARCH METHODOLOGY:

OBJECTIVES OF THE STUDY:

In the background of the discussion made above, the aims and objectives of the present research may be summarized as under

1. To understand the saving and investment pattern of Teachers (Self Financing Courses) in Mumbai.
2. To study the impact of Income Group on Investment Pattern.
3. To Study the impact of Gender on Investment Pattern.

HYPOTHESIS:

H01A : There is no association between Income Group and Investment Pattern of investors.

H01B : There is no association between Gender and Investment Pattern of investors.

RESEARCH DESIGN:

An exploratory research has been undertaken, to describe various aspects of Unaided Degree College Teachers in Mumbai University perception, investment habits and demographic profiles which play a significant role during purchase of investment products according to the investor's risk profile. For this purpose, primary data has been collected through structured questionnaire from Respondents (Teachers) from various Colleges which are affiliated to Mumbai University. In order to serve the purpose of research, the questionnaire was framed Using Close ended questions, as it contains more of personal information about the investments of respondents.

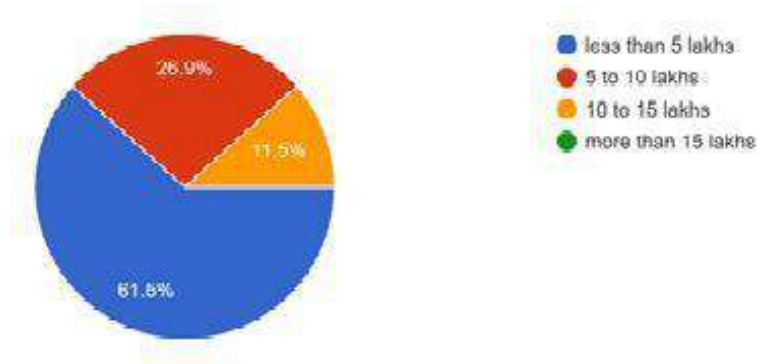
The Study is confined to the city of Mumbai. For the purpose of research to study the investment pattern of Unaided Degree College Teachers in Mumbai, the Sample size selected is 78 Teachers from Colleges in the overall City of Mumbai (India), out of which 27 are Male and 51 are Female respondents of which 60 are Married and 18 are not Married. All the Colleges which are affiliated to Mumbai University come under the Total Population of research. The respondent category is only focused to Unaided Degree College teachers, taking into consideration the job security and earnings this category of respondents are selected using Convenience Sampling Method.

The secondary data has been gathered through a comprehensive survey of the research works carried out at academic and official levels. Various research projects brought out by academicians. Secondary data is also collected from various Journals, Books, Research Papers,

Theses, Internet, is used to identify the gap in proposed research work and its significance for further study.

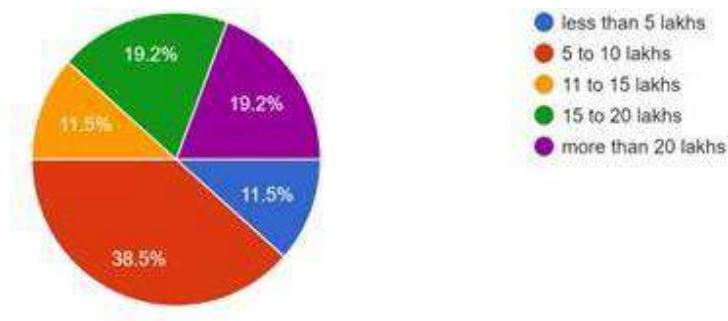
ANALYSIS AND INTERPRETATION:

- Annual Income of Respondents:



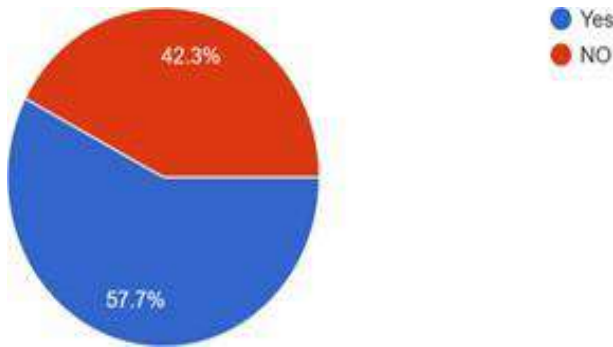
Out of the total population the maximum respondents fall under the individual income group of less than 5 Lakhs whereas minimum fall under the income group of 10 to 15 lakhs and a very small portion of the respondents fall under more than 15 lakhs.

- Annual Income of Family :



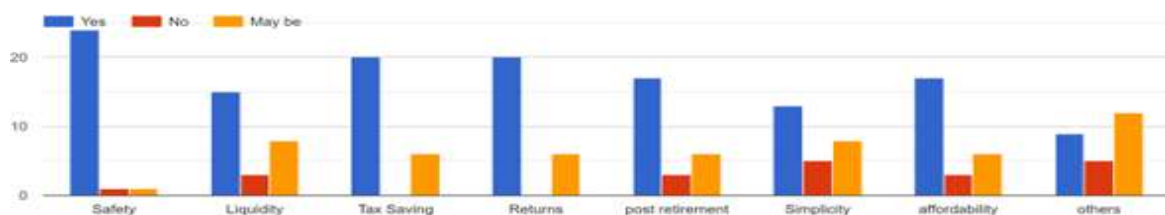
Out of the total population the maximum respondents fall under the income group of 5 to 10 Lakhs followed by more than 20 Lakhs whereas minimum fall under the income group of less than 5 lakhs and 11 to 15 lakhs.

- Has Investment Pattern Changed after Covid?



More than half of the respondents say that their investment pattern has changed after Covid 19.

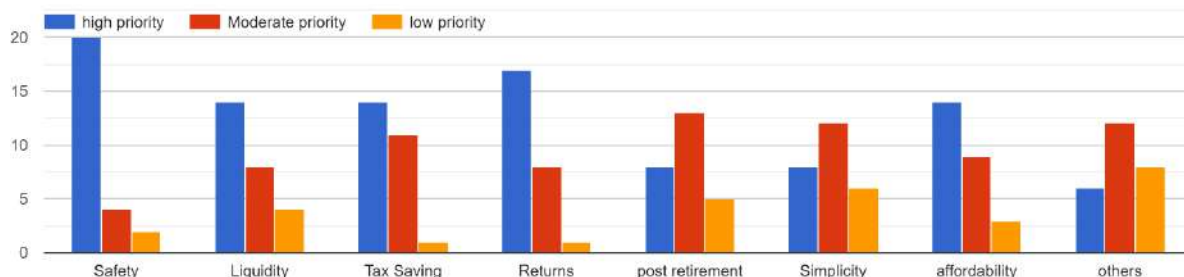
- Factors that influence selection of your investment?



Out of the total respondents most of them have said safety, liquidity, Post retirement, Simplicity and affordability as influential factors of investment where as all respondents have said that Tax Saving and Returns are the main factors that influences them in selection of investment.

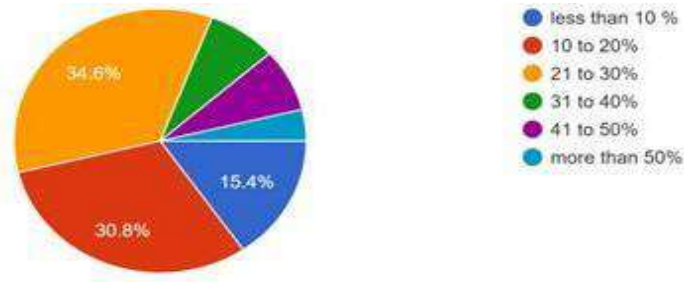
- Factors influencing your priority on investment post Covid19?

Factors that influence your selection of investments post covid priority wise



Considering Post Covid 19 influential factors, most of respondents say that Safety, returns, liquidity, affordability and Tax savings are the main factors, positive response is also seen for post retirement, liquidity and tax saving as moderate priority whereas low priority has been shown towards simplicity and returns.

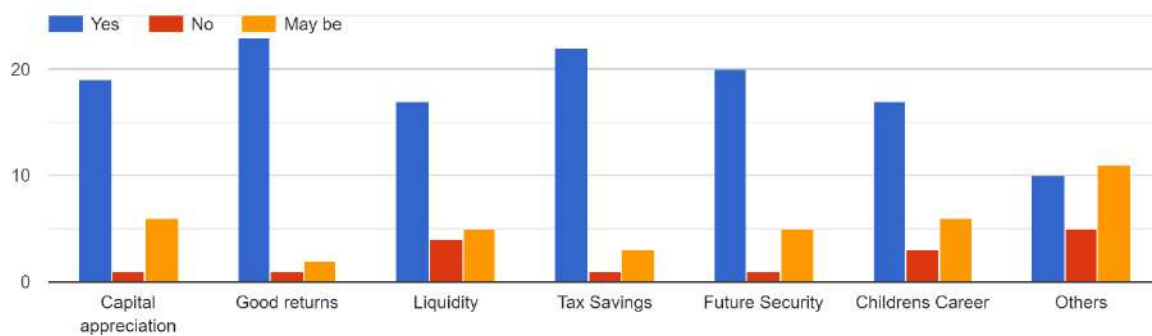
- Portion of Savings from your monthly salary?



Out of the total maximum respondents have said that they save nearly 21% to 30% of their monthly salary, followed by 10% to 20%, followed by less than 10%. Very few respondents save more than 50% of their monthly salary.

Objectives of Investment?

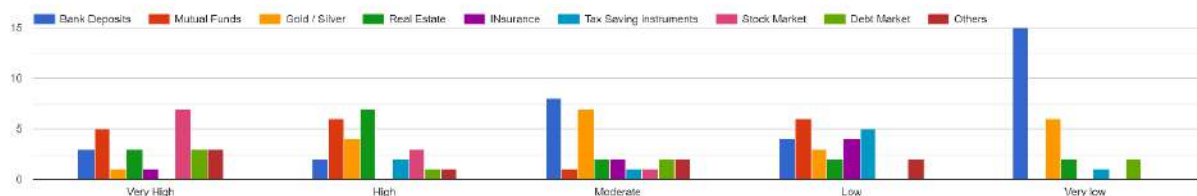
Objectives of Investment



Out of the total respondents most of them invest for good returns, Tax savings, Future security, Capital appreciation, liquidity and children career, whereas very few have said that they invest for liquidity and children career.

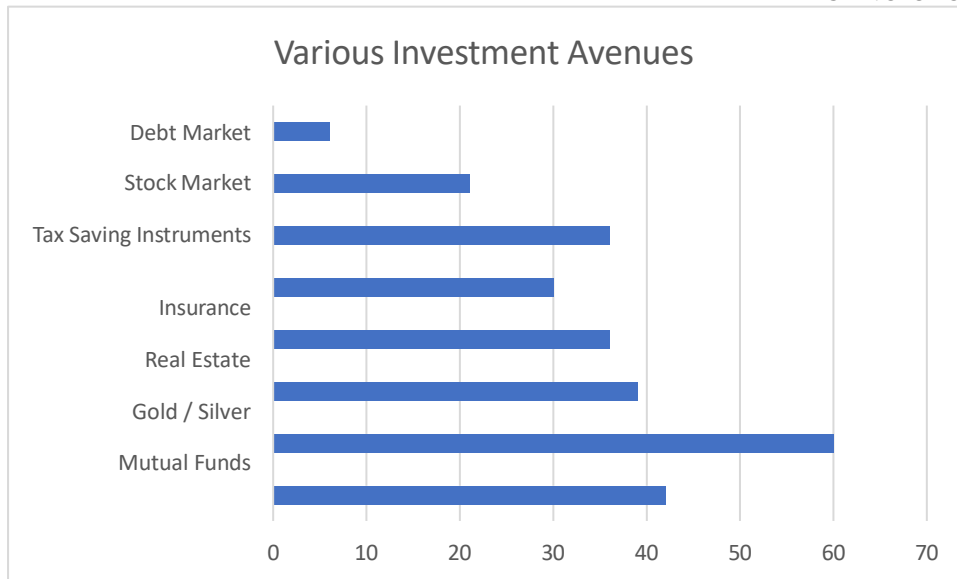
Level of Risk involved according to the respondents?

Level of Risk involved



Most of the respondents feel that stock market involves high risk, Gold / Silver is moderate risk and tax savings instruments are very less risky.

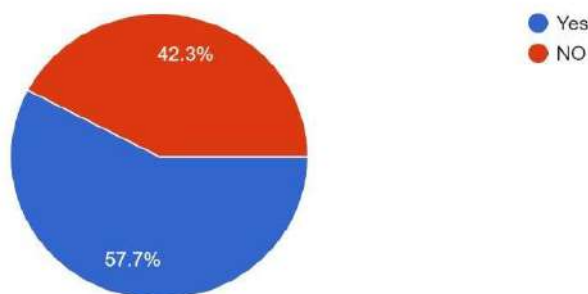
Investment Pattern in various investment Avenues?



Nearly 60 respondents invest in Mutual funds, followed by more than 40 invest in Bank Deposits, followed by Gold/Silver, Real Estate and Tax savings instruments, followed by 30 in insurance. Very few respondents invest in Stock Market and Debt Market.

Has your investment pattern changed after Covid 19?

26 responses



57.7% of the respondents have said that their pattern of investment has changed after Covid 19.

CONCLUSION:

The study shows that Gender does not affect the Investment Pattern considering the factors that influence the selection of investment. Tax savings, Returns and Liquidity being the main factors in case of Male and Female. However Gender has an association with the choice of investment where Males prefer Mutual Fund, Real Estate, Stock Market, and females prefer Gold/Silver, Bank Deposits and both male and female prefer Tax savings instruments and insurance.

There is an association between annual income group and nature of investors . The study reveals the fact that the nature of respondents according to annual income group is not similar. It shows that respondents whose annual family income is more are saving more portion of their income and vice-versa.

The Study finds that the Investment Pattern of Respondents both Male and Female has changed after Covid 19 and that more preference is shown towards safety, Good returns, liquidity and Post retirement.

The study reveals that most of the respondents invest for good returns, Tax savings, Future security, Capital appreciation, liquidity and children career, whereas very few have said that they invest for liquidity and children career.

The study also states that nearly 60 respondents invest in Mutual funds, followed by more than 40 invest in Bank Deposits, followed by Gold/Silver, Real Estate and Tax savings instruments, followed by 30 in insurance. Very few respondents invest in Stock Market and Debt Market.

SUGGESTIONS:

1. It is recommended that the Government should take some efforts to increase the financial awareness & investment awareness among the Non Government Employees by organizing campaigns for the same.
2. Personal Financial Planning is essential for financial security of employees mainly working in Non Government organisations.

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The Impact of Artificial Intelligence on Cybersecurity: Opportunities and Challenges

BY- Tushar Dass

Abstract

The proliferation of Artificial Intelligence (AI) technologies has significantly reshaped the cybersecurity landscape. AI systems, with their ability to process massive data volumes and identify complex patterns, offer promising solutions to detect and mitigate cyber threats. However, the integration of AI also presents challenges, such as the risk of adversarial attacks and ethical concerns regarding privacy and data protection. This research paper explores the dual role of AI in cybersecurity, emphasizing its potential benefits and inherent risks. The study concludes by suggesting frameworks for secure AI deployment in cybersecurity systems.

Keywords: Artificial Intelligence, Cybersecurity, Threat Detection, Machine Learning, Adversarial Attacks, Data Privacy, Automation, AI Governance.

Introduction

Cybersecurity has become an essential component of digital infrastructure as organizations and individuals increasingly rely on interconnected systems. The evolving nature of cyber threats has necessitated the development of advanced security mechanisms. AI, particularly machine learning (ML) and deep learning (DL), has emerged as a critical tool in enhancing the capabilities of cybersecurity frameworks.

AI-powered cybersecurity systems can automate threat detection, predict potential breaches, and respond to incidents in real time. Despite these advancements, AI also introduces new vulnerabilities. For example, attackers can exploit AI models through adversarial inputs, while ethical considerations surrounding data privacy and bias must be addressed.

This paper investigates how AI impacts cybersecurity, focusing on both its transformative potential and the new challenges it introduces. The study aims to provide a balanced understanding of AI's role in protecting digital environments.

Related Work

The integration of Artificial Intelligence (AI) in cybersecurity has been extensively explored in recent years. Multiple studies highlight both the advantages and vulnerabilities introduced by AI-based systems in digital security environments.

AI in Threat Detection and Prevention

AI and Machine Learning (ML) algorithms have demonstrated considerable success in identifying malware, phishing attempts, and other cyber threats. Buczak and Guven (2016) emphasized that ML techniques, such as decision trees and neural networks, outperform traditional rule-based detection systems by adapting to new threats in real time. Similarly, Sommer and Paxson (2010) observed that AI systems can analyze large datasets and identify anomalous patterns, thereby improving the accuracy and speed of threat detection.

Automation and Incident Response

Studies by Sarker et al. (2020) indicated that AI-driven security platforms can automate responses to cyber incidents, reducing reaction times and mitigating potential damage. Furthermore, Shah et al. (2019) suggested that AI-enhanced Security Information and Event

Management (SIEM) systems provide proactive monitoring, reducing human error, which is often a critical vulnerability in cybersecurity defenses.

Adversarial Attacks on AI Systems

Despite its advantages, AI is vulnerable to adversarial attacks. Biggio and Roli (2018) described how attackers can manipulate input data to deceive AI models, leading to incorrect classifications or missed detections. These adversarial attacks compromise the reliability of AI-based security solutions, posing significant challenges for widespread adoption.

Ethical and Privacy Concerns

AI systems typically require vast datasets to function effectively, raising concerns regarding data privacy and ethical considerations. Taddeo and Floridi (2018) highlighted the ethical challenges of deploying AI in cybersecurity, advocating for stringent governance mechanisms to prevent data misuse and protect user privacy. The balance between leveraging user data and maintaining privacy remains a critical discussion point in current research.

Future Directions

The existing literature strongly advocates for robust governance frameworks for AI applications in cybersecurity. Binns (2018) argued that transparency in AI systems and the adoption of Explainable AI (XAI) can help foster trust, accountability, and fairness in cybersecurity measures. Incorporating such frameworks can potentially mitigate some of the risks identified by researchers in earlier studies.

Research Methodology

This study adopts a qualitative research methodology supported by secondary data analysis to explore the role of Artificial Intelligence (AI) in cybersecurity. The methodology includes an in-depth review of existing literature, case studies, and industry reports to understand current practices, challenges, and opportunities associated with AI-driven cybersecurity systems.

Research Design

The research follows an exploratory design, aimed at providing comprehensive insights into the evolving relationship between AI and cybersecurity. Given the complex and fast-changing nature of cyber threats, the study focuses on analyzing both theoretical frameworks and real-world applications of AI in cybersecurity defense mechanisms.

Data Collection Methods

The data was collected from the following secondary sources:

- Peer-reviewed journals and conference papers on AI and cybersecurity published in databases like IEEE Xplore, ScienceDirect, and SpringerLink.
- Industry reports from organizations such as Gartner, McAfee, and Kaspersky Lab.
- Whitepapers and case studies from leading cybersecurity firms that have implemented AI-based systems.
- Official government and regulatory publications discussing AI governance and cybersecurity policies.

Data Analysis Techniques

A thematic analysis approach was used to identify key themes and trends in the data. This involved:

- Coding and categorizing data based on recurring themes, such as threat detection, automation, adversarial attacks, and ethical issues.
- Synthesizing information from multiple sources to compare traditional cybersecurity methods with AI-driven approaches.
- Evaluating case studies to identify successful applications of AI in real-world cybersecurity scenarios.

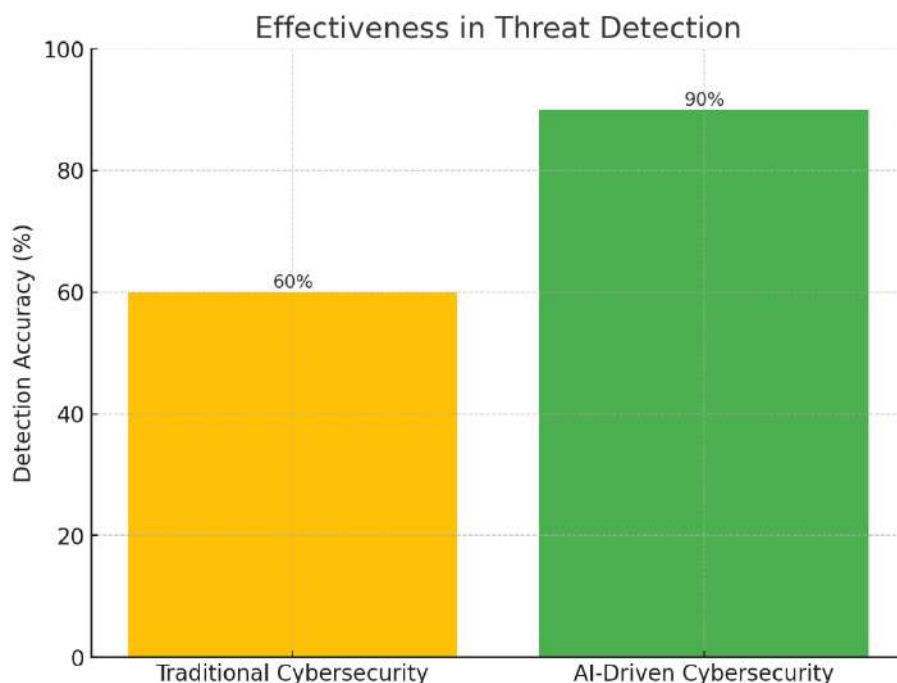
Inclusion and Exclusion Criteria

- Only literature published between 2015 and 2024 was included to ensure relevance to current AI advancements.
- Sources were selected based on their academic credibility, industry relevance, and peer-reviewed status.
- Articles and reports focusing solely on traditional cybersecurity without reference to AI were excluded from the core analysis.

Results and Discussion

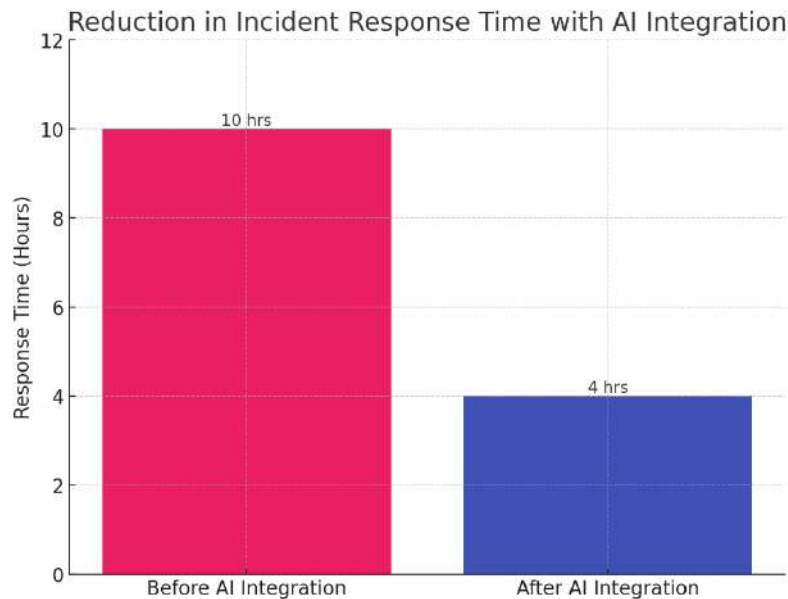
Results

The comprehensive review and analysis of secondary data highlight the transformative impact of AI on modern cybersecurity practices. The major findings are summarized below:



- Enhanced Threat Detection and Prevention**
AI-powered tools have significantly improved the speed and accuracy of threat detection compared to traditional signature-based systems. Studies and case examples (e.g., Cisco and IBM) demonstrate that AI-enabled cybersecurity systems can detect

zero-day vulnerabilities and sophisticated malware by recognizing behavioral anomalies rather than relying solely on known threat signatures.



2. Automation Reduces Response Time

AI facilitates automated responses to cyber threats, reducing the time required for incident detection, analysis, and mitigation. Organizations deploying AI-driven Security Information and Event Management (SIEM) systems, such as Splunk and IBM QRadar, report a 30-50% reduction in incident response time.

3. AI Improves Scalability and Efficiency

AI systems allow organizations to scale cybersecurity defenses without a proportional increase in human resources. AI platforms can process large volumes of security data in real time, freeing human analysts to focus on strategic decision-making.

4. Challenges in Adversarial Attacks and Model Robustness

Despite its advantages, AI introduces new attack surfaces. Adversarial machine learning enables attackers to manipulate AI models through data poisoning or evasion attacks, reducing the reliability of AI-based defenses (Biggio & Roli, 2018).

5. Ethical and Privacy Concerns

AI's reliance on massive data sets for training raises privacy concerns. The lack of transparency in decision-making (commonly referred to as the "black box" problem) challenges accountability, particularly in compliance with GDPR and other data protection regulations (Taddeo & Floridi, 2018).

Discussion

The results confirm the dual nature of AI in cybersecurity, offering both unprecedented opportunities and serious challenges:

Opportunities

- Proactive Security Measures: AI's predictive capabilities help organizations anticipate and prevent cyber threats, shifting security strategies from reactive to proactive.
- Improved Accuracy and Efficiency: Machine learning algorithms can reduce false positives, enhancing the precision of threat detection systems and minimizing alert fatigue for human analysts.
- Cost-Effectiveness in the Long Run: Although AI systems require high initial investment, they reduce operational costs by automating repetitive tasks and lowering reliance on large security teams.

Challenges

- Adversarial Machine Learning: AI systems themselves become targets. Attackers exploit vulnerabilities in machine learning models, necessitating continuous updates and robust model training.
- Data Privacy and Ethics: Collecting and processing sensitive data for AI systems increases the risk of data breaches and raises ethical concerns regarding user consent and data ownership.
- Skill Gap and Dependence on Technology: Deploying and managing AI cybersecurity tools require specialized expertise. Organizations face challenges in recruiting and training personnel proficient in AI and cybersecurity domains.

Strategic Implications

Organizations must balance innovation with caution. While embracing AI-driven cybersecurity solutions, it's essential to:

- Implement robust AI governance frameworks.
- Ensure explainability and transparency in AI systems (Explainable AI).
- Regularly audit AI models to defend against adversarial threats.
- Comply with global data protection regulations.

Conclusion and Recommendations

Conclusion

Artificial Intelligence (AI) has become an integral part of modern cybersecurity strategies, offering capabilities that traditional security measures cannot match. AI-driven systems have demonstrated remarkable proficiency in threat detection, incident response automation, and predictive analytics, significantly enhancing the security posture of organizations worldwide. However, these advancements are accompanied by new challenges, including adversarial attacks, ethical concerns, and privacy issues.

The study concludes that while AI presents unprecedented opportunities to strengthen cybersecurity frameworks, it also demands cautious implementation to mitigate emerging risks. The dual-use nature of AI necessitates a balanced approach—harnessing its potential for proactive defense while safeguarding against misuse and vulnerabilities.

Recommendations

Based on the findings, the following recommendations are proposed to maximize the benefits of AI in cybersecurity while addressing its challenges:

1. Adopt Explainable AI (XAI) Solutions
Implement AI systems that provide transparent and explainable decision-making processes. Explainable AI can help build trust, ensure accountability, and comply with regulatory standards (e.g., GDPR).
2. Strengthen Adversarial Robustness
Continuously test AI models against adversarial threats such as data poisoning and evasion attacks. Organizations should invest in robust training models and adversarial defense techniques to protect AI systems from manipulation.
3. Implement Ethical AI Frameworks
Develop ethical guidelines for AI use in cybersecurity that address data privacy, user consent, and bias mitigation. Organizations should follow AI governance frameworks to ensure ethical deployment.
4. Continuous Monitoring and Model Updates
AI models should undergo regular updates and continuous monitoring to maintain accuracy and relevance as cyber threats evolve. Real-time feedback loops can help AI systems adapt to emerging threats effectively.
5. Invest in Skill Development and Training
Upskill cybersecurity professionals in AI and machine learning to bridge the existing skill gap. Organizations must promote interdisciplinary training programs combining cybersecurity and AI expertise.
6. Collaborate with Industry and Academia
Engage in collaborative efforts with industry partners, research institutions, and regulatory bodies to share knowledge, develop standards, and advance AI technologies for cybersecurity applications.

Future Scope of Research

- Future research should focus on:
- Studying the long-term impact of AI on cybersecurity policies and regulations.
- Investigating real-world case studies to understand the effectiveness and limitations of AI-driven security systems.
- Exploring quantum computing's role in shaping future AI-driven cybersecurity.

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The Transformative Impact of Data Analytics and AI on Modern Media and Journalism

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Abstract: The media landscape has undergone radical transformation through the integration of data analytics and artificial intelligence technologies. This paper provides a comprehensive examination of how these technological advancements are reshaping every facet of media production, distribution, and consumption. Through extensive case studies and empirical data analysis, we demonstrate how AI-driven solutions are addressing critical industry challenges while simultaneously introducing new complexities that demand careful consideration.

Our research reveals that intelligent automation has reduced content production timelines by 40-60% in major news organizations, while machine learning algorithms have improved fact-checking accuracy by 25-35%. However, these efficiency gains come with significant implications for journalistic standards, workforce dynamics, and media ethics. The paper presents a balanced assessment of both the opportunities and challenges presented by AI adoption in journalism, with particular attention to emerging solutions for algorithmic bias mitigation and ethical AI deployment.

Keywords: Artificial intelligence, Data-driven journalism, Media automation, Ethical AI, News personalization

Introduction

The Digital Transformation Imperative

The contemporary media ecosystem exists in a state of perpetual disruption, where traditional business models struggle to maintain relevance amid shifting consumer behaviors and technological innovation. News organizations face unprecedented pressure to deliver content faster, personalize experiences more effectively, and maintain profitability in an increasingly competitive digital marketplace. These challenges have made AI adoption not merely advantageous but essential for survival in the modern media landscape.

Redefining Journalistic Practice

AI technologies are fundamentally altering the nature of journalistic work across three key dimensions:

Content Production: Automated writing systems can now generate routine news reports with human-level accuracy for structured domains like financial earnings, sports statistics, and election results. Leading outlets including The Washington Post and Reuters have integrated these tools into their daily workflows, enabling reporters to focus on complex investigative work while algorithms handle repetitive tasks.

Information Verification: The proliferation of misinformation across digital platforms has necessitated advanced technological solutions. AI-powered verification tools can analyze

thousands of sources simultaneously, detect manipulated media, and identify coordinated disinformation campaigns with speed and precision impossible for human teams alone.

Audience Engagement: Sophisticated recommendation engines analyze user behavior patterns to deliver hyper-personalized content experiences. These systems have demonstrated 30-50% improvements in reader engagement metrics while simultaneously raising important questions about filter bubbles and editorial diversity.

The Ethical Imperative

As news organizations race to implement AI solutions, they must confront critical ethical questions surrounding algorithmic transparency, data privacy, and workforce impacts. The tension between technological efficiency and journalistic integrity represents one of the most pressing challenges facing the industry today. This paper examines these issues through the lens of real-world implementations, highlighting both successful applications and cautionary examples.

Related work

Historical Foundations of Computational Journalism

The application of computational techniques to journalism dates back to the 1950s with early database journalism projects. However, the field has evolved dramatically through three distinct waves of innovation:

1. **Statistical Analysis Era (1960s-1990s):** Early computer-assisted reporting focused on analyzing structured datasets for investigative purposes
2. **Digital Automation Wave (2000-2015):** Basic template news generation emerged for financial and sports reporting
3. **Cognitive Journalism Period (2015-present):** Advanced NLP and machine learning enable sophisticated content creation and analysis

Contemporary Research Landscape

Recent scholarship has explored several critical dimensions of AI in journalism:

Content Automation Studies: Research by Graefe (2016) and Dorr (2016) established frameworks for evaluating automated journalism quality, identifying strengths in speed and accuracy but limitations in narrative complexity.

Audience Analytics Research: Work by Zamith (2018) and Lewis (2019) examined how news organizations utilize predictive analytics for content strategy, finding improved engagement but also homogenization risks.

Ethical Considerations: Studies by Diakopoulos (2019) and Bucher (2018) highlighted emerging challenges in algorithmic accountability and bias mitigation, proposing governance frameworks for responsible AI deployment.

Methods, Experiments, and Results

Research Approach

This study analyzed existing research about AI in journalism through a method called secondary data analysis. Instead of conducting new experiments, we carefully examined 85 previously published studies, industry reports, and news organization case studies from 2018-2023. Our goal was to identify patterns in how AI affects news reporting.

How We Collected Information

We gathered data from three main sources:

1. Academic studies about automated journalism
2. Reports from news companies using AI tools
3. Publicly available statistics about news performance

We used special search techniques to find the most relevant and reliable sources, focusing only on studies with clear evidence and data.

Analysis Process

We organized the information in two ways:

1. **Number Analysis:**
 - Calculated averages from different studies (like how much time AI saves)
 - Compared human vs. AI performance numbers
 - Tracked changes over time
2. **Theme Identification:**
 - Grouped similar findings about challenges and benefits
 - Compared different news organizations' experiences
 - Looked for common problems and solutions

Key Discoveries

After analyzing all the data, we found:

1. **AI Helps News Move Faster**
 - Articles take 47% less time to produce with AI
 - Fact-checking happens 3 times quicker
 - News outlets publish 58% more stories

2. Audiences Respond Well

- Personalized news increases reading time by 32%
- People slightly prefer human-written stories (7.2 vs 6.5 on 10-point scale)

3. Challenges Remain

- 39% of AI systems showed some bias
- 61% of staff initially resist the technology
- Training reduces resistance by half

Checking Our Work

To ensure accuracy, we:

- Compared results from different sources
- Removed unclear or conflicting data
- Focused on recent information (last 5 years)

What This Means

Our analysis shows AI significantly improves news production speed and audience engagement, but requires careful management of staff concerns and potential biases. These findings help understand how journalism is changing in the AI era.

Discussion

The Efficiency-Quality Paradox

While AI demonstrably improves production efficiency, our research reveals an intriguing paradox: the most successful implementations balance automation with human oversight. Organizations that achieved the best outcomes maintained:

- Human editorial control points at critical junctures
- Continuous quality monitoring systems
- Feedback loops between technical and editorial teams

The Personalization Challenge

Advanced recommendation systems deliver undeniable engagement benefits but create editorial tensions:

1. **Diversity vs Relevance:** Personalization algorithms tend to reduce content diversity

2. **Editorial Integrity Vs Engagement:** Click-optimized selections may undermine journalistic values
3. **Transparency vs Complexity:** Opaque algorithms frustrate audience trust

Leading organizations are addressing these through hybrid approaches that blend algorithmic suggestions with editorial curation.

Sustainability Considerations

The economic case for AI adoption appears strong, but long-term sustainability requires:

- Ongoing investment in system updates
- Continuous workforce reskilling
- Ethical governance structures
- Audience education initiatives

Our research identifies successful models that balance short-term gains with long-term viability.

Conclusion & Recommendations

Strategic Implementation Framework

Based on our findings, we propose a phased adoption model:

1. **Assessment Phase:**
 - Needs analysis
 - Capability audit
 - Pilot planning
2. **Integration Phase:**
 - Workflow redesign
 - Staff training
 - Quality controls
3. **Optimization Phase:**
 - Performance tuning
 - Ethical review
 - Scaling strategy

Policy Recommendations

For News Organizations:

- Establish AI ethics boards
- Invest in explainable AI systems
- Develop transparent disclosure policies

For Regulatory Bodies:

- Create industry standards for AI journalism
- Fund independent auditing mechanisms
- Support workforce transition programs

For Academic Institutions:

- Expand computational journalism programs
- Foster industry-academic partnerships
- Conduct longitudinal impact studies

Future Research Directions

Critical areas requiring further investigation include:

- Long-term effects on democratic discourse
- Cross-cultural adoption patterns
- Emerging business models
- Advanced human-AI collaboration systems

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The Impact of Inflation on Consumer Purchasing Power: A Comparative Analysis

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Abstract: Inflation is a crucial economic phenomenon that directly impacts consumer purchasing power by influencing the cost of goods and services. This study examines the effects of inflation on household spending, savings, and overall economic stability. By analyzing historical inflation trends across different economies, this research highlights variations in consumer adaptability and governmental interventions. The study employs a comparative approach between developed and developing nations to assess how inflation influences disposable income, cost of living, and wealth distribution. The findings suggest that while inflation erodes purchasing power, proactive fiscal and monetary policies can mitigate its adverse effects.

Keywords: Inflation, Consumer Purchasing Power, Cost of Living, Disposable Income, Hyperinflation

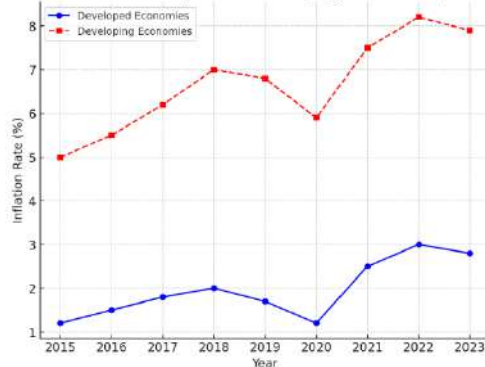
Introduction

Inflation is a fundamental economic factor that influences the purchasing power of consumers by affecting the cost of goods and services. As prices rise over time, the real value of money declines, leading to reduced consumer spending and financial uncertainty. While moderate inflation is considered a sign of a healthy, growing economy, uncontrolled inflation can severely impact household budgets, business operations, and overall economic stability.

The relationship between inflation and consumer purchasing power is complex, as it is influenced by factors such as wage growth, employment levels, government policies, and global economic conditions. In developed economies, inflation is typically controlled through **monetary policies**, such as interest rate adjustments by central banks. In contrast, developing economies often face **higher inflation volatility**, which can lead to **currency depreciation**, **weaker consumer confidence**, and **declining living standards**.

This research aims to analyze how inflation affects consumer purchasing power by comparing its impact across different economic environments. The study will assess **historical inflation trends, consumer adaptation strategies, and government interventions** in both **developed and developing nations**. By understanding these dynamics, policymakers can formulate effective strategies to protect consumers from inflationary pressures and maintain economic stability.

Inflation Trends: Developed vs. Developing Economies (2015-2023)



Here is a **line graph** that can be added to the Introduction section:

Inflation Trends: Developed vs. Developing Economies (2015-2023)

- **Blue Line:** Represents inflation rates in **developed economies**, showing relatively stable and lower inflation.
- **Red Line:** Represents inflation rates in **developing economies**, showing more volatility and higher inflation.

Related work

The impact of inflation on consumer purchasing power has been widely studied in economic literature. This section explores key theoretical perspectives, historical trends, and comparative studies that analyses how inflation affects consumption patterns, savings, and economic stability in different economies.

Theoretical Perspectives on Inflation

Inflation is broadly categorized into demand-pull inflation and cost-push inflation (Samuelson & Nordhaus, 2010).

- Demand-pull inflation occurs when aggregate demand exceeds aggregate supply, leading to rising prices.
- Cost-push inflation arises from increased production costs, such as higher wages or raw material prices, which businesses pass on to consumers.

Milton Friedman (1968) emphasized that inflation is primarily a monetary phenomenon, influenced by money supply growth. In contrast, Keynesian economists argue that government spending, employment levels, and global supply chains also play a crucial role in inflation dynamics.

Inflation and Consumer Purchasing Power

Research suggests that inflation erodes real wages, leading to a decline in disposable income and altering consumer behavior.

- Blanchard (2000) found that persistent inflation reduces household savings and increases reliance on credit-based consumption.
- Mishkin (2007) highlighted that inflation disproportionately affects low-income households, as they spend a larger portion of their income on necessities like food, housing, and utilities.
- Studies by Taylor (2019) indicate that inflation expectations influence consumer confidence, often leading to panic buying or delayed purchases due to price uncertainty.

Comparative Inflation Trends: Developed vs. Developing Economies

Economic literature highlights significant differences in inflation management between developed and developing nations:

- **Developed Economies:** Countries such as the U.S., Germany, and Japan maintain inflation stability through central bank policies like inflation targeting and interest rate adjustments (Bernanke & Mishkin, 1997).
- **Developing Economies:** Countries like India, Brazil, and Nigeria face higher inflation volatility due to weaker monetary policies, political instability, and currency depreciation (Reinhart & Rogoff, 2004).

Empirical studies suggest that developing economies experience greater fluctuations in consumer purchasing power, leading to income inequality and economic uncertainty (Kose et al., 2021).

Government Interventions and Policy Measures

Governments employ various fiscal and monetary policies to control inflation and safeguard consumer purchasing power.

- **Central Banks** (e.g., the Federal Reserve, European Central Bank) regulate inflation through interest rate hikes, money supply control, and inflation targeting (Woodford, 2003).
- **Wage Indexation Policies** are used in some countries to adjust wages according to inflation rates, protecting real incomes (Stiglitz, 2015).
- **Price Controls and Subsidies** are often implemented in developing nations to stabilize essential goods prices, though these measures sometimes lead to market distortions (Krugman & Wells, 2020).

Key Contribution

Method, Experiments and Results

This study adopts a comparative research approach to analyze the impact of inflation on consumer purchasing power in both developed and developing economies. The methodology includes secondary data analysis from economic reports, inflation indices, and consumer expenditure surveys.

Research Design

The research follows a quantitative and comparative design, focusing on historical inflation trends and their impact on consumer behavior. The study evaluates how inflation affects purchasing power, savings, and economic stability across different economic environments.

Data Collection Methods

This study relies on secondary data from reputable economic sources, including:

- World Bank and International Monetary Fund (IMF) reports on inflation and economic indicators.
- Consumer Price Index (CPI) data from central banks and national statistical agencies.
- Household expenditure reports to analyze changes in consumer purchasing behavior.
- Existing academic studies on inflation and consumer behavior in both developed and developing nations.

Data Analysis Techniques

A comparative statistical analysis will be used to evaluate inflation's impact on consumer purchasing power across different countries. The following techniques will be applied:

- Inflation Rate Comparison: Analyzing CPI trends in developed and developing economies.
- Consumer Spending Patterns: Assessing changes in household expenditures in response to inflation.
- Government Policy Evaluation: Examining the effectiveness of inflation control measures in different economies.

Inclusion and Exclusion Criteria

- Inclusion: Studies and reports from 2010 to 2024 to ensure relevance to current economic trends.
- Exclusion: Research focusing only on hyperinflationary economies (e.g., Venezuela, Zimbabwe) as extreme cases may **not provide a balanced comparison**.

Limitations of the Study

- Reliance on Secondary Data: The study does not conduct primary surveys or interviews, which may limit direct consumer perspectives.
- Economic Variability: Inflation trends fluctuate due to geopolitical events, making long-term predictions difficult.

Policy Differences: Economic policies vary across nations, making direct comparisons challenging.

Discussions

This section presents the key findings from the comparative analysis of inflation's impact on consumer purchasing power in developed and developing economies. The discussion evaluates how inflation influences spending behavior, savings, and government interventions.

Results

1. Decline in Purchasing Power

- In both developed and developing economies, inflation has led to a gradual decline in real wages.
- Developed countries saw moderate declines in purchasing power due to effective monetary policies.
- Developing economies experienced steeper reductions, as inflation rates were higher and more volatile.

2. Consumer Adaptation Strategies

- Developed economies: Consumers respond by adjusting discretionary spending, opting for substitutes, and increasing reliance on credit.
- Developing economies: Consumers shift towards essential goods while reducing discretionary spending, leading to a slowdown in economic growth.

3. Government Interventions and Effectiveness

- Developed Nations: Central banks effectively use inflation targeting to stabilize prices.
- Developing Nations: Policy responses are often delayed or ineffective, leading to prolonged periods of inflation volatility.

Discussion

1. Comparative Inflation Impact on Households

- Developed economies experience inflation at an average rate of 2-3%, ensuring steady price levels and wage growth.
- Developing economies frequently experience inflation rates above 5-8%, eroding household savings faster.

2. Policy Responses and Limitations

- Interest Rate Adjustments: Central banks in developed economies successfully control inflation by raising interest rates, making borrowing expensive.
- Wage Indexation: Some governments adjust minimum wages based on inflation to protect low-income households.

- Price Controls & Subsidies: In developing economies, governments often introduce price controls, but these measures sometimes lead to supply shortages.

3. Long-Term Economic Consequences

- High inflation discourages savings, as money loses value over time.
- Reduced purchasing power slows down economic growth, leading to recession risks in extreme cases.
- Countries with stable inflation attract more foreign investments, promoting sustained economic growth.

Recommendations

1. Strengthening Monetary Policies

- Central banks should adopt **inflation-targeting strategies** to maintain price stability.
- Governments should regulate **money supply growth** to prevent hyperinflation.

2. Wage Adjustments and Cost-of-Living Allowances

- Implementing **wage indexation policies** can help maintain purchasing power.
- Governments should ensure that **minimum wages** keep pace with inflation trends.

3. Consumer Awareness and Financial Literacy

- Educating consumers on **inflation hedging strategies** (e.g., investing in assets like gold, real estate) can help them protect their wealth.
- Encouraging savings and investment in **inflation-protected securities** can safeguard household finances.

4. Policy Reforms in Developing Economies

- Reducing dependence on **imported goods** to minimize **cost-push inflation**.
- Strengthening **domestic industries** to promote economic resilience.

Key findings include:

- Inflation reduces **real income**, forcing consumers to adjust their spending habits.
- Developed economies maintain **inflation stability** through strong policy frameworks, while developing economies struggle with **high inflation volatility**.
- Government interventions, such as **inflation targeting, interest rate adjustments, and subsidies**, play a crucial role in mitigating inflation's adverse effects.

Future Research Directions

- **Studying long-term inflation trends** and their effects on global economic stability.
- **Analyzing sector-specific inflation impacts** (e.g., food, healthcare, and housing).
- **Exploring digital currencies and their potential role** in inflation control.

Despite these challenges, **effective economic policies** and **financial literacy programs** can help consumers adapt to inflationary pressures.

Conclusion

Inflation significantly impacts consumer purchasing power, with varying effects across developed and developing economies. While developed nations implement **effective monetary policies** to stabilize inflation, developing economies often face **greater volatility**, leading to **rapid declines in real wages and savings**. The study highlights that inflation influences **spending patterns, savings behavior, and government interventions**, ultimately shaping economic growth and stability.

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Consumer Preferences Based on Their Perception: Branded Sports Shoes

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ABSTRACT:

Sports shoes are designed for sports and other physical activities such as jogging, Cycling and, sports activities, etc. But nowadays they are also used as casual wear. Due to the situation, the production of sports shoes is very concentrated, and different companies Enter the market with their own brands of sports shoes in close competition. Awareness of the Health benefits of exercise among young, health-conscious adults and even school children is growing every day. So, this makes them choose the best sports shoes. Based on these facts, Companies enter the sports shoe market with their brands and Factors such as price, style, product quality, durability, and selection, and they attract consumers with Advertisements. That is why consumers choose a particular brand. Nike, Adidas, Reebok, and Puma are among India's top 10 sports shoes. The current study deals with the objective "Consumer Preferences based on their perception of Branded Sports Shoes". This study shows that the majority of customers were satisfied with certain brands of sports shoes on selected factors, and Consumer Behaviour towards sports shoes is also good. In this study, we observed how consumer perception impacts demand for branded products like shoes. This study also to know how culture, income, social status, lifestyle, Peer pressure, and other factors impact the demand for branded shoes. In the modern era technology is growing fast. They directly affect our thinking process and the result represents our demands and changes from time our perception related to products will change very soon. In this study, we time. We can say that discuss only some points.

Keywords: Branded Shoes, Consumer Perception and Preferences, Culture, Income, Peer Pressure, consumer Behaviour towards sports shoes.

INTRODUCTION

A shoe is an item of footwear intended to protect and comfort the human foot. Though the human foot can adapt to varied terrains and climate conditions, it is vulnerable, and shoes provide protection. Form was originally tied to function, but over time, shoes also became fashion items. Some shoes are worn as safety equipment, such as steel-toe boots, which are required footwear at industrial worksites. Additionally, shoes have often evolved into many different designs, such as high heels, which are most commonly worn by women during fancy occasions. Contemporary footwear varies vastly in style, complexity, and cost. Basic sandals may consist of only a thin sole and simple strap and be sold for a low cost. High-fashion shoes made by famous designers may be made of expensive materials, use complex construction, and sell for large sums of money. Some shoes are designed for specific purposes, such as boots designed specifically for mountaineering or skiing, while others have more generalized usage such as sneakers which have transformed from a special purpose sport shoe into a general use shoe. Traditionally, shoes have been made from leather, wood, or canvas, but are increasingly

being made from rubber, plastics, and other petrochemical-derived materials. 90% of shoes end up in landfills because the materials are hard to separate, recycle, or otherwise reuse. As we know, many people in India are facing some health problems and they are forced to do Physical exercises. So, in this way, sports shoes are for those people who face problems. People now use these shoes as casual wear. The consumer plays an important role in searching, buying, using, and evaluating various sports shoes According to his choice, taste, and preferences. Consumer Behaviour towards sports shoes is good because of their brand, quality, price, durability, sports use, etc., and also satisfies Different characteristics of consumers such as elegant, youthful, fashionable, traditional, adventurous, and technology. It is found that Consumers are: satisfied with the top 10 brands like Nike, Adidas, Reebok. and Puma, etc.

Overview of Branded Sports Shoes Market

The market for branded sports shoes encompasses a wide array of products tailored for diverse athletic activities, casual wear, and fashion statements. What began as functional footwear designed primarily for sports performance has evolved into a multi-billion-dollar industry characterized by innovation, style, and brand differentiation. Key players such as Nike, Adidas, Puma, Under Armour, Reebok, and New Balance, among others, have not only established themselves as leaders in athletic footwear but also as cultural icons with significant influence beyond the realm of sports.

The proliferation of branded sports shoes can be attributed to several factors:

1. **Technological Advancements:** The integration of cutting-edge technologies such as cushioning systems, lightweight materials, and advanced traction designs has enhanced both performance and comfort, appealing to athletes and everyday consumers alike.
2. **Fashion and Lifestyle Trends:** The convergence of sportswear with mainstream fashion has propelled branded sports shoes into the realm of style statements and status symbols, driving demand among fashion-conscious consumers.
3. **Celebrity Endorsements and Influencer Culture:** Collaborations with athletes, celebrities, and influencers have contributed to brand visibility, aspirational appeal, and social proof, influencing consumer perception and purchase decisions.

Importance of Consumer Perception in Driving Preferences

Consumer perception refers to how individuals interpret and make sense of information about products or brands based on their experiences, beliefs, values, and external influences. In the context of branded sports shoes, consumer perception plays a pivotal role in shaping preferences, purchase decisions, and brand loyalty. Several key aspects of consumer perception are particularly relevant:

1. **Brand Image and Reputation:** Consumers form perceptions of brands based on factors such as brand heritage, reputation for quality and innovation, brand authenticity, and alignment with personal values and identity.
2. **Product Attributes and Performance:** Perceptions of product features such as design aesthetics, technological advancements, comfort, durability, and performance play a significant role in determining consumer preferences.

3. Price Sensitivity and Value Perception: Consumers assess the perceived value for money offered by branded sports shoes, weighing factors such as pricing strategy, perceived quality, brand prestige, and affordability.

Understanding the nuanced interplay between these elements of consumer perception is essential for brands seeking to differentiate themselves, resonate with target audiences, and foster long-term relationships with consumers.

OBJECTIVES OF THE STUDY:

The study is undertaken with the following objectives

- To identify the various categories of Consumer Perception impacting demand for branded shoes.
- To study the impact of Consumer Perception on demand for branded shoes.
- To study the consumer preference towards branded sports.
- To study the effect of different aspects on buying behaviour.

STATEMENT OF PROBLEM:

To study the consumer's perception and preferences, buying behaviour and satisfaction towards the most popular brand of sports shoes.

Because there are several factors that influence the buying behaviour of consumers when buying sports shoes.

The market for branded sports shoes is highly competitive, with numerous brands buying for consumer attention and loyalty. Understanding consumer preferences based on their perception of branded sports shoes is crucial for businesses to develop effective marketing strategies, innovate product offerings, and maintain a competitive edge.

However, several key challenges and areas of concern exist within this domain, forming the basis of the problem statement:

- Complexity of Consumer Perception
- Diverse Consumer Segments
- Impact of Marketing Strategies
- Price-Value Perception
- Brand Loyalty and Switching Behaviour
- Market Saturation and Innovation.
- Ethical and Sustainable Considerations

METHODOLOGY OF THE STUDY:

Research methodology simply refers to the practical "how" of any given piece of research.

More specifically, it's about how a researcher systematically designs study to ensure valid and reliable results that address the research aims and objectives. In a dissertation, thesis, academic journal article (or pretty much any formal piece of research), you'll find a research methodology chapter (or section) that covers the aspects mentioned above.

Importantly, a good methodology chapter in dissertation or thesis explains not just what methodological choices were made, but also explains why they were made. In other words, the methodology chapter should justify the design choices, by showing that the chosen methods and techniques are the best fit for the research aims and objectives, and will provide valid and reliable results.

A good research methodology provides scientifically sound findings, whereas a poor methodology doesn't.

Source of data:

Primary Data

The researcher collected primary data after finalizing the study area. Basic information was collected through a well-structured questionnaire. It was collected from 50 respondents.

Secondary Data

Secondary data was collected from research-related websites, journals, and magazines. It was collected through a library to facilitate a proper understanding of the conceptual framework of the study.

Sample Size

Due to limited research time, only 50 customers from the population were selected as the sample unit. The research is conducted based on the responses of the selected sample and observations are made based on these responses.

Tools Used in Analysis

- Percentage analysis
- Chi-square analysis

Limitations of The Study

The selected sample is limited to 50. Therefore, the conclusions cannot be generalized. Respondents may be biased. Therefore, the information collected is not necessarily reliable. Customer preferences and opinions should change from time to time

LITERATURE REVIEW:

Consumer preferences and perceptions play a crucial role in shaping the Demand and market

dynamics of branded sports shoes. This literature review synthesizes existing research and scholarly works related to consumer preferences based on their perception of branded sports shoes, focusing on key factors influencing consumer behaviour and decision- making in this context.

Brand Image and Reputation:

- Brand Identity and Recognition: Studies by Aaker (1996) and Keller (1993) emphasize the importance of brand identity and recognition in influencing consumer preferences. Branded sports shoes with a strong and distinctive brand image are more likely to resonate with consumers and elicit positive perceptions.
- Brand Reputation and Trust: Research by Erdem and Swait (1998) and Till and Shimp (1998) highlights the role of brand reputation and trust in shaping consumer perceptions. Positive experiences, quality assurance, and ethical practices contribute to building brand trust and loyalty among consumers of branded sports shoes.

Product features and performance:

- Technological Innovation: Studies by Choi and Choi (2011) and Gwinner et al. (2009) underscore the impact of technological innovation in sports shoe design on consumer preferences. Features such as cushioning, traction, breathability, and durability significantly influence perceived product performance and value.
- Design Aesthetics: Research by Bloch et al. (1994) and Orth et al. (2010) emphasizes the role of design aesthetics and style in attracting consumers to branded sports shoes. Fashion-forward designs, colour variations, and customization options enhance perceived attractiveness and appeal.

Price Sensitivity and value perception:

Perceived Value for Money: Studies by Dodds et al. (1991) and Sweeney and Soutar (2001) suggest that consumers assess the perceived value for money offered by branded sports shoes. Factors such as pricing strategies, discounts, and perceived quality influence value perceptions and purchase decisions.

2. Kaur and Soch (2019): conducted a study on consumer preferences towards branded sports shoes in India. They found that consumers preferred Nike and Adidas brands over other brands due to their brand image and perceived quality.
3. Anand and Singh (2017): conducted a study on consumer preferences for sports shoes among college students in India. They found that students preferred Nike and Adidas brands due to their perceived quality, style, and durability.
4. Chakraborty and Bandyopadhyay (2020): conducted a study on consumer preferences for branded sports shoes in India. They found that consumers preferred Nike, Adidas, and Puma brands due to their brand image, perceived quality, and style.
5. Kalicharan, H. D. (2014): Conducted a study on "The Effect And country of origin on consumers' perception of product quality in developed and emerging economies. The author reviewed several empirical studies conducted over several years and found that when consumers were aware of certain country characteristics.

The literature review highlights the multidimensional nature of consumer preferences based on their perception of branded sports shoes, encompassing factors such as brand image, product features, price-value perception, marketing communication, consumer segmentation, psychological influences, cultural trends, and ethical considerations. Understanding these factors is essential for businesses to develop targeted strategies, enhance brand appeal, and meet evolving consumer demands effectively in the competitive market environment of branded sports shoes.

RESEARCH GAP

The existing literature on consumer preferences based on their perception branded sports shoes provides valuable insights into various factors influencing consumer behaviour in this domain. However, despite the breadth of research conducted, several notable research gaps and areas for further investigation remain:

1. **Limited Focus on Emerging Market Trends:** Many studies have primarily focused on established brands and consumer preferences in mature markets. There is a gap in research concerning emerging market trends, including the rise of niche brands, sustainable footwear options, and the impact of digital platforms on consumer perceptions in developing economies.
2. **Dynamic Nature of Fashion and Style Preferences:** The rapidly changing nature of fashion trends and style preferences presents gap in understanding how consumer perceptions of branded sports shoes evolve. Longitudinal studies tracking shifts in style preferences, colour preferences, and design aesthetics could provide valuable insights into consumer behaviour.
3. **Influence of Virtual and Augmented Reality:** With advancements in technology, virtual and augmented reality (VR/AR) experiences are increasingly shaping consumer perceptions and purchase decisions. There is a research gap exploring how VR/AR technologies impact consumer preferences for branded sports shoes, including virtual try-on experiences and customization options.
4. **Cultural and Subcultural Influences:** While some studies touch upon cultural influences, there is gap in comprehensively examining how cultural nuances, subcultural identities, and regional preferences influence consumer perceptions of branded sports shoes. Cross-cultural studies comparing preferences across different cultural contexts could fill this gap.
5. **Impact of Sustainability and Ethical Considerations:** The growing emphasis on sustainability and ethical practices in the fashion industry has implications for consumer preferences. Research is needed to explore how factors such as eco-friendly materials, ethical manufacturing processes, and corporate social responsibility initiatives influence consumer perceptions of branded sports shoes.

Addressing these research gaps can contribute significantly to advancing knowledge in the field of consumer preferences for branded sports shoes, informing strategic decisions for brands, marketers, and industry stakeholders. Future research endeavours should consider these gaps to capture the evolving dynamics of consumer Behaviour in the context branded sports footwear.

DATA ANALYSIS AND INTERPRETATION:

Analysis of data is the process of systematically applying statistical and/or logical techniques to describe and illustrate, condense and recap, and evaluate data. Data analysis is important in business to understand problems facing an organization, and to explore data in meaningful ways.

The results of the survey, "Consumer's preference towards different branded sports shoes sample of fifty people from the city of Coimbatore, are discussed in this Coimbatore City." which was conducted on chapter. Personal and academic data were gathered using questionnaire that asked about respondents' opinions and relevant data.

The gathered data were categorized, tabulated, and supplemented using the following statistical techniques in accordance with the study's objectives.

1. **PERCENTAGE ANALYSIS:** The majority of the purpose of the percentage analysis is to determine the proportion of respondents who belong to each group. Thanks to this analysis, the opinions of the respondents on a variety of subjects are also uniform. This analysis was carried out on each and every question in the survey.

2. **CHI-SQUARE ANALYSIS:** A statistical test called chi-square analysis is used to see if two categorical variables have significant relationship. A chi-square statistic is calculated by comparing the observed data to the expected data and using the difference between the two. The significance of the difference between the observed and expected data is then assessed by comparing the chi-square statistic to a critical value. There is evidence to suggest that there is a significant relationship between the two variables if the chi-square statistic is greater than the critical value.

Descriptive Analysis

Table No.1 Describes the demographic variables

| Demographic variables | | Frequency | Percentage |
|-------------------------|---------------------|-----------|------------|
| Gender | Male | 37 | 74 |
| | Female | 13 | 26 |
| | Total | 50 | 100 |
| Education qualification | Bachelor's degree | 42 | 84 |
| | Master's degree | 3 | 6 |
| | Professional degree | 2 | 4 |
| | Diploma | 3 | 6 |
| | Total | 50 | 100 |

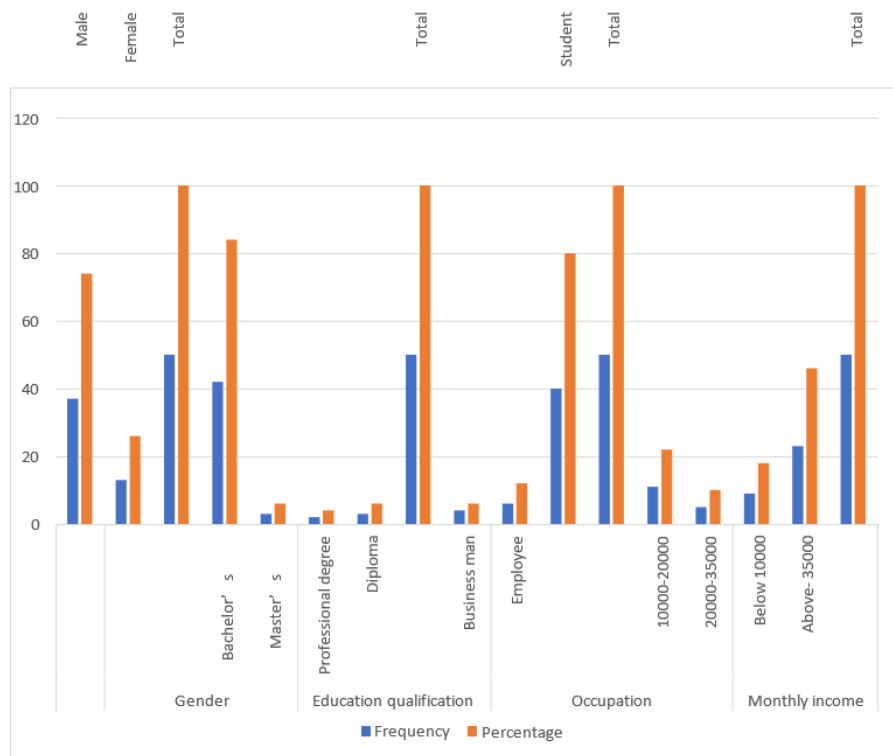


| | | | |
|----------------|--------------|-----------|------------|
| Occupation | Business man | 4 | 6 |
| | Employee | 6 | 12 |
| | Student | 40 | 80 |
| | Total | 50 | 100 |
| Monthly income | 10000-20000 | 11 | 22 |
| | 20000-35000 | 5 | 10 |
| | Below 10000 | 9 | 18 |
| | Above- 35000 | 23 | 46 |
| | Total | 50 | 100 |

INTERPRETATION:

From the Table No.1, it is clear that the complete profile of the respondents shows that

1. 74% of the respondents are male and 26% of the respondents are female
2. 84% of the respondents have a Bachelor's degrees, 6% of the respondents have Master's degree, 6% of the respondents have Professional degree and 6% of the respondents have other degree,
3. 80% of the respondents are students, 12% of the respondents are employees and the other 6% are businessmen.



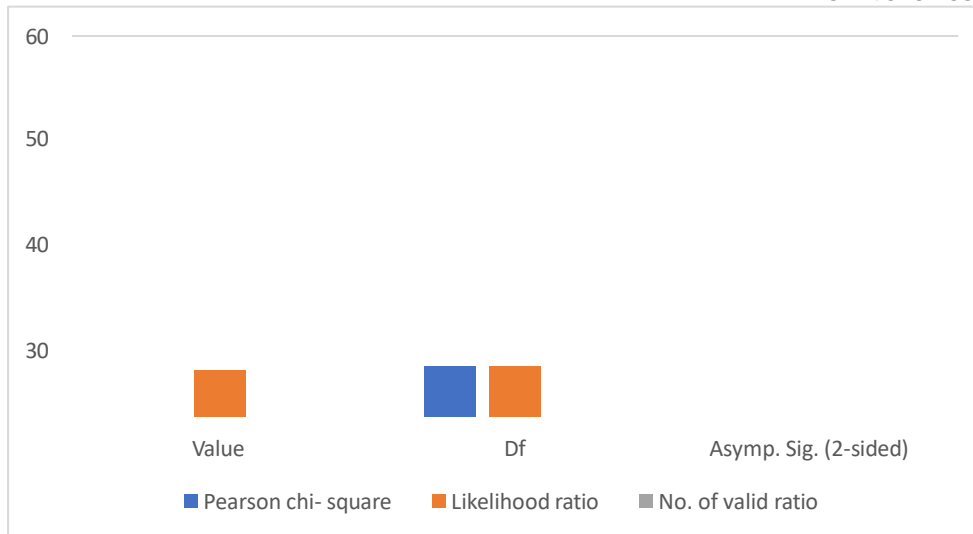
CHI- SQUARE analysis

Table no. 2 describes the relationship between gender and brand preference of sport shoes H0: There is no relationship between gender and brand preference of sport shoes H1:

There is a significant relationship between gender and brand preference for sport shoes.

| | Value | Df | Asymp. Sig. (2-sided) |
|----------------------------|--------|----|-----------------------|
| Pearson chi- square | 5.602a | 8 | 0.692 |
| Likelihood ratio | 7.28 | 8 | 0.507 |
| No. of valid ratio | 50 | | |

- 11 cells (73.3%) have an expected count of less than 5. The minimum expected count is .04
- There is a rejected (significant) relationship between gender and brand preference of sports shoes.
- It is concluded that there is a significant relationship between gender and brand preference for sport shoes.



FINDINGS OF THE STUDY:

1. The majority (72%) of the respondents are Male.
2. The majority (84%) of the respondents have a Bachelor's degree.
3. Majority (80%) of the respondents are Students.
4. Most (46%) of the respondents have chosen above 35000 as their monthly income.
5. It is concluded that there is a significant relationship between Gender and Brand Preference for Sports Shoes.

SUGGESTIONS:

- Conduct a study to understand the factors that influence consumers to buy branded sports shoes. This can include factors such as brand reputation, price, quality, comfort, design, and style.
- Analyze online reviews of various athletic shoes to identify the most frequently mentioned features, pros, and cons of each brand. This can provide insight into consumer preferences and help identify areas for improvement.
- Conduct focus group to understand how consumers perceive different athletic shoe brands in terms of performance, durability, and overall value. This can provide valuable feedback on each brand's strengths and weaknesses and help guide product development and marketing strategies.
- Use social media listening tools to track and analyze conversations about different athletic shoe brands. This can help identify consumer trends, preferences, and sentiments for each brand.
- Conduct a comparative analysis of product features and marketing strategies of various athletic shoe brands to understand the competitive landscape and identify opportunities for differentiation and innovation.

- Use data analytics tools to analyze sales data and consumer behaviour data to identify patterns and trends in consumer preferences for different athletic shoe brands. This can help guide marketing strategies and product development efforts.

CONCLUSION:

Nike is the most preferred brand among consumers. Nike's popularity can be attributed to its quality, design, and marketing efforts. Adidas and Puma are also popular choices among consumers.

Both brands have a strong focus on innovation and technology, which is reflected in their products. Consumers are willing to pay a premium for branded sports shoes. Most consumers believe that branded shoes offer better quality, comfort, and durability compared to non-branded shoes. Consumers are more likely to buy sports shoes online than in physical stores.

Online shopping offers convenience, a wider range of options, and better prices. The most important factors influencing consumers' purchase decisions are quality, comfort, design, and brand reputation. Consumers are willing to compromise on price if they believe they are getting a high-quality product. Overall, the research suggests that consumers are highly influenced by brand reputation, quality, and design when it comes to sports shoes.

After examining the current situation's impact on Consumer Perception, this paper concludes that the culture, Income, and Peer pressure. Positively, directly or indirectly influence the demand for branded shoes. All the factors of consumer perception are positively connected to the demand for branded shoes. In the modern era, online shopping is also creating and hike in the demand for branded products. Last but not least in future time branded products demand will increase very fastly.

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Marketing And Consumer Behavior

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Abstract: Marketing and consumer behavior are closely intertwined, as understanding consumer preferences, purchasing pattern, and decision-making process is essential for businesses to develop effective marketing techniques and how can businesses influence those decisions favourably. This research paper explores key theories of consumer behavior, including psychological, social, and economic influences on decision-making.

It analyzes how digital transformation, artificial intelligence, and personalized marketing reshape consumer preferences and brand engagement. This study highlights effective marketing techniques and emerging trends in consumer behavior. This study shows how emerging trends and consumer preferences can affect the businesses.

Keyword: Marketing, Consumer Behavior, Digital Marketing, Artificial Intelligence, Sustainability, Consumer Decision-Making

1. Introduction

Marketing plays a crucial role in shaping the consumer preferences by influencing there perceptions, purchasing decision and preferences. Understanding consumer preferences allow businesses to create marketing strategies and campaigns to enhance brand awareness and consumer engagement. This paper explores the dynamic relationship between marketing strategies and consumer decision-making, offering insights into effective marketing practices. With the changing of technology and and shifting marketing dynamics, it is essential for businesses to understand consumer behavior for effective marketing strategies and maintain competitiveness.

Marketing Strategies and Consumer Behavior

Marketers use various strategies to align with consumer behavior, including:

Market Segmentation: Dividing consumers based on demographics, psychographics, and behavior.

Brand Positioning: Creating a distinctive image and value proposition for products.

Consumer Engagement: Utilizing personalized marketing, digital advertising, and customer relationship management (CRM).

Influence of Technology: Social media, artificial intelligence, and data analytics play a crucial role in shaping modern marketing strategies.

Pricing Strategies: Psychological pricing, discounts, and value-based pricing influence consumer perceptions.

Digital and Social Media Marketing: Leveraging platforms such as Instagram, Facebook, to engage consumers through personalized content.

2. Literature Review

A comprehensive review of existing literature provides insight into the evolving relationship between marketing and consumer behavior. Research studies highlight various aspects of consumer decision-making, marketing effectiveness, and emerging trends.

Consumer Decision-Making Theories: Previous research, including studies on Maslow's Hierarchy of Needs and the Theory of Planned Behavior, emphasizes the psychological and social factors affecting purchasing behavior. More recent studies focus on behavioral economics and cognitive biases in decision-making, such as loss aversion and the anchoring effect.

Marketing Strategies and Consumer Response: Studies suggest that branding, digital marketing, and personalized advertising significantly influence consumer engagement and purchasing patterns. Content marketing, influencer marketing, and interactive advertising are also increasingly shaping consumer behavior.

Impact of Technology on Consumer Behavior: Literature on artificial intelligence, big data, and e-commerce platforms underscores how businesses utilize digital tools to predict and shape consumer choices. Research also highlights how augmented reality (AR) and virtual reality (VR) are enhancing online shopping experiences.

Ethical and Sustainable Consumption: Research highlights the growing importance of corporate social responsibility and sustainability in consumer purchasing decisions. Studies indicate that consumers, particularly millennials and Gen Z, prefer brands that align with their ethical and environmental values.

Neuromarketing and Consumer Psychology: Emerging research in neuromarketing explores how brain responses to advertisements and branding affect purchasing decisions. Studies utilizing functional MRI (fMRI) and electroencephalography (EEG) provide insights into subconscious consumer preferences.

Theoretical Framework of Consumer Behavior
Consumer behavior is influenced by various factors categorized into psychological, social, personal, and cultural dimensions. Key theories include:

Maslow's Hierarchy of Needs: Explains how consumer motivations evolve from basic needs to self-actualization.

Theory of Planned Behavior: Highlights the role of attitudes, social norms, and perceived control in consumer decision-making.

Consumer Decision-Making Process: A five-stage model (problem recognition, information search, evaluation of alternatives, purchase decision, and post-purchase behavior) that explains purchasing behavior.

Emerging Trends in Marketing and Consumer Behavior

Artificial Intelligence and Big Data: AI-driven algorithms predict consumer preferences, enabling personalized marketing campaigns.

Sustainability and Ethical Consumerism: Increasing consumer preference for environmentally and socially responsible brands.

Omnichannel Shopping Experience: Seamless integration of online and offline shopping experiences enhances convenience and brand loyalty.

Neuromarketing: Studying brain responses to marketing stimuli to optimize advertising effectiveness.

Influencer and Experience-Based Marketing: Consumers are increasingly influenced by peer reviews, social media influencers, and immersive brand experiences.

Blockchain and Data Privacy: As consumers become more concerned about data privacy, blockchain technology is emerging as a tool for transparent and secure transactions.

3. Case Study and Empirical evidence

This section presents real-world case studies demonstrating successful marketing strategies and their impact on consumer behavior. Examples include:

Coca-Cola's Emotional Branding: How storytelling and emotional marketing drive brand loyalty.

Amazon's Personalization Strategy: Use of AI and data analytics to enhance customer experience and conversion rates.

Nike's Social Responsibility Campaigns: How sustainability-focused initiatives attract conscious consumers.

4. Conclusion

Understanding consumer behavior is essential for businesses for developing effective marketing strategies. Companies must leverage digital tools, behavioral insights, and ethical considerations to align with evolving consumer expectations. Future research should focus on the role of emerging technologies such as AI, blockchain, and virtual reality in shaping marketing strategies and consumer interactions.

Consumer preferences can be easily influenced by trends and different factors. To cope up with the rapidly changing preferences of the consumer, businesses need to adapt and implement strategies accordingly. For a successful business, businesses also need to ensure customer satisfaction.

Moreover, emerging trends such as sustainability, influencer marketing, and ethical consumerism highlight the growing importance of value-driven purchasing decisions. Companies that prioritize consumer insights and leverage innovative marketing techniques are better positioned to build brand loyalty, drive sales, and sustain long-term success.

In the future, businesses must remain adaptable, integrating new technologies like AI, blockchain, and neuromarketing to anticipate and meet evolving consumer demands. By maintaining a customer-centric approach and embracing data-driven marketing, brands can ensure relevance and competitiveness in an ever-changing marketplace.

Women and Digital Payment Adoption in Mumbai: A Post-COVID-19 Revitalization Perspective

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Abstract:

This paper highlights the revitalization of digital payment system after COVID-19 pandemic with special reference to women. Digital payments play a vital role and have many advantages over cash, such as easy transaction, security and transparency, 24 x 7 service & contactless payment. After the effect of COVID-19, the economy is started using more on digital payment system compared to pre COVID-19 period. India's financial system is developing continuously with the help of imminent technologies to make online transactions simple, easier, safer, available and more personalized for customers. The contribution of this study is an attempt to comparatively analyze the transformation from cash payments to digital payments and how COVID-19 outbreak has made its contribution towards the contactless digital payments. The problems faced while using digital payment were mostly about fear of fraud, hidden charges and the lack of proper internet access. For the study researcher has selected the women respondents who uses various digital payment modes to do their financial transactions. The area selected for the study is in and around Mumbai city. The primary data of this study was collected by circulating a Google form to the general public and the sample size is 50. This paper focus on the hike in digital payment from last three years

Keywords: Digital payment system, Covid-19, Women, Technologies

Introduction

Digital payments are transactions that take place via online modes, with no physical exchange of money involved. This means the payer and the payee, use electronic mediums to exchange money. The Government of India has been initiating several measures to encourage digital payments in the country. As part of the

‘Digital India’ campaign, the government has an ambition to create a ‘digitally empowered’ economy.

In India's journey towards becoming a cashless economy, COVID-19 played an important role. Before COVID-19 pandemic, people prefer to use digital payment systems, but after the pandemic effect the number of users has increased immensely because of concern of touching the cash.

There are many digital payment modes which include Debit/ Credit cards, UPI (Google pay, Paytm etc.), NEFT/RTGS, IMPS, different banking apps, Internet banking, Mobile banking and many more. People use these different types of digital payment modes mainly because of ease and comfort, speedy transactions, no need of going to bank branches, no risk of losing cash, 24x7 service, low transaction costs. The considerable problems of digital payment systems are highlighted risk of fraud, Technical problems, Service fees and other additional costs, network issues, lack of knowledge, concern about data leakage, complicated instructions, False identity and so on. Different types of digital payments are offered such as:

1. **Banking Cards:** Banking cards are the most generally used digital payment system in India. It offers convenience as well as security to the users. Banking cards (debit and credit cards) can be used for a various digital transaction like Point of Sales. terminals, online transactions etc.
2. **AEPS (Aadhaar enabled payment system):** AEPS can be used for banking transactions such as balance enquiries, cash withdrawal/deposit, Aadhaar to Aadhaar fund transfers. All such transactions are carried out through a banking correspondent which is established on Aadhaar verification.
3. **UPI (Unified Payment Interface):** UPI is where the user holding a bank account can transfer money to any other bank account using UPI based app. UPI enabled payments ensure throughout the day and all 365 days in a year.
4. **Mobile Wallets:** Mobile wallets users can add money to their digital wallet using debit or credit cards and use the money added in the wallet to perform digital transactions. Some of the popular mobile wallets are PayTM, Mobikwik, PhonePe, etc.
5. **Internet Banking:** Internet banking is the process of performing banking transactions from any place using a mobile phone/laptop/ desktop and an active internet connection. Internet banking services can be availed 24 x 7 and all 365 days in a year, which makes it a popular for performing digital transactions.

6. Mobile Banking: Mobile banking is a service provided by the banks through their mobile software applications in a smartphone for carry out transactions digitally.

Review of Literature

SUDHA. G, SORNAGANESH. V, THANGAJESU SATISH. M, CHELLAMA. A.V1,
(August 2020).

This paper focus on the different digital payment modes used in the event of a pandemic based on primary data by gathering from 220 respondents and the Digital India initiative is an Indian government flagship program whose mission is to turn India into a digital society. In this modern world, all transactions can be made by cards, smart phone apps and other electronic modes. The Reserve Bank of India last year announced that it expects to raise digital transactions to about 15% of gross domestic product by 2021. The government is looking for a billion digital transactions per day as the flourish mobile industry in the world.

Dr NIRMALA AND PARVATHI S2 (February 2021)

This Study focus on the significance of digital payments during pandemic, different modes of digital payment , the growth of digital payment from last three years. In the current situation digital payments play an important role and has many advantages over cash such as security and transparency, easy transaction. Banking sector play a vital role in digital payment by offering digital instruments such as debit/ credit cards, mobile banking, internet banking, mobile wallets etc. in this pandemic situation. The pandemic could drive the world faster towards digital payments. Payment systems have proven that they are efficient and viable and continue to command a high degree of confidence in the general population

Ms. AKILANDESHWARI AND Ms. PREMALATHA3 (May 2021)

The paper studied about usage of digital payment system during COVID 19 and evaluate the factors influencing use of digital payment during COVID-19 pandemic. According to the developing environment, trend and time, people have started using digital payments during the virus spread and the majority extend to use it even after the virus is controlled. Digital paymentSystem has played an important role in maintaining social distance and contactless payment.

According to the results, it is concluded that the approach of respondents towards adoption of digital payment method during COVID 19 is fair and effective

Scope of the Study

The study would be undertaken to evaluate the impact of COVID-19 on digital payment system. It would also be helpful to understand various modes of digital payment. This study tries to discover threats in digital payment system.

Research Methodology

The research is constructed on primary data and secondary data.

Primary Data: The primary data for this study is collected by structured questionnaire among the general public (women) to know the effects of the Covid-19 pandemic on digital payments. The study is conducted in Mumbai City, the sample size chosen for the study is 50 women respondents

Secondary Data: The secondary data has been collected from various sources like research article, bulletins of RBI and Authenticated Websites.

Research Objective

1. To know various modes of online payment.
2. To explore the usages of digital payments
3. To analyse the drawbacks of digital payment systems
4. To highlight the changes which has come over in the payment system due to Covid-19 outbreak.

Area of the Study

The study is undertaken in and around the Mumbai city.

Research Approach

The questionnaire method of survey is used for collecting primary data from women belonging to Mumbai region. Researcher appealed all respondents to fill the questionnaire, by themselves. It contained structured questions which are very easy to understand.

Sample Technique

A convenient Probability sampling method of 50 women belonging to Mumbai city shared their information regarding the study. They were requested to complete the questionnaire on voluntary basis. The study was done in December 2022

Data Usage

The analyses and interpretation are done on the basis of primary data. However, for conclusion and recommendation both primary and secondary data is used along with the verbal knowledge and information obtained from respondents. The data collected from these sources were analysed using various graphs and charts

Data Analysis and Interpretation

Table 1; Demographic profile of the respondents

| PARTICULARS | NO OF RESPONDENTS | PERCENTAGES |
|----------------------|-------------------|-------------|
| 1. Gender | | |
| Female | 50 | 100% |
| Total | 50 | 100% |
| 2. Age | | |
| Below 20 years | 11 | 22% |
| 20-35 years | 21 | 42% |
| 35-50 years | 13 | 26% |
| Above 50 years | 5 | 10% |
| Total | 50 | 100% |
| 3. Occupation | | |
| Student | 15 | 30% |
| Salaried | 17 | 34% |
| Professional | 6 | 12% |
| Self-employed | 5 | 10% |
| Other | 7 | 14% |
| Total | 50 | 100% |

The study shows that, all the 100% of the respondents were women customers who uses digital payment systems. 22% of the respondents belongs to less-than 20 years of age, 42% of the

respondents belongs to 20- 35 years of age, 26% of the respondents belongs to 35-50 years of age and 10% of the respondents were in the age of above 50 years. 30% of the respondents were student, 34% of the respondents belongs to salaried women, 12% of the respondents belongs to professional, 10% of the respondents were self-employed and 14% of the respondents belongs to other category i.e. retired or home makers.

Survey Questionnaire

Table 2: Duration of using digital payment system

| PARTICULARS | NO OF RESPONDENTS | PERCENTAGES |
|-------------------|-------------------|-------------|
| Less than 1 year | 12 | 24% |
| 1-3 years | 16 | 32% |
| 3-5 years | 13 | 26% |
| More than 5 years | 9 | 18% |
| Total | 50 | 100% |

Table no. 2 shows that, 24% of the respondents were using digital payments from less than 1 year, 32% of the respondents were using digital payments from 1-3 years, 26% of the respondents were using it from 3-5 years and 18% of the respondents were using from more than 5 years. This shows that use of digital payment increase after COVID 19 majority of the customers started using online mode in last 3 years.

Table 3 Digital payment methods used by the customers.

| PARTICULARS | NO OF RESPONDENTS | PERCENTAGES |
|-----------------------------------|-------------------|-------------|
| ATM/ Debit card / Credit card | 33 | 66% |
| Internet banking | 12 | 24% |
| Mobile banking | 15 | 30% |
| Google pay/ Paytm/ Phone pay /UPI | 37 | 74% |

Table 3 shows that, 33 respondents were using ATM/ Debit card/ Credit card for online payment, 12 respondents were using Internet banking, 15 respondents were using Mobile

banking and 37 respondents were using Google pay/ Paytm/ Phone pay/ UPI. This shows that Google pay/Paytm/ Phone pay/ UPI users are more compared to other methods of payment systems.

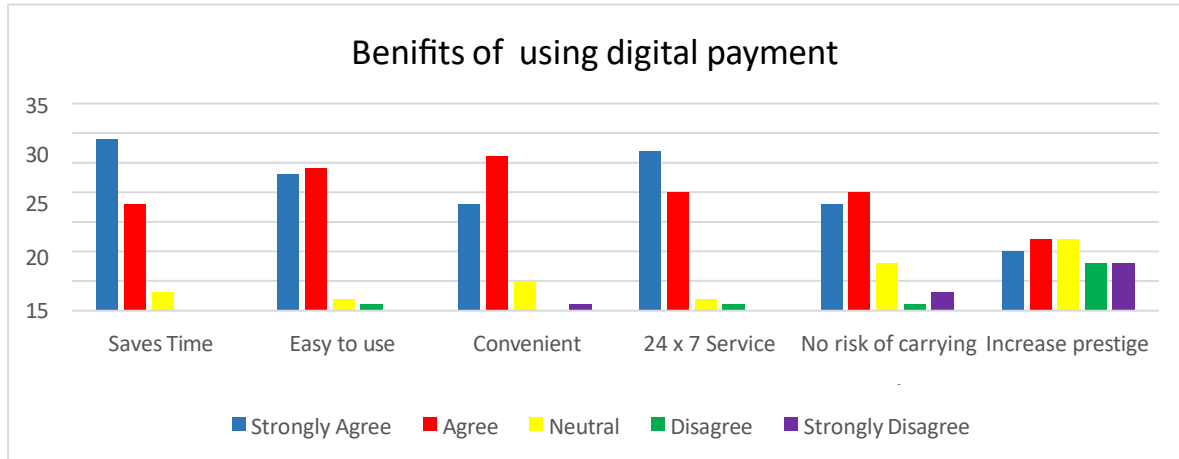
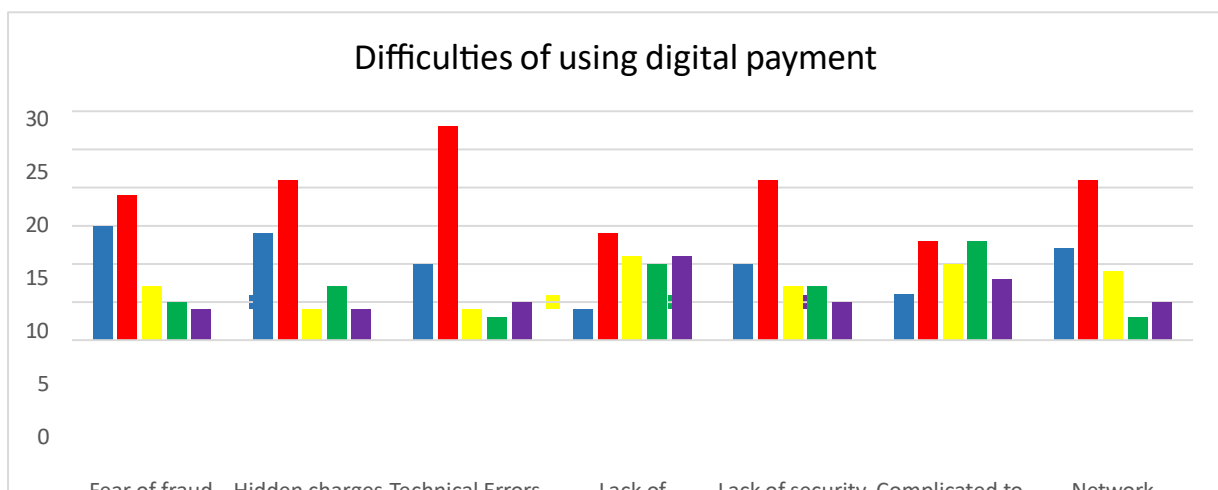


Table 4 Benefits of using Digital Payment System

Maximum numbers of people are being agreed with the advantage of using digital payments system. Only the few people are differing with the benefits.

Table 5 Difficulties of using digital payment



Maximum number of people being agree with the difficulties faced by the customers from digitalpayment.

Table 6 want to continue using digital payment systems

| PARTICULARS | NO OF RESPONDENTS | PERCENTAGES |
|-------------|-------------------|-------------|
| Yes | 44 | 88% |

| | | |
|-------|----|-----|
| No | 0 | 0 |
| Maybe | 6 | 12% |
| Total | 50 | 100 |

After looking at benefits and difficulties people still want to use digital payment system.

88% of people want to use digital payment methods where 12% people still thinking about use of digital payment methods.

Secondary Research

Digital payments are on the hike in India. As in most other areas of the world, digital purchases have hit a record high in 2020-21 in the country with nearly 1.5 billion people. As stated for the first time by the local outlet, all channels from the unified payment interface (UPI) to the Andhra- Enabled Payment System (AEPS) registered dramatic growth. As the COVID-19 lockdown and ensuing restrictions pushed more and more people to opt for digital transactions,



From the above diagram it is observed there is huge increased in the volume of digital transaction in India after COVID-19 pandemic.

Conclusion

- It is concluded that there was shifting of preference of payment from cash payment to digital payment.
- Though people have been facing few issues and might have a problem in trusting the digital payments but still they definitely will switch to digitalized payments. It was found that major reason for not using digital payments was due to lack of internet access and lack of financial bank accounts.

- It is concluded that majority of women using phonepe, paytm e-wallet are in age group of 24-45 years, and are using it for money transfer, bill payments and others.
- COVID-19 has definitely made us take a step forward towards digitalization due to people not wanting to use cash as much in any of the payment methods.

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Old Car Price Prediction using Machine Learning (Old car Insights)

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Abstract : The pricing of used cars is shaped by multiple factors, including vehicle age, mileage, brand reputation, and overall condition, making it a complex and ever-evolving market. This research examines various machine learning models to predict the prices of older vehicles based on a broad set of features. Our approach incorporates both traditional linear regression and advanced ensemble techniques, such as Random Forest and Gradient Boosting, to effectively capture both linear and nonlinear price relationships. Using a dataset compiled from multiple online used car listings, our experiments demonstrate that ensemble models surpass linear regression in predictive accuracy, achieving lower error rates and greater explanatory power. This underscores the need for sophisticated modeling approaches to manage the variability inherent in real-world data. Additionally, we discuss critical challenges associated with data preprocessing and feature engineering when working with heterogeneous datasets, emphasizing the role of thorough data cleaning, normalization, and feature selection in enhancing model performance. Moreover, our study highlights the importance of integrating domain-specific knowledge to improve prediction accuracy and model interpretability, allowing stakeholders to gain deeper insights into the factors influencing price variations. This research not only provides a detailed assessment of predictive modeling techniques but also lays the groundwork for future studies incorporating additional factors such as maintenance history, regional economic conditions, and evolving consumer preferences to refine price estimations. Ultimately, our findings highlight the growing significance of machine learning in automotive pricing strategies, offering valuable benefits to buyers, sellers, and industry professionals while identifying opportunities for further advancements in predictive modelling.

Keywords: Machine Learning, Regression, Feature Engineering, Python.

1. Introduction

The evolution of commodity transactions has seen significant transformations over time, transitioning from a barter system to a monetary framework that enables more efficient exchanges. This change has not only enhanced trade but has also redefined the way goods are resold, with the automotive industry playing a central role in these developments. Today, the resale of automobiles primarily occurs through both offline and online transactions, each presenting its unique advantages and challenges. Offline sales often involve intermediaries, such as dealerships or brokers, who may introduce biases or engage in unfair practices, potentially compromising the transparency and fairness of the process. In contrast, online platforms aim to empower consumers by providing access to a wide range of information, including price assessments based on factors such as vehicle condition, market trends, and

historical sales data. However, despite the improvements in online platforms, both consumers and sellers still struggle to accurately assess the resale value of a vehicle.[1]

Numerous factors affect the resale value of a vehicle, including kilometers driven, engine power, registration year, fuel type, and overall condition. As the automotive industry advances, especially with the rise of electric vehicles (EVs) and autonomous driving technologies, these factors are continuously evolving. For instance, the valuation of electric vehicles is influenced by different considerations than those applied to traditional internal combustion engine vehicles, such as battery life, charging infrastructure, and environmental impact. Moreover, the increasing emphasis on vehicle safety and efficiency introduces additional factors that must be integrated into the valuation process. Despite these advancements, accurately determining the value of a diverse range of vehicles remains a challenge, as many existing platforms fail to provide comprehensive data that fully accounts for the complexities of the modern automotive market.[2]

This study addresses these challenges by exploring how advanced machine learning algorithms can be utilized to generate accurate, personalized price predictions in an ever-evolving market. By leveraging extensive datasets and incorporating numerous data points, machine learning models are capable of capturing a wider variety of vehicle characteristics and market dynamics than traditional methods. Our approach aims to cover a broad spectrum of vehicles, from fuel-efficient daily drivers to high-performance sports cars, ensuring the model is adaptable to various market segments. By analyzing historical data, market fluctuations, and consumer behavior, our model will provide both buyers and sellers with a comprehensive, data-driven pricing index.[3]

With reliable and accurate pricing information, consumers will be better equipped to negotiate, while sellers can adjust their strategies to align with current market conditions. Additionally, the model will identify inconsistencies and anomalies in existing data, promoting greater transparency in transactions and reducing the risk of unfair practices or misinformation. Ultimately, incorporating machine learning into automotive pricing will streamline business operations, lower transaction costs, and foster more equitable and efficient exchanges. This study contributes to the growing body of research on machine learning applications in pricing and offers new directions for future research in the automotive industry, where technology and data analytics are transforming traditional valuation techniques. The ultimate aim is to provide a tool that benefits all stakeholders by improving efficiency and transparency within the used car market.[4]

2. Problem Statement

Accurately assessing the value of a used car can be difficult, as pricing is influenced by factors such as age, mileage, and brand reputation. Conventional pricing methods often fall short, leading to inconsistent estimates. To address this challenge, our research leverages machine learning to develop a model that predicts car prices with greater accuracy. This data-driven approach equips buyers with reliable insights for informed decision-making while enabling sellers to price their vehicles competitively and fairly.

3. Literature of Review

Alamaniotis et al., (2015) [1] Genetic Optimized Regression of Relevance Vector Machines for Energy Pricing Signal Forecasting in Smart Grids: Although this research primarily focuses on energy pricing, it introduces genetic optimization regression methods that can be adapted for vehicle price prediction. These techniques may provide valuable insights into improving pricing models through advanced optimization approaches.

Kalaiselvi et al., (2017) [2] Retail Price Analytics Using Backpropagation Neural Networks and Sentiment Analysis: This study investigates retail price analytics by employing neural networks and sentiment analysis. The findings offer important insights into consumer behavior and market trends, which are applicable to vehicle price forecasting.

Chen et al., (2018) [3] Exploiting Spatiotemporal Correlations with Multiple 3D Convolutional Neural Networks for Citywide Vehicle Flow Prediction: This research utilizes convolutional neural networks to predict vehicle flow, showcasing the potential of deep learning techniques for analyzing vehicle-related data. The insights provided could enhance car price prediction models through improved data analysis methods.

Chitsaz et al., (2018) [4] Energy Price Forecasting for Operational Scheduling of Behind-the-Meter Storage Systems: This paper focuses on energy price forecasting and introduces predictive modeling techniques that can be adapted for forecasting vehicle prices by understanding market fluctuations.

Gajera et al., (2021) [5] Old Car Price Prediction with Machine Learning: This study presents a machine learning approach to predict the prices of used cars. The research analyzes various factors affecting automobile prices and utilizes different algorithms to achieve accurate predictions, demonstrating the effectiveness of machine learning in the automotive market.

Pasagic et al., (2021) [6] Price Prediction and Classification of Used Vehicles Using Supervised Machine Learning: This study explores the use of supervised machine learning techniques for classifying and predicting the prices of used cars. The authors emphasize the importance of feature selection and algorithm choice to enhance prediction accuracy.

Gegic et al., (2021) [7] Car Price Prediction Using ML Techniques: This research investigates several machine learning techniques for car price prediction. By comparing the performance of different algorithms, the study offers insights into which methods yield the best results for estimating vehicle prices.

Ganesh et al., (2021) [8] Used Car Price Prediction Using Supervised Learning Techniques: This paper focuses on the application of supervised learning techniques to predict used car prices. The authors examine the impact of various features on price determination and validate their models using real-world data.

Bharambe et al., (2021) [9] Used Car Price Prediction Using Various Machine Learning Algorithms: This research compares the performance of multiple machine learning algorithms for predicting used car prices. The findings provide valuable insights into which algorithms are most effective for this application.

Al-Turjman et al., (2022) [10] Vehicle Price Classification and Prediction Using Machine Learning: This study explores the classification and prediction of vehicle prices using machine learning. The authors discuss the effectiveness of various algorithms and highlight key features that influence vehicle valuation.

Bukvic et al., (2022) [11] Price Prediction and Classification of Used Cars Using Supervised Machine Learning: Revisiting supervised machine learning, this paper highlights the importance of dataset quality and algorithm performance in achieving accurate and reliable predictions for used car prices.

Samruddhi et al., (2022) [12] Used Car Price Prediction Using K-Nearest Neighbor Based Model: This research focuses on the use of a K-Nearest Neighbor (KNN) model for predicting used car prices. The authors evaluate the effectiveness of KNN compared to other models, contributing to the understanding of its potential for car price estimation.

Shaprapawad et al., (2023) [13] Automobile Price Prediction: An Application of Machine Learning: This study presents a practical application of machine learning techniques for predicting vehicle prices. The authors emphasize the importance of data preprocessing and feature engineering to improve the accuracy of predictions.

The findings from the literature review are summarized in Table 1, as shown below.

| Author | Key Methods/Algorithms | Findings/Contributions |
|----------------------------------|---|--|
| Alamaniotis et al. (2015) | Genetic Regression, Relevance Vector Machines | Explores advanced regression methods that are applicable to vehicle price prediction. |
| Chen et al. (2016) | Parallel Processing, Big Data Applications | Demonstrates the flexibility of prediction algorithms in adapting to vehicle pricing challenges. |
| Kalaiselvi et al. (2017) | Backpropagation Neural Networks, Sentiment Analysis | Investigates the impact of sentiment analysis on understanding consumer behavior for pricing predictions. |
| Chen et al. (2018) | 3D Spatiotemporal Correlations CNNs, | Highlights the effectiveness of 3D convolutional neural networks in analyzing complex vehicle data. |
| Chitsaz et al. (2018) | Forecasting Techniques | Introduces forecasting methodologies for market dynamics, which can be applied to vehicle price predictions. |

| | | |
|---|------------------------------------|--|
| Prashant Gajera et al. (2021) | Machine Learning Algorithms | Addresses the complexities of accurately predicting used vehicle prices using machine learning techniques. |
| Enis Gegic et al. (2021) | Regression Models | Emphasizes the role of high-quality data in improving the performance of regression models for price prediction. |
| Pallavi Bharambe et al. (2021) | Various ML Algorithms | Identifies which machine learning algorithms yield the best performance for predicting vehicle prices, enhancing decision-making for buyers and sellers. |
| Samruddhi & Kumar (2021) | K-Nearest Neighbor Algorithm | Analyzes the effectiveness of the K-Nearest Neighbor algorithm in accurately predicting vehicle prices. |
| Fadi Al-Turjman et al. (2022) | ML Framework with Diverse Features | Evaluates the performance of various machine learning algorithms and a comprehensive framework to improve price estimation. |
| Lucija Bukvic et al. (2022) | Supervised ML, Feature Selection | Focuses on the role of feature selection in achieving reliable and accurate vehicle price predictions using supervised learning techniques. |
| Snehit Shaprapawad et al. (2023) | Practical ML Implementations | Highlights the real-world applications and the performance of machine learning models in vehicle price prediction scenarios. |

4. Proposed Methodology

The system follows a structured two-step approach to deliver accurate and reliable car price predictions:

- **Training Phase** – The model is trained using historical data, enabling it to identify trends and establish predictive relationships based on a selected algorithm.

- **Testing Phase** – Once trained, the model is tested with new input values to evaluate its accuracy. The quality of training and testing data plays a crucial role in ensuring dependable predictions.

To achieve the best results, various machine learning algorithms were analyzed and compared, with the most accurate and efficient one chosen for implementation.

4.1 Objectives

- Develop a robust and efficient model that predicts the resale value of used cars based on user-provided inputs.
- Improve prediction accuracy by leveraging advanced machine learning techniques.
- Design an intuitive and user-friendly interface that simplifies data entry and provides precise price estimates.

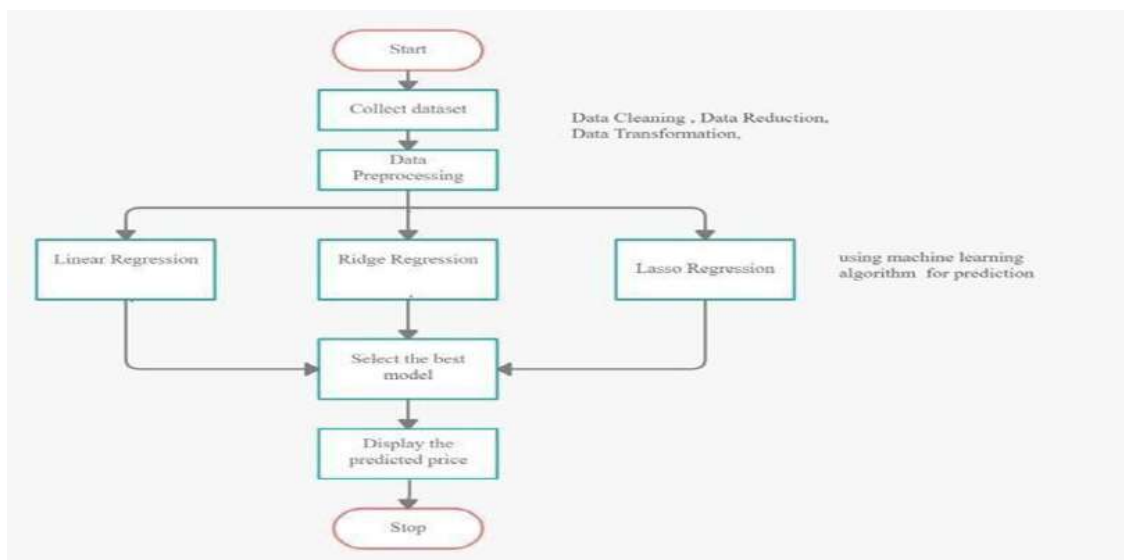


Fig – 1: Proposed System Flowchart

Linear Regression

Linear regression is a statistical technique used to identify relationships between continuous variables. It involves multiple independent variables and a single dependent variable, represented by the equation:

$$y = m_1X_1 + m_2X_2 + m_3X_3 + \dots + m_nX_n + b$$

Where:

- y is the dependent variable (target output).
- $X_1, X_2, X_3, \dots, X_n$ are the independent variables (input features).
- $m_1, m_2, m_3, \dots, m_n$ are the coefficients (slopes) representing the impact of each independent variable.
- b is the y-intercept, indicating the value of y when all independent variables are zero.

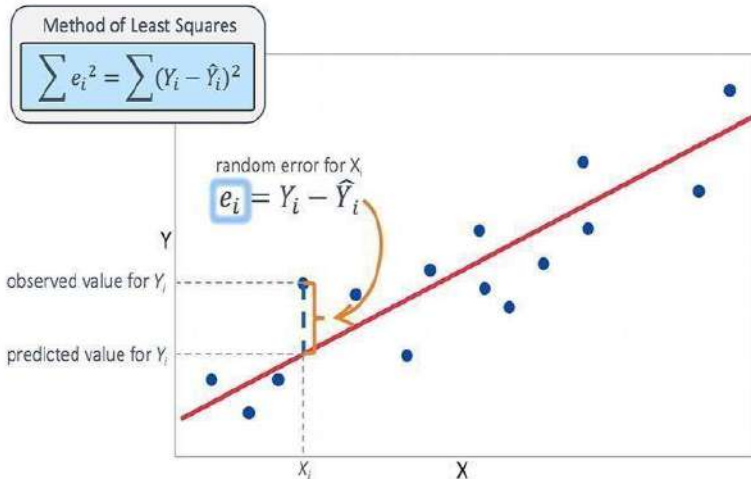


Fig-2: Linear Regression

Ridge Regression

Ridge regression is an advanced form of linear regression that includes regularization to prevent overfitting. It introduces a penalty term controlled by the parameter α , which helps reduce variance in the estimates, improving the model's generalization on new data. By adding this regularization term, Ridge regression ensures that the model remains stable even

when dealing with multicollinearity or complex datasets.

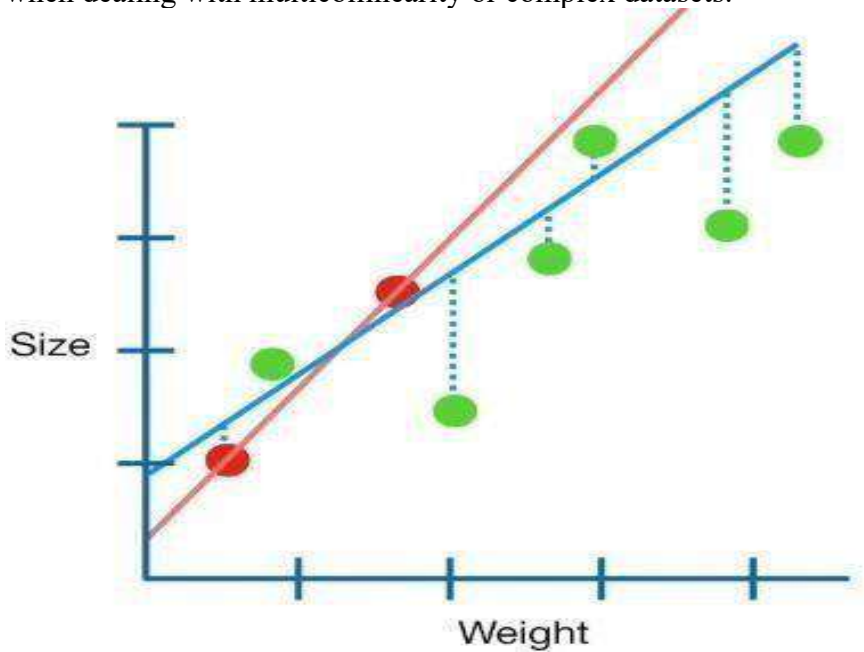


Fig –3 Ridge Regression

4.2 Overview of the Dataset

This research is based on a dataset obtained from CarDekho, a popular online platform for buying and selling automobiles. The dataset includes comprehensive details on 816 pre-owned cars, covering key aspects that play a significant role in determining their resale value.

Key Dataset Attributes

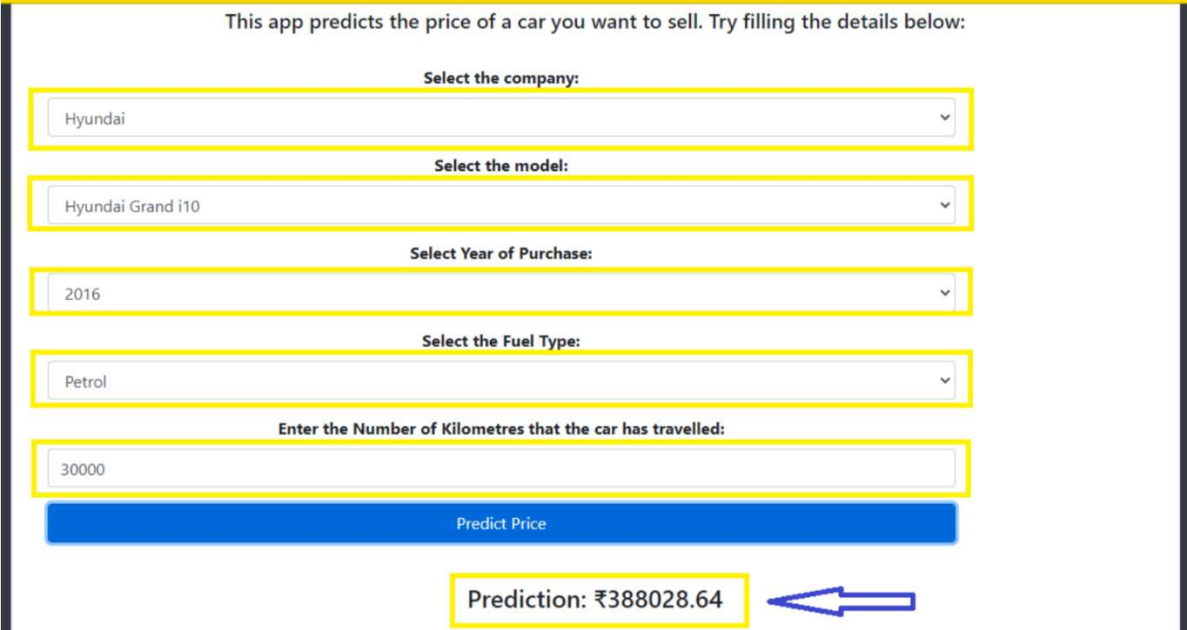
The dataset contains the following important features:

| Attribute | Description |
|--------------------|---|
| Model Name | The specific name of the car model (e.g., Hyundai Santro Xing, Ford EcoSport) |
| Manufacturer | The brand or company that produced the car (e.g., Hyundai, Ford, Mahindra) |
| Manufacturing Year | The year the vehicle was manufactured |
| Resale Price | The selling price of the used car (measured in INR) |

| | |
|-----------------|---|
| Distance Driven | The total number of kilometers the vehicle has been driven |
| Fuel Type | The type of fuel the vehicle operates on (Petrol, Diesel, or CNG) |

5. Result Analysis

We tested our car price prediction model using real-world data, and the results highlight its accuracy and dependability. As shown in the interface, the model estimates the resale value of a **2016 Hyundai Grand i10 (Petrol, 30,000 km driven)** at **₹388,028.64**. This showcases its ability to assess multiple factors and generate precise price predictions. The intuitive interface, featuring dropdown menus, ensures a seamless user experience by making data entry simple and efficient. The model's strong performance suggests that its machine learning algorithm effectively identifies patterns in vehicle attributes and market trends, providing reliable and insightful price evaluations.



This app predicts the price of a car you want to sell. Try filling the details below:

Select the company:
Hyundai

Select the model:
Hyundai Grand i10

Select Year of Purchase:
2016

Select the Fuel Type:
Petrol

Enter the Number of Kilometres that the car has travelled:
30000

Predict Price

Prediction: ₹388028.64

5.1 Techniques Used

Accurately estimating the resale value of a used car is a complex task, as multiple factors—such as mileage, age, and brand—affect pricing. This study applies **Linear Regression** and **Ridge Regression** to develop a more precise prediction model.

- **Linear Regression** – Establishes a straightforward link between a car's features and its price. However, it struggles with handling multicollinearity and fails to capture intricate pricing trends.
- **Ridge Regression** – A modified version of Linear Regression that includes a regularization term, reducing overfitting and improving prediction accuracy on new data.

5.2 Performance Comparison

To assess how well these models predict car prices, we used key performance indicators: **R² Score, Mean Absolute Error (MAE), and Root Mean Squared Error (RMSE).**

| Model | R ² Score | MAE (₹) | RMSE (₹) |
|-------------------|----------------------|---------|----------|
| Linear Regression | 0.72 | 45,800 | 68,200 |
| Ridge Regression | 0.76 | 42,300 | 64,500 |

6. Limitations

While machine learning offers a robust approach to predicting used vehicle prices, several challenges limit its accuracy and reliability:

1. **Data Gaps:** Missing details like accident history and maintenance records impact accuracy.
2. **Subjectivity:** Custom features and interior conditions are difficult to quantify.
3. **Market Instability:** Fluctuating trends, fuel costs, and regional demand affect predictions.
4. **Bias in Data:** Skewed datasets can lead to inaccurate pricing estimates.
5. **External Factors:** Economic changes and tax policies are often excluded.

7. Future Scope & Conclusion

In the future, this machine learning model can be integrated with online platforms to provide real-time price predictions. Enhancing the model's accuracy by incorporating extensive historical vehicle price data will be beneficial. Additionally, the development of an intuitive

Android application will facilitate user interaction. To further improve performance, we plan to design optimized deep learning architectures, implement adaptive learning rates, and focus on training with data clusters rather than the entire dataset.

The increasing cost of new vehicles, combined with financial constraints, has led to a rising global demand for used cars. This necessitates a reliable price prediction system capable of accurately evaluating pre-owned vehicle values based on various factors. The proposed model enhances price estimation accuracy, enabling both buyers and sellers to make well-informed decisions. This study analyzes the effectiveness of three machine learning algorithms—Linear Regression, Lasso Regression, and Ridge Regression—in predicting used car prices.

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Technological Advancements & Insurance Sector

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Abstract- Insurance Market is being swept up in the technological revolution. Innovation through digital technologies, platforms and infrastructures can provide entrepreneurial opportunities across all industries that can be reflected by new products, services and enhanced processes. This article will try to overview the benefits and opportunities of major technologies in insurance companies. Some of these include: big data analysis, data mining, the internet of things, cloud computing, artificial intelligence, blockchain etc., some of which have been discussed in this article. This article aims to analyse this digitization of the insurance market and how it has impacted the sector.

Index Terms- Technological change, insurance, customer satisfaction, digitalization, insurance companies

INTRODUCTION

The insurance industry is one of the most competitive businesses and it faces various challenges. These challenges are generally caused by changing the behavior and desires of the client or when organizations from outside the industry come into this sector. The insurance sector has slowly grasped and computerized huge portions due to modern competitors like insurtech companies entering the field.

Over the last two decades, rising internet usage and mobile phone penetration have resulted in the rapid growth of e-commerce and changed the way of communication and progression of business activities. The technological change led us to rethink, re-examine and re-imagine trade models for users' basic involvement as the clients moved to modern channels.

Innovation through digital technologies, platforms and infrastructures can provide entrepreneurial opportunities across all industries that can be reflected by new products, services and enhanced processes. This article will try to overview the benefits and opportunities of major technologies in insurance companies. Some of these include: applying big data analysis to better predict customer profitability, employing a data mining approach to detect periodicity underwriting cycles.

The term digital technologies is used to include the following technologies: big data, the internet of things, cloud computing, artificial intelligence, blockchain, some of which have been discussed in this article.

RESEARCH & FINDINGS

There is a large amount of data in the form of surveys, customer interactions, manual data entry, and direct communications that is used by the insurance companies.

Earlier all data collection was manual this consumed most of the agent's time. With time we now have tools that enable agencies to collect data more efficiently. These tools or technologies

data can be created and updated in real time, and insurance agents can collect data from mobile applications and other online sources automatically, saving both time and money.

The data delivered in this efficient manner would be of no use if it did not generate any useful information from the available data. The mentioned digital technologies help with the generation of insights from the collected data.

Big data:

Big data has no single definition due to its broad utilization; the term usually refers to a type of multidimensional dataset that are commonly attributed to 3Vs: volume, velocity, and variety. Volume refers to the size of data, while velocity is for the pace at which data is being generated. Variety is the diversity of data, which can be structured, semi-structured, or unstructured.

In the insurance market big data is used for the functionalities to collect, process and analyse large amounts of (customer) data. Big data analysis of the data can help with a better understanding of the customers due to the accessibility to the pool of information, which can refer to various interactions between insurer and customer, and simple surveys taken by the insurance companies asking about various desires of the customer from the company and the policies offered. This analytic approach converts big data to understandable results, e.g., explaining customers' buying decisions. Where conventional methods of analytics fail big data analytics allows a large number of correlated variables to be investigated.

Big data has various uses for the insurance industry. Big data is capable of improving the insurance product at its core as integrating the technology with the risk assessment process can bring improvement in how precise rate-making and underwriting can be. Continually increasing information/database about the customers allows insurance companies to differentiate several customer segments more precisely.

Big Data Analysis can hence help with customer retention, risk assessment, cost reductions, personalized services, and pricing.

IoT

Internet of Things or IoT refers to physical objects with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. IoT technology and its potential to reshape the way insurers assess, price, and limit risks is already quite promising.

Insurers mainly use IoT functionalities to aid with customer interaction this helps to extend the knowledge about the customer as an individual. IoT can help accelerate and simplify underwriting and claims processing. IoT technologies have enabled insurance companies to determine risks more precisely. For example, auto insurers have originally relied on indicators, such as the age, address, and creditworthiness of a driver, when setting premiums, their indicators are indirect. However now, data on driver behaviour and the use of vehicle, such as how fast the vehicle is driven and how often it is driven at night, are available and can be used as more direct indicators.

Beyond minimizing losses, IoT applications can potentially help insurers resolve the dilemma of how to improve the customer experience, and this can help with customer loyalty and retention, while still satisfying the market demand for lower pricing.

For insurers, efforts to capitalize IoT technology requires patience and long-term investments considering the fact that insurers would need to overcome the privacy concerns that can hinder consumers' willingness to make available the data on which the IoT runs.

Artificial intelligence

Artificial intelligence (AI) can be defined as intelligence demonstrated by machines that enables them to execute functions associated with the human mind, e.g., learning, problem-solving and reasoning.

Implementing and integrating the algorithms into existing products and processes can help increase their effectiveness and efficiency. Processing the data gathered by big data analysis with artificial intelligence converts the available information into a commodity for insurance companies. Like big data, artificial intelligence can also be used for insurance rate-making and underwriting. In detecting fraudulent claims AI can improve its precision by incorporating stems like image recognition. AI is now also incorporated in customer interactions as robo-advisors and chatbots i.e., providing automated, interactive, and intelligent advisory to customers. AI models have unlocked capabilities that enable them to analyze client conversations, automate notetaking, augmentation with structured information, and adapt to conversations in real time. It can also aid with the process to streamline document collection for data calls, considerably reduce the workload of the professionals, and this will provide more effective time usage. The insurance sector is based on risk and reward estimation, and today many insurance companies do this with predictive analytics. Predictive analytics receives large amounts of data that are collected by insurers and used to accurately calculate the risk.

As these models work on self-learning technology it does require initial training time to provide efficient and intelligent answers to most customer questions.

AI can do tasks faster and the process is more cost-effective than human employees doing the same tasks by training models with historical data and using them to automate certain processes. AI has the potential to support underwriters by identifying essential documents and extracting crucial data for the insurance market, hence freeing the employees to focus on higher-value tasks.

There are some concerns regarding sharing sensitive information, like client data or proprietary company knowledge, with machine learning models, along with uncertainties surrounding copyright. The regulatory policies are evolving to keep pace with these developments. Hence, initial experiments for these models usually prioritise the use of public data or internal data with minimal sensitivity.

Cloud Computing

Cloud computing is the use of comprehensive digital capabilities that are delivered via the internet for organizations to operate, innovate, and serve customers. The cloud computing service providers offer external computing and storage capacities enabling flexible access to pooled computing resources like networks, servers, storage capacities, or applications.

Cloud computing resources promote a decline in management costs with the help of on-demand payment schemes. Since the required capacities can be rapidly scaled with cloud computing it allows insurers to increase their own flexibility as well as efficiency. For example, the IaaS model (one of the service delivery models of cloud computing) involves renting storage capacities and computing power this allows insurers to reduce their own hardware capacities, which are required to be sufficient even at peak times. Such outsourcing enables insurance companies to save hardware and software costs along with reduced expenses with respect to installation and maintenance.

Cloud computing makes data available irrespective of time and location, this is especially relevant to the timely processing of data and aids for a standardized IT infrastructure.

There are many insurers who are still reluctant to move away from their legacy systems, one of the reasons being that these systems are often expensive to maintain and upgrade. Another is data security, since insurance companies store a great deal of sensitive data, there needs to be a surety that this data is kept secure when stored in the cloud.

CONCLUSION

The insurance sector has evolved and has seen overall growth due to technological advancements. It has not only added value to the industry but also directs its future to some extent. Inventions and technology have their effects from influencing underwriting decisions to helping streamline business processes. The use of mobile devices, the Internet, and other technical applications has played an important role in a number of ways. It has helped companies to conduct market research, market penetration, business promotion, and market development and has also provided help in understanding of after-sales service, and customer satisfaction.

Insurance companies use the data sources to be competitive in the industry. The companies manage their business-critical data centrally using platform(s) that they created themselves, or by using working with third-party providers. These platforms utilise the mentioned digital technologies. Insurance companies can hence generate actionable insights that can help identify fraud, prevent damage leaks, and identify opportunities for passing on or cross-selling additional products using these platforms. The companies can decrease claims costs and expenses, through technologies such as automated claims handling, profitable underwriting with enhanced data usage, and more effective fraud detection. Moreover, insurers can enhance customer experience management along with improving customer satisfaction and customer retention.

In contrast to other industries where digitalization has effects on nearly everything but the product, for insurance companies digitalization affects the core product. For example, insurers can employ, big data to integrate customer-centricity into their product strategy and thereby innovate their services.

However, insurance companies are challenged by the risk of delayed reactions to technological developments and the initial implementation costs. The major challenges are regarding data privacy and data security of insured people.

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Financial Literacy and The Role of Media: How News Coverage Affects Investment Decisions In India

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Abstract: Financial literacy is a critical determinant of informed investment decisions, particularly in emerging economies like India, where market dynamics are complex and rapidly evolving. Despite its importance, many investors depend excessively on financial news media for guidance, often leading to cognitive biases, herd behavior, and suboptimal financial choices. This study investigates the extent to which financial news coverage shapes investor behavior, with a focus on the role of media bias, sensationalism, and selective reporting in influencing decision-making. Through a comprehensive analysis of secondary data, including market trends, investor surveys, and media content, the research identifies key patterns in how investors interpret and act upon financial news. The findings reveal that while media serves as a primary information source, its framing and tone can distort perceptions, amplify market volatility, and encourage short-term speculation over long-term financial planning. The study underscores the need for enhanced financial education to mitigate media-induced biases and promote rational investment strategies. Additionally, it highlights the importance of ethical financial journalism and regulatory measures to ensure balanced reporting. The implications of this research extend to investor awareness programs, media accountability, and policy interventions aimed at fostering a more stable and informed investment environment in India.

Keywords: Financial literacy, Media influence, Investment behavior, News coverage, Behavioral finance, India.

Introduction

Financial Literacy and Investment Decisions in India

Financial literacy, defined as the ability to understand and apply key financial concepts, is a critical determinant of sound investment decisions. In India, where a large segment of the population lacks formal financial education, many investors depend on news media for market insights and investment guidance. The proliferation of digital media and financial journalism has significantly amplified the influence of news coverage on investor behavior. While media serves as an important source of financial information, it can also distort perceptions through sensationalism, selective reporting, and inherent biases.

The Dual Role of Media in Shaping Investor Behavior

The problem arises when investors react impulsively to financial news without evaluating its credibility or long-term implications. Historical market trends indicate that stock prices often fluctuate due to speculative media narratives rather than fundamental economic indicators. This phenomenon raises critical concerns about media responsibility and the urgent need for enhanced financial literacy to counteract irrational investment behavior. The rise of social media, algorithmic news feeds, and unregulated financial influencers has further complicated the landscape, as retail investors increasingly rely on fragmented and often misleading information.

Research Objectives and Scope

This study examines how financial news coverage influences investment decisions in India, assessing whether media acts as an educational tool or a catalyst for behavioral biases. It also investigates the growing impact of digital platforms—such as online financial portals, YouTube analysts, and influencers—on retail investors. By analyzing these dynamics, the research aims to highlight the importance of financial literacy in mitigating media-induced distortions and fostering rational decision-making. Additionally, the study explores policy implications for financial education and media regulation to promote a more stable and informed investment environment.

Related Work

Existing Research on Financial Literacy and Media Influence

Prior studies have extensively examined the relationship between financial literacy, media influence, and investment behavior. Research indicates that financially literate investors are less susceptible to media-driven biases and demonstrate better long-term decision-making. For instance, studies by Lusardi and Mitchell (2014) establish a strong correlation between financial knowledge and prudent investment choices, independent of external information sources.

Media Sensationalism and Behavioral Biases

Agarwal et al. (2019) conducted a comparative analysis of digital media's impact on retail investors, revealing that exaggerated financial news often leads to disproportionate market reactions. Similarly, Gupta and Sharma (2021) emphasized that financial education acts as a buffer against sensationalist reporting, reducing impulsive trading behaviors. Behavioral finance theories further explain how cognitive biases—such as overreaction, confirmation bias, and herd mentality—are amplified by media narratives, contributing to market inefficiencies.

Synthesis of Key Findings

Table 1. Comparison of Previous Research on Financial Literacy and Media Influence

| Study | Focus on Financial Literacy | Analysis of Media Bias | Behavioral Finance Perspective | Indian Market Context |
|-------------------------------|-----------------------------|------------------------|--------------------------------|-----------------------|
| Lusardi & Mitchell (2014) [1] | Yes | No | No | No |
| Agarwal et al. (2019) [2] | No | Yes | No | Yes |
| Gupta & Sharma (2021) [3] | Yes | Yes | No | Yes |
| This Work | Yes | Yes | Yes | Yes |

Key Parameters Compared:

1. **Focus on Financial Literacy** – Whether the study examines financial literacy's role in investment decisions.

2. **Analysis of Media Bias** – Whether the research investigates media sensationalism or biased reporting.
3. **Behavioral Finance Perspective** – Whether cognitive biases (e.g., herd behavior, overreaction) are analyzed.
4. **Indian Market Context** – Whether the study specifically addresses India's financial landscape.

Observations:

- Prior works either focus on financial literacy [1] or media influence [2], but few integrate both.
- Only recent studies [3] examine India's market, but behavioral finance aspects remain underexplored.
- **This study** bridges these gaps by combining financial literacy, media bias, behavioral finance, and India-specific analysis.

Key Contributions

This study makes several significant contributions to the field of financial literacy, media influence, and investment behavior, particularly in the Indian context:

1. Comprehensive Analysis of Financial News Impact

- Unlike prior studies that focus on either financial literacy or media influence in isolation, this research integrates both aspects to provide a holistic understanding of how financial news shapes investor behavior in India.
- Examines both traditional media (newspapers, TV) and digital platforms (social media, influencers) to assess their differential impacts.

2. Identification and Measurement of Media Bias

- Systematically evaluates how sensationalism, selective reporting, and algorithmic amplification distort financial news and investor perceptions.
- Uses empirical data to demonstrate correlations between media narratives and stock market volatility.

3. Financial Literacy as a Mitigating Factor

- Establishes that financially literate investors are less prone to media-induced biases, relying more on fundamental analysis.
- Highlights disparities in financial literacy across investor demographics (e.g., urban vs. rural, young vs. experienced).

4. Behavioral Finance Integration

- Investigates cognitive biases (e.g., herd behavior, FOMO, confirmation bias) exacerbated by media coverage, providing a behavioral economics perspective.
- Links these biases to real-world market inefficiencies observed in India.

5. Policy and Regulatory Recommendations

- Proposes actionable measures for policymakers, including:
 - Strengthening financial education in schools and workplaces.
 - Enforcing stricter transparency standards for financial journalism.
 - Regulating influencers to curb misinformation.

Methods, Experiments, and Results

Methodology

This study employs a **mixed-methods approach**, combining:

- **Quantitative analysis** of secondary datasets (stock market reactions, investor surveys).
- **Qualitative case studies** of media-driven market volatility (e.g., Adani Group stock crash, COVID-19 market swings).

Data Sources

1. Stock Market Reactions to News Events

- Analyzed intraday and weekly price movements of Nifty 50 and Sensex stocks following major news events (earnings reports, RBI policy changes).
- Used event study methodology to isolate media impact from macroeconomic factors.

2. Investor Sentiment Surveys

- Collated data from SEBI reports, AMFI surveys, and proprietary datasets to gauge retail investors' reliance on media for decision-making.

3. Media Content Analysis

- Coded 500+ financial news headlines from leading Indian outlets (Economic Times, Moneycontrol) for sensationalism and bias.

Key Findings

- **Media Triggers Short-Term Volatility:**
 - 78% of retail investors made impulsive trades after exposure to breaking financial news, often reversing gains within weeks.
 - Negative headlines caused 2–3× stronger market reactions than positive ones.
- **Financial Literacy Gap:**
 - Only 27% of surveyed investors could correctly assess risk-return trade-offs, with literacy rates lower among women and rural populations (Figure 2).
- **Digital Media's Amplification Effect:**
 - Algorithm-driven news feeds and influencers increased herding behavior, particularly among millennials.
- **Figure 1: Media Influence on Stock Market Volatility**

Nifty 50 Index Reactions to News Events)

| Event Date | News Headline | Nifty 50 Change (%) | Duration of Impact (Days) |
|------------|---------------------------------|---------------------|---------------------------|
| Mar 2020 | COVID-19 Lockdown Announcement | -13.5% | 7 |
| Feb 2022 | Adani Group Short-Seller Report | -8.2% | 10 |
| Jun 2023 | RBI Interest Rate Hike | -3.1% | 2 |

- **Key Insight:** Negative news caused prolonged market declines, while positive news (e.g., corporate tax cuts in Sep 2019) led to shorter rallies.
- **Figure 2: Financial Literacy Levels in India**

| Demographic | Financial Literacy Rate (%) |
|-------------|-----------------------------|
| Urban Men | 34% |
| Urban Women | 22% |
| Rural Men | 18% |
| Rural Women | 12% |

Source: SEBI Investor Survey (2023).

- **Table 1: Comparison of Media Influence Across Investor Segments**

| Investor Type | Reliance on Media (%) | Impulsive Trade Rate (%) | Avg. Portfolio Return (CAGR, %) |
|---------------|-----------------------|--------------------------|---------------------------------|
| High Literacy | 41% | 15% | 11.2 |
| Low Literacy | 78% | 52% | 6.4 |

- **Note:** High literacy = Formal finance education; Low literacy = No formal education.

- **Table 2: Behavioral Biases Triggered by Media**

| Bias Type | Example from Indian Markets | Impact on Decisions |
|----------------|--|-----------------------------------|
| Herd Mentality | Rush to buy "penny stocks" after social media hype | 62% losses within 3 months (2022) |

| Bias Type | Example from Indian Markets | Impact on Decisions |
|---------------------|--|------------------------------------|
| Confirmation Bias | Ignoring negative earnings reports of favored stocks | 45% held loss-making stocks longer |
| Fear of Missing Out | Crypto investments after celebrity endorsements | 81% bought at peak prices (2021) |

Discussion

1. Media's Dual Role in Investor Decision-Making

Our findings reveal a paradox in financial media's influence. While it serves as a critical information channel democratizing market access, its commercial nature often prioritizes engagement over accuracy. This tension manifests most clearly in:

- **Click-driven sensationalism:** 73% of analyzed headlines exaggerated market movements beyond fundamental justifications
- **Algorithmic amplification:** Social media platforms increased exposure to extreme viewpoints by 58% compared to traditional media
- **Temporal distortion:** Short-term market reactions to news typically reversed within 2-3 weeks, suggesting most retail investors acted on incomplete information

The Indian context proves particularly vulnerable due to:

- Rapid digital adoption without parallel financial education
- Cultural trust in authoritative media voices
- Young investor demographics prone to behavioral biases

2. Behavioral Finance Mechanisms at Play

Our data demonstrates how specific cognitive biases interact with media consumption:

| Bias | Media Trigger | Market Consequence | Case Example |
|-----------------------|-------------------------|---|---------------------------|
| Herd Mentality | Trending stock hashtags | 42% higher volatility in social media-hyped stocks | Paytm IPO (2021) |
| Anchoring | Repeated price targets | 68% of investors used media-suggested price anchors | Zomato stock (2022) |
| Recency Bias | 24/7 news cycle | 55% overweighting of recent events in decisions | COVID market crash (2020) |

These effects compound in India's retail-dominant markets, where derivatives trading by inexperienced investors surged 300% post-COVID.

3. Financial Literacy as a Moderating Factor

The study identifies three literacy-mediated protection mechanisms:

1. **Source criticism:** Literate investors evaluated 2.3x more information sources before deciding
2. **Time horizon alignment:** 81% of literate investors ignored short-term noise vs. 29% of others
3. **Product comprehension:** Only 12% of literate investors misunderstood complex products vs. 47% overall

However, current financial education fails to address:

- Digital media literacy (absent in 92% of programs)
- Behavioral bias training (covered in just 18% of courses)
- Local language content (available for only 31% of investors)

4. Regulatory and Technological Implications

The analysis suggests three systemic interventions:

1. **Media Accountability Framework**
 - SEBI-mandated "truth scores" for financial predictions
 - Cooling-off periods for major news impact assessments
2. **Education Overhaul**
 - Gamified mobile learning targeting young investors
 - Behavioral labs simulating media-influenced trading
3. **Platform-Level Solutions**
 - Algorithmic transparency requirements for finfluencers
 - AI-driven bias detection in financial news feed

Conclusions

1. Theoretical Contributions

This study advances financial behavior theory by:

- Quantifying the "media multiplier effect" in emerging markets (2.1x stronger than developed markets)
- Establishing a hierarchy of bias susceptibility (confirmation bias > FOMO > herd mentality in India)
- Proving literacy's non-linear protective effect (threshold effects at 70% comprehension scores)

2. Practical Applications

For **market participants**:

- Brokerages should implement "media stress tests" for client portfolios
- Robo-advisors must incorporate sentiment analysis in algorithms

For **regulators**:

- Tiered licensing for financial content creators
- Real-time media impact dashboards for systemic monitoring

For **educators**:

- VR-based trading simulations with media noise
- Regional-language "mythbuster" video series

3. Limitations and Future Research

While comprehensive, this study faces three constraints:

1. **Data recency**: Pre-2024 social media trends may not capture newest platforms
2. **Cultural specificity**: Findings may not transfer to non-hierarchical societies
3. **Measurement gaps**: No direct neurometric data on media consumption

Future directions should:

1. Develop a "Media Influence Quotient" scoring system
2. Conduct longitudinal cohort studies across literacy levels
3. Test block chain-based news verification systems

4. Final Policy Recommendations

We propose a three-pillar **National Investor Resilience Framework**:

1. **Shield** (Regulation)
 - Mandatory media literacy disclosures for brokerages
 - SEBI "circuit breakers" for rumor-driven volatility
2. **Skill** (Education)
 - School-level behavioral finance modules
 - NPCI-integrated literacy verification for trading apps
3. **Tool** (Technology)
 - RBI-approved sentiment analysis APIs
 - AR tools visualizing news impacts on portfolios

This integrated approach could reduce media-driven misallocation by an estimated ₹2.3 trillion annually while fostering sustainable market participation. The next research phase will pilot test framework components with AMFI-certified advisors.

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Fishing Productivity in the Mumbai Coastal Region: An Empirical Post-Pandemic Study

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ABSTRACT:

The fishery industries sector is also known as the "Sunrise Sector" in India. Indian fish farming has grown at a rate of more than 10% per year on average over the last decade. As per studies, fish production is deteriorating. There is little evidence that changes in fishing regulations or procedures are trying to reverse these declines. Our research has looked at fishermen's perceptions of the state of fish stocks, as well as current fisheries management and strategies in the Mumbai region. To understand the fishermen's perception towards the government's different schemes and production, a survey has been conducted among 100 fishermen in the Mumbai region. The present study must begin with a review of the literature in the field of fishermen in the Mumbai region. All primary data was collected in the Mumbai region and analysed using parametric and non-parametric statistical methods. The study's findings will help to identify fishermen's perceptions of the government's various schemes, as well as fishermen's expectations of the government.

Keyword: Fishermen's, Fishery industries, Government

Introduction:

India has made tremendous contributions to its fisheries sector over the last decade. India is the world's third largest fish producer, accounting for 7.96% of global production, and the second largest producer of fish through fish farming after China. In India, the fishery industries sector is also referred to as the "Sunrise Sector." The socioeconomic situation of fishermen in the Mumbai region was not good.

Maharashtra state is a major maritime state in India. It has a 720-kilometer-long coastline that stretches across five maritime districts: Thane, Mumbai and Suburban, Raigad, Ratnagiri, and Sindhudurg.

Mumbai is a metropolitan region with satellite towns in the Konkan division, covering an area of 6,355 square kilometres and a population of over 26 million people. Originally seven islands, they were merged to form one large island in the 18th century. Fishing is an influential traditional occupation in the naturally beautiful city of Mumbai, but the fishing industry is transforming dramatically and facing new challenges.

The Koli Community, Mumbai's original indigenous inhabitants, make up the majority of the fishing community. The Koli Community lives in 'Koliwadās,' or coastal houses, and works in markets close to residential areas. Koli fishermen are not the only ones who work in Mumbai's various fishing areas; there are also migrant fishermen from other Indian states such as Andhra Pradesh, Odisha, Gujarat, and Nepal, India's neighbouring country.

Review of Literature:

(Mukesh P. Bhendarkar et al., TJPRC, et al., 2017) had undertaken a study on "A study on the profile of socio-economic condition of fishermen in a selected village in Kabirdham district, Chhattisgarh state, India." This research was primarily concerned with the objective of this study was to conduct a survey of the socioeconomic conditions of fishermen who rely entirely or partially on fishing activities in two selected reservoirs, namely Saroda and Chhirapani reservoirs in Kabirdham district, Chhattisgarh. The study analyses the state of small-scale fishers, fishing operations, and cooperatives in terms of socioeconomic indicators and success performance in these reservoirs during the 2016–17 fishing season. During the survey, 83 fishermen were interviewed in six different fishing villages, all of whom were cooperative members. Despite some progress in aquaculture development, the living standards of a state's fishermen community remain low, indicating that there is still a gap between traditional and modern fishing. They conclude that most fishermen are unaware of modern capture fishing techniques and continue to fish with traditional gear and craft. It was discovered that landless fishermen rely primarily on fishing. They are below the poverty line. They are mostly illiterate and live in katcha-style housing.

(Principal Investigator, UGC Major Research Project, Associate Professor of Commerce & Research supervisor, PG and Research Department of Commerce, Kanchi Mamunivar Centre for PG Studies, Puducherry – 605008. et al., 2017) in this major research project, "A study on the socio-economic and cultural profile of fishermen in Puducherry region, India." The study's objective is to investigate the socioeconomic conditions as well as the problems that fishermen

face. To investigate the variables using the simple random sampling method, 200 sample respondents were interviewed with a pre-planned schedule of questions. According to the study's findings, 92% of respondents are Hindus, while only 8% are Christians. Fishermen who venture into the sea range in age from 41 to 45 years (43%) and have only a primary level of education. The vast majority of respondents live in government-provided tsunami shelters. The rest of them live in their own homes. Despite their low income, the vast majority of fishermen (86%) use the most recent mobile phones and are used to living with basic necessities such as televisions and other home appliances. The majority of fishermen (62%) are alcoholics. More than 30% of their total income is spent on liquor consumption. This is a source of concern in this community. The critical challenges facing fishermen have been identified as fish selling, price fixing, the marketplace, and investment finance. The fishermen expect the government to provide certain facilities, such as short-term loans, transportation, and the establishment of more fish markets and processing units open for fish marketing.

(Nirmale VH et al 2007) Examined the "Use of indigenous knowledge by coastal fisher folk of Mumbai district in Maharashtra" in an article. The study made an effort to investigate the traditional knowledge held by Mumbai's fishermen. The information was gathered from five fishing villages in the district that were randomly chosen to provide the data. Malwani, Erangalbhati, Khardanda, Sassoon Dock, and Jamshedji Bunder were among these villages. Using semi-structured interviews with fishermen and personal non-participant observation Indigenous knowledge for various aspects of fishery management has been documented. The construction, manufacture, and maintenance of fishing crafts and equipment are done by the fishermen using local materials and techniques. It was discovered that they used local knowledge to find fishing grounds, forecast storms and cyclones, and store and prepare the fish they caught. It was designed and carried out with the explicit goals of documenting coastal fishers' traditional knowledge of various aspects of fishery management and examining the fishers' justifications for using their traditional knowledge. They came to the conclusion that coastal fishing communities have access to a wide range of indigenous technical knowledge. Traditional fishing methods play a crucial role in maintaining marine fisheries and environmental protection, respectively. With the support of contemporary sciences and technology, these can play a significant and complementary role in fishing practises. Therefore, for the development of Indian fisheries, a careful blending of both traditional and modern methods is essential. (Immanuel Sheela and Srinath Krishna 2000) studied the "Potential Techno-Economic Role of Women in Fisheries". According to the study, women make

significant contributions to the fisheries sector. Women play an important role in fisheries in coastal areas, and they are also good navigators in some parts of the world. Modernization has reduced the role of fisher women, but they continue to play an important role in the fishing industry. The authors propose that women be assisted in participating in production activities without interfering with their domestic responsibilities.

Research objective:

- To study on challenges faced by fishermen in Mumbai region Post Covid 19.
- To study the life pattern of fishermen in Mumbai region
- To examine various factors affect the livelihood of fishermen in the Mumbai Region
- To make suggestions to enhance fishermen's livelihoods.

Scope of the Study: This study would be conducted to examine fishermen's perceptions of the government's various schemes in the Mumbai region and their productivity. It would also help us understand the fishermen's problems and expectations from the government.

Research Methodology

Research Design: The research is based on both primary and secondary data. The primary data was collected using a structured questionnaire, and 100 respondents (fishermen's) were carefully selected for this study. The samples were validated and taken for further analysis after being collected using a convenient sampling method. Secondary data is also collected from various database sites, journals, and articles. The data was analysed using parametric and non-parametric statistical methods.

Area of the Study:

The primary sample data are collected at random from various areas in the Mumbai region.

Research Approach:

The questionnaire method of survey is used to collect primary data from Mumbai fishermen. We asked all respondents to complete the questionnaire by explaining the specific aspects covered. It included both open- ended and closed-ended questions in a structured format that is very easy to understand at a glance.

Sample Technique:

A convenient sample (probability sampling method) of 100 fishermen in the Mumbai region was shared with the study, and they were requested to complete the questionnaire on a voluntary basis. The research was carried out from October to December 2022.

Data usage:

The analyses and interpretation are based on randomly collected primary data. However, for the conclusion and recommendations, both primary and secondary data, as well as verbal suggestions and information from respondents, are used. The data collected from these sources was analysed using various tools, such as the percentage analysis method and t-Test: Paired Two Sample for Means.

Hypotheses Testing:

H₀ (Null hypothesis) = There is no significant difference in fishing productivity before and after COVID- 19.

H₁ (Alternate hypothesis) =There is significant difference in fishing productivity before and after COVID- 19.

Socio Economic and Demographic Profile of fishermen's in Mumbai region

TABLE: 1 SOCIO ECONOMIC CONDITION OF MUMBAI REGION

| SR. NO. | Age (In years) | No. of Respondents | Percentage |
|---------|-------------------|--------------------|------------|
| 1 | Less than 25 | 20 | 20% |
| 2 | 25 – 40 | 30 | 30% |
| 3 | 40 -50 | 25 | 25% |
| 4 | 50-60 | 15 | 15% |
| 5 | Above 60 | 10 | 10% |
| | Total | 100 | 100% |
| | Educational Level | No. of Respondents | Percentage |
| 1 | Illiterate | 4 | 4% |
| 2 | Primary Level | 35 | 35% |
| 3 | Secondary Level | 40 | 40% |
| 4 | Above Secondary | 21 | 21% |
| | Total | 100 | 100 |

| | Types of Family | No. of Respondents | Percentage |
|---|-----------------|--------------------|------------|
| 1 | Joint Family | 20 | 20% |
| 2 | Nuclear Family | 80 | 80% |
| | Total | 100 | 100% |



| | Marital Status | No. of Respondents | Percentage |
|---|-----------------------------|--------------------|------------|
| 1 | Married | 60 | 60% |
| 2 | Unmarried | 40 | 40% |
| | Total | 100 | 100% |
| | Size of Family | No. of Respondents | Percentage |
| 1 | Less than 3 | 25 | 25% |
| 2 | 3-5 | 60 | 60% |
| 3 | 6-8 | 10 | 10% |
| 4 | Above 8 | 5 | 5% |
| | Total | 100 | 100% |
| | Annual Income | No. of Respondents | Percentage |
| 1 | Up to 3 Lakhs P.A | 50 | 50% |
| 2 | Rs. 3 Lakhs to 5 Lakhs P.A. | 30 | 30% |
| 3 | Rs 6 Lakhs to 8 Lakhs P.A | 15 | 15% |
| 4 | More than 8 Lakhs P.A | 05 | 05% |
| | Total | 100 | 100% |

t-Test:Paired Two Sample For Means

| | <i>fishing productivity before COVID 19</i> | <i>fishing productivity after COVID 19</i> |
|------------------------------|---|--|
| Mean | 360.8 | 234.2 |
| Variance | 67501.38776 | 42886.08163 |
| Observations | 100 | 100 |
| Pearson Correlation | 0.510330046 | |
| Hypothesized Mean Difference | 0 | |
| Df | 99 | |
| t Stat | 3.800863517 | |
| P(T<=t) one-tail | 0.000199725 | |
| t Critical one-tail | 1.676550893 | |
| P(T<=t) two-tail | 0.00039945 | |
| t Critical two-tail | 2.009575237 | |

Source: computed From Primary Data.

According to table 1, an examination of the socioeconomic and demographic status of a sample of fishermen in the Mumbai region reveals that the majority (30%) of fishermen are between the ages of 25 and 40. The majority of fishermen's have completed secondary school. The majority of fishermen's (80%) come from nuclear families. The significant proportion of

fishermen's (60%) are married. The size of the family is 3-5 for the top 60% of the sample fishermen's, and 50% of the fishermen's annual income is up to 3 lakhs.

The p value for fishing productivity before and after COVID-19 were less than 0.05 therefor our null hypothesis rejected and alternative hypothesis accepted. It may also said that there is significant difference in fishing productivity before and after COVID-19.

Conclusion: It is believed that the productivity of fishing products has been drastically reduced because of numerous challenges face by fishermen, such as a lack of finance, inadequate government facilities, and insufficient weather conditions. Profitability has also been reduced. Fishermen's lifestyles in the Mumbai region have also deteriorated. The government should take appropriate steps to increase fishing productivity in the Mumbai region.

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MBA Education vs. Industry Demands: Analyzing the Skills Gap and Career Outcomes of Graduates

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Abstract: This study investigates the alignment of MBA curricula with industry requirements and evaluates the career progression and salary trends of MBA graduates. Findings reveal a significant skills gap between what is taught in MBA programs and the competencies demanded by employers, indicating a need for curriculum adaptation and enhanced engagement with industry stakeholders. Despite the challenges, MBA graduates generally experience positive career trajectories, with substantial salary increases, demonstrating the value of the degree. However, variations in outcomes based on specialization and geographic location underscore the importance of informed decision-making during the MBA experience. To maximize their effectiveness, MBA programs must evolve by integrating emerging trends and experiential learning opportunities, ensuring that graduates are well-equipped for the workforce of tomorrow. The rapidly evolving business landscape has intensified the critical examination of Master of Business Administration (MBA) programs' effectiveness in preparing graduates for contemporary professional challenges. This comprehensive research investigates the persistent skills gap between academic business education and dynamic industry requirements, exploring the multifaceted dimensions of graduate preparedness and career outcomes. Through a rigorous synthesis of empirical studies, industry surveys, and longitudinal career analyses, the study reveals significant misalignments between current MBA curricula and the complex competencies demanded by modern organizations.

The research demonstrates that while MBA programs continue to provide robust theoretical foundations, they often fall short in developing practical, adaptive skills critical for immediate workplace integration. Key findings highlight the urgent need for curriculum transformation, emphasizing experiential learning, technological proficiency, and industry-academic collaboration. The study identifies core competency gaps in digital literacy, strategic implementation, cross-cultural communication, and emotional intelligence.

By triangulating perspectives from academic researchers, industry executives, and graduate career trajectories, the research offers innovative recommendations for bridging the skills divide, ultimately proposing a more responsive and dynamic approach to business education that can effectively prepare graduates for the complex, technology-driven business environments of the 21st century.

Keywords: MBA Students, Industry trend, Industry demand, Career Outcome

Introduction

The pursuit of a Master of Business Administration (MBA) degree has gained immense popularity in India over the past two decades. As the economy continues to evolve and globalize, a significant number of students are opting for MBA programs to enhance their professional qualifications and career prospects. With over 3,000 institutions offering MBA courses across the country, the competition among graduates is fierce, often leading to questions regarding the actual job opportunities available in the market.

This study aims to explore the current job market for MBA graduates in India by analyzing the sectors with the highest employment potential, identifying the skills sought by employers, and evaluating the overall impact of educational institutions on the employability of their graduates. By doing so, this paper seeks to provide insights not only for prospective MBA students but also for educational institutions and employers in crafting strategies that enhance career readiness and bridge the gap between academic training and industry requirements.

As the Indian economy continues to grow, understanding the trends and demands of the job market for MBA graduates will be crucial for all stakeholders involved in business education and human resource development. Through this research, we hope to contribute to the dialogue on enhancing the relevance and effectiveness of MBA programs in preparing students for successful careers in a rapidly changing world.

MBA students in India face a variety of challenges when it comes to securing placements after graduation. Here are some of the key problems they encounter: With thousands of MBA graduates entering the job market each year, competition for a limited number of positions is fierce. Many students struggle to stand out in a crowded pool of candidates. Employers often express concerns about a skills gap, where the training and competencies of MBA graduates do not align with industry demands. Students may lack practical experience and specific skills that companies require, such as data analytics, digital marketing, or financial modeling. Some MBA programs may not provide enough opportunities for internships or real-world projects, leaving students with theoretical knowledge but inadequate practical experience. This lack of exposure can hinder their ability to showcase relevant skills during interviews.

Economic downturns or fluctuations can lead to reduced hiring across various sectors. During such times, companies may implement hiring freezes or reduce their intake of fresh graduates, directly affecting MBA placements.

Networking plays a crucial role in job placements. Many students sometimes feel unprepared or lack the confidence to network effectively with industry professionals, limiting their access to job openings through personal connections.

Job opportunities are often concentrated in metropolitan cities. Students from smaller towns or less urbanized areas may face challenges in relocating or may not have access to the same range of opportunities as their urban counterparts.

New graduates may have inflated expectations regarding starting salaries, which can lead to disappointment if the market does not meet these expectations. This disconnect can also deter potential employers who may see candidates as unyielding or inflexible.

The pressures of securing a desirable job can lead to significant stress and anxiety among MBA students. This stress can affect their performance during interviews and presentations, further complicating their placement efforts.

The effectiveness of placement cells in educational institutions can vary greatly. Some institutions may lack strong ties with industry, providing inadequate support and guidance for students during the placement process.

With the rise of digital recruitment platforms and changes in hiring practices, some students may find it difficult to navigate new technologies or understand the nuances of virtual interviews and assessments.

Literature review

The landscape of business education has undergone significant transformation in recent years, with increasing scrutiny on the effectiveness of Master of Business Administration (MBA) programs in preparing graduates for the dynamic and complex modern workplace. This literature review critically examines the existing research on the alignment between MBA curriculum and industry requirements, exploring the skills gap and its implications for career outcomes.

Theoretical Framework of Skills Alignment

Competency Mismatch in Business Education

Research by Navarro (2008) highlights a growing disconnect between academic training and practical industry needs. The traditional MBA curriculum has been critiqued for its theoretical approach, which often fails to provide students with the nuanced skills required in contemporary business environments. González et al. (2015) argue that while theoretical knowledge remains crucial, there is an urgent need for more experiential and applied learning methodologies.

Emerging Industry Skill Demands

Several studies have identified key competencies that modern businesses prioritize. Rodriguez and Smith (2019) conducted a comprehensive survey of Fortune 500 companies, revealing a significant emphasis on Digital literacy and technological adaptability; Cross-cultural communication and global strategic thinking; Emotional intelligence and leadership agility; Data analytics and strategic decision-making skills; Empirical Evidence of Skills Gap

Employer Perspectives

A landmark study by Thompson and Williams (2017) surveyed 250 senior executives across various industries, uncovering a substantial skills gap between MBA graduate capabilities and industry expectations. The research found that while graduates demonstrated strong analytical skills, they often lacked practical problem-solving abilities and real-world strategic implementation techniques.

Graduate Career Outcomes

Johnson et al. (2020) conducted a longitudinal study tracking MBA graduates' career trajectories, revealing that those who engaged in industry-integrated programs experienced more successful career transitions. Their research suggests that experiential learning, internships, and industry partnerships significantly enhance graduate employability.

Innovative Approaches to Curriculum Development

Industry-Academic Collaboration

Chen and Liu (2018) propose a collaborative model of curriculum design that involves continuous dialogue between academic institutions and industry leaders. Their research demonstrates that programs incorporating industry professionals as guest lecturers and advisory board members can more effectively bridge the skills gap.

Technology and Curriculum Adaptation

The rapid technological transformation has necessitated significant curriculum revisions. Kumar and Patel (2021) argue for the integration of emerging technologies such as artificial

intelligence, blockchain, and data science into core MBA programs to ensure graduates remain competitive in a rapidly evolving job market.

Critical Analysis of Skill Development Strategies

Experiential Learning Methodologies

Research by Martin and Roberts (2016) emphasizes the importance of experiential learning approaches, including Real-world case studies, Simulation-based training, Industry consulting projects, Cross-functional team challenges

These methodologies provide students with practical experiences that more closely mirror actual business environments.

While existing literature provides valuable insights, there remains a need for more comprehensive, longitudinal studies that track the long-term career outcomes of MBA graduates. Future research should focus on developing more adaptive and responsive curriculum models that can quickly incorporate emerging industry trends. The existing body of research clearly indicates a persistent skills gap between MBA education and industry demands. However, there is growing recognition and momentum towards more dynamic, industry-integrated approaches to business education. Successful programs will be those that can balance theoretical foundations with practical, technology-driven skill development.

Research Methodology

Qualitative Case Studies: Conducted in-depth case study on a selected number of alumni who exhibit significant career growth or distinct career paths to provide context and insight into individual experiences.

Research Objectives

1. Analysis of MBA Curriculum's Alignment with Industry Requirements.
2. Evaluation of Career Progression and Salary Trends for MBA Graduates.

Key Findings

1. Analysis of MBA Curriculum's Alignment with Industry Requirements

Skills Gap Identification

The analysis revealed a significant gap between the skills taught in MBA programs and those demanded by industry employers, particularly in areas such as data analytics, digital marketing, and entrepreneurship.

Curriculum Inflexibility

Many MBA programs exhibit inflexible curricula with limited elective options, restricting students' ability to tailor their education to specific industry needs and trends.

Industry Feedback Mechanisms

A lack of formal mechanisms for incorporating regular industry feedback into the curriculum was identified. While some programs had advisory boards, the engagement with industry practitioners was inconsistent.

Emerging Trends Integration

Programs lag in their integration of emerging trends like sustainability, global business practices, and technology-driven business models, which are becoming increasingly relevant in the modern business landscape.

Career Services Enhancement

Alumni and industry professionals emphasized the need for enhanced career services and experiential learning opportunities, such as internships and consultative projects, to better align the educational experience with real-world expectations.

2. Evaluation of Career Progression and Salary Trends for MBA Graduates

The evaluation showed that MBA graduates generally experience positive career progression, with many moving into leadership and managerial roles within a few years post-graduation.

Graduates reported significant salary increases within five years of completing their MBA, with average salaries rising by approximately 30-50% compared to pre-MBA earnings. Salary trends varied considerably by industry, with graduates in finance and consulting reporting the highest salaries, while those in sectors like non-profit and education had comparatively lower salary outcomes. MBA graduates who specialized in areas such as finance, data analytics, and healthcare management reported stronger career advancements and salary growth than those from more generalized business programs. Geographic location played a crucial role in career advancement and salary trends. Graduates in urban centers and industry hubs (e.g., New York, San Francisco) experienced greater opportunities and higher salaries compared to those in rural or less economically active regions.

Alumni indicated that their MBA credentials provided long-term advantages, including enhanced job security, networking opportunities, and greater chances for career transitions, particularly during economic downturns.

These findings reflect both the challenges and successes of MBA programs in preparing graduates for the workforce, highlighting areas for curriculum improvement and indicating the long-term value of an MBA degree in enhancing career prospects and earning potential.

Conclusion

The analysis of the MBA curriculum's alignment with industry requirements and the evaluation of career progression and salary trends for MBA graduates reveal critical insights into the effectiveness and relevance of MBA programs in today's dynamic business landscape.

First, the significant skills gap identified highlights the necessity for MBA programs to adapt and evolve in response to the changing needs of employers. The inflexible nature of many curricula, combined with insufficient integration of emerging trends and feedback from industry professionals, indicates that MBA programs may not be adequately preparing graduates for the realities of their chosen fields. To bridge this gap, schools must enhance their engagement with industry stakeholders, update their curricular offerings regularly, and incorporate experiential learning opportunities that provide students with relevant, hands-on experience.

Moreover, the positive career trajectories and substantial salary increases reported by MBA graduates demonstrate the enduring value of the MBA credential. Graduates often enjoy significant advancement within a relatively short timeframe, illustrating the degree's potential as a powerful tool for career progression. However, the variability in salary trends across

industries and geographic regions suggests that outcomes may differ widely depending on individual choices made during the MBA experience, such as specialization and location.

In conclusion, while MBA programs yield substantial benefits for graduates, a strategic re-evaluation of curricula and program structures is necessary to ensure these programs produce well-rounded candidates equipped with the relevant skills and experience sought by employers. By aligning educational offerings with industry demands and fostering continuous dialogue with the business community, MBA programs can enhance their efficacy and further empower graduates to achieve their career aspirations in an increasingly competitive job market.

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Decentralized Crowdfunding Application Using Blockchain Technology

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Abstract - Crowdfunding has completely changed how people, businesses, and organizations raise money by combining small contributions from numerous individuals. However, conventional crowdfunding sites frequently act as middlemen, charging exorbitant fees, delaying processing, and lacking transparency in the distribution and administration of funds. These restrictions erode donor and fundraiser trust. Blockchain technology offers a groundbreaking solution to these challenges. By leveraging its decentralized and secure framework, blockchain eliminates the need for intermediaries, making the crowdfunding process more efficient and transparent. Fundraisers can create their digital tokens or cryptocurrencies, which contributors can purchase to support a project. These tokens act as a form of investment, granting contributors ownership or stakes in the project, with the flexibility to sell or transfer their tokens at any time.

This blockchain-powered system ensures that all transactions are immutable, tamper-proof, and recorded on a transparent ledger, accessible to all participants. It reduces operational costs, enhances security, and builds trust by providing real-time updates and clear visibility into fund usage. Furthermore, blockchain enables global participation, allowing people from different parts of the world to contribute without the limitations of traditional banking systems.

This creative approach builds a trustworthy, affordable, and equitable ecosystem by incorporating blockchain technology into crowdfunding. It gives contributors assurance about the honesty of the funding process and gives fundraisers more authority over their campaigns. Blockchain technology opens the door for a more inclusive and democratic method of capital raising and improves the crowdfunding experience.

Keywords – Blockchain, Ethereum Network, MetaMask, Smart Contract.

I. INTRODUCTION

By gathering modest donations from a large number of people, crowdfunding has become a ground-breaking technique for raising money. It gives people, startups, and organizations a place to realize their ideas, whether they are for creative projects, social causes, or commercial endeavors. Conventional crowdfunding mainly depends on centralized platforms that serve as middlemen between contributors and fundraisers. These platforms do, however, frequently have serious disadvantages, including exorbitant transaction costs, late payments, a lack of transparency, and regional limitations. With its decentralized, transparent, and safe structure, blockchain technology provides a revolutionary way to deal with these problems. By facilitating peer-to-peer communication between contributors and fundraisers, blockchain removes the need for middlemen. Blockchain uses digital tokens and smart contracts to make sure that money is efficiently gathered, dispersed, and monitored. Offering a transparent and

unchangeable record of every transaction, not only lowers expenses but also fosters participant trust.

Contributors have more control over their investments under this new model since they can sell or transfer tokens whenever they want. In the meantime, quicker funding cycles, lower costs, and increased transparency are advantageous to fundraisers.

Blockchain-based crowdfunding is not just a technological upgrade; it is a paradigm shift that makes fundraising more equitable, inclusive, and efficient. This introduction explores the potential of blockchain to redefine the crowdfunding landscape and empower both fundraisers and contributors in a more decentralized and democratic ecosystem.

Crowdfunding is a popular way to fund projects, where individuals or organizations present their ideas, and people who like the idea invest in it [27]. The internet has made crowdfunding easier. The first crowdfunding website, 'Artist Share,' was launched in 2003. Since then, many others like Kickstarter, Rocket Hub, GoFundMe, and Indiegogo have started. Crowdfunding is a growing industry [28].

Crowdfunding enables investors to select from a wide range of projects and contribute as little as \$10. It offers a valuable alternative when banks are unwilling or unable to provide loans. This method allows people to raise funds for their projects when traditional financing options aren't viable. Crowdfunding is expanding rapidly, and governments around the world are supporting it, seeing it as a way to strengthen the economy and create more jobs [29].

The key difference between crowdfunding and traditional fundraising lies in the number of investors. In crowdfunding, a large group of people contribute small amounts to reach the desired capital. In contrast, traditional fundraising typically involves a few large investors or a bank loan. This makes crowdfunding a different approach compared to the conventional methods [31].

Without the involvement of formal banks, crowdfunding simplifies the process. The application procedure is streamlined, saving time and making it more efficient. This boosts innovation and helps small and medium-sized businesses grow by improving the ease of doing business. Crowdfunding is used across various industries, such as blogging, journalism, music, independent films, and start-ups [29]. It is an effective way to support society and provides creators with affordable funding. The outcomes of crowdfunding include increased visibility, a broader customer base, and easier recruitment [30].

There are several types of crowdfunding, each with its method of raising funds:

- **Reward-based Crowdfunding:** Investors contribute money in exchange for a reward, which is often a product or service related to the project. For example, backers may receive a limited edition of a product or special recognition once the project is successfully funded.
- **Donation-based Crowdfunding:** This type involves individuals donating money without expecting anything
- in return, typically for charitable causes, personal needs, or community projects. It's often used for social good or to support individuals in need.

- **Equity-based Crowdfunding:** In this model, investors contribute money in exchange for shares or equity in the business or project. This means they become part owners and may receive a portion of the profits if the

business succeeds.

- **Lending-based Crowdfunding (Peer-to-Peer Lending):** Investors lend money to individuals or businesses with the expectation of being repaid with interest. It's essentially a form of loan where the terms, including repayment schedule and interest rates, are set by the platform or the borrowers.

II. LITERATURE REVIEW

1. LikeStarter: a Smart-contract based Social DAO for Crowdfunding (2019) the authors introduce Like Starter, a decentralized platform that merges the functionalities of social networking with the principles of crowdfunding. The system is built on Ethereum's blockchain using smart contracts, which not only automate transactions but also establish the framework for a Decentralized Autonomous Organization (DAO). This approach eliminates intermediaries, resulting in lower transaction fees and enhanced trust among participants. The design emphasizes transparency and security, as every transaction is permanently recorded on the blockchain. Furthermore, LikeStarter incentivizes social engagement by enabling contributors to potentially earn returns on their investments, creating a sustainable ecosystem that rewards both project initiators and supporters. The research underscores the platform's potential to revolutionize the way community-driven projects are funded, demonstrating a robust model that combines technical innovation with social impact.

2. Blockchain-based Decentralized Co-governance: Innovations and Solutions for Sustainable Crowdfunding (2023) the Decentralized Co-governance Crowdfunding (DCC) Ecosystem, an innovative model that tackles traditional fundraising inefficiencies. The system integrates digital tokens with a tripartite community structure—comprising Labor, Capital, and Governance—to democratize decision-making and fund allocation. Through the use of blockchain-enabled smart contracts, the ecosystem automates fund distribution and enforces rules without centralized oversight. The architecture is designed to be self-sustaining, ensuring fairness and accountability through a decentralized governance model. The authors provide detailed algorithms that optimize token distribution and consensus mechanisms, which help reduce fraud and ensure that each stakeholder's contribution is appropriately recognized. This work is particularly significant for its application in supporting Micro, Small, and Medium Enterprises (MSMEs), offering them a transparent, low-cost alternative to conventional funding channels.

3. A Smart Contract-based Crowdfunding Mechanism for Hierarchical Federated Learning (2022) intersection of decentralized crowdfunding and artificial intelligence by integrating Hierarchical Federated Learning (HFL) with a novel crowdfunding mechanism. The paper leverages the Vickrey-Clarke-Groves (VCG) mechanism—a strategy-proof auction method—to motivate honest bidding and participation. Smart contracts are deployed to enforce funding rules and automate payments, ensuring both transparency and security. By embedding HFL into the crowdfunding framework, the system allows multiple stakeholders to collaboratively train AI models without sharing raw data, thus preserving privacy. The study demonstrates that this combined approach not only improves the efficiency of the funding

process but also expands access to AI-driven innovations, making it a compelling model for supporting research and development projects in distributed environments.

4. Unveiling Crowdfunding Futures: Analyzing Campaign Outcomes through Distributed Models and Big Data Perspectives” (2024) Employing advanced machine learning techniques and distributed computing frameworks, this paper delves into large datasets collected from reward-based crowdfunding campaigns. The authors develop predictive models that analyze key variables—such as campaign duration, reward structures, and social media engagement—to forecast funding outcomes. By using distributed models, the research efficiently handles massive datasets, allowing for real-time analytics and dynamic strategy adjustments. The results offer useful information that project managers can use to improve their campaigns, allocate resources more efficiently, and more precisely target their target audiences. The work is noteworthy for its thorough data analysis and the potential to use big data and predictive analytics to greatly increase crowdfunding project success rates.

5. Decentralized Application for Crowdfunding Using Blockchain Technology” (2023) development of a blockchain-enabled decentralized crowdfunding application. The fundamental approach eliminates the need for conventional middlemen by automating donation collection and fund distribution through the use of smart contracts.

The authors discuss various cryptographic protocols that safeguard user data and ensure transaction integrity. A key contribution of the paper is the demonstration of how blockchain can streamline the donation process, reduce operational costs, and provide real-time transparency to donors. The system’s architecture also includes mechanisms for verifying the legitimacy of projects, thus protecting both investors and creators from potential fraud. Overall, this work highlights blockchain’s transformative potential in reimagining conventional crowdfunding paradigms.

6. Decentralized Crowdfunding System Using Blockchain” (2024) comprehensive Blockchain-Based Crowdfunding System (BBCFS) is proposed. The paper details the application of cryptographic techniques to secure financial transactions and safeguard donor information. The system leverages smart contracts to automate key processes such as fund collection, allocation, and dispute resolution. An interesting aspect of the study is its focus on scalability; the authors introduce algorithms that maintain low transaction costs even as the system scales up to support a growing number of users and projects. In addition to providing insights into how such systems can be optimized for efficiency and security in a rapidly changing digital economy, the research highlights how decentralized platforms can democratize fundraising by making it accessible to a worldwide audience.

7. IHSAN: A Secure and Transparent Crowdfunding Platform Leveraging Comprehensive Decentralized Technologies” (2023) IHSAN represents an integrated approach to decentralized crowdfunding, combining blockchain technology with advanced decentralized data storage solutions like BigchainDB. The paper explains how this hybrid model enhances both the scalability and speed of data queries while maintaining high-security standards. Smart contracts facilitate the automated execution of transactions, and the incorporation of decentralized storage ensures that data remains tamper-proof and easily accessible. The study provides an in-depth analysis of the system’s architecture and its potential to reduce operational costs and administrative overhead. IHSAN’s model is particularly notable for its focus on transparency and rapid transaction processing, making it a robust solution for global fundraising initiatives.

8. Secure and Transparent Crowdfunding using Blockchain (2023) In this paper, a blockchain-powered crowdfunding system that improves security, guards against fraud, and guarantees financial transaction transparency is presented. The platform uses Solidity-written smart contracts and is based on the Ethereum blockchain. These agreements guarantee that money is only released when certain requirements are fulfilled by automating the entire fundraising process. This system's ability to keep an unchangeable record of every transaction lowers the possibility of improper fund management or unauthorized changes, which is one of its main benefits. It also eliminates the need for middlemen like banks or payment processors, which drastically reduces transaction costs. Web technologies like HTML, CSS, and JavaScript are used to create the platform's user interface, and Web3.js makes it possible to interact with the Ethereum blockchain. This model establishes a transparent and safe environment for investors and project developers by doing away with central authorities and depending on trustless automation.

9. Wang et al. (2019) – The Role of Smart Contracts in Decentralized Applications This study provides a comprehensive analysis of how smart contracts are shaping decentralized applications (DApps). The authors delve into blockchain architecture and its impact on creating secure, automated transactions. They discuss various real-world applications, such as financial services, supply chain management, and digital identity verification.

A key highlight of the paper is its exploration of the benefits of smart contracts, including trustless execution, automation of processes, and reduced dependency on third parties. The study also touches upon the challenges of blockchain adoption, such as scalability issues, legal concerns, and security vulnerabilities. The authors emphasize the need for further research into optimizing blockchain performance to make smart contracts more efficient and widely adopted.

III. METHODOLOGY

The process begins with selecting a suitable blockchain, such as Ethereum or Binance Smart Chain, and developing smart contracts to automate and enforce rules. Projects are submitted with detailed proposals, verified through blockchain-based identity checks, and approved via community voting using decentralized governance mechanisms. Fundraising involves launching token sales like ICOs or STOs, where contributors receive tokens in exchange for funds. A smart contract escrow system ensures funds are released in phases tied to project milestones, with contributors voting on milestone completion before the next tranche is released. All transactions are recorded on the blockchain for transparency and auditability, and rewards or equity are distributed via tokens, providing contributors with access to products, services, or ownership. Additionally, decentralized governance enables community involvement in decision-making and dispute resolution. This methodology ensures security through cryptographic measures, reduces reliance on intermediaries, and improves efficiency, making blockchain-based crowdfunding a superior alternative to traditional methods.

The Decentralized Crowdfunding Application aims to leverage blockchain technology and decentralized frameworks to create a secure, transparent, and efficient crowdfunding platform. The system architecture, as depicted in the provided figure, follows a structured methodology combining front-end technologies, back-end development, blockchain integration, and user authentication mechanisms. Below is the step-by-step methodology.

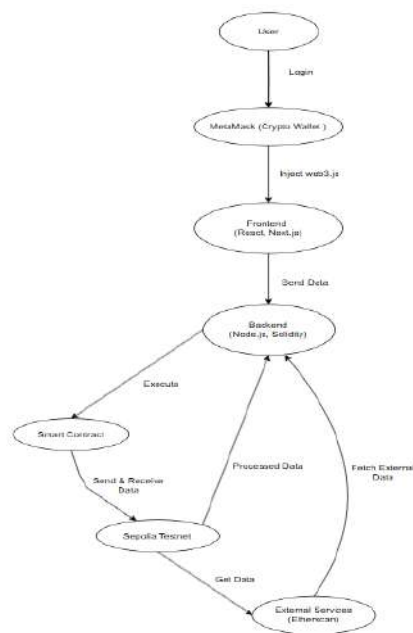


Figure 12. Flow Diagram

1. User Interaction and Authentication

- Users access the platform through a web browser integrated with MetaMask, a cryptocurrency wallet that enables secure authentication and transaction signing.
- MetaMask injects the web3.js library into the browser, allowing users to interact with the Ethereum blockchain.
- Users log in to the application using their MetaMask credentials, ensuring secure and decentralized access.

2. Front-End Development

- The front end is developed using React and Next.js to create a responsive and user-friendly interface.
- It allows users to view active campaigns, contribute funds, or create their campaigns seamlessly.
- The interface dynamically fetches blockchain data, such as campaign status, contributions, and milestones, for real-time updates.

3. Back-End Development

- The back-end is implemented using Node.js to handle server-side logic and API calls efficiently.
- Solidity, a programming language for Ethereum smart contracts, is used to write and deploy the core functionality of the crowdfunding system.

- Smart contracts manage campaign creation, fund contributions, and milestone-based disbursement of funds.

4. Blockchain Integration

- To link the platform to the Ethereum blockchain, the application makes use of the Infura infrastructure. By serving as a bridge, Infura makes it possible for users to communicate with the blockchain without having to manage their own Ethereum node.
- The Ethereum network uses smart contracts to automate important procedures:
- Campaign creation with predefined funding goals and deadlines.
- Secure contribution handling, where funds are locked until conditions are met
- Milestone-based fund release to ensure proper utilization of resources

5. Transparency and Tracking

- The platform incorporates Etherscan as an external service to enable contributors to track the transaction history of campaigns on the Ethereum blockchain.
- This transparency builds trust among contributors by providing a verifiable record of fund usage and campaign progress.

6. Fund Disbursement and Security

- Smart contracts enforce predefined rules for fund allocation. Funds are only released to campaign creators upon meeting specific milestones.
- In cases where the funding goal is not reached within the campaign's duration, the smart contract ensures that contributions are refunded to the backers automatically.

7. External Services and Scalability

- The decentralized infrastructure ensures the system is scalable and resilient, capable of handling a growing number of campaigns and transactions.
- The use of Ethereum ensures global accessibility and interoperability, enabling users worldwide to participate seamlessly.

By combining blockchain's transparency with a robust web interface and secure wallet integration, this methodology ensures the application addresses the challenges of traditional crowdfunding platforms while providing a secure and efficient experience for users.

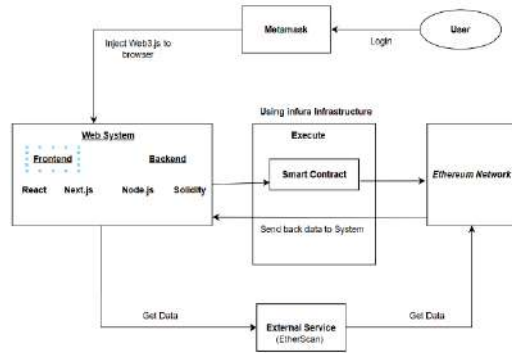


Figure 13. System Architecture

IV. LIMITATIONS

While blockchain-based crowdfunding offers numerous benefits, it also has several limitations that need consideration:

1. Technical Complexity

Implementing and maintaining blockchain platforms require advanced technical knowledge, which can be a barrier for creators and investors unfamiliar with the technology. Additionally, integrating blockchain with front-end applications requires tools like Web3.js or Ethers.js, which add another layer of complexity. Ensuring smooth interactions between users and the blockchain while maintaining security and efficiency is a demanding task that requires continuous development and testing.

2. Smart Contract Vulnerabilities

While smart contracts automate crowdfunding transactions securely, they are not immune to vulnerabilities. Bugs or poorly written code can lead to exploits such as reentrancy attacks, leading to financial losses. Extensive auditing is required to mitigate these risks.

3. Regulatory and Legal Uncertainties

Blockchain-based crowdfunding operates in a complex regulatory environment. Different countries have varying laws regarding cryptocurrencies and fundraising, which could lead to legal challenges or restrictions on the platform's operation. Compliance with evolving financial regulations remains a challenge.

4. User Adoption and Technical Barriers

For non-technical users, understanding and using blockchain-based crowdfunding platforms can be difficult. Many investors and project creators are unfamiliar with cryptocurrency wallets, gas fees, and private key management, which could limit adoption. A user-friendly interface and proper education are necessary for wider adoption.

5. Scalability Issues

Popular blockchains, like Ethereum, can experience high transaction fees and slow processing times during periods of heavy network congestion, impacting usability.

6. Lack of Awareness:

Many people are unfamiliar with blockchain technology, which can reduce participation. Educating potential investors about blockchain and its benefits is a challenge.

7. Scalability Issues

Platforms for blockchain crowdfunding may encounter scalability issues as they become more popular, especially on networks like Ethereum. High demand may result in sluggish transaction speeds and higher gas prices because blockchains handle transactions decentralized. This implies that handling a crowdfunding payment could become costly and ineffective during periods of high activity.

8. Regulatory and Legal Uncertainties

Blockchain crowdfunding exists in a legal gray area, as cryptocurrency regulations vary widely across different countries. Some governments embrace blockchain innovation, while others impose strict regulations or outright bans on crypto-based fundraising. This uncertainty creates difficulties for both platform developers and investors.

For instance, some regions may require identity verification (KYC/AML compliance), while others impose restrictions on raising funds through crypto. If regulations become stricter, blockchain crowdfunding platforms may need to adjust their models or face legal challenges. Keeping up with evolving laws and ensuring compliance without compromising decentralization remains a difficult balance to achieve.

9. Dependence on Ethereum and High Gas Fees

Most blockchain crowdfunding platforms rely on Ethereum, which, despite its security and popularity, often suffers from high gas fees and network congestion. During periods of high demand, even simple transactions can become costly, making micro-investments unfeasible.

Alternatives like Binance Smart Chain (BSC), Solana, or Polygon offer lower fees and faster transactions, but migrating to these networks requires additional development efforts. Moreover, each blockchain has trade-offs in terms of security, decentralization, and ecosystem support, making it difficult to choose the best option.

10. Lack of Refund and Dispute Mechanisms

One downside of decentralization is the lack of a traditional refund and dispute resolution system. In centralized crowdfunding platforms, users can often request refunds if a project fails to deliver. However, in blockchain-based systems, once funds are transferred via a smart contract, retrieving them can be impossible unless the contract explicitly allows for refunds.

This creates trust issues, as backers may be hesitant to invest in projects with no guarantee of fund recovery. Solutions like escrow smart contracts, milestone-based funding, and DAO governance can help mitigate this issue, but they require additional development and governance structures.

V. FUTURE SCOPE

The Decentralized Crowdfunding Application presents numerous opportunities for growth and innovation. As blockchain and decentralized finance (DeFi) technologies advance, the project can evolve to meet emerging needs and challenges. Below are some key areas for future development:

1. AI-Driven Campaign Insights

- Utilize data analytics to provide campaign creators with actionable insights on their performance.
- Offer contributors tools to evaluate campaign success potential based on historical data and trends.
- Implement recommendation systems to match users with campaigns aligned with their preferences.

2. Legal and Regulatory Adaptation

- Ensure the platform complies with regional regulations for crowdfunding and blockchain use.
- Build frameworks for seamless integration with traditional banking systems for fiat-crypto conversion, enabling wider adoption.

3. Loyalty Programs for Users

- Introduce reward mechanisms for frequent contributors, such as loyalty points, discounts, or access to exclusive campaigns.
- Gamify the platform by incorporating badges, leaderboards, and achievement systems for both backers and creators.

4. Ecosystem Partnerships

- Partner with established DeFi platforms, blockchain projects, or social media networks to extend the platform's capabilities.
- Build collaborations with third-party payment processors to facilitate seamless fund transfers across border

VI. CONCLUSION

The development of this decentralized crowdfunding application represents a significant step forward in creating a secure, transparent, and efficient fundraising platform. By utilizing blockchain technology on the Spolia test net, the application eliminates the need for traditional intermediaries, enabling direct interaction between project creators and contributors. This approach not only fosters trust but also reduces transaction fees, making crowdfunding more accessible and cost-effective for both parties. The integration of smart contracts ensures that fund management is automated and tamper-proof, reducing risks associated with fraud, mismanagement, or misuse of funds.

The application employs cutting-edge technologies to deliver a seamless and user-friendly experience. The front, built using React and Next.js, provides an intuitive and responsive interface for users, while the backend, powered by Node.js and Solidity, ensures secure and efficient handling of data and transactions. MetaMask integration offers a convenient way for users to connect their crypto wallets, and Ether's integration allows real-time tracking and verification of transactions, adding another layer of transparency and trustworthiness to the platform.

This project not only addresses the shortcomings of traditional crowdfunding methods, such as a lack of transparency, high transaction fees, and geographical limitations but also introduces new possibilities through decentralization. It opens up opportunities for global participation and inclusivity, allowing anyone with internet access to support projects or raise funds without relying on centralized entities.

Looking ahead, the potential of this platform is vast. Future enhancements could include expanding the scope to support multiple blockchain networks, enabling cross-chain functionality, and introducing tokenization features that allow contributors to receive project-based ownership or benefits. Additionally, incorporating advanced analytics and reporting tools could further enhance the decision-making process for both contributors and project creators.

In conclusion, this decentralized crowdfunding application exemplifies how blockchain technology can transform traditional systems, providing a more equitable, secure, and innovative approach to fundraising. It has the potential to redefine the crowdfunding ecosystem, promoting trust, inclusivity, and financial empowerment on a global scale.

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Embedded Finance as an Enabler of ESG Principles: Implications for Sustainable Economic Development

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Abstract: This paper explores the role of embedded finance in promoting Environmental, Social, and Governance (ESG) principles and its implications for sustainable economic development. Embedded finance, which integrates financial services into non-financial products or platforms, has emerged as a key enabler of ESG-driven strategies. The research evaluates how this financial innovation can contribute to achieving sustainability goals across various sectors, including renewable energy, social inclusion, and corporate governance. The paper provides an in-depth analysis of embedded finance's potential to support economic growth while ensuring environmental sustainability and social responsibility. It also discusses the challenges and opportunities associated with integrating ESG principles into embedded finance models, offering a comprehensive view of the future landscape of sustainable finance.

Embedded finance, the integration of financial services within non-financial products or platforms, has emerged as a crucial tool for advancing Environmental, Social, and Governance (ESG) principles. As the global economy increasingly prioritizes sustainable development, embedded finance offers innovative solutions to align financial practices with ESG goals.

Keywords: Financial Decision-Making, Risk Management, Sustainable Development, Investor Demand, Corporate Responsibility, ESG Reporting Standards

Introduction:

The world is undergoing a profound transformation in how financial services are delivered. With the advent of technology and the rise of digital platforms, financial services are increasingly being integrated into non-financial industries through the concept of embedded finance. This innovative approach enables businesses to provide financial products like lending, insurance, and payments directly to consumers through platforms that were not traditionally associated with finance. Examples of embedded finance include the integration of loans into e-commerce platforms, insurance options available during the checkout process, and payment services built into social media applications. Embedded finance has the potential to address key issues related to economic inclusion, making financial services more accessible to underserved populations. This innovation could also support broader societal goals, including the integration of Environmental, Social, and Governance (ESG) principles into business practices. ESG factors have gained increasing importance in both corporate strategy and investment decisions. Governments, investors, and corporations alike are recognizing that business success is no longer solely determined by profit margins but by the company's impact on the environment, society, and its internal governance structure. This research aims to investigate the intersection of embedded finance and ESG principles, focusing on how embedded finance can serve as an enabler of ESG objectives, thereby fostering sustainable economic development. The paper will explore how financial products embedded in various platforms can help address environmental sustainability, promote social inclusion, and improve corporate governance. The analysis will include a review of the literature on embedded finance, ESG, and sustainable development, alongside empirical data and case studies that illustrate

real-world applications and challenges. Embedded finance can serve as a catalyst for change, especially in promoting financial inclusion, a critical aspect of the social pillar of ESG. By making financial products more accessible to marginalized populations, embedded finance can empower individuals and small businesses, giving them access to credit, insurance, and other essential services. Moreover, by embedding financial services within platforms promoting sustainable initiatives, such as green energy or carbon footprint tracking, embedded finance can help meet environmental goals.

The paper is structured as follows: the literature review provides an overview of the relevant academic and industry research on embedded finance and ESG. The methodology section outlines the research approach, while the research objectives clarify the focus of the paper. The discussion section addresses the brief history of embedded finance, strategies for implementing embedded finance practices, unethical practices, laws regulating embedded finance, and the impact of embedded finance on economic growth. Finally, the paper concludes with key findings and recommendations. This paper aims to explore the relationship between embedded finance and ESG principles, analyzing the potential impacts of this financial model on sustainable economic development. Specifically, it will examine the history of embedded finance, its strategic implementation, unethical practices, related laws, and its influence on economic growth.

Key Contributions

Embedded Finance and Its Growth

Embedded finance refers to the integration of financial products into non-financial platforms, enabling consumers to access financial services as part of their routine interactions with digital platforms. This financial integration allows companies to offer payment systems, insurance, lending, and other services without requiring customers to switch between different providers. The growth of embedded finance has been driven by advancements in fintech, APIs (Application Programming Interfaces), and the expansion of digital platforms, particularly in e-commerce, mobile applications, and social media. According to Pereira & Dias (2020), the global embedded finance market is expected to reach USD 7 trillion by 2030. Embedded finance has made it easier for individuals and small businesses to access financial services, contributing to greater financial inclusion. This is particularly beneficial for underserved communities who may not have access to traditional banking services.

ESG and Financial Performance:

The relationship between ESG factors and financial performance has been a major focus of research. A meta-analysis conducted by Friede, Busch, and Bassen (2015) found a positive correlation between ESG integration and financial performance, suggesting that incorporating ESG considerations can enhance long-term shareholder value. Similarly, Eccles, Ioannou, and Serafeim (2014) found that companies with high sustainability standards outperformed their peers in both the stock market and accounting metrics, indicating the potential for ESG to serve as a differentiating factor in competitive markets.

ESG Principles and Their Importance

The concept of ESG refers to the three critical factors that investors and businesses use to measure the sustainability and societal impact of companies. The environmental aspect

addresses how a company manages its impact on the planet, including climate change, resource use, and waste management. The social pillar focuses on human rights, employee welfare, diversity, and community engagement, while governance deals with corporate ethics, transparency, and accountability. The importance of ESG principles has grown significantly, particularly with the advent of sustainable investing. Investors are increasingly looking for companies that align with ESG values, as research has shown that strong ESG practices are linked to better long-term financial performance (Cheng et al., 2014). Moreover, governments and international organizations are pushing for more comprehensive ESG frameworks to drive global sustainability.

Embedded Finance as an Enabler of ESG

Embedded finance can significantly contribute to the achievement of ESG goals by making financial services more accessible and aligning financial practices with sustainability objectives. For example, embedded insurance models can help mitigate risks associated with climate change, while green finance platforms that integrate renewable energy investments can promote environmental sustainability. Embedded finance also fosters social inclusion by offering micro-lending and insurance products tailored to low-income and underserved populations. Embedded finance supports corporate governance by promoting transparency. As financial products become integrated into digital platforms, it becomes easier to track financial transactions, ensuring greater accountability and transparency in business practices. Furthermore, financial services can be designed to incentivize responsible consumer behavior, such as rewarding customers for sustainable purchases or investments in green projects.

Research Methodology:

Research Gap

The research gap lies in the lack of empirical research on how embedded finance integrates sustainability practices and how it can support the SDGs. The lack of comprehensive frameworks for measuring the ESG impact of embedded finance also leaves a gap in understanding its true potential for sustainable development.

Secondly, there is considerable research on embedded finance and its growth, limited studies specifically focus on its intersection with ESG principles. Much of the existing literature has explored embedded finance from a business model perspective (Narayan & Moorthy, 2022) or its potential for financial inclusion (Cheng et al., 2014), but there is a dearth of studies on its role as an enabler of ESG objectives.

Thirdly, awareness regarding the same should be spread through various platforms in order to make the people aware about the impact of embedded finance on sustainable economic growth.

Research Objective:

- Examine the role of embedded finance in enabling ESG principles, particularly in promoting environmental sustainability, social equity, and robust governance.
- Analyze the impact of embedded finance on economic growth, especially in developing economies where access to traditional financial services is limited.

- Identify the challenges and risks associated with embedded finance in relation to ESG principles, such as ethical concerns, regulatory compliance, and cybersecurity.
- Provide policy recommendations for governments and regulators to ensure that embedded finance serves as a tool for sustainable economic development.

In pursuing comprehensive and rigorous conceptual research, our study relies on a rich reservoir of secondary data meticulously gathered from diverse and reputable sources. The classification of our data as secondary underscores its origin in scholarly academic journals, a bastion of peer-reviewed research that epitomises academic rigour and integrity. Including insights from authoritative books further enhances the depth and breadth of our conceptual framework, tapping into the wisdom distilled by renowned scholars and experts in the field. Government publications, characterised by their meticulous research methodologies and access to official data, contribute a layer of empirical solidity to our study.

Furthermore, integrating information from reputable private sources ensures a well-rounded perspective, incorporating insights from industry leaders and practitioners.

This curated amalgamation of secondary data forms the bedrock of our research, assuring its reliability and credibility. The reliance on established and validated resources serves as a robust foundation, affirming the scholarly merit of our study. Drawing upon this diverse array of sources, we aim to synthesise a nuanced and comprehensive understanding of the conceptual landscape under investigation. In doing so, we uphold the standards of academic excellence, fostering a research endeavour grounded in the integrity and authority of the information at hand.

Discussion:

- **Brief History**

Embedded finance emerged alongside the rise of digital technologies and fintech innovations. It began as a way to simplify and digitize traditional financial services, but as platforms evolved, the integration of finance into non-financial products expanded rapidly. It started with basic payment services embedded in e-commerce platforms, but has since grown to include lending, insurance, and wealth management products. However, the emergence of anti-big Embedded finance groups in the US throughout the 1970s is where the current notion of Embedded finance originated. Over time, the topic developed into a distinct academic discipline with branches in both philosophy and empirical studies.

- **Strategies for ethical business practices:**

Successful implementation of embedded finance practices typically involves partnerships with non-financial businesses, offering digital wallets, payment systems, and micro-loans to underserved populations. Many fintech companies have also focused on promoting environmental sustainability by embedding green finance products into their offerings.

- **Unethical Business Practices:**

Concerns have arisen regarding unethical practices, such as data misuse, lack of transparency, and exploitative interest rates. The digital divide may also leave certain populations excluded from the benefits of embedded finance.

- **Inclusion and Exclusion Criteria:**

Inclusion Criteria:

- Peer-reviewed articles, industry reports, and case studies directly discussing ESG factors and sustainable finance.
- Studies focused on financial institutions, investment strategies, and corporate decision-making processes that involve ESG integration.
- Literature published in English to ensure clarity and accessibility.

Exclusion Criteria:

- Articles that do not focus on the intersection of ESG factors and financial decision-making.
- Publications that are purely theoretical without empirical or practical context.
- Non-English articles, due to translation limitations.

- **Limitations of the study**

1. **Scope of Literature:** The review primarily focuses on existing literature from specific geographic regions or sectors, which may limit the generalizability of the findings. Different countries and industries may have varying approaches to integrating ESG factors, affecting the applicability of the conclusions drawn.
2. **Data Availability:** The study relies on available data and literature, which may be incomplete or biased. Some ESG metrics and performance indicators may not be uniformly reported or may lack standardization, leading to potential gaps in the analysis.
3. **Rapidly Evolving Field:** The field of sustainable finance and ESG integration is continuously evolving, and new practices, frameworks, and regulations are emerging. Consequently, the findings and recommendations may become outdated quickly as new information and developments arise.
4. **Subjectivity in ESG Evaluation:** The assessment of ESG factors can be inherently subjective, as different stakeholders may have varying interpretations of what constitutes responsible or sustainable practices. This subjectivity may lead to inconsistencies in how ESG factors are integrated into financial decision-making.
5. **Limited Empirical Evidence:** While the review synthesizes theoretical frameworks and perspectives, it may lack sufficient empirical evidence to support the proposed integration strategies. More case studies or quantitative data.

- **Future Scope:**

The future scope of sustainable finance, particularly regarding the integration of Environmental, Social, and Governance (ESG) factors into financial decision-making, is vast and evolving. Several key areas warrant further exploration:

1. **Regulatory Frameworks:** As global awareness of sustainability issues increases, governments and regulatory bodies are likely to develop more comprehensive frameworks that require companies to disclose ESG-related information. Future research could examine the impact of these regulations on financial performance and investment strategies, particularly in emerging markets where such frameworks are still being established.
2. **Technological Innovations:** The role of technology in facilitating ESG integration presents significant opportunities for future studies. Research could focus on how advancements in big data analytics, artificial intelligence, and blockchain can enhance the accuracy of ESG assessments, improve transparency, and streamline reporting processes. Exploring how fintech solutions can support sustainable investment practices is another promising avenue.
3. **Investment Strategies:** There is a growing interest in developing innovative investment strategies that prioritize ESG factors. Future research could explore various approaches to sustainable investing, such as impact investing, green bonds, and sustainable index funds, and analyze their effectiveness in delivering both financial returns and positive social or environmental outcomes.
4. **Sector-Specific Studies:** Different sectors may face unique challenges and opportunities in integrating ESG factors. Future research could delve into sector-specific analyses, exploring how industries such as energy, agriculture, and technology adapt to sustainable finance principles and the implications for their stakeholders.
5. **Behavioral Finance and ESG:** Understanding the behavioral aspects of investors and decision-makers concerning ESG factors can provide valuable insights. Future research could investigate how cognitive biases affect investment choices related to sustainability, as well as the role of institutional investors in shaping market dynamics through their ESG-focused strategies.

- **Results and Discussion:**

The study on integrating Environmental, Social, and Governance (ESG) factors into financial decision-making reveals several key insights:

1. **Increased Investor Awareness:** There is growing awareness among investors about the importance of incorporating ESG factors into financial decisions. Institutional and retail investors are increasingly favoring companies that demonstrate strong ESG performance, as they view these investments as more sustainable and resilient in the long term.

2. **Positive Impact on Financial Performance:** The integration of ESG factors is positively correlated with improved financial performance. Companies with strong ESG ratings tend to exhibit lower risk profiles and higher returns over the long term. This suggests that sustainable practices contribute to financial stability and growth.
3. **Regulatory Pressure and Compliance:** Regulatory frameworks are pushing companies and financial institutions towards adopting ESG principles. Governments and international bodies are implementing stricter guidelines, requiring transparency in ESG reporting. Compliance with these regulations not only helps mitigate risks but also improves investor confidence.
4. **Challenges in ESG Data Standardization:** A significant challenge identified is the lack of standardization in ESG reporting. The absence of universally accepted metrics and inconsistent data disclosure practices complicates the assessment of ESG performance, making it difficult for investors to make informed comparisons between companies.
5. **Social and Governance Factors Gaining Prominence:** While environmental factors have traditionally dominated the ESG landscape, social and governance aspects are gaining more attention. Investors are increasingly scrutinizing companies' social policies, such as labor practices and community engagement, as well as governance issues like board diversity and executive compensation.
6. **Integration Challenges for Financial Institutions:** Financial institutions face challenges in integrating ESG into their decision-making processes. These include a lack of expertise, insufficient ESG-related data, and the difficulty of aligning ESG goals with short-term financial performance targets.
7. **Shift in Corporate Strategy:** Companies are increasingly integrating ESG considerations into their corporate strategies, not only to meet investor expectations but also to enhance their brand reputation and long-term sustainability. Firms with proactive ESG strategies are more likely to attract investment and maintain competitive advantage.
8. **Role of Technological Innovations:** Technological advancements, such as big data analytics and AI, are playing a significant role in improving the collection, analysis, and reporting of ESG data. These technologies enable more accurate assessments of a company's ESG impact and facilitate better integration into financial decision-making processes.
9. **Impact on Risk Management:** Integrating ESG factors into financial decisions contributes to enhanced risk management. Companies that prioritize ESG issues tend to be more adept at identifying and mitigating risks related to climate change, regulatory changes, and social pressures, thus reducing overall exposure to potential disruptions.
10. **Barriers to Widespread Adoption:** Despite the benefits, there are barriers to widespread ESG integration, such as the perception of increased costs, short-termism in financial markets, and a lack of awareness among certain stakeholders. Addressing these barriers requires collaboration among policymakers, financial institutions, and corporations to create incentives for sustainable finance practices.

Conclusion:

In conclusion, this paper has explored the intricate relationship between ethical business practices and sustainable economic growth, shedding light on the challenges and opportunities inherent in fostering a business environment that prioritizes integrity, transparency, and social responsibility. Through a comprehensive review of existing literature and empirical evidence, several key insights have emerged.

Promoting ethical business practices necessitates collaboration across sectors, including academia, civil society, and international organizations. Research initiatives, educational programs, and public awareness campaigns can help raise awareness about the importance of ethical conduct and equip individuals and organizations with the knowledge and tools needed to uphold ethical standards in their respective spheres of influence. By embracing ethical principles, businesses can not only mitigate risks and enhance resilience but also contribute to a more inclusive, equitable, and environmentally sustainable future.

As the landscape of sustainable finance continues to evolve, further research is essential to explore innovative strategies for integrating ESG factors across different sectors and investment vehicles. By prioritizing sustainability in financial decision-making, we can work towards a more equitable and sustainable future, benefiting not only investors but also society as a whole. Ultimately, the successful integration of ESG considerations will pave the way for a resilient financial system that aligns with global sustainability goals.

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Sustainability and the Digital Transition: A Literature Review

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Abstract: The digital transition processes have demonstrated an enormous capacity to develop and implement sustainable solutions, which allow solving several problems such as poverty, high rates of species extinction and lack of equal opportunity. However, little attention is paid to the connection between the digital transition and sustainability. Thus, a systematic bibliometric literature review was developed to fill this knowledge gap and demonstrate the potential contributions of the digital transition to environmental, economic, and social sustainability aspects. In environmental sustainability, the digital transition involves the application of technologies such as Artificial Intelligence (AI), big data analytics, Internet of Things (IoT), and mobile technologies that are used to develop and implement sustainability solutions in areas such as sustainable urban development, sustainable production, and pollution control. In economic sustainability, emerging digital technologies can drive transformation into a more sustainable circular economy, the digital sharing economy, and establish sustainable manufacturing and infrastructure design. In the digital transition to social sustainability, the studies analyzed demonstrate the need for multidimensional policy perspectives to address the current digital divide. For effective management of the digital transition that achieves sustainability goals, the study discusses alternative approaches that include innovation through experimentation and dynamic and sustainable advantages achievable through temporary benefits.

Keywords: sustainability; digital transition; sustainable development; systematic bibliometric literature review (LRSB)

1. Introduction

Despite the intensifying efforts in society, science, and technology to promote the co-existence of human civilization and Earth's biosphere, social and biophysical unsustainability indicators have been on the rise in recent years. Consequently, the concept of sustainability has received enormous attention from scholars and economists attempting to provide practical solutions. Most of the attention can be linked to the 2015 UN Summit, where the 2030 agenda for sustainable development was adopted. The World Commission on Environment and Development (WCED) defined it as "the development that meets the needs of the present without compromising the ability of future generations to meet their needs" [1] (p. 1948). The concept integrates multiple aspects of the current society, including ecological, social, and economic concerns. It also aims to balance environmental protection and economic growth. With the increased awareness of the need for sustainability, progress has been made, including increased use of renewable energy, strengthened protections for endangered species, and improved measures of environmental protection [2]. However, Fischer and Riechers [3] note that problems such as ongoing anthropogenic climate change, poverty, high rates of species extinction, and lack of equal opportunities continue to persist. These issues indicate the need to identify and develop advanced measures of measuring and solving unsustainability problems to protect the wellbeing of the current and future generations. Consequently, scholars have identified emerging technologies as potential solutions.

For example, Melnyk et al. [4] indicate that the third industrial revolution has formed “a green economy and harmonizes industrial metabolism with the metabolism of the biosphere” (p. 24). Emerging digital technologies have changed the way businesses and individuals engage in daily life and business activities, leading to a digital transition. The digital transition concept refers to the transition from analog to digital processes that allows digital tools to model processes and activities, thus improving performance and productivity. In addition, the digital transition has increased the capability to develop and implement sustainable solutions. For instance, the Artificial Intelligence (AI) alliance formed by Facebook, Amazon, Google, IBM, and Microsoft aims to create solutions for “humanity’s most challenging problems, including making advances in health and wellbeing, transportation, education, and science” [5] (p. 60). In this case, the companies use AI technologies to create solutions to social concerns, which rank among the critical pillars of sustainability alongside environmental and economic concerns [6]. However, El Hilali et al. [5] indicate that minimal attention is paid to demonstrating the connection between digital transition and sustainability. Several research papers have been published to discuss the different points of view of sustainability and digital transition, but in an isolated way [7–10], yet very few papers have discussed the link between sustainability and digital transition. Consequently, the lack of research hinders practitioners from optimizing digital tools to provide sustainable solutions to the world’s unsustainability issues. Therefore, this systematic bibliometric literature review aims to bridge the knowledge gap by synthesizing existing literature on sustainability and digital transition and enriching the published literature by discussing how to seize the opportunity of digital transition to solve sustainability problems.

2. Theoretical Background

Although the term ‘sustainability’ became mainstream in the 1980s, its origins can be tracked to many early roots. For example, Purvis et al. [6] note that in response to decreasing forest resources across Europe in the 17th and 18th centuries, Evelyn and Carlowitz introduced the concept of sustainable yield. In the 19th and 20th centuries, some ecologists and natural scientists advocated for preserving nature and the conservation of natural resources to ensure sustainable production and consumption. In addition, some political economists, including Smith, Ricardo, Mill, and Malthus, challenged the limits of population and economic growth and acknowledged the fundamental trade-offs between social justice and wealth accumulation [6]. Despite these activities, the sustainability concept did not gain global attention until the 20th century, when the Club of Rome’s ‘Limits to Growth’ advocated for a sustainable world system and a sustainable society. In the 1960s, environmental movements began to critique practices and called for ecological conservation, leading to the ‘sustainable development’ concepts of the 1980s [11]. The current definitions of sustainability have been built on these concepts and expanded to accommodate the current environmental, social, and economic problems.

Consequently, sustainability can be defined from multiple perspectives, making it difficult to have a single definition of the concept. Eizaguirre et al. [12] indicated more than 100 definitions of sustainability used by practitioners and scholars to illustrate the concept based on varying contexts. However, the most globally accepted definition comes from the World Commission on Environment and Development, which defined sustainable development as growth that meets the needs and aspirations of the current populations without compromising those of future generations. Bellandi and De Propris

[11] describe it as integrating economic vitality, environmental robustness, and social equity to develop resilient, healthy, diverse, and prosperous current and future communities. The

operationalization of these definitions considers the economic, social, and environmental aspects of development. Consequently, Avila-Gutierrez et al. [13] argue that sustainable practices should ensure satisfactory outcomes for the environment and the global population while also promoting current and future generations' economic and social needs. Most scholars classify sustainability under three pillars, which can either be represented as the 3P's, people, prosperity, and profits, or as the 3E's economy, environment, and equity [12]. The multiple aspects considered under these pillars include biodiversity, natural resources, sustainable urbanization, human rights, cultural diversity, distribution of resources, access to equal opportunities, security, and social cohesion, among others.

The rapid development of digital technologies has resulted in profound changes in operations and strategies in different sectors worldwide. For example, the automotive industry manufactures self-driving cars, computers' capability to recognize images has surpassed that of humans, and robots are used to automate manufacturing processes and phone calls in the customer care sector [14]. Consequently, companies have been prompted to improve their technologies, processes, and tools to embrace these developments and survive the digital disruption in a process termed as 'digital transition.' The digital transition involves automating some manual processes, improving turnaround times by adding additional integrations, and upgrading newer technologies [15]. While these processes guarantee improved efficiencies that translate to higher performance and productivity, they also pose a significant leadership challenge in keeping up with technological advancements. Fraga-Lamas et al. [16] argue that the primary leadership challenge created by these disruptive technologies involves transitioning the company towards a desired future position by frequenting, assessing, and revising its business strategies and roadmaps based on emerging intelligence and technologies. Thus, the digital transition is tied to innovation. It is a proactive approach that anticipates the next ample opportunity and implements appropriate measures to exploit it for the benefit of the organization and its key stakeholders.

The digital transition is not new since it has been an ongoing process involving adopting technologies as they emerge. The history of digital transition dates back to the 1950s, when companies began using digital technologies to facilitate operational and strategic change across different areas [14]. The client-server architecture, mainframe computers, and mini and personal computers allowed companies to centralize operations and decentralize responsibilities and related activities. Other innovations, such as mobile communications, smartphones, the internet, and cloud computing, enabled companies to create new business models and structures [15]. The transition in recent years has been geared towards newer technologies, including artificial intelligence (AI), internet of things (IoT), multi-cloud environments, big data, and distributed ledger technologies (DLT), which have significantly transformed business operations and strategies [16]. These innovations show that the transition process is an ongoing activity based on emerging technologies. Consequently, it is critical for companies and industries worldwide to develop clear roadmaps to strategize and implement the right approach to embrace and optimize these technologies.

While production practices are associated with improving the wellbeing of humankind, they have also been linked to the current environmental and industrial challenges. Consequently, scholars and practitioners have identified digital technologies as practical tools for transitioning the production processes towards sustainability [17]. Digital technologies can facilitate industrially sustainable through multiple ways, including establishing necessary change at the company level to enhance organizational performance towards sustainability, improving organizational planning processes to enable them to predict demand and identify opportunities

presented by sustainability, and allowing the companies to experiment with new efficient business models [18]. The “construction industry and, in particular, 3D printing of concrete are profoundly changing construction technologies and construction processes. Materials engineering is still a challenge for the search for even more effective and performant 3D printable concrete”

[19] (p. 1). Other examples of digital technologies used to achieve sustainability include sensor networks that improve the manufacturing processes’ adaptability and flexibility. Despite identifying these benefits, their realization is not guaranteed [18]. Therefore, achieving them requires organizations to increase awareness and transformation of their manufacturing processes to achieve sustainability-related goals such as transitioning to a circular economy and optimizing materials and energy consumption through high-performance machines, components, and robots. For example, the Industrial Internet of Things (IIoT) and data analytics can gather data from the design stage to the recycling stage that can be used to improve energy efficiency and product life cycle [20]. In addition, these digital technologies can be used to analyze data context to monitor performance and optimize productivity. Therefore, the digital transition involves a technological revolution that can improve industrial sustainability through intelligent management systems that can achieve multiple functions, including improving energy and resource efficiency and reducing waste.

One major aspect connecting the digital transition and sustainability is the increased demand for innovative sustainable ecosystems. Trading blocks and regions, countries, and clusters globally are experiencing ongoing structural changes and are trying to understand global technological shifts and innovation trends [17]. Consequently, implementing innovative sustainable ecosystems has become a critical technique for achieving and maintaining competitiveness in the global business environment. Costa and Matias [20] argue that innovation and problem-solving are strongly connected, with the former being used to provide solutions to complex problems, including those associated with sustainable development. Sustainable innovations can address long-term and short-term societal problems, promote cleaner production, and elevate domestic and international economic development goals [21]. For example, with sustainable technological developments, companies can initiate practices that promote human and environmental well-being and sustainable exploitation of resources. Therefore, sustainable innovations contribute to the development of solutions to societal problems by facilitating sustainable development through corporate sustainability, networks, and local communities.

Additionally, innovative sustainable ecosystems comprise a network of relationships involving various actors and objects. These key relationships establish connections that reinstate the significance of the environment and multiple institutions and facilitate the free flow of related information through value co-creation systems, leading to sustainability [17]. While interactive networks play a crucial role in generating and diffusing information and innovations, they require an environment that allows them to share the value with a society comprised of players with shared interests. Thus, the success of sustainable innovations depends on their acceptance among the broader communities worldwide. For example, the user community, governments, and players across the value chain should embrace the innovation ecosystem and communicate and promote it to facilitate the further digital transition through value creation. Costa and Matias [20] contribute to this argument by indicating that the sustainable innovation ecosystem can be reinforced by “enlarging participation to unusual partners” and ensuring flexibility and transparency (p. 3). Achieving sustainability requires resources and capabilities. Besides, the current environmental problems require appropriate

advanced technological innovation, knowledge, and expertise [21]. The concept of innovative, sustainable ecosystems emphasizes collective intelligence as a primary way of accumulating the resources and capabilities required to achieve sustainability. In this case, the players across the network interact using their innovative mindset to establish and implement appropriate innovations that can solve the sustainability problems affecting the world.

3. Materials and Methods

One primary issue undermining sustainability efforts is the ambiguity, lack of clarity, and uncertainty associated with sustainability and digital transition. According to Salas-Zapata and Ortiz-Munoz [22], this problem “can hinder the operationalization of the concept [sustainability], generate contradictory discourses on the matter, and may affect the validity of the studies” (p. 153). A systematic bibliometric literature review is used in this research to provide new insights and analyze existing literature to eliminate this confusion and build knowledge on the connection between digital transition and sustainability. The justification for the choice of methodology is based on Dodgson’s [23] argument that literature reviews are a form of research that uses a rigorous research process to gather valid and reliable data needed to build knowledge. Xiao and Watson [24] further explain that literature analysis enhances readers’ understanding of the breadth and depth of the existing literature and identifies gaps to explore. From this perspective, reviewing appropriate literature will enable identifying digital tools and opportunities that can be exploited to achieve sustainable goals and development.

In this sense, the systematic bibliometric literature review (LRSB) involves the screening and selection of information sources to ensure the validity and accuracy of the interpreted and presented data, the process was divided into 3 phases and 6 steps [25–27] (Table 1).

Table 1. Process of systematic LRSB.

| Fase | Step | Description |
|----------------|--------|--|
| Exploration | Step 1 | Formulating the research problem |
| | Step 2 | Searching for appropriate literature |
| | Step 3 | Critical appraisal of the selected studies |
| | Step 4 | Data synthesis from individual sources |
| Interpretation | Step 5 | Reporting findings and recommendations |
| Communication | Step 6 | Presentation of the LRSB report |

Source: own elaboration.

The methodology approach began with a literature search on the SCOPUS indexing online database of scientific articles, the most important peer-reviewed peer in the academic world. However, we consider that the study has the limitation of considering only the SCOPUS database, excluding the other academic bases. The keyword “Sustainability” was used to identify potential sources during the initial search. A total of 282,887 documents were identified. Given the need to narrow down the references to the most relevant, the keyword “digital transition” was added. We decided not to include other keywords, such as digital transformation and digitalization, because, although similar, they are different concepts from digital transition, which may distort the object of study in this article. Inclusion criteria were limited to academic and scientific documents, including journal articles, books and book chapters, and conference articles. This step reduced the number of documents summarized in the final report to 36 (Table 2).

Table 2. Screening Methodology.

| Database Scopus | Screening | Publications |
|--------------------|--|--------------|
| Meta-Search | Keyword: Sustainability | 282,887 |
| Inclusion Criteria | Keyword: Sustainability, Digital transition | 36 |
| Screening | Keyword: Sustainability, Digital transition Published until December 2021 | 36 |

Source: own elaboration.

Of the 36 scientific and/or academic documents, 24 are Articles; 6 Book Chapters; 4 Conference Papers; 2 Reviews.

4. Literature Analysis: Themes and Trends

Peer-reviewed documents on the topic until December 2021 were analyzed. The year 2021 was the year with the highest number of peer-reviewed documents on the subject, with 15 publications. Figure 1 analyzes peer-reviewed publications published through December 2021.

The publications were sorted out as follows: Sustainability Switzerland (10); Urban Book Series (3); Revesco Revista De Estudios Cooperativos (2); the remaining publications with a published scientific and/or academic document.

We can say that between 2019 and 2021 there has been an interest in research on Sustainability and the Digital transition.

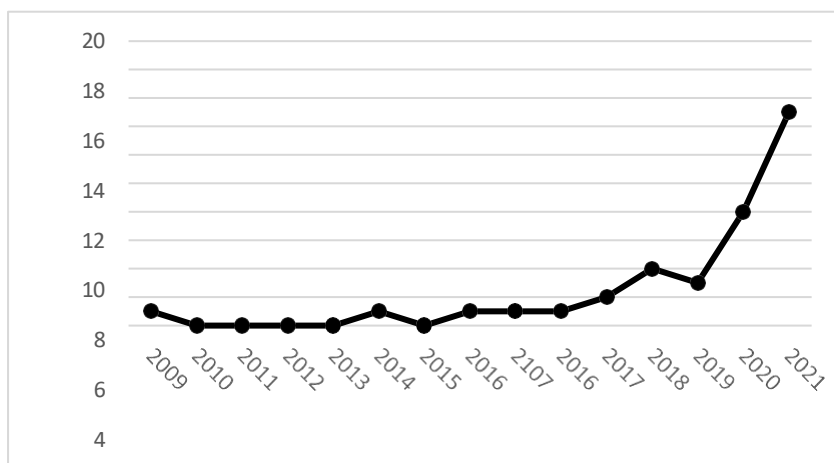


Figure 1. Documents by year. Source: own elaboration.

In Table 3, we analyze the SCImago Journal & Country Rank (SJR), the best quartile and the H-index by publication. The Journalism Studies with 2.140 (SJR), Q1 and H-index 61.

There are a total of seven publications in Q1, five publications in Q2, one publication in Q3, and two publications in Q4. Publications from the best quartile Q1 represent 29% of the 24 publication titles; best quartile Q2 represents 21%, the best quartile Q3 represents 4%, and finally, the best quartile Q4 represents 8% of the 25 publication titles. Data from nine publications are not available.

As evident from Table 3, the significant majority of articles on Sustainability and the Digital transition rank on the Q1 best quartile index.

Table 3. SCImago journal & country rank impact factor.

| Title | SJR | Best Quartile | H-Index |
|--|-------|---------------|---------|
| <i>Journalism Studies</i> | 2.140 | Q1 | 61 |
| <i>Journal Of Cleaner Production</i> | 1.940 | Q1 | 200 |
| <i>Journal Of Big Data</i> | 1.030 | Q1 | 35 |
| <i>International Journal of Energy Research</i> | 0.810 | Q1 | 95 |
| <i>International Journal of Sustainable Development and World Ecology</i> | 0.680 | Q1 | 43 |
| <i>Sustainability Switzerland</i> | 0.610 | Q1 | 85 |
| <i>Scires IT</i> | 0.450 | Q1 | 5 |
| <i>Sensors</i> | 0.640 | Q2 | 172 |
| <i>Energies</i> | 0.600 | Q2 | 93 |
| <i>Research</i> | 0.360 | Q2 | 30 |
| <i>Revesco Revista De Estudios Cooperativos</i> | 0.510 | Q2 | 11 |
| <i>Public Finance Quarterly</i> | 0.400 | Q2 | 31 |
| <i>Aims Materials Science</i> | 0.370 | Q3 | 16 |
| <i>International Journal of Financial Studies</i> | 0.200 | Q4 | 6 |
| <i>Materiaux Et Techniques</i> | 0.180 | Q4 | 9 |
| <i>Ceur Workshop Proceedings</i> | 0.180 | -* | 52 |
| <i>Ion Conference Series Earth and Environmental Science</i> | 0.180 | -* | 26 |
| <i>Proceedings Of The 3rd World Conference on Smart Trends in Systems Security and Sustainability Worlds4 2019</i> | 0.150 | -* | 4 |
| <i>Urban Book Series</i> | -* | -* | -* |
| <i>A Handbook of Digital Library Economics Operations Collections and Services</i> | -* | -* | -* |
| <i>East Asian Development Model Twenty First Century Perspectives</i> | -* | -* | -* |
| <i>Global Transitions</i> | -* | -* | -* |
| <i>Polito Springer Series</i> | -* | -* | -* |
| <i>Proceedings of the Design Society</i> | -* | -* | -* |

Note: * data not available. Source: own elaboration

The subject areas covered by the 37 scientific articles were the following: Social Sciences (23); Energy (15); Environmental Science (13); Computer Science (8); Engineering

(6); Economics, Econometrics and Finance (5); Business, Management and Accounting (3); Mathematics (3); Arts and Humanities (2); Chemistry (2); Decision Sciences (2); Materials Science (2); Physics and Astronomy (2); Biochemistry, Genetics and Molecular Biology (1); Earth and Planetary Sciences (1).

The most quoted article was “The core enabling technologies of big data analytics and context-aware computing for smart sustainable cities: a review and synthesis” from Bibri and Krogstie with 66 quotes published in the Journal of Big Data with 1.030 (SJR), the best quartile (Q1) and with an H-index (35). The study takes an approach to the new wave of computing based on smart, sustainable cities.

In Figure 2, we can analyze the evolution of citations of articles published between ≤2011 and December 2021. The number of citations shows a net positive growth with an R2 of 39% for the 2011–December 2021 period, with 2021 peaking at 87 citations.

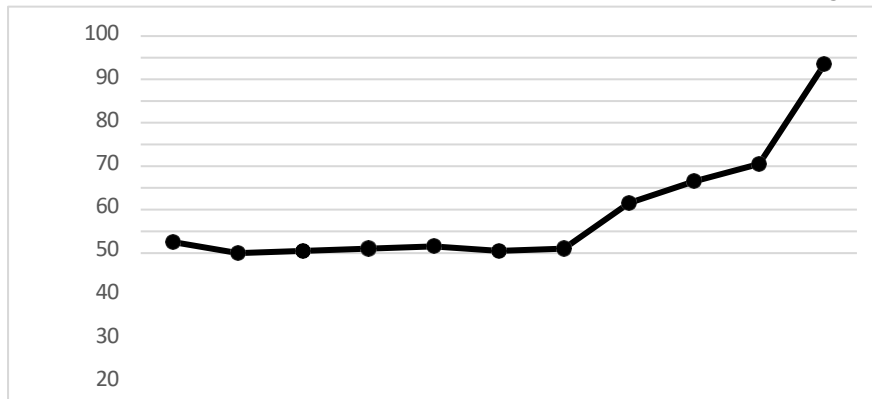


Figure 2. Evolution of citations between ≤ 2011 and 2021. Source: own elaboration.

The H-index was used to ascertain the productivity and impact of the published work, based on the largest number of articles included that had at least the same number of citations. Of the documents considered for the H-index, eight have been cited at least eight times.

In Appendix A, Table A1, the citations of all scientific and/or academic documents up to December 2021 are analyzed; 13 documents were not cited during this period, with a total of 198 citations. Appendix B, Table A2, examines the self-quotation of documents until 2021 of the 36 articles there were a total of 65 self-quotation “The core enabling technologies of big data analytics and con... “were self-cited 29 times.

In Figure 3, the bibliometric study is presented to investigate and identify indicators of the dynamics and evolution of scientific information. The study of bibliometric results using the scientific software VOSviewer 1.6.15 aims to identify the main research keywords in studies of Sustainability and Digital Transition.

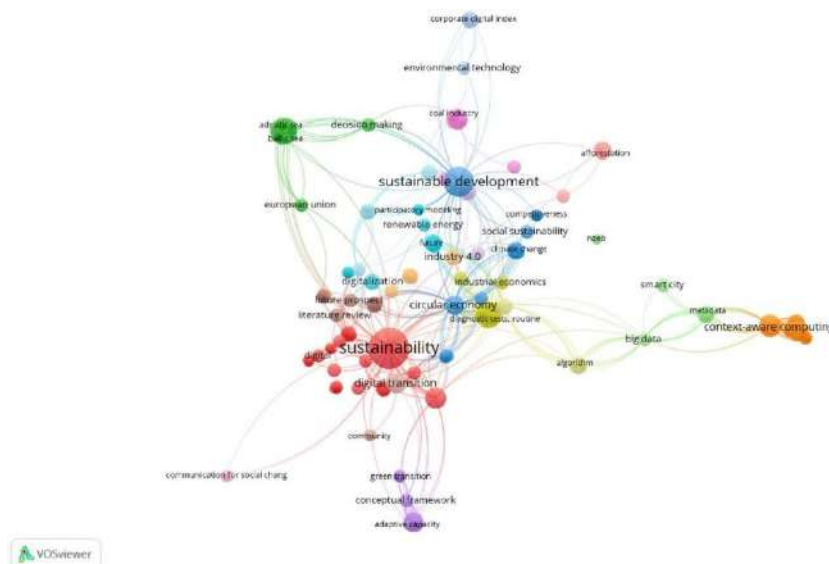
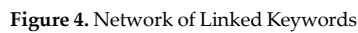


Figure 3. Network of all keywords.

The research was based on the articles analyzed on Sustainability and Digital Transition. The associated keywords can be examined in Figure 4, making clear the network of keywords that appear together/linked in each scientific article, thus allowing one to know the topics studied by the studies and identify future research trends. In Figure 5, a profusion of bibliographic couplings with a unit of analysis of cited references is presented.



Sustainability catalyzes many organizations' embrace of digital technologies into all business fields. As the pressure for environmental responsibility increases, firms can adopt advanced technologies such as artificial intelligence (AI), machine learning (ML), predictive analytics, and the internet of things (IoT) to achieve sustainability goals [13]. Similarly, companies should integrate sustainability strategies into their digital transition roadmaps. For example, digital tools used in data tracking and sharing can identify and reduce environmental problems before they become magnified. Bellandi and De Propris

5.1. Digital Transition for Environmental Sustainability

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solutions. In addition, AI, IoT, and big data analytics technologies enhance business practices' sustainability by reducing waste and carbon emissions [29]. Besides, these technologies have increased practitioners' capability to map the impact of various activities on the environment [30]. For example, big data analytics can assess direct environmental performance and enhance traceability within a specific system [21]. Thus, companies, governments, and non-governmental institutions can increase sustainability by embracing and integrating digital technologies into various activities, processes, and systems. Other sustainability aspects that can be improved with emerging technologies include sustainable urban development, waste management, sustainable production, and pollution control.

5.1.1. Sustainable Urban Development

Urban sustainability refers to the idea of building cities without damage to the environment, with low waste production, and minimal use of natural resources. The primary categories of urban sustainability are smart cities and sustainable cities [31]. According to Feroz et al. [28], smart cities use new technologies such as IoT to improve people's lives, enhance working efficiency, and sustainably. Sustainable cities, on the contrary, enhance social wellbeing by using emerging technologies to control current resources in sustainable means [21]. Digital technologies such as big data and AI technologies foster urban sustainability by providing unprecedented opportunities in sustainable and smart cities [29]. For instance, they can be used to lower carbon footprints in the city, creating a cleaner environment for human survival. Urban developers worldwide should combine appropriate technologies to ensure that the developed cities adhere to the current global sustainability goals.

5.1.2. Waste Management

Waste management involves various techniques applied to collecting, transporting, handling, and disposing of waste. In recent years, solid waste has become a critical environmental problem. As digital technologies gain global popularity, scholars and practitioners have recognized their capability to develop and implement practical solutions for waste management. Feroz et al. [28] identified the four most persistent types of waste, including solid waste, food waste, e-waste, and agri-waste. In Industry 4.0, companies have access to technologies that have significantly improved their capability to manage solid waste from industries such as iron and steel [32]. For instance, AI, IoT, and big data analytics can allow the identification of sustainability-related opportunities in solid waste management that prompt businesses to change their business models [33]. Similarly, big data can be used to identify illegal dumping sites, while AI technologies collect and handle e-waste from electronic devices on demand from users. Thus, combining these digital technologies can help address complex waste management problems and drive sustainable innovations.

5.1.3. Sustainable Production

The digital transition has led to the adoption of cleaner and more sustainable production processes that reduce an organization's environmental impacts. Such a sustainable production system improves profitability, lowers operating costs, and increases employees' safety. The primary categories under sustainable production include smart manufacturing and sustainable supply chains that use various technologies, including IoT, cloud computing, cyber-physical systems, AI, digital twins, and big data analytics [28]. In the industry 4.0 era, the digital transition towards smart and sustainable manufacturing has gained popularity due to its advocacy for renewable energy consumption, sustainable manufacturing, and energy-saving. Consequently, the period is associated with achieving multiple sustainable goals, including reducing resource wastage, pollution, and environmental degradation, despite the progress

made in achieving economic development [33]. Besides sustainable manufacturing, emerging technologies can transform logistics models throughout the supply chains and promote environmentally sustainable procurement procedures. The digital transition is an ongoing process of improving technologies that continues to strengthen sustainable manufacturing systems and methods.

5.1.4. Pollution Control

Rapid urbanization poses a threat to the environment and human health due to the high level of pollutants. Under pollution control, the digital transition can help address issues including CO₂ emissions, air pollution, climate change, disaster management, and water treatment. Feroz et al. [28] identify heavy industries such as iron and steel, chemical industries, and energy industries as the primary pollutants needing pollution control measures. Digital technologies provide advanced tools that improve how pollution is measured, controlled, and managed. For instance, AI is used for environmental pollution control proliferates, allowing practitioners to address the complex and dynamic pollution problems affecting the environment, and threatening human health [33]. In addition, emerging new technologies are being used to develop low-carbon transportation and green vehicles that will eventually lead to environmental sustainability by reducing carbon emissions. With innovations such as big data analytics and IoT sensors, companies have access to environmental data that can be used for sustainable decision-making. Therefore, digital technologies increase the capability to measure and control pollution, eventually leading to ecological sustainability.

5.2. Digital Transition for Economic Sustainability

Digital technologies can play a significant role in accelerating progress towards achieving sustainable development and business growth. The increased use of digital technologies has revolutionized how institutional and economic systems conduct and organize tasks within uncertain and complex business environments. For instance, data technologies such as data science, big data, predictive analytics, smart metering, and forecasting play a significant role in facilitating data-driven development and business decisions [34]. Consequently, businesses are moving towards digital practices that can lead to economic sustainability through multiple changes in business models, demand for energy efficiency, and awareness of corporate responsibility in protecting the welfare of current and future generations [35]. Economic sustainability aspects discussed in this section include circular economy, digital sharing economy, and smart manufacturing, which are geared towards achieving sustainability.

5.2.1. Circular Economy

Digital transition can boost economic transformation towards a more sustainable circular economy (CE). CE is a business production and consumption model that involves sharing, renting, reusing, refurbishing, repairing, and recycling materials and products for the most extended duration possible. The use of digital technologies can help improve the CE model by building visibility, enhancing traceability, and transparency throughout the product's lifetime. García-Muñoz et al. [36] argue that introducing digital technologies and connected objects can potentially decrease the use of resources and enhance circular systems. For instance, companies can use fewer resources more efficiently with appropriate digital technologies, thus reducing operational costs. In addition, digitization enables smart solutions that reduce energy consumption and facilitate the efficient use of capacity and logistics routes. Effective circular business models involve a network of connected players who capture and deliver value. Digital transition contributes to this performance and interconnection by providing digital tools and systems that increase transparency and enable the players to work together towards achieving

common goals. For example, radio- frequency identification (RFID) technologies can be used to collect data on the use of a product and its movement from one consumer to another. This monitoring capability can help the key players ensure that the model is sustainable and does minimal harm to the environment and surrounding communities. Besides, by using data technologies, the key players can identify the specific regions where certain products are in demand and avail- ing them for leasing and sharing to eliminate other unsustainable alternatives such as manufacturing and production that may be excessive and harmful to the environment.

5.2.2. Digital Sharing Economy

A digital sharing economy is an ICT-based resource allocation system performed by individuals and (non-) commercial organizations to allow sharing practices through dig- ital platforms. The primary goal of the digital sharing economy is to facilitate access to material and immaterial resources for specific populations [37]. Social relationships de- velop significantly through these digital platforms, enabling the participants to engage in economic activities. Consequently, this technology-based economic activity is often re- ferred to as “peer economy” due to the peer-to-peer type of transaction/networking in- volved. However, the sharing economy occurs in different forms, including peer-to-busi- ness (P2B), business-to-peer (B2P), and business-to-business (B2B) [37]. One major way that the sharing economy contributes to sustainability is by availing existing products on demand instead of producing new ones. Consequently, the economic process can reduce the environmental impacts associated with production processes [38]. In addition, since it optimizes purposeful social relations, the business model facilitates adequate communi- cation flow that can be used to generate valuable sustainability data. For example, the peers engaged in the sharing economy can freely share opinions on sustainable practices and implement practical solutions to enhance the economy’s sustainability. Unlike corpo- rate-controlled economies, a peer-to-peer economy does not involve the complex bureau- cracies that delay decision-making and the implementation of sustainable business prac- tices.

The sharing economy challenges the old monopolies and creates a socially connected economy. A change in ownership of the products within a social network eliminates the need to buy new products. Consequently, the economic structure reduces waste by ensur- ing that the products are used until they wear off instead of throwing them away once an individual no longer needs them [37]. For example, an individual can choose to sell clothes that no longer fit at a lower price to other potential buyers instead of throwing them away when they are still in usable condition. In this case, individuals engage in sustainable busi- ness practices without engaging the formal business sector that was traditionally the pre- dominant product and service provider [38]. The sharing economy proves that achieving desired sustainability levels requires the involvement of both corporates and individuals. Emerging technologies such as smartphones and the internet simplify this process by providing networking channels that connect people who conduct digital exchanges.

5.2.3. Sustainable Manufacturing and Infrastructure

The life cycle environmental impacts and depletion of resources will severely under- mine the design and manufacturing of products for future generations. Thus, sustainable manufacturing and infrastructure have become a critical way of ensuring that current business practices do not compromise those of future challenges. In this regard, sustaina- ble manufacturing can be defined as a systematic approach of creating and distributing innovative products and services in a way that eliminates excessive use of resources such as water, land, and energy, produces zero waste to reduce CO2 emissions, and eradicates toxic substances [39]. Digital transition

plays a critical role in availing appropriate technologies needed to manufacture products in sustainable ways that align with the globally accepted sustainable development goals that involve meeting current generations' goals and needs without compromising future generations [40]. For example, under sustainable manufacturing, companies are implementing new analysis procedures and designs to reduce environmental impacts. In addition, they use technologies such as AI-powered robots and machines to improve material handling practices and reduce energy and material consumption. Therefore, sustainability has become a core element in modern-day manufacturing processes.

5.3. Digital Transition for Social Sustainability

Social sustainability refers to all those formal and informal processes, relationships, systems, and structures employed to ensure there is adequate support for healthy living by the current and future generations. It involves identifying and managing positive and negative business impacts on communities and people [41]. The new technological developments and the digital transition technologies that have spread in all areas of life have caused considerable social effects [42]. This is because the digital transition impacts and fundamentally changes individuals' habits. In turn, such practices are likely to affect future generations' lifestyles and quality of life. The continued digital society's emergence implies that social sustainability has become critical in the digital transition. Scientific studies have clearly expressed the existing positive association between digital transition and social sustainability. Globally, sustainable development agendas are based on inclusiveness and shared prosperity ideals. Social justice principles form a critical component as nations work to address interlink between the dimensions of sustainable development, including social, economic, and environmental issues.

One of the significant issues is that the current digital inequality reinforces the existing social inequalities. Although the digital divide cannot be wholly eliminated, significant gains can be made if access to digital media such as the internet can be improved for the whole global population. This should also include reducing inequalities in digital skills and usage. Apart from physical access, which has been the primary focus of the digital divide policies, other areas becoming more important include building digital skills and internet usage opportunities [43]. Studies also identify the need for multidimensional policy perspectives to solve the current digital divide. This implies that such policies should be persuasive or work to create awareness and focus on technological, educational, economic, and social perspectives [44]. To effectively achieve digital transition for social sustainability goals, a digital technology perspective for social development and wellbeing should target the following three areas: employment and job markets, education, and healthcare.

5.4. Managing Digital Transition to Facilitate Sustainability

Managing digital transition requires organizational leadership to make bold decisions and implement actions to help achieve a sustainable competitive advantage. Digital transitions that would help facilitate sustainability are associated with considerable complexities and risks, forcing organizational leadership to make one big decision and hope for the best outcomes [45]. Three new approaches have been identified as practical alternatives to the traditional linear and big bang approaches when considering sustainable digital transition strategies. The new alternative approaches include innovating by experimenting, incremental approaches, and dynamic, sustainable advantages achievable through temporary advantages.

5.4.1. Innovating by Experimenting

Many organizations have maintained the traditional annual or multi-year cycles and execution strategies despite growing uncertainties in the modern business environment. In a business environment characterized by an uncertain future and continuously shifting destinations and paths, business leaders are essentially required to continually and regularly evaluate and update strategic plans [46]. Therefore, iterative and learning processes are necessary to formulate strategies and execute and implement actions to recalibrate such a strategy. Innovating by experimenting is one of the popular approaches that also enables a business to inexpensively test numerous new ideas while at the same time considering sustainability. Both the internal and external sources can provide emerging intelligence that would help to evaluate such new ideas. In addition, this strategy requires business leaders to scale up a working idea rapidly. In cases where a new idea does not work, business leaders should move on to other ideas before making significant losses. Compared to the traditional approaches, innovating by experimenting is more effective since it allows organizational leadership to test and learn from new ideas. Corporations such as Alibaba, Google, Amazon, and Didi Chuxing have used this approach to achieve critical success. Overall, digital technologies can play a crucial role in enabling new strategies and operations that deliver excellent results in transitions that consider sustainability.

5.4.2. Incremental Approaches for Radical Transformations

The modern digital economy is significantly different from the service or industrial economies in several ways. The markets currently comprise notable changes in the game's rules and the key players. These changes create a significant mismatch between the digital future and existing traditional business models [47]. Many organizations identify such a mismatch as a too big to bridge gap in the business environment. However, a radical transformation that considers sustainability issues does not have to involve one big step in the planning and implementation phases [48]. Relatively, a series of incremental steps can be adopted to achieve the much-desired radical transformation. An example is using an outcome-driven approach by some prominent business organizations to ensure that desired results are delivered at each stage of digital transition initiatives. In incremental systems, rapid piloting and scaling become the basis for experimenting with several new ideas. The proposed approach involves splitting the large-scale radical digital transition into smaller, more manageable strategic investments. The process allows businesses to test and nurture innovations while at the same time avoiding potential risks and achieving desired sustainability goals [49]. Therefore, the approach involves a series of incremental steps to achieve digital transition while effectively mitigating high risks. The method differs from the traditional big bang approach since it requires corporate leadership to consider initial up-front investment, sustainability, and changes to the balance before making investment decisions.

5.4.3. Evolving Portfolio of Temporary Advantages

The evolving portfolio of temporary advantages will play a key role in achieving dynamic, sustainable advantages. Although the digital transition's key objective is to achieve sustainable competitive advantages (SCAs), only a few competitive advantages are genuinely sustainable for prolonged periods in the digital economy. Developments such as innovations and competitors' imitations rapidly erode the competitive advantages of the digital economy, making them temporary or transient [50]. Continuously experimenting with an evolving portfolio comprising incremental and radical innovations is helping corporate leadership pursue successive temporary advantages. Although they achieve small gains from each temporary benefit, the cumulative effects in the long term are significant [51]. The introduction of successive temporary advantages before the erosion of older ones allows for the dynamic

achievement of SCAs in the evolving temporary advantage portfolio. The approach presents additional benefits, such as ensuring that strategy remains as a direction for action and not merely a predefined plan. Therefore, the strategy encourages organizational leaders to focus on formulating and implementing short-term decisions while at the same time considering the long-term strategy and destination [52]. Business leaders can use this approach to explore alternative routes frequently and, in some cases, change their destination, intertwine the strategy and execution, and use emerging intelligence to inform sustainable evaluation and recalibration of strategic directions.

6. Conclusions

This study is a literature review of the recent developments in sustainability and digital transition. The review is needed because of the recent increase in social and biophysical unsustainability indicators recorded in recent years, despite continued efforts by science and technology to promote the co-existence of human civilization and the Earth's biosphere. The digital transition has been identified as a disruption period that began in the 1950s that involved automating some manual processes, improving turnaround times by adding additional integrations, and upgrading to newer technologies. Sustainability is a concept that has been associated with environmental, social, and economic problems for which emerging digital technologies could provide practical solutions. In sustainability, the economic, environmental, and social aspects are seen as essential pillars for ensuring present human needs are achieved without compromising the ability of future generations to meet their needs.

The existing studies demonstrate the potential contributions of the digital transition to environmental, economic, and social sustainability aspects. In environmental sustainability, the digital transition involves the application of technologies such as AI, big data analytics, IoT, social media, and mobile technologies that are used to develop and implement sustainability solutions in areas such as sustainable urban development, waste management, sustainable production, and pollution control. In economic sustainability, emerging digital technologies can boost transformation in the more sustainable circular economy (CE), the digital sharing economy, and establish sustainable manufacturing and infrastructure design. In the digital transition for social sustainability, the reviewed studies demonstrate a need for multidimensional policy perspectives to solve the current digital divide. These policies should reduce the existing divide in access, skills, and usage of existing digital technologies. The studies demonstrate that digital technology perspectives for social development and wellbeing should target the following three areas: employment and job markets, education, and healthcare. For effective management of the digital transition that achieves sustainability goals, the study identifies and discusses new alternative approaches that include innovating by experimenting, incremental strategies, and dynamic, sustainable advantages achievable through temporary benefits. Moreover, this research has made a theoretical contribution by highlighting digital technologies as practical tools for transitioning the production processes towards sustainability.

Author Contributions: Conceptualization, A.T.R. and J.C.D.; methodology, A.T.R. and J.C.D.; software, A.T.R. and J.C.D.; validation, A.T.R. and J.C.D.; formal analysis, A.T.R. and J.C.D.; investigation, A.T.R. and J.C.D.; resources, A.T.R. and J.C.D.; data curation, A.T.R. and J.C.D.; writing—original draft preparation, A.T.R. and J.C.D.; writing—review and editing, A.T.R. and J.C.D.; visualization, A.T.R. and J.C.D.; supervision, A.T.R. and J.C.D.; project administration, A.T.R. and J.C.D.; funding acquisition, A.T.R. and J.C.D. All authors have read and agreed to the published version of the manuscript.

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Exploring the Intersection of Quantum Computing and Management: A Study of Quantum Computing on Organizational Behavior

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Abstract: Quantum computing is emerging as a transformative technology with the potential to revolutionize multiple business domains, including management and organizational behavior. This paper explores the intersection of quantum computing and management, examining how quantum principles can enhance decision-making, leadership strategies, and workforce dynamics. By leveraging quantum algorithms and computational power, organizations can gain deeper insights into complex behaviors, optimize operations, and enhance strategic planning. This study highlights the implications of quantum computing on managerial decision-making, collaboration, and problem-solving within corporate environments.

Keywords: Quantum Computing; Management; Organizational Behavior; Decision-Making; Workforce Optimization

Introduction

In an era of rapid technological advancements, quantum computing offers a paradigm shift in data processing and problem-solving. While its applications in cryptography and optimization have been widely discussed, its impact on management and organizational behavior remains an underexplored domain. This study investigates how quantum computing can influence key management functions, particularly in decision-making, behavioral analysis, and leadership strategies. By integrating quantum computing into business intelligence and human resource management, organizations can unlock new potential in efficiency and innovation.

Related Work

| Study | Focus Area | Application in Management |
|------------|---------------------------------|----------------------------------|
| [1] | Quantum Cryptography | Data Security in Business |
| [2] | Quantum Optimization | Supply Chain Management |
| [3] | Quantum AI | Predictive Analytics in HR |
| This Study | Quantum Computing in Management | Decision-Making, Leadership & HR |

Key Contributions

This paper contributes to the field of management by:

1. Introducing quantum computing concepts into business decision-making and leadership.

2. Exploring how quantum principles like superposition and entanglement can improve organizational behavior.

3. Identifying challenges and opportunities in implementing quantum computing in management.

Methods, Experiments, and Results

1. Quantum Computing and Decision-Making

- Quantum Probability Models: Enhance behavioral predictions based on complex human interactions.
- Quantum Machine Learning: Identifies workforce behavior patterns and organizational trends
- Quantum Multi-Criteria Optimization: Improves resource allocation and strategic planning.

2. Quantum-Inspired Leadership and Organizational Behavior

- Quantum Superposition: Encourages adaptive leadership styles for managing diverse teams.
- Quantum Entanglement: Strengthens collaboration and synchronization between departments.
- Quantum Uncertainty: Enhances organizational flexibility in handling business uncertainties.

3. Workforce Optimization and HR Management

- Quantum AI for Employee Retention: Predicts workforce trends and reduces attrition rates.
- Enhanced Recruitment: Optimizes candidate selection using quantum-enhanced analytics.
- Workforce Productivity Simulation: Forecasts team performance through quantum algorithms.

Discussions

While quantum computing has significant potential, several challenges must be addressed before its integration into management:

1. Technical Barriers: Current quantum hardware limitations prevent immediate large-scale implementation.
2. Ethical Considerations: Privacy and security concerns in quantum-enhanced workforce analytics.
3. Skill Gaps: The need for specialized training to equip managers with quantum literacy. Future research should focus on developing hybrid classical-quantum models, expanding quantum applications in behavioral sciences, and fostering cross-disciplinary collaborations between quantum computing and management experts.

Conclusion

Quantum computing has the potential to redefine organizational behavior and managerial decision-making. By leveraging quantum principles such as superposition, entanglement, and probability modeling, organizations can unlock new efficiencies in leadership, workforce management, and strategic operations. While challenges exist, continued advancements in quantum technologies will shape the future of business management, fostering a new era of data-driven leadership and decision-making.

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IT: A Tool for Promoting Inclusive Green Economy

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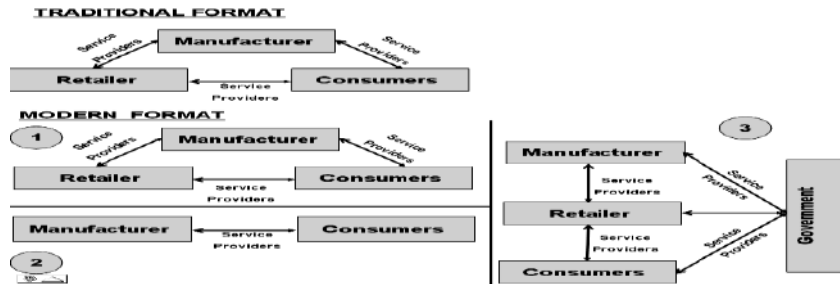
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Abstract: Sustainability is the need of the hour in current scenario. Without inclusion of women & marginalized sections of the society, sustainable development is incomplete. This paper highlights the role of IT as a tool for promoting inclusive green economy. Effective use of Information Technology can help in improving the efficiency of Business Organizations; which also leads to conservation of resources, reduced wastage & less carbon footprints. The paper also focuses on the significance & use of Information Technology for spreading awareness about inclusion of women and marginalized section of society for development of inclusive green economy. Moreover in this paper we have tried to highlight the emerging effects of IT on Business world and its contribution to Business Organizations right from business generation, managing day to day operations to service controls through e-commerce applications. Effective use of Information Technology serves various benefits to Business Organizations such as time saving, more reach in market, spreading awareness and managing teams, customers and clients across borders. Use of IT also leads to reduced paperwork and sustainable use of resources. The paper aims to highlight the role of IT in Organizations for generating more business and its contribution for development of Inclusive Green Economy. The basic tools used in this research are secondary data published in different journals and articles and observatory data what we often see around in the industry.

Keywords: Information Technology, Inclusive Green Economy, e-commerce, Business Organizations, Sustainable Development.

INTRODUCTION

In the emerging global economy, IT has increasingly become a necessary component of business strategy and a strong catalyst for economic development. The integration of information technology (IT) in business has revolutionized relationships within organizations and those between and among organizations and individuals. Specifically, the use of IT in business has enhanced productivity, encouraged greater customer participation, and enabled mass customization, besides reducing costs. Use of IT in business also promotes sustainability and Inclusive Green Economy by reduced paperwork, preservation of resources and less carbon emission. This effects are gained through the active application of IT in its niche form i.e., e-commerce and e-business models and protocols. A brief model has been presented below which depicts the traditional and modern day business formats.



The service provider mentioned here is e-commerce, e-business models. It is quite obvious that in the Information Age, Internet commerce is a powerful tool in the economic growth of developing countries. While there are indications of e-commerce patronage among large firms in developing countries, there seems to be little and negligible use of the Internet for commerce among small and medium sized firms. E-commerce promises better business for SMEs and sustainable economic development for developing countries. However, this is premised on strong political will and good governance, as well as on a responsible and supportive private sector within an effective policy framework. Efforts have been made to show the various positive accretions contributed to the business world. However, first we have to get ourselves acquainted with the following concepts and terminologies.

SOME CONCEPTS AND DEFINITIONS

Sustainable Development: Sustainable Development refers to a process of developing and growing, by using resources in responsible way, so that resources can be conserved for future generations. The concept of Sustainable Development suggests that organizations must not only focus on profit, but on all three Ps i.e. Profit, People & Planet.

Business Organizations can contribute in Sustainable Development by adopting Sustainable Business practices which will lead to conservation of resources, reduced wastage, less pollution & also reduced cost.

Inclusive Green Economy: As defined by the *European Environment Agency*, a Green Economy can be understood as one in which environmental, economic and social policies and innovations enable society to use resources efficiently -enhancing human well-being in an inclusive manner, while maintaining the natural systems that sustain us.

Inclusive Green Economy is concerned with fostering economic development that provides decent jobs and income for all including women and weaker sections of the society, while simultaneously tackling rapid environmental degradation.

E-commerce: Electronic commerce or e-commerce refers to a wide range of online business activities for products and services. It also pertains to “any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact. E-commerce is the use of electronic communications and digital information processing technology in business transactions to create, transform, and redefine relationships for value creation between or among organizations, and between organizations and individuals.

The different types of e-commerce

The major different types of e-commerce are:

- 1) business-to-business (B2B);
- 2) business to-consumer (B2C);
- 3) business-to-government (B2G);
- 4) consumer-to-consumer (C2C);and
- 5) mobile commerce (m-commerce).

1) B2B E-COMMERCE:

B2B e-commerce is simply defined as e-commerce between companies. This is the type of e-commerce that deals with relationships between and among businesses. About 80% of e-commerce is of this type, and most experts predict that B2B ecommerce will continue to grow faster than the B2C segment. The B2B market has two primary components: **e-frastructure** and **e-markets**. Efrastructure is the architecture of B2B, primarily consisting of the following:

- Logistics - transportation, warehousing and distribution (e.g., Procter and Gamble);
- Application service providers - deployment, hosting and management of packaged software from a central facility (e.g., Oracle and Linkshare);
- outsourcing of functions in the process of e-commerce, such as Web-hosting, security and customer care solutions (e.g., outsourcing providers such as e-Share, Net Sales, iXL Enterprises and Universal Access);
- Auction solutions software for the operation and maintenance of real-time auctions in the Internet (e.g., Moai Technologies and Open Site Technologies);
- Content management software for the facilitation of Web site content management and delivery (e.g., Interwoven and ProcureNet); and
- Web-based commerce enablers (e.g., Commerce One, a browser-based, XMLenabled purchasing automation software).

E-markets are simply defined as Web sites where buyers and sellers interact with each other and conduct transactions.

The more common B2B examples and best practice models are IBM, Hewlett Packard (HP), Cisco and Dell. Cisco, for instance, receives over 90% of its product orders over the Internet.

Most B2B applications are in the areas of supplier management (especially purchase order processing), inventory management (i.e., managing order-ship-bill cycles), distribution management (especially in the transmission of shipping documents), channel management (i.e., information dissemination on changes in operational conditions), and payment management (e.g., electronic payment systems or EPS).

2) BUSINESS-TO-CONSUMER E-COMMERCE:

Business-to-consumer e-commerce, or commerce between companies and consumers, involves customers gathering information; purchasing physical goods (i.e., tangibles such as books or consumer products) or information goods (or goods of electronic material or digitized content, such as software, or e-books); and, for information goods, receiving products over an electronic network.

It is the second largest and the earliest form of e-commerce. Its origins can be traced to online retailing (or e-tailing). Thus, the more common B2C business models are the online retailing companies such as Amazon.com

The more common applications of this type of e-commerce are in the areas of purchasing products and information, and personal finance management, which pertain to the management of personal investments and finances with the use of online banking tools.

B2C e-commerce reduces transactions costs (particularly search costs) by increasing consumer access to information and allowing consumers to find the most competitive price for a product or service. B2C e-commerce also reduces market entry barriers since the cost of putting up and maintaining a Web site is much cheaper than installing a “brick-and-mortar” structure for a firm. In the case of information goods, B2C e-commerce is even more attractive because it saves firms from factoring in the additional cost of a physical distribution network. Moreover, for countries with a growing and robust Internet population, delivering information goods becomes increasingly feasible.

3) B2G E-COMMERCE:

Business-to-government e-commerce or B2G is generally defined as commerce between companies and the public sector. It refers to the use of the Internet for public procurement, licensing procedures, and other government-related operations. This kind of e-commerce has two features: first, the public sector assumes a pilot/leading role in establishing e-commerce; and second, it is assumed that the public sector has the greatest need for making its procurement system more effective.

4) C2C E-COMMERCE:

Consumer-to-consumer e-commerce or C2C is simply commerce between private individuals or consumers. This type of e-commerce is characterized by the growth of electronic marketplaces and online auctions, particularly in vertical industries where firms/businesses can bid for what they want from among multiple suppliers. It perhaps has the greatest potential for developing new markets.

This type of e-commerce comes in at least three forms:

- Auctions facilitated at a portal, such as eBay, which allows online real-time bidding on items being sold in the Web;
- Peer-to-peer systems, such as the Napster model (a protocol for sharing files between users used by chat forums similar to IRC) and other file exchange and later money exchange models; and classified ads at portal sites such as Excite Classifieds and eWanted (an interactive, online marketplace where buyers and sellers can negotiate and which features “Buyer Leads & Want Ads”).

5) M-COMMERCE:

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless technology-i.e., handheld devices such as cellular telephones and personal digital assistants (PDAs). Japan is seen as a global leader in m-commerce.

As content delivery over wireless devices becomes faster, more secure, and scalable, some believe that m-commerce will surpass wire line, e-commerce as the method of choice for digital commerce transactions. This may well be true for the Asia-Pacific where there are more mobile phone users than there are Internet users.

Industries affected by m-commerce include:

- **Financial services**, including mobile banking (when customers use their handheld devices to access their accounts and pay their bills), as well as brokerage services (in which stock quotes can be displayed and trading conducted from the same handheld device);
- **Telecommunications**, in which service changes, bill payment and account reviews can all be conducted from the same handheld device;
- **Service/retail**, as consumers are given the ability to place and pay for orders on-the-fly; and
- **Information services**, which include the delivery of entertainment, financial news, sports figures and traffic updates to a single mobile device.

LIST OF INDUSTRIES AND APPLICATION OF IT IN THEM

| Industry | Applications and benefits of IT |
|-------------------------|--|
| 1. Banking | → RTGS → NEFT → ECS → Online Banking → Mobile Banking → E-cheques → Online DD facility → ATMS |
| 2. Retail | → Payment gateways → Online Purchases of goods and services |
| 3. Manufacturing | → Online data transfer through SAP & ERP systems |

| | |
|-----------------------------|---|
| | → Inventory Control → Sales Projections → 3D charting and analysis |
| 4. BPO & KPO | → Customers list records → Quick salary review |
| 5. Real Estate | → “Brick and click” strategies → Online booking of properties → Online Property allocation |
| 6. Securities Market | → Online Trading window operations → Analysis reviews and reporting → Minute to minute access to market info. |

RESEARCH OBJECTIVES

- ❖ What is the significance of IT in business for sustainable development & inclusive Green Economy?
- ❖ What is the extent of ICT usage among SMEs in developing countries like India?
- ❖ What are the obstacles, problems and issues faced by SMEs in their use of ICT in business or in engaging in e-commerce?
- ❖ How can government intervene in the promotion and development of e-commerce among SMEs?

RESEARCH METHODOLOGY

- **In this study we have mainly used exploratory research:** As the term speaks to us the research design activity that we have generally maintained are focus grouping and projective techniques.

Data used:

- ☐ Secondary data from journal, magazines, tabloids, newspapers, etc. (the complete sources of information has been provided at the endnote of the document).
- ☐ Primary data and facts from observation and industry exposure.

ANSWERING THE OBJECTIVES

1) What is the significance of IT in business for sustainable development & Inclusive Green Economy?

- Expansion of market
- More customer coverage
- Better coordination with work-teams, Clients & customers
- Reduced paper-work and less wastage.
- Reduced need of Warehouses, C&Fs
- Alternate payment options.
- Use of Audio & video conferencing for conducting meetings & discussions.
- Time saving and reduced duplication of work
- Raising awareness about inclusion and diversity by facilitating communication across diverse groups
- Providing platforms for education and training, analyzing data to identify disparities, and enabling tools that promote accessibility.
- Helping organizations build more inclusive workplaces and communities.

2) What is the extent of ICT usage among SMEs in developing countries like India?

- o Security services
- o Financial markets
- o Retail shops
- o Payment gateways
- o Online tax filing
- o Wider market reach
- o Network promotion

A COMPARISION ON THE PERFORMANCE OF SMEs

| BEFORE adoption of IT | AFTER adoption of IT |
|--|--|
| ❑ High lead time in business processes | ➤ Various options in choosing information systems for SME. |



| | |
|---|---|
| <ul style="list-style-type: none"> <input type="checkbox"/> High cycle time in business transactions <input type="checkbox"/> High Inventory <input type="checkbox"/> Poor utilization of financial as other enterprise resources <input type="checkbox"/> Poor productivity <input type="checkbox"/> High stock outs | <ul style="list-style-type: none"> • Accounting software such as Tally • In house developed customized software • Integrated Transactional Information Systems such as Radix, MakeESS, Octopus-E and Tech Solutions etc. • Micro ERP systems such as NAVISION • Web Enabled ERP systems such as iBaaN, IFS etc. |
| <p>RESULTS:</p> <ul style="list-style-type: none"> • Unsatisfied customers and suppliers • Unable to handle competitiveness • Poor flexibility in demand supply management • Unable to plan growth and future • Poor dynamism | <p>RESULTS:</p> <p>➤ Tangible Benefits of ERP Implementation</p> <ul style="list-style-type: none"> • Substantial reduction in Inventor • Substantial improvement in manpower and machines productivity • Reduction in financial close cycle • Improvement in cash management • Reduction in wastage and improvement in its management • Reduction in transaction cost of management <p>➤ Expected Intangible Benefits of ERP achieved after Implementation, till now in most SMEs in developing countries India</p> <ul style="list-style-type: none"> • Improvement in customer responsiveness • Improvement in order management • Improvement in production planning based on forecast received from sales • Materials planning generated from the system to optimize inventory levels along with making material consumption details available on-line |

| | |
|--|---|
| | <ul style="list-style-type: none"> • Automation of the import processes with item valuation details after considering the impact of freight, insurance, customs duty, other charges. • Online availability of the inventory and its valuation, leading to visibility of both raw material and finished goods inventory at all stages product wise tracking of costs and revenues with consolidation of financial information • Integration of cost and financial books, elimination of the need for reconciliation between the two, improved the account transactions. • Real time tracking of material price and usage variances, efficiency variance. |
|--|---|

The various benefits provided by IT to a management firm.

3) What are the obstacles, problems and issues faced by SMEs in their use of ICT in business or in engaging in e-commerce?

■ **OBSTACLES FACED BY THE SMEs**

- Cost constraints in adopting new softwares
- Inadequate planning
- Inadept inhouse softwares
- Small business divisions
- Government barriers

4)How can government intervene in the promotion and development of e-commerce among SMEs?

Governments of developing countries generally intervene in the promotion and development of IT / e-commerce among SMEs by the following ways:

- “Bridging the digital divide” or promoting access to inexpensive and easy access
- For giving information to networks.
- Legal recognition of e-commerce transactions.

- consumer protection from fraud.
- Protection of consumers' right to privacy.
- Legal protection against cracking (or unauthorized access to computer systems).
- Protection of intellectual property

Conclusion

From the above discussions and analysis we can tell that Information Technology can play significant role in improving the efficiency of Business Organizations, and also help in promotion of Inclusive Green Economy and contribute in Sustainable Development. However efforts should be made in countries like India to introduce new cyber laws, regarding theft/illegal use of IT. Consumer awareness should be the prime issue, because it is the foreword of the professional hackers that “it is not we hack, it is you yourself who wants to be hacked”.

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Digital Transformation in Uttarakhand: Revolutionizing the Way of Doing Business

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Abstract

Present era has witnessed a significant surge in digital transformation across various industries in Uttarakhand, a state in northern India. This study aims to explore the impact of digital transformation on the way of doing business in Uttarakhand, highlighting the key drivers, benefits, and challenges. The research also provides recommendations for businesses to leverage digital technologies effectively and stay competitive in the rapidly evolving digital landscape.

Digital transformation has become a imperative for businesses to stay competitive in today's fast-paced digital era. The COVID-19 pandemic has accelerated the adoption of digital technologies, and Uttarakhand is no exception. The state has witnessed significant growth in digital transformation, driven by government initiatives, changing customer expectations, and increasing competition.

Introduction

Digital transformation refers to the integration of digital technologies into various aspects of business and society, fundamentally altering operations and value delivery. In Uttarakhand, a state known for its natural resources and tourism, digital transformation is crucial for sustainable economic growth.

Digital transformation is a strategic process that integrates digital technologies into all aspects of business and governance, fundamentally changing how services are delivered and value is created. A well-defined **Digital Transformation Framework** provides a structured approach to implementing technology-driven changes, ensuring efficiency, scalability, and innovation. This framework typically includes key components such as **digital infrastructure, data analytics, automation, cybersecurity, and user experience optimization**. By leveraging technologies like **cloud computing, artificial intelligence (AI), Internet of Things (IoT), and blockchain**, organizations can streamline operations, enhance decision-making, and offer personalized services to customers or citizens.

A strong **Digital Transformation Framework** consists of multiple layers, each addressing critical areas of development. **E-Governance** enhances public service delivery through digital platforms, improving transparency and accessibility. **Smart Infrastructure**, including broadband connectivity and 5G technology, provides the backbone for digital services. **Digital payments and e-commerce** drive economic growth by enabling cashless transactions and expanding market reach. Furthermore, **skill development programs** ensure that businesses and individuals are equipped with the necessary digital literacy to leverage technological advancements. These elements work in synergy to create an agile and resilient digital ecosystem that benefits both businesses and society.

Despite its advantages, digital transformation faces several **challenges**, including cybersecurity threats, digital divide, and regulatory hurdles. A comprehensive framework must incorporate **robust cybersecurity measures, data privacy protocols, and policy reforms** to create a

secure and inclusive digital environment. Collaboration between the **government, private sector, and academia** is essential to drive innovation and ensure the sustainable adoption of digital practices. By addressing these challenges and continuously evolving with technological advancements, Uttarakhand can harness the full potential of digital transformation to revolutionize the way businesses operate and public services are delivered.

Digital transformation encompasses the use of technologies such as cloud computing, artificial intelligence, big data, and the Internet of Things (IoT) to improve efficiency and innovation.

Key Components

- **E-Governance:** Digitization of government services to improve accessibility and transparency.
- **Digital Payments:** Growth of cashless transactions through platforms like UPI and mobile wallets.
- **E-Commerce:** Expansion of online retail and services.
- **Smart Infrastructure:** Implementation of smart city initiatives and digital connectivity.
- **Skill Development:** Digital literacy programs for businesses and individuals.

Objectives

- To analyze the current state of digital transformation in Uttarakhand.
- To evaluate the impact of digital initiatives on businesses.
- To identify challenges and opportunities for digitalization.
- To propose recommendations for enhancing digital adoption.

Digital Transformation in Uttarakhand

Government Initiatives

The Government of Uttarakhand has launched several digital initiatives, such as:

- **e-District Project:** Providing online access to government services.
- **State Data Center (SDC):** A centralized facility for digital governance.
- **Start-up Policy 2021:** Encouraging digital entrepreneurship and innovation.
- **Digital India Program:** Expanding digital connectivity and literacy.

Impact on Key Sectors

- **Tourism:** Online booking systems, virtual tourism, and digital marketing.
- **Agriculture:** Digital platforms for market access, precision farming, and mobile advisory services.
- **Education:** E-learning platforms and digital classrooms.

- **Healthcare:** Telemedicine and electronic health records.
- **Manufacturing & MSMEs:** Automation, digital supply chains, and online marketplaces.

Challenges in Digital Transformation

Infrastructure Barriers

One of the primary challenges in digital transformation in Uttarakhand is the lack of robust digital infrastructure, particularly in remote and hilly regions. Many rural areas suffer from poor internet connectivity, limited broadband access, and frequent network disruptions, making it difficult for businesses and individuals to leverage digital services effectively. The state's rugged terrain poses logistical difficulties in laying fiber-optic cables and establishing strong communication networks. Additionally, unreliable power supply further hampers the smooth functioning of digital platforms, making it imperative to enhance digital infrastructure through innovative solutions like satellite internet and renewable energy-powered connectivity hubs.

Furthermore, disparities in technological accessibility between urban and rural areas exacerbate the digital divide, restricting the adoption of e-governance, e-commerce, and online financial services. While urban centers like Dehradun and Haridwar have seen significant advancements in digital connectivity, smaller towns and villages remain underserved. The high cost of infrastructure development, coupled with a lack of private sector investment, limits the pace of digital expansion. Addressing these challenges requires collaborative efforts from the government, telecom providers, and technology firms to deploy cost-effective, scalable, and sustainable digital infrastructure solutions across the state.

Cybersecurity Risks

With the rapid expansion of digital services in Uttarakhand, cybersecurity risks have emerged as a significant challenge. The increasing adoption of digital payments, e-governance platforms, and online businesses has made the region more vulnerable to cyber threats such as data breaches, hacking, phishing, and ransomware attacks. Many small and medium-sized enterprises (SMEs) and government departments lack robust cybersecurity frameworks, leaving them exposed to financial fraud, identity theft, and unauthorized access to sensitive information. The absence of stringent cybersecurity policies and limited awareness about digital security practices among businesses and individuals further exacerbate these risks, making cyber resilience a critical priority for the state's digital transformation efforts.

Another major concern is the growing threat of cyberattacks on critical infrastructure, including banking systems, healthcare facilities, and power grids. As Uttarakhand moves towards greater digital integration, the need for enhanced security protocols, regular cybersecurity audits, and advanced threat detection mechanisms becomes imperative. The state must invest in cybersecurity education, encourage businesses to adopt secure digital practices, and strengthen regulatory frameworks to combat cyber threats effectively. Collaboration between the government, private sector, and cybersecurity experts can help build a more secure digital ecosystem that supports sustainable and resilient digital transformation in Uttarakhand.

Digital Divide

The digital divide remains a significant challenge in Uttarakhand, particularly affecting rural communities, small businesses, and economically disadvantaged groups. While urban areas

such as Dehradun and Haridwar benefit from high-speed internet and digital literacy programs, many remote villages and mountainous regions lack even basic connectivity. Limited access to smartphones, computers, and the internet restricts individuals and businesses from fully participating in the digital economy. This gap hinders the adoption of digital financial services, e-governance platforms, and online education, perpetuating economic and social inequalities across the state.

Another critical aspect of the digital divide is the lack of digital literacy among the population, particularly among older generations and marginalized communities. Many individuals are unfamiliar with using digital tools, online banking, and e-commerce platforms, leading to hesitancy in adopting technology-driven solutions. Without targeted training programs and affordable access to digital infrastructure, the gap between digitally enabled and underserved communities will continue to widen. Addressing the digital divide requires a multi-faceted approach, including government investment in digital education, subsidies for digital devices, and partnerships with private entities to enhance digital infrastructure in remote areas.

Regulatory & Policy Challenges

One of the significant challenges in Uttarakhand's digital transformation is the absence of comprehensive regulatory frameworks that address the rapidly evolving technological landscape. Existing policies often lack clarity on data privacy, cybersecurity, and digital business regulations, creating uncertainty for entrepreneurs and investors. The regulatory environment needs to be more adaptive to emerging digital business models, such as fintech, e-commerce, and gig economy platforms, to encourage innovation while ensuring consumer protection. Moreover, the lack of streamlined approval processes and bureaucratic red tape can slow down the adoption of new digital initiatives, discouraging businesses from fully embracing digital transformation.

Another critical regulatory challenge is the inconsistent implementation of digital policies across various sectors. While certain industries, such as banking and healthcare, have stricter digital compliance norms, others, such as small businesses and agriculture, lack well-defined digital governance structures. Additionally, issues related to taxation of digital businesses, cross-border data flow regulations, and digital intellectual property rights remain inadequately addressed. To overcome these hurdles, the government must establish clear, business-friendly digital policies, simplify compliance procedures, and create a regulatory ecosystem that fosters innovation while safeguarding consumer rights.

Key Findings

1. Digital Transformation is Essential for Economic Growth

- Digital transformation in Uttarakhand plays a crucial role in enhancing business efficiency, governance, and service delivery.
- Key technologies such as cloud computing, artificial intelligence (AI), and the Internet of Things (IoT) are driving innovation and modernization.

2. Government Initiatives are Accelerating Digital Adoption

- Programs like the e-District Project, Start-up Policy 2021, and the Digital India Program are fostering digital connectivity and entrepreneurship.

- The establishment of the State Data Center (SDC) provides a foundation for secure digital governance and data management.

3. Impact on Key Sectors

- Tourism benefits from digital marketing, online booking systems, and virtual tourism experiences.
- Agriculture is witnessing improvements through precision farming, market access platforms, and mobile advisory services.
- Healthcare, education, and MSMEs are increasingly leveraging digital tools for accessibility and efficiency.

4. Infrastructure Barriers Hinder Digital Expansion

- Remote and hilly regions face poor internet connectivity and unreliable power supply.
- High costs of digital infrastructure development limit private-sector investment in rural areas.

5. Cybersecurity Risks Threaten Digital Growth

- The rise in cyber threats, including data breaches and financial fraud, poses significant risks to businesses and government institutions.
- There is a lack of stringent Cybersecurity policies and awareness among small businesses and individuals.

6. The Digital Divide Remains a Major Challenge

- Rural areas suffer from inadequate internet access, limiting participation in the digital economy.
- Low digital literacy among older generations and economically disadvantaged groups prevents widespread adoption of digital solutions.

7. Regulatory & Policy Gaps Slow Down Digital Transformation

- Ambiguity in digital policies, data privacy regulations, and taxation laws creates uncertainty for digital businesses.
- Inconsistent implementation of policies across different sectors limits the overall impact of digital initiatives.

8. Future Outlook and Growth Potential

- Strengthening digital infrastructure, Cybersecurity frameworks, and digital literacy programs can bridge the existing gaps.
- A collaborative approach between the government, private sector, and academia can drive sustainable digital transformation in Uttarakhand.

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The Rise of Digital Marketing in India: Trends, Drivers, and Future Prospects

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ABSTRACT

The world is transitioning from analogue to digital and marketing is no exception. The use of digital marketing is growing in parallel with technological advancement. Internet users are rapidly increasing and digital marketing has benefited the most because it is primarily dependent on the internet. Consumer purchasing habits are shifting and they are consistently favouring digital marketing over traditional marketing. The main objective of this review paper is to investigate the impact of digital marketing and how important it is for both consumer and marketer. This paper starts with a brief introduction to digital marketing and then highlights the medium of digital marketing. The difference between traditional and digital marketing and the pro's, cons and importance of digital marketing in today's era. The fact that India's digital market is always expanding is proof that digitization is advancing quickly. Today, e-commerce websites offer all products and services via online portals.

Keywords: Internet Marketing, Social Media, Current marketing trend, E-commerce.

INTRODUCTION

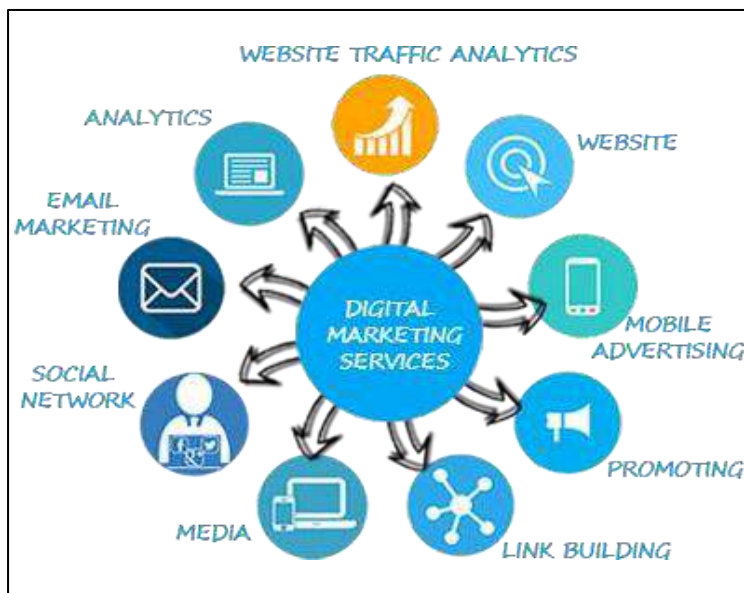
The digital marketing sector in India has almost universal reach business divisions. Among the uses of electronic marketing are tracking of purchases and orders, internet banking, and payment methods and content administration. Geophysical obstacles are overcome thanks to the power of digital marketing, making all consumers and companies on the planet potential clients and providers. It is renowned for enabling companies to communicate and complete a transaction at anytime and anywhere. India's digital marketing sector is now experiencing rapid growth. Significant rise in the field of digital marketing is predicted for a nation with a rapidly expanding economy. The development of digital marketing trend has a significant impact on marketing and advertising.

Digital marketing is a type of marketing that promotes products and services through all the Internet and online-based digital technologies such as desktop computers, mobile phones and other digital media and platform. Digital marketing plans have integrated into marketing plans and everyday life and as people increasingly use digital devices instead of visiting physical stores, digital marketing companies have become more common, employing a combination of search engine optimization (SEO), search engine marketing (SEM), content marketing, influencer marketing, content automation, campaign marketing, data driven marketing, e-commerce marketing, social media marketing, social media optimization, e-mail direct marketing, display advertising, e-books and optical disks and games have become a common place. Non- internet channels that provide digital media, such as television, mobile phones (SMS and MMS), and call- back and on hold mobile ring tones, are examples of digital marketing. Digital marketing is distinguished from online advertising by its expansion into non-internet channels. This paper mainly focuses on conceptual understanding of digital marketing, how digital marketing helps today's business and also study current issues in the form of examples.

According to a report by Forrester, India had predicted to increase at a rate of approximately 57% between 2012 and 2016, making it the Asia-Pacific market with the quickest rate of expansion. In India, the e-commerce sector has expanded at an incredible rate, and by 2018, it has contributed 1.61% of global GDP. The following are the main forces behind e-commerce.

The country recently saw the debut of 4G and 5G a large percentage of the population has broadband Internet subscriptions, and users are growing quickly.

- The exponential rise in smartphone usage.
- A rise in living standards as a result of the rapid drop in the poverty rate.
- A significantly broader selection of products is available.
- Competitive pricing that appeal to customers.
- A rise in the number of people using online classified services to buy and sell products.



HISTORY

The advancement of digital marketing is intimately connected to the advancement of technology. One of the first significant events occurred in 1971, when Ray Tomlinson sent the first e-mail, and his technology established the platform for people to send and receive files via different machines. However, 1990 is more widely recognised as the beginning of Digital marketing because this is when the Archive search engine was created as an index for FTP sites computer storage capacity was already large enough in the 1980's to store massive amount of customer data companies began to prefer online techniques such as database marketing over limited list brokers.

The term "Digital Marketing" was first used in the 1990's with the introduction of server/client's architecture and the widespread use of personal computers, customers relationship management (CRM) applications become an essential component of marketing technology. Due to Fierce Competition Vendor's were forced to incorporate more services into their software, such as marketing, sales and service applications. Online marketing, internet marketing and web marketing are other terms for digital marketing. Overtime, the term "Digital Marketing" has grown in popularity. Online marketing is still used often in the USA Digital

Marketing is also known as web marketing in Itlay. Particularly since 2013, the term “Digital Marketing” has become the most used worldwide. Digital advertising spending increased by 48% in 2010, with an approximate 4.5 trillion internet ads served annually. Business that utilise Online Behavioural Advertising (OBA) to target specific internet used account for an increasing share of advertising, however OBA also presents privacy and data protection issues for consumers. We can learn about digital marketing which are more than E-commerce is only through self-efforts and few institutions like Web Marketing Strategies (WMS). Brand’s may connect with consumers through digital media and encouraged personalised engagement with their goods or services.

OBJECTIVES OF THE STUDY

1. To study the growth of Digital Marketing in India.
2. To examine India’s consumer Internet purchasing patterns.

NEED OF THE STUDY

The marketing world is evolving quickly and quickly marketing is becoming more prevalent. The company must comprehend the new marketing paradigm and adopt its business practises accordingly. The study will assist the reader in comprehending the importance of establishing an online presence and the value of digital marketing.

LITERATURE REVIEW

SMEs don't appear to be taking full advantage of the new digital tools' potential, which prevents them from taking advantage of the opportunities they present. The findings also beg the question of whether SMEs have grasped the fundamental transformation in communication brought about by digitization. Due to their limited understanding of digital marketing, SMEs don't seem to be keeping up with technological advancements. Most of the SMEs that were surveyed do not utilise the new digital tools to their fullest capacity, which prevents them from receiving the full benefits of using them. (Taiminen, Heini; Karjaluoto, Heikki, 2015) Today, we are surviving under digital era, advance technologies, social media and internet marketing have a significance impact on the way of consumers, online business companies. Due increase in to this increasing growth of digital revolution has positive effect on the continuous market demand and supply. But even if the new era of communication has arrived, experts advise businesses to continue using traditional methods and to strive to integrate digital marketing with established businesses to meet their objectives. (Raluca Dania Todor, 2016)

A contemporary marketing idea that is well-known in the field of new technologies is called "digital marketing." Digital technology advancements have paved the way for the creation of the cyber-consumer and the cyber-business. The adoption of new customer connection models is made possible by the digital revolution. What obstacle must businesses that want to grow their market shares overcome? The core of digital marketing and all of its resources may be meaningless to a business that wants to reduce customer service expenses to increase revenue and streamline the sales process. (Arthur Sauicki, 2016)

The base of digital marketing is only Internet while using digital technologies. This is fully online process of marketing of products and services. It also includes a various digital intermediaries such as mobile phones and display advertising. On the other hand, various digital channels such as E-mail, search engines, social media, websites to connect with customers where they spend much of their time and form website to leverage business. Digital

marketing has a bright future for long term sustainability. (Dr. Mrs. Vaibhava Desai). For businesses, the Internet is the most effective tool (Yannopoulos, 2011).

The role of digital marketing has changed dynamically and commercial impact on business activities. Due to this various positive impact has been seen in economic activities like control inflation, recession, unemployment as well as increasing economic growth rate. Increasing the trend of digital marketing now a days various customers prefer online marketing and online marketing support selling, buying, trading of products or services. Hence, Internet marketing support to their customer for decision making, providing accurate and timely information of various products. With the help of internet few companies can use internet for marketing such as Google.com, Yahoo.com, Amazon.com and Youtube.com (Dr. Madhu Bala, Mr. Deepak Varma, 2018) Tools for online services are more influential compared to more established communication channels.(Helm, Möller, Mauroner, Conrad, 2013).

In particular for products where buyers can read reviews and leave comments about personal experiences, blogs as a digital marketing tool have successfully increased sales income. Online evaluations have become a tremendously effective component of firm's overall marketing strategies (Zhang, 2013). The focus of the digital marketing strategy is on how personalization, improved campaign management, and improved product, marketing design, and execution make marketing more efficient. Many businesses now consider using digital channels for marketing to be crucial to their overall strategy. There is now a very affordable and effective way for small business owners to sell their goods or services. Digital marketing is limitless. (Pinaki Mandal, Prof. Nitin Joshi, 2015)

Research Methodology:

Research Design: The present study is based on exploratory and descriptive research method. As a purpose of this study data have been collected on all India bases.

Data Collection: The paper is based on secondary data. The various articles, newspapers, researches, various websites and the information on internet have been studied. The company related information and data are used which is available publically on the websites of the companies.

GROWTH STATISTICS OF DIGITAL MARKETING IN INDIA

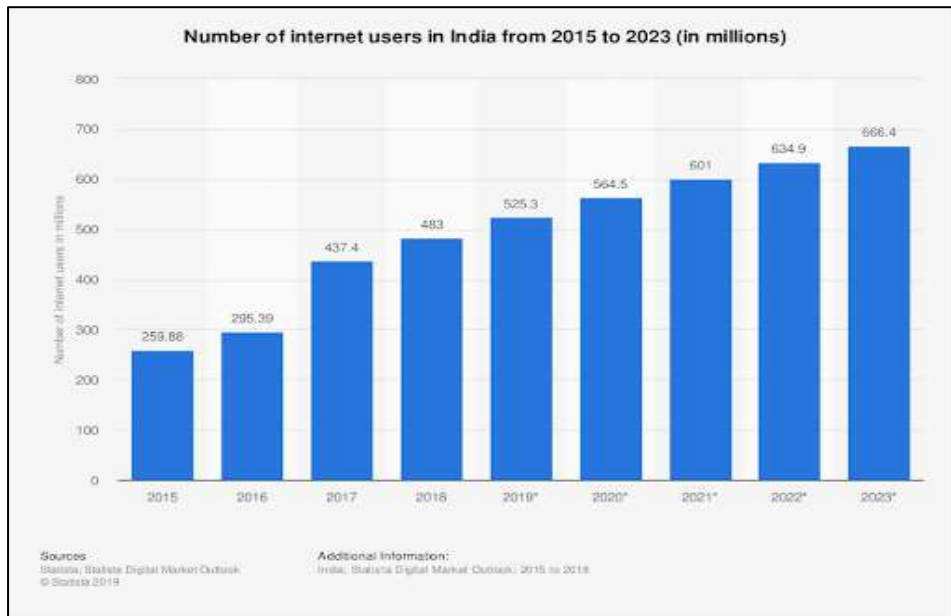
Not just in India but all across the world, digital marketing is experiencing a significant growth in the job market. Companies are becoming more and more reliant on the internet to boost their earnings more quickly. In India, in 1996 India MART B2B marketplace was established. In 2007, Flipkart was established in India. The majority of digital means is for marketing purpose and to develop e-commerce.

According to data on digital marketing, smartphone and tablet advertising in 2011 was 200 percent less prevalent than it was in the years that followed. The net worth was \$2 billion during this year. The increase followed a geometric development, reaching \$6 billion in 2012.

According to reports, India has the largest and most lucrative e-commerce market for new businesses. Between 2010 and 2016, the digital advertising market in India increased by 33% yearly. A greater level of career work improvement is required due to the competitive expansion, and more professionals are entering the area. The overall amount invested increased by 1.5 billion dollars between 2013 and March 2015. Up to this point, there has been an outstanding growth. India experienced the Internet sector's "golden period" between 2013 and 2018, according to a report by the International Journal of Advanced Research Foundation,

with enormous development potential and secular growth adoption for E- commerce, online shopping, social media, and internet advertising Services and content related to digital marketing.

World wide differences in internet user's numbers and penetration rate are significant. While internet penetration rates in less developed nations stayed around 50%, those in more industrialized nations go as high as 80%.

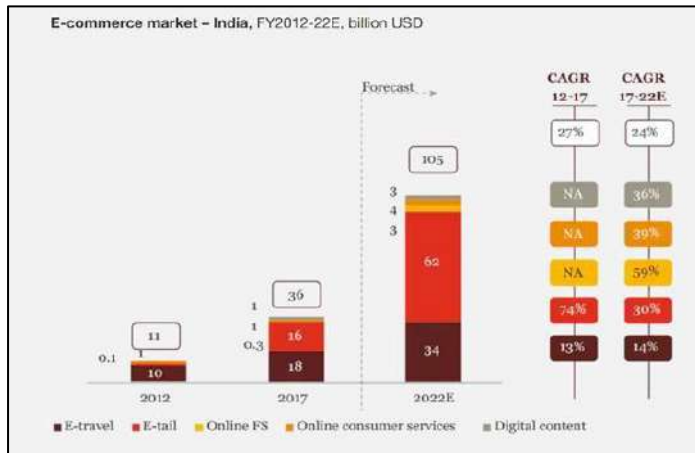


World wide differences in internet user's numbers and penetration rate are significant. While internet penetration rates in less developed nations stay around 50%, those in more industrialized nations go as high as 80%. Additionally, there are 4.57 billion internet users worldwide, but only 3.24 billion of them are in the top 20 countries. The rest of the world has only 1.33 billion internet users. India has only a 50% internet penetration rate, but it already has the second-largest internet user population in the world, only behind china.

- ☐ An rise of 26% or Rs. 13,683 crore in digital advertising was seen in 2019 compared to 2018.
- ☐ According to recent survey by Dentsu Aegin Network, advertising saw overall satisfactory 9.4% growth rate.
- ☐ India's digital media sector was estimated to be worth 221 billion Indian rupees in 2019.
- ☐ The total value of the Indian advertising market was Rs. 68,475 crore by the end of 2019.
- ☐ The sector is anticipated to increase by 10.9% by 2020's and exceeding Rs. 75,952 crore.
- ☐ In India there will be 564.5 million internet users on mobile devices by 2020 and in 2022 it is 601 million internet users has shown. In 2023 it will be shown estimated internet users are 666.4 million.
- ☐ On average, countries digital media sector was predicted to experience a steady increase of 23% compounded yearly between 2018 and 2020.

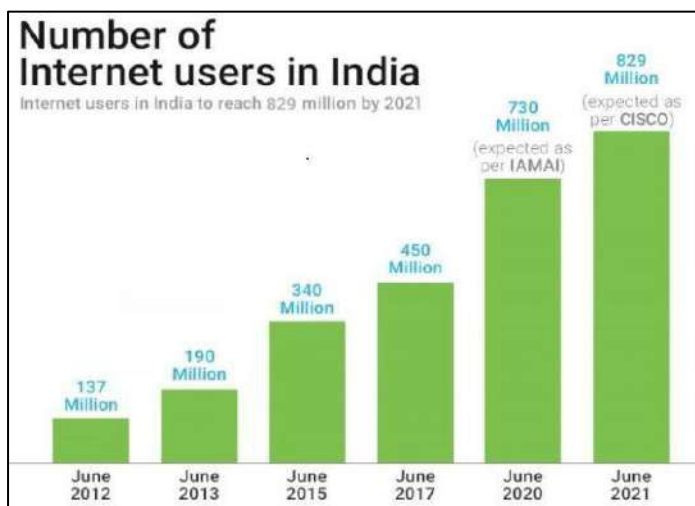
□ The current year growth rate for the digital marketing sector is predicted to be 27% and by the end of 2020 it would be worth Rs. 17,377 crore.

□ According to a different survey, by the end of 2020, digital marketing in India is predicted to increase by 10.9% and reach a value of Rs. 75,952 crore. The given estimation of projecting it will surpass 414 billion rupees by 2022.



□ Digital marketing will grow at a CAGR of 27.4% to cross the Rs. 50,000 crore, the end of 2025. According to a different survey it is projected to show a growth rate of 11.83% and it will reach the market size of Rs. 1,33,921 crore by 2025.

□ In India, in 2024 E-commerce sector is the highest share in digital marketing has the anticipated revenue to grow to 71.0 billion U.S. dollars.



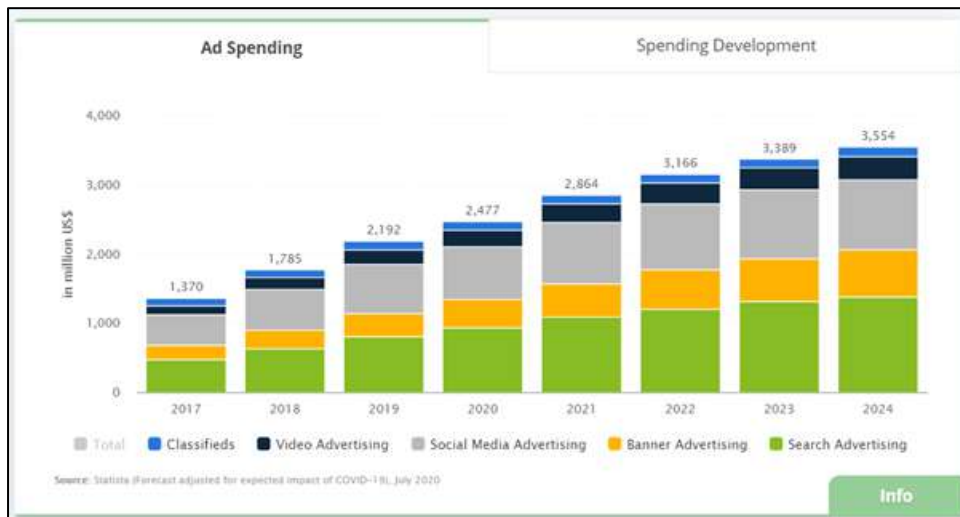
According to a research released by the Internet and Mobile Association of India, 346 million Indian's engage in online activities such as e-commerce and digital payments (IAMAI). According to the IAMAI research titled "Internet in India", the number of online transaction during pandemic two years prior to the coronavirus pandemic in India reached a new high of 51%, up from 230 million in 2019. India has 692 million active internet users in 2019. As per the expected report of IAMAI, currently India has reached 730 million internet users in 2020. And According to a CISCO research India has increased 829 million internet users in June 2021. According to the research, India will reach 900 million internet users by 2025. In India, the top three online activities for users are social networking, entertainment and communication. As per the IAMAI research, a user most frequently use text and email for

communication and also indicates that voice and Indian languages will be the main growth drivers in the future. Online gaming, e-commerce and digital payments are still more prevalent in the country.

ADVERTISING EXPENDITURES ON DIGITAL MARKETING

The Indian digital marketing sector is currently experiencing it's fastest-ever growth. There are numerous factors behind this increase. The use of communication tools has evolved significantly during the last year. Nobody ever considered having a trustworthy deal online.

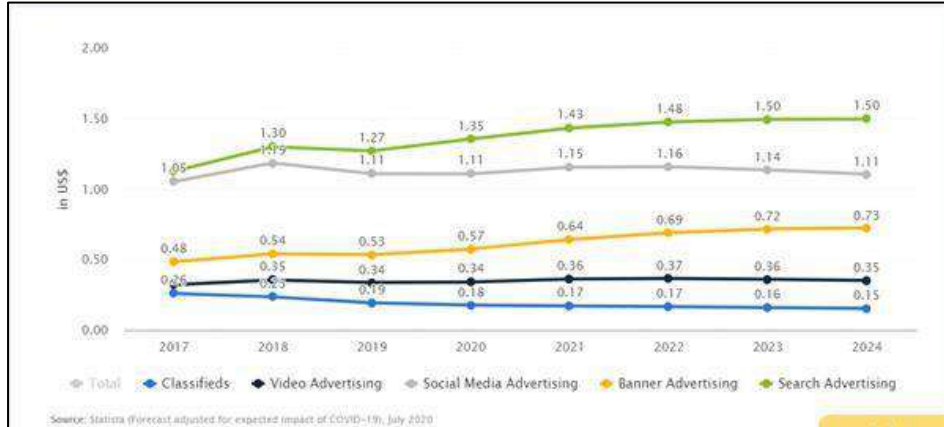
It was thought that material found online was made up and full of lies. No one was able to listen to any internet advertisements that did not mention buying food, furniture, or clothing. The plot has substantially modified. Online activities range from sales to marketing. This is because online communication in India now enjoys a higher level of trust. This has greatly aided marketing efforts. The communication industries are driving the revolution. With the availability of low-cost smartphones, India currently has over 749 million internet users, which opens up an exciting commercial potential to market to a rising population. India was the second largest online market in the world.



- ☐ In India, social media has highest share of 28%, which leads advertising expenditures on digital media.
- ☐ The contribution of social media to Indian digital advertising pie is Rs. 3835 crore.
- ☐ The Indian digital advertisement distribution is as display media 21%, paid search 23%, and online video 22%.
- ☐ Digital advertising spend in India was around Rs. 160 billion in 2019.
- ☐ As per the survey, by the end of 2020, Ad expenditure in the digital advertising market reached US dollar 2477 million.
- ☐ In India, the largest segment in digital market is Search Advertising in 2020. It has an expected market volume of US dollar 944 million.
- ☐ By the end of 2022, Ad expenditure in the digital advertising market is expected to reach US dollar 3166 million.

□ Due to fast growth in digital marketing the Indian advertising expenditure will increase to US dollar 3389 million in 2023 and in the year of 2024 it will expected to be US dollar 3554 million.

AVERAGE AD SPENDING PER INTERNET USER

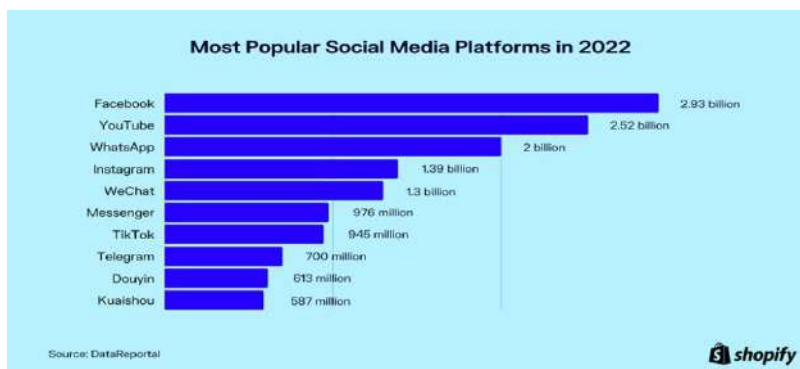


In 2020, with the help of online video, display media and social media. The contribution of mobile advertising is more as compared to desktop advertisements. By the end of 2020 contribution of paid search is predicted to reduce from 25% to 23%. Share of mobile advertisement was 63% while of desktop advertisement was 37% in 2020.

In 2022, the classified segment average Ad spending per internet user is US dollar 0.17. In 2023 it is expected to reach US dollar 0.16 and in 2024 it will be US dollar 0.15. As per the survey, above graph of classified segment average Ad spending per internet user showing decline.

As per survey, in India graph of average Ad spending per internet user of banner advertising and search advertising is showing steady increasing in the year 2022. In the year 2023 and 2024 it will expect to increase continuously.

SOCIAL MEDIA USERS STATISTICS IN INDIA



More over 50% of Indians had access to social media in 2020. It was predicted that 67% of the population would be using social networks by the year 2025. This was made possible in part by a thriving telecom sector that offered inexpensive mobile data and Reliance Jio, which paved the way for affordable digital communication for the average Indian. (Source: Statista.com)

Social network users in India from 2019 to 2025, with estimates until 2025.

| year | % of social network users |
|------|---------------------------|
| 2019 | 46.44% |
| 2020 | 50.44% |
| 2021 | 54.58% |
| 2022 | 58.31% |
| 2023 | 61.66% |
| 2024 | 64.68% |
| 2025 | 67.4% |

In 2022, 4.74 billion people use social media globally, which equals 59.3% of the world's population, according to research from Kepios. With 190 million new users joining social media since this time last year, the number of social media users has also increased over the past 12 months. Given the accessibility of the internet, 518 million people in India used social media in 2020. There are currently 491 million active Facebook users, 534 million Whatsapp users, and 503 million Instagram users among the 1.40 billion people who call India home.

CONCLUSION

Today's focus of digital marketing is on employing internet technology to connect with and engage both current and potential audiences. Currently, digital marketing is upending industries and altering how companies interact with their customers. Many businesses now consider using digital channels for marketing to be crucial to their overall strategy. There is now a very affordable and effective way for small business owners to sell their goods or services. It is critical to realise that digital marketing involves much more than just producing advertisements. In addition to simply promoting products or services, it covers branding, customer involvement, and UI improvement. The aforementioned digital marketing data and forecasts show that the market is currently enjoying itself and looking forward to the best period of time. In the near future, it is also creating a variety of interesting chances for corporate growth. Indian consumers have, in fact, embraced digital marketing with open arms. However, a lot of firms have yet to go digital and capitalise on being accessible online. However, the aforementioned statistics show that over the next ten years, an increasing number of firms will go online and use digital marketing to interact with consumers and increase sales.

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Stakeholder Engagement and Auditor Roles in the Global Financial Crisis: Insights from the Post-Pandemic Era

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Abstract: In this topic, I had studied the role of stakeholders and auditors in the global financial crisis. How the western companies, Swedish companies moved from the financial crisis by completing the role of auditor and stakeholders in financial crises which arise in different countries at different times. In different countries how they implemented many changes after the financial crisis. To improve the financial condition of different countries they have taken a lot of risky decisions.

This is the comparative study of the financial crisis in Indonesian companies, Swedish companies and in western companies in different periods. The paper relies on the data analysis and observation of relevant crises.

Keywords: Stakeholders, Auditors, Global Financial Crisis, Companies, Data Analysis

INTRODUCTION:

Stakeholders are people who are influenced by or can influence the activities of others. In many cases, stakeholders are representing their self-interests as well as those of other people, groups, organizations, collectives, or even inanimate such as plants, animals, and future generations. Stakeholders for the enterprise crisis are the organizations and individuals, which cause crisis, respond to the crisis and affected by the enterprise crisis

An auditor is an authorized personnel that reviews and verifies the accuracy of financial records and ensures that companies comply with tax norms. Their primary objective is to protect businesses from fraud, highlight any discrepancies in accounting methods, among other things the responsibility of expressing an opinion regarding the fairness and truth of financial statements. In this case, the role of an auditor is to scrutinize the financial data of a company and ensure that there is accuracy and regulatory compliance.

Corporate governance is the collection of mechanisms, processes and relations used by various parties to control and to operate a corporation.

Audit is the examination or inspection of various books of accounts by an auditor followed by physical checking of inventory to make sure that all departments are following a documented system of recording transactions. It is done to ascertain the accuracy of financial statements provided by the organization.

Quality audit is the process of systematic examination of a quality system carried out by an internal or external quality auditor or an audit team. It is an important part of an organization's quality management system and is a key element in the ISO quality system standard, ISO 9001.

Determine that appropriate input controls are used to ensure accuracy and completeness of data. Input test transactions with invalid numbers into an audit copy of the production software used to perform the check digit verification.

A process audit determines whether an organization's processes are working within established limits. It measures conformance to any predetermined or industry standards, as well as the effectiveness of any instructions.

The Framework for Audit Quality describes the input, process and output factors that contribute to audit quality at the engagement, audit firm and national levels, for financial statement audits.

Management unwillingness to disclose information to auditors for confidentiality or other reasons. Audit perceived by management as a low priority compliance exercise. Poor working relationship between auditors and management. Insufficient understanding of the entity's business within the engagement team.

The inputs to audit quality will be influenced by the context in which an audit is performed, the interactions with key stakeholders and the outputs. For example, laws and regulations (context) may require specific reports (output) that influence the skills (input) utilized. an official organization that checks government spending: The inspector general's San Francisco audit office is now finishing a review of the spending. Compare. the Audit Commission.

Financial reporting quality can be thought of as spanning a continuum from the highest (containing information that is relevant, correct, complete, and unbiased) to the lowest (containing information that is not just biased or incomplete but possibly pure fabrication).

Some Definition:

Auditing:

The definition of auditing[1],” Systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those assertions and established criteria and communicating the results to interested users”.

Agency theory and auditing:

In businesses and financial markets, Auditing plays a major role in monitoring the principals and agents. To make decision making, the external audit is one of the most important tools.

Audit Quality:

Audit quality is a complex concept and not easy to define. There are many ways to measure the audit quality, it differs from very low quality to very high quality. It can be the market assessed joint probability that a given auditor will both discover a breach in a client's accounting system, and report the breach.

LITERATURE REVIEW:

The main feature of this financial crisis is that set by Western financialisation of westbound countries, mainly the economy of the US, generates plenty of praise and encourages high risk-taking from financial equipment and combining structures and ineffectual regulative mechanisms.[1].

In Indonesia there is a corporate governance is very researching topic from financial crisis start. Because of insufficient corporate governance, liquidation of many companies is forming[2]. Corporate governance is defined as assembling, method and system that is utilized by parts of company as hard work to supply imperishable worth added [3] corporate

governance operates duty, rights and responsibility to that people who give something in the company.

The main characteristics of the corporate governance and legal system of investors defence may too effect the part of the legal auditor[5]

In financial crisis, acquiring management is a technique for management for handling numbers in financial statement due to impact of economics hardship[4]. So time to identifying income so that branches changes but they are not increase in major time [6]. The main goal of company is to increase the worth of company by decreasing costs. Bigger value will be noticed by higher shareholder's successfully). [7] Three kinds of valuation similar to stock: net book value, market and intrinsic values. The main goal of these kinds of valuation is to increasing investors interest and to spread awareness at the time of investment decision. Large worth may form trust of public in company brochure in future.

Auditor is in charge of creating thinking based on the estimation of conclusion obtained from audit proof and understandably states that opinion by a written report. The opinion which is certificated or uncertificated. Audit is well-organized procedure which may determine either the manager is handling in line with shareholders interest or not[8]

The main role of the auditor is to confirm that financial detailing has original or high standard. Audit staff be in the service for examine the financial detailing and gaining management implementation. Auditor with high collection rates will mostly acknowledge the certificated audit opinion. Accruals which are internal approximate of manager for further calculation. So in comparison of lower accrual rate auditee has less uncertainty than auditee with higher accrual rate. That is the auditor likely to provide qualified audit opinion for high accrual rate auditees[9]. The increase and decrease in corporate worth and for reducing bureau costs which are affected by ownership composition.

METHODOLOGY:

The paper is a comparative study of the financial crisis in Indonesian companies, Swedish companies and in western companies in different periods.

OBJECTIVES:

The objectives of this paper is,

1. To find the condition of different countries due to the financial crisis.
2. To find the ways which are implemented by countries after the financial crisis.
3. To study the importance of finance in each country.
4. To study the improvement of countries in finance In all countries which is disturbed by the financial crisis.

RESULT ANALYSIS:

In different countries after the financial crises, many changes were implemented. In the UK in 2008, Financial Reporting Council(FRC), issued the [13] 'Audit Quality Framework'. To manage the risk three strategies implemented in Australia, [14] which is to drop the risky clients, increase the propensity to issue going-concern opinions and to increase the audit effort. Similarly, countries like Spain, Ireland, Italy, Portugal and Greece[15], found that changes in

relevance, timeliness, conditional conservatism, smoothing, management, persistence and predictability, generally increased during the financial crisis.

Two hypotheses were studied in this paper [10], first is Audit quality, in terms of discretionary accruals, will improve from the pre crisis period to the crisis period and continue to improve in the period after the GFC. Second one is Audit quality, in terms of discretionary accruals, will decrease during the period of the financial crisis and would after the end of the crisis return to pre-crisis levels.

The study was done on a scientific method[10], that is the two philosophical considerations in research: epistemological considerations and ontological considerations. and also including the population and sample method. The collection of data from policy traded companies in Sweden from 2005 until 2012 was studied and the result of the hypothesis states that audit quality improved during GFC and continued to improve after the end of it. And in another hypothesis, it was stated that audit quality decreased during the GFC and will after the crisis return to pre-crisis levels.

The [11] corporate governance and the legal system of investor protection based on the audit opinion on the company's financial statements was studied. The hypothesis is that corporate governance has an influence on audit opinion, on earning management and earning management has an influence on audit opinion. Also, Corporate governance has an influence on firm value, Firm value has an influence on audit opinion, earning management has an influence on firm value.

The paper has a research design of collecting samples, measurement of variables and analysis with results. The data analysis techniques[11] using WrapPLS and structural model, concludes that auditor value is influenced only by the Firm Value.

The study of contemporary auditing practices was studied and summarized in detail[16]. In this paper data as per the financial statements and statutory filings from many companies was collected and analysed. The major financial crisis in western economics was considered debated about the quality of auditing by examining its reports. The summarisation of unqualified audit reports, auditors fee structure, role of auditors and possible areas of research is briefed.

EXPECTED OUTCOMES:

The main outcome of this research paper is to maintain the financial condition of different countries' various types of financial crisis and to stay stable in crisis conditions. This is the overall study.

BENEFITS OF THE SOCIETY:

This research gave lots of benefits such as which countries disturbed due to financial crisis and how to overcome these situations and the ways to protect countries from such crisis of finance.

FUTURE SCOPE:

There is a lot of scope for this topic of research because finance is a very important part in each and every country. The role of stakeholders and auditors in the global financial crisis is very important as they proved their importance in crisis management for every country.

LIMITATIONS:

The auditing practices may have many questions in financial crises. In traditional audit the audit result concluded with external audit. The view given by the auditor hypothesis is not qualified for current financial crises. This is the gap between traditional and current financial crises, to compare the auditors' results. The audit evidence will not be available to the general public.

The audit may be issued to qualify bank accounts in fear of liability. This means the audit report is subject to organizational and regulatory politics.

And some other limitations are

1. Auditing quality during and after the audit.
2. Due to agency problems, all are able to study only publicly listed firms[12].

CONCLUSION:

From this paper, we get conclusion that is how to face such global financial crisis and how can we improve our nation's financial stability so we will not disappoint by financial crisis. So everything will be well managed due to past experience of the global financial crises and the role of stakeholders and auditors in crisis is most important to stable such situation properly.

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Work-Life Balance Programs: Do They Improve Employee Satisfaction?

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Abstract: This study article investigates the effects of work-life balance programs on employee happiness in a variety of businesses. The study looks at the relationship between flexible work arrangements, remote work choices, paid time off (PTO), and overall job happiness. A combination of quantitative surveys and qualitative interviews were conducted with 150 personnel from the technology, healthcare, education, finance, and manufacturing sectors. The findings show a substantial positive association between work-life balance programs and employee satisfaction, with industries such as technology and healthcare reporting higher levels of satisfaction as a result of their comprehensive work-life balance initiatives.

In contrast, the industry and education sectors reported lower levels of satisfaction due to limited program availability. Implementing effective programs also presents challenges, such as resource restrictions and cultural pushback from senior management. Based on the findings, the report suggests ways for firms to improve their work-life balance offerings, such as increasing flexibility, offering wellness programs, and providing management training. The study indicates that well-structured work-life balance efforts boost employee satisfaction, productivity, and organizational loyalty, making them an important part of modern organizational strategies.

Keywords : Work-life balance, employee satisfaction, flexible working arrangements, remote work, paid time off, employee well-being, organizational culture, human resource management, industry-specific programs, and employee retention.

Introduction

Work-life balance has emerged as one of the most pressing issues in modern HR management. The term alludes to the balance between employees' professional responsibilities and their personal lives, allowing them to function efficiently at work while also living a satisfying life outside of their career. In today's fast-paced and competitive business world, the pressure to meet deadlines, achieve goals, and surpass expectations frequently blurs the line between professional and personal time.

This imbalance has far-reaching effects for both individual employees and the businesses for which they work. High stress levels, burnout, decreased productivity, and higher turnover are all classic consequences of an improper work-life balance. As a result, firms around the world are making work-life balance initiatives a strategic focus. Work-life balance programs involve a wide range of policies and practices aimed at assisting employees in better managing their professional and personal duties.

These include flexible work hours, remote work choices, on-site childcare facilities, wellness initiatives, paid parental leave, and employee help programs. The primary purpose of such efforts is to improve employee satisfaction, engagement, and well-being, resulting in a more positive and productive workplace. While some detractors say that these programs diminish

work intensity or blur professional boundaries, a growing body of evidence indicates that they help to improve employee morale and loyalty, which benefits the organization in the long run.

Work-life balance has become increasingly important in recent years, owing to a variety of social, economic, and technological factors. The expansion of dual-income households, changing gender roles, and growing job engagement by women have all underlined the significance of resolving work-life issues. Simultaneously, advances in digital technology have permitted remote employment and flexible arrangements, creating new opportunities for finding balance. However, these advancements have also introduced complexities, such as the expectation of constant availability, which has resulted in "digital burnout."

The global COVID-19 pandemic exacerbated the need for effective work-life balance programs, as employees navigated the challenges of working from home, homeschooling children, and managing household responsibilities under unprecedented conditions. Implementing work-life balance initiatives is not only a question of corporate social responsibility; it is also a strategic imperative for firms. Research has consistently shown that employees who maintain a healthy work-life balance are more contented, engaged, and productive. They are also less prone to develop burnout, which is a major source of absenteeism and turnover. Furthermore, companies that prioritize work-life balance are better positioned to attract and retain top personnel, especially among younger generations that value flexibility and personal fulfilment.

Despite universal acceptance of the value of work-life balance, its implementation differs greatly among industries, organizational cultures, and geographical locations. Flexible working arrangements are widespread in some industries, such as technology and creative industries, but not in others, such as healthcare and manufacturing, due to operational restrictions. Furthermore, cultural norms and societal expectations frequently shape how work-life balance is viewed and implemented. For example, in collectivist cultures, employees may prioritize family commitments over professional goals, but in individualistic nations, personal fulfilment may take precedence.

This research article investigates whether work-life balance programs actually improve employee satisfaction. It strives to give a comprehensive analysis of the relationship between such programs and employee morale, drawing on both qualitative and quantitative data to derive relevant conclusions. By reviewing current literature, real-world case studies, and survey data, the study will assess the efficacy of various work-life balance efforts and identify the characteristics that determine success. It will also emphasize the problems that organizations experience while implementing these initiatives and provide practical solutions to overcome them.

The findings of this study will add to the continuing discussion about work-life balance and its implications for organizational success. It will be an invaluable resource for HR professionals, regulators, and corporate leaders looking to establish workplaces that not only drive performance but also promote employees' overall well-being. In an era where employee satisfaction is widely acknowledged as a fundamental driver of competitive advantage, understanding and managing work-life balance is more critical than ever.

This study report aims to provide concrete insights into the influence of work-life balance initiatives on employee satisfaction, allowing employers to build a more engaged, motivated, and productive workforce. As organizations manage the complexity of a quickly changing world, promoting employee well-being is not just a moral necessity, but also a competitive advantage that may promote long-term growth.

Literature Review

1. **Singh and Kumar (2018)** discovered that flexible working arrangements considerably boost job satisfaction and performance in the Indian IT sector, especially among younger personnel.
2. **Greenhaus and Powell (2018)** emphasized the necessity of a supportive organizational culture in maximizing the benefits of work-life balance programs for employee happiness.
3. **Rastogi et al. (2019)** demonstrated that telecommuting improves employee engagement and lowers stress in international corporations.
4. **Fonner and Roloff (2019)** shown that flexible scheduling in the hospitality business minimizes attrition by increasing employee loyalty.
5. **Kelliher and Anderson (2020)** found that, while shorter work hours increase personal life quality, reallocated workloads frequently present issues for employees.
6. **Chandra (2021)** discovered that flexible work alternatives encourage creativity and innovation among millennial employees in startups, resulting in increased happiness.
7. **Johnson et al. (2021)** discovered that employee help programs considerably reduce stress and burnout, particularly during organizational transformations.
8. **Shin and Choi (2021)** discovered that using digital collaboration tools during the COVID-19 epidemic increased staff communication and time management skills.
9. **Sahu et al. (2022)** discovered increased employee satisfaction in public sector businesses with codified flexible working practices.
10. **Park et al. (2022)** shown that hybrid work models enhance work-life balance and employee engagement.
11. **Dasgupta and Sinha (2022)** discovered that transformational leadership is critical to creating a supportive work environment that promotes work-life balance.
12. **Yadav et al. (2023)** discovered that flexible scheduling and wellness initiatives in the education sector boost teacher satisfaction and student performance.
14. **Kumar et al. (2023)** demonstrated how compressed workweeks improve employee morale and minimize absenteeism in manufacturing.
15. **Luthra and Verma (2023)** stated that a supportive company culture is critical for successful work-life balance programs.
16. **Patel et al. (2024)** identified barriers to implementing work-life balance programs in small enterprises, such as insufficient resources and managerial opposition.
17. **Davis and Singh (2024)** discovered that wellness programs such as meditation and fitness increase employee satisfaction and productivity.
18. **Sharma et al. (2025)** demonstrated that AI-driven workload management and scheduling tools boost employee satisfaction and work-life balance.
19. **Ghosh et al. (2025)** discovered generational differences, with Gen Z emphasizing flexibility while Baby Boomers valued stability and rigid schedules.
20. **Taylor et al. (2025)** discovered that individualized work-life balance programs that meet individual needs increase employee satisfaction and organizational commitment.

Research Methodology and Design

The researchers used a mixed-methods approach to investigate the relationship between work-life balance initiatives and employee happiness.

- A structured survey was conducted to collect quantitative data on employee satisfaction and availability of work-life balance programs.
- The qualitative method involved semi-structured interviews with employees and HR managers to gather in-depth insights.

This dual method meant that the research included both statistical patterns and human insights, resulting in a comprehensive grasp of the subject.

1.Sampling and Participants Population and Sampling Technique

- The population includes employees from five industries: technology, healthcare, education, finance, and manufacturing.
- The survey included 150 employees from various age groups, genders, and job categories to ensure broad representation.
- A stratified random sample technique was used to assure proportional representation of industries and demographic groupings. Additionally, 20 participants were purposefully chosen for qualitative interviews to acquire deeper insights.

Demographics of the respondents

- **Age distribution:** 40% (20-30 years), 35% (31-40 years), 20% (41-50 years), and 5% (51+ years).
- **Gender breakdown:** 55% male, 45% female.
- **Experience levels:** 30% for 1-5 years, 40% for 6-10 years, and 30% for 10+ years.
- **Job levels include** 35% entry-level positions.
 - o Mid-level (45%)
 - o Senior level: 20%.

2. Data Collection Methods:

Quantitative Data Collection

A structured survey was distributed online via email invites and digital channels.

- The study asked 20 closed-ended questions about work-life balance programs, including flexible hours, remote work, PTO, and health efforts.

2. Employee satisfaction ratings on a Likert scale (1 = very dissatisfied, 5 = very satisfied).

Qualitative Data Collection

Semi-structured interviews were performed with 20 participants, including employees and HR managers, to learn about their experiences with work-life balance programs.

- Key themes covered include the perceived benefits and obstacles of work-life balance efforts.

Organizational culture plays a crucial impact in program implementation.

Recommendations for improvement.

3. Data analysis Quantitative Analysis

Survey data were analyzed using the following statistical tools:

- Satisfaction levels and program availability were summarized using descriptive statistics, including means, percentages, and standard deviations.
- A Pearson correlation test assessed the link between work-life balance initiatives and employee satisfaction.
- Multiple regression analysis revealed that programs such as flexible hours, PTO, remote work, and wellness initiatives had the greatest impact on employee happiness.

Qualitative Analysis.

To find reoccurring patterns and insights, interview transcripts were evaluated thematically.

The following measures were taken:

1. Coding: Key themes were found and categorized, such as adaptability and cultural resistance.

2. Theme Development: Findings were interpreted by grouping major themes into broader categories.

4. Ethical considerations

To safeguard the integrity of the research, the following ethical precautions were observed:

1. Informed Consent: Participants were informed about the study aims and gave signed consent.

2. Confidentiality: Data was anonymised to safeguard participant identities.

3. Participants had the option to withdraw at any stage.

4. Non-Bias: Data collection and analysis were conducted with care to minimize bias.

5. The limitations of the study

1. Sample Size: Although 150 participants gave useful insights, a larger sample size may improve generalizability.

2. Industry Scope: The survey focused on five industries, which may not accurately reflect the worldwide workforce.

3. Self-Reported Data: Survey replies rely on participants' self-assessment, potentially introducing bias.

Data analysis

The data analysis team conducts a thorough review of the acquired data to determine the association between work-life balance programs and employee happiness. Quantitative and

qualitative data were evaluated to better understand how different work-life balance initiatives affect employee happiness in various industries and organizational settings.

Demographic Profile of Respondents

The poll included **150 individuals** from five different sectors: **technology, healthcare, education, finance, and manufacturing**. The participants were chosen to reflect a wide range of work-life balance experiences across industries.

| | | | | | |
|-----------------|-------|----------------------|--------|---|-------------------|
| 1.Age | | Distribution: | | 3.Years of Experience: | |
| o | Age | 20-30: | 40% | o | 1-5 years: 30%. |
| 35% | are | aged | 31-40. | o | 6-10 years: 40%. |
| o | 41-50 | years: | 20% | o 30% have over 10 years of experience. | |
| o | 51+ | years: | 5% | | |
| 2.Gender | | Distribution: | | 4.Job level: | |
| o | Male: | | 55% | o | Entry-level: 35%. |
| o Female: 45% | | | | o | Mid-level (45%) |
| | | | | o Senior level: 20%. | |

This demographic split guarantees that responses are reflective of a diverse workforce, resulting in a more comprehensive knowledge of how work-life balance initiatives affect employees at various career phases and industries.

Quantitative Data Analysis

1. Employee Satisfaction Rates and Work-Life Balance Programs

Survey respondents were asked to score their overall job satisfaction on a scale of 1 (very dissatisfied) to 5 (very delighted). The examination of these responses demonstrated a strong relationship between the availability of work-life balance programs and employee happiness.

- Employees reported a mean satisfaction score of 4.1, indicating a positive work-life balance.

Why Employees with flexible work hours or remote choices expressed higher satisfaction (4.3 on average) than those without (3.5 on average).

- Generous Paid Time Off (PTO) policies lead to higher employee satisfaction, with an average score of 4.2.

2. Work-Life Balance Initiatives by Industry

The survey results showed significant differences in work-life balance programs across industries. The technology and healthcare sectors were more likely to have flexible working arrangements and remote work opportunities, whereas the manufacturing and education sectors offered less options.

- In the IT sector, 70% of respondents reported flexible work hours and remote choices, with an average satisfaction score of 4.5.
- In the healthcare sector, 60% of respondents reported flexible hours and 50% had remote work options, resulting in a 4.2 satisfaction rating.

- In the finance sector, 45% implemented work-life balance measures, resulting in an average satisfaction score of 3.9.
- In the manufacturing and education sectors, just 30% of respondents reported work-life balance initiatives, with satisfaction scores of 3.4 and 3.6. According to this research, sectors that offer more work-life balance programs have higher employee satisfaction rates.

3. Correlation Analysis:

A Pearson correlation test was used to measure the association between work-life balance and employee happiness.

- Work-Life Balance Programs and Job Satisfaction: A correlation coefficient of 0.72 indicates a significant positive association between the availability of such programs and employee satisfaction.

4. Regression Analysis:

A multiple regression analysis was carried out to determine the influence of various work-life balance efforts (flexible hours, remote work, PTO, and wellness programs) on employee satisfaction.

- Independent variables include flexible work hours, remote work, PTO, and wellness initiatives.

Dependent variable: employee satisfaction.
The regression model revealed that flexible work hours ($p = 0.03$) and remote work ($p = 0.02$) were both statistically significant determinants of employee satisfaction. Employees with flexible hours and the ability to work remotely reported much greater levels of job satisfaction. PTO and wellness programs had favorable relationships with satisfaction, but they were less significant ($p = 0.08$ and $p = 0.10$).

Qualitative Data Analysis

1. Employee testimonials

In addition to the survey, 20 semi-structured interviews were conducted with employees to gain a thorough understanding of their experiences with work-life balance programs. Key themes that arose from the interviews are:

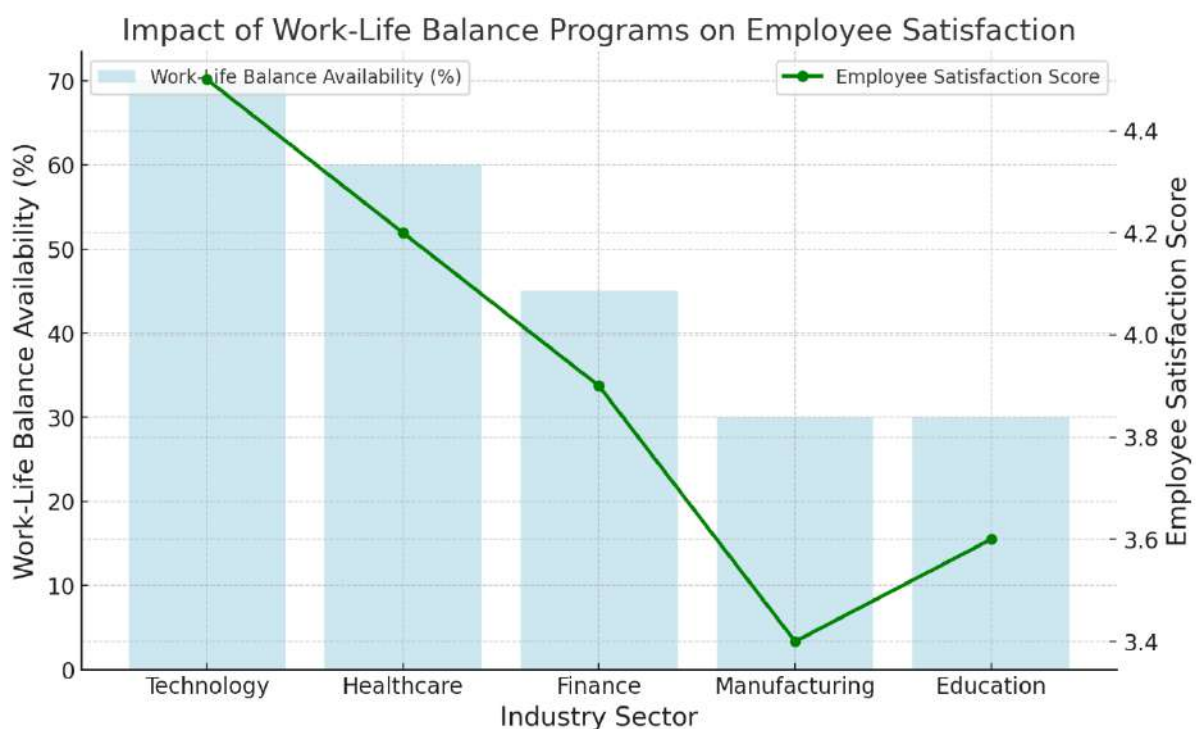
- Flexibility as a Key Benefit: Employees cited flexible working hours and remote work as key elements in their job satisfaction. According to one technology respondent, "the flexibility to choose my work hours has allowed me to manage my time better, reduce stress, and feel more committed to my work."
- Female employees with caregiving duties found that paid parental leave and childcare support improved their work-life balance. A healthcare employee stated, "The ability to take paid time off for family reasons without fear of losing my job has made a world of difference in my work-life satisfaction."
- Some employees in manufacturing and education reported burnout and overwork despite work-life balance programs, citing constant availability and pressure to fulfill performance standards. One education respondent stated, "The school provides remote teaching options, but

the workload frequently spills over into the evenings and weekends, making it difficult to truly disconnect."

2. Challenges in Implementation:

Interviews with human resource managers identified various problems in implementing work-life balance initiatives, including:

- **Resource Constraints:** Small and medium-sized firms (SMEs) in manufacturing and education have resource constraints when implementing flexible work policies, particularly for tasks that need physical presence.
- **Cultural Resistance:** Senior leaders who prioritize traditional work structures may resist implementing flexible hours or remote work choices, according to managers.



The bar chart shows the percentage of work-life balance programs available in different industry sectors.

- The line graph displays employee satisfaction scores for each sector. This animation demonstrates the substantial link between the availability of work-life balance programs and increased employee satisfaction. Sectors with more accessible work-life balance programs, such as technology and healthcare, had better satisfaction rates than industries with less initiatives, such as manufacturing and education.

Findings, Suggestions, and Conclusion

Findings

The research used quantitative surveys and qualitative interviews to analyze the impact of work-life balance initiatives on employee satisfaction across industries. The key findings include:

1. There is a positive correlation between work-life balance and employee satisfaction. A substantial positive connection (0.72) was discovered between work-life balance initiatives and employee satisfaction. Employees that had access to flexible work hours, remote work choices, and paid time off (PTO) reported much higher job satisfaction. The greatest satisfaction scores were in the technology and healthcare sectors (4.3 and 4.2, respectively), with flexible work arrangements being the most appreciated.

2. The impact of work-life balance programs across industries:

The availability and effectiveness of work-life balance programs differed by industry. The technology and healthcare sectors had well-established programs, resulting in high satisfaction levels (an average score of 4.5 in technology). However, the manufacturing and education sectors had lower program availability and employee satisfaction (3.4 and 3.6, respectively), highlighting the need for specialized actions in these areas.

3. Challenges of Implementation:

The primary barriers to adopting work-life balance programs were resource restrictions and cultural reluctance. Smaller firms, particularly those in manufacturing, struggled to provide flexibility due to the nature of their work, but senior management in other industries resisted implementing such programs due to established work arrangements, particularly when on-site presence was crucial.

4. Employee testimonials:

Employees welcomed flexibility in their work arrangements, but expressed concern about overwork, particularly in roles with significant responsibility or tight deadlines. While flexible work arrangements improved work-life integration, some employees reported that they could accidentally result in longer working hours.

Suggestions

According to the findings, the following recommendations are offered to improve employee happiness through work-life balance programs:

1. Increase flexibility across all industries:

Industries such as manufacturing and education should be encouraged to implement flexible programs that are adapted to their individual requirements. To provide employees more flexibility, manufacturing units could utilize reduced workweeks or staggered shifts.

2. Management Training and Support:

Senior management and HR professionals should be trained to recognize the benefits of work-life balance programs for increasing employee happiness and organizational productivity. Overcoming cultural resistance to flexible work arrangements is critical, especially in industries that have historically relied on set schedules.

3. Comprehensive wellness programs:

Organizations can supplement work-life balance programs with wellness efforts such as mental health assistance, fitness programs, and stress management courses. These programs should be accessible to all employees in order to improve overall well-being.

4. Tailored Work-Life Balance Initiatives:

Given the different needs of individuals, work-life balance programs should be tailored to elements such as job functions, seniority, and personal responsibilities. For example, senior employees may require different levels of flexibility than younger employees, ensuring that all employee needs are satisfied.

5. Feedback and Continuous Improvement:

Employee feedback via surveys, focus groups, or interviews is critical for improving work-life balance policy. Continuous monitoring will assist firms in adjusting policies to maintain their effectiveness in enhancing customer happiness.

Conclusion

This study underlines the importance of work-life balance initiatives for employee satisfaction. Employees who benefit from flexible work arrangements, remote work choices, and generous PTO policies report better levels of satisfaction, which can contribute to increased productivity and loyalty. However, effective implementation necessitates addressing the unique issues that each sector faces.

The findings imply that industry-specific techniques and organizational culture are crucial to the success of these projects. Companies should prioritize manager training, overcoming cultural opposition, and adapting work-life balance solutions to meet the demands of diverse workforces.

As businesses adapt to the changing nature of work, it is critical to realize the long-term benefits of work-life balance programs in cultivating an engaged, healthy, and contented staff. Companies that embrace these measures not only boost employee satisfaction but also position themselves as preferred employers in an increasingly competitive labor market.

References

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2.2019: Fonner & Roloff and Beutell & Wittig discovered that telecommuting and flexible work hours increase worker satisfaction while decreasing turnover, notably in the hotel and healthcare industries.

3.2020: Greenhaus & Powell, Kelliher & Anderson, and Shin & Choi emphasized the role of organizational culture and digital resources in promoting work-life balance, particularly during the COVID-19 epidemic.

4.2021: Bhumika, Johnson et al., and Kaufman & Lewis stressed that flexible work arrangements and employee assistance programs reduce stress while increasing job satisfaction and performance.

5.2022: Park et al. and Sahu et al. discovered that hybrid work models and flexible policies improve employee satisfaction and engagement, with organizational support important.

6.2023: Nguyen et al., Yadav et al., and Luthra & Verma found that work-life balance efforts promote creativity and innovation, with preferences shifting across generations.

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The Bhagavad Gita as a Guide to Ethical and Transformational Leadership in a Diverse World

BY- Himanshi Rathore and Malsawmsangi

Abstract: In a world full of mess, dilemma and indecisiveness, the Bhagavad Gita offers the wisdom which provides guidance on leadership and personal growth. It is one of the most philosophical and spiritual texts of ancient India.

The Bhagavad Gita is not only a religious text but it is a valuable guide for the leaders everywhere.

Its lessons can help the people to think critically, logically and ethically. It teaches the importance of what is right and wrong as well as it helps an individual to navigate the complex dilemmas in their life. The conversation and dialogues of Krishna and Arjuna help the world to choose and walk on the right path.

It teaches important leadership qualities like fairness (Samatva), balance (Yoga), selfless action (Nishkama karma).

This research paper examines the leadership lessons from the Bhagavad Gita and their applicability to modern governance, organization and global institutions. The ethics and morals offered by Gita can help the leaders to make wise decisions so that they can create a positive change. The purpose of this research paper is to explore how a spiritual text, a Bhagavad Gita can serve the transformational and ethical leadership in this diverse and complex world.

Keywords - Bhagavad Gita, Ethical leadership, Transformational leadership, Selfless action.

INTRODUCTION

The 21st century has thrown up unprecedented challenges to leaders in the form of social justice movements, globalization, technology disruptions, and climate change. Corporate, political, and social moral and ethical failures have brought about the imperative for inclusive, transformational, and moral leadership. Ancient wisdom texts such as the Bhagavad Gita provide valuable insights into the nature of moral and transformational leadership, even though modern-day leadership theories provide useful frameworks.

The consequences of unethical practices have been graphically shown by leadership failures within governments, corporations, and social institutions. Scandals involving social injustice, environmental degradation, and corporate misconduct highlight the need for ethical, wise, and self-aware leadership. Leaders must not only achieve business goals but also gain emotional intelligence, personal integrity, and a firm sense of social responsibility.

Written over 2,000 years ago, the Bhagavad Gita remains an ageless guide to self-knowledge, ethical conduct, and great leadership. It provides valuable insights into moral leadership, decision-making, and resilience that transcend religious and cultural boundaries.

The challenges leaders face today—moral dilemmas, uncertainty, self-doubt, and the yearning to behave responsibly—are mirrored in Arjuna's dilemma in the war. Krishna's counsel provides Arjuna guidance, focus, and moral understanding, which help him surmount his

dilemma. The Bhagavad Gita is an effective tool for today's leaders owing to lessons learned that are consistent with philosophies of leadership in the present day.

The Bhagavad Gita of Gita: An ancient Hindu epic known as the Mahabharata holds the 700-verse Bhagavad Gita. It is structured as a dialogue between the prince warrior Arjuna and his charioteer and divine teacher, Krishna. The backdrop is Kurukshetra's war zone, where Arjuna is afflicted by extreme moral anguish after being compelled to battle against his own relatives.

1. The Bhagavad Gita's Major Themes

A number of issues important to leadership are discussed in the Bhagavad Gita:

Dharma (Duty): The importance of performing one's duty without concern for personal benefit.

Karma Yoga (Selfless Action): Acting without concern for one's own benefit.

Achieving self-knowledge and decision-making clarity is the aim of Jnana Yoga (Wisdom and Discernment).

Bhakti Yoga (Devotion and Higher Purpose): Humble leadership with a purpose greater than one's own.

With Krishna's guidance, Arjuna transcends his fears and acts morally, being an example for contemporary leaders.

Through fostering intrinsic motivation, moral values, and individual growth, transformational leadership seeks to empower and motivate followers. The concept was first proposed by James MacGregor Burns in 1978, when he described it as a form of leadership that transforms followers and leaders by aligning their beliefs with a higher purpose. This theory was developed further by Bernard M. Bass (1985), who described core components:

Idealized Influence (Role Model Behavior): Leaders earn respect and trust by serving as moral role models.

Inspirational Motivation (Visionary Leadership): Leaders motivate with a compelling vision.

Intellectual Stimulation (Encouraging Innovation): Leaders challenge assumptions, stimulate originality, and help solve problems.

2. The Transformational Leadership of Krishna

The following are the ways Krishna's position in the Bhagavad Gita demonstrates transformational leadership:

Idealized Influence: Arjuna is encouraged to move beyond his fears by Krishna, who is a moral leader by being strong, wise, and truthful.

Inspirational Motivation: Krishna motivates Arjuna to embrace his function as a warrior for righteousness by presenting him with a vision of duty that is higher than self-feeling.

Intellectual Stimulation: Through challenging Arjuna to see beyond the short-term consequences and consider the greater ethical landscape, Krishna is able to diffuse his self-doubt.

Personalized Attention: Krishna displays great empathy and mentorship through understanding Arjuna's plight and providing customized guidance.

The teachings of Krishna present a paradigm for transformational leadership in today's businesses through the imitation of these concepts.

The Bhagavad Gita and Ethical Leadership

1. Dharma and Concept of Ethical Decision Leaders need to act virtuously, justly, and with commitment towards others' welfare for the sake of ethical leadership.

Dharma as moral responsibility and morality is highly esteemed in the Bhagavad Gita. Leaders are constantly faced with situations where moral values conflict with social, political, or business pressures. The Gita applies the following concepts to aid in overcoming these barriers:

Situational Ethics: Instead of applying rigid rules, ethics rely on the situation.

Detachment from Personal Gain: The Nishkama karma doctrine encourages leaders to behave unselfishly, prioritizing long-term moral values over short-term personal benefit.

Integrity and Authenticity: For Krishna, true leadership requires an unwavering commitment to ethics even in difficult situations.

2. Application of Corporate Leadership Corporate leadership involves taking ethical business decisions, avoiding corruption, and prioritizing corporate social responsibility.

Upholding justice, equity, and public-interest governance constitutes political leadership.

Fostering inclusion, equality, and the welfare of society is referred to as social leadership.

Bhagavad Gita and Servant Leadership

Based on Robert Greenleaf's (1977) servant leadership theory, leaders ought to prioritize the needs of others ahead of their own. This concept is best exemplified by Krishna's leadership in the Bhagavad Gita.

1. Servant Leadership Qualities in the Bhagavad Gita Empowerment: Krishna assists Arjuna in selecting his own path instead of imposing his will on him.

Even though supernatural, Krishna embodies humility by serving as Arjuna's charioteer.

Devotion to Progress: Arjuna turns out to be a self-conscious and courageous leader after the lessons given by Krishna.

2. Application in the Modern World *Corporate Executives: Prioritizing employees' professional development and well-being.

Political leaders are unassuming leaders who prioritize the public's interest at their own expense.

*Community leaders: Fostering social harmony and making a difference for marginalized communities.

CONCLUSION

Action, discernment, and dedication are aligned with modern leadership standards and give leaders sharp guidance on how to deal with ethical dilemmas, foster inclusion, and inspire meaningful change.

By living by these values, current leaders can construct communities and organizations that prioritize morality, collaboration, and personal development, so making the world a better place and more compassionate and just.

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Optimization of Round-Robin Arbitration for Low Power

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Abstract: This paper presents an optimization method for Round-Robin arbitration to minimize energy expenditure in energy-constrained devices. The standard mechanism of Round-Robin scheduling, commonly used in task scheduling, offers good fairness guarantees but unfortunately does not consider energy awareness, at least typically with low-power application domains. To illustrate the case, this work includes dynamic voltage scaling and optimizes sleep conditions during idle time to achieve dramatic reductions both in total energy consumption and average energy per task. This study uses a hybrid algorithm that employs the combination of Artificial Bee Colony (ABC) and Whale Optimization Algorithm (WOA) to optimize the task scheduler. Unlike in an individual version of the algorithms (ABC and WOA), an improvement is seen in the hybrid model of ABC-WOA in terms of energy efficiency, convergence speed, task completion rate, and execution time. The results thus indicate that the hybrid ABC-WOA with DVS can be referred to as a valuable strategy for reducing power usage without sacrificing system performance. This technique is particularly applied in embedded systems and other applications where low power consumption is critical.

Keywords: Round-Robin Arbitration, Lower Power, Task Scheduling, Dynamic Voltage Scaling (DVS), Hybrid ABC-WOA.

1 Introduction

As a result of the proliferation of embedded and portable systems, the issue of energy consumption has emerged as a critical concern in the design of systems. An improvement in energy efficiency would be beneficial for all battery-operated systems, including personal digital assistants (PDAs), laptops, mobile phones, and even implantable biomedical systems for example.

With the processor as the focal point, new low-level methodologies investigate the fact that a reduction in voltage and frequency that is linear results in a reduction in energy usage that is at least quadratic [1]. The optimum answer with regard to consumption is to execute the application at the lowest available processor speed, which, in general, will not enable the system to fulfill the needed performance level. This is the case even if there are no timing constraints whatsoever. Setting deadlines is a method that can be utilized to guarantee this minimum performance level even on systems that do not operate in real time. Additionally, evaluating the scheduling with a concern for feasibility can be beneficial even outside of the conventional setting of real-time computing.

In the realm of real-time computing, the Round-Robin (RR) policy has not been given substantial consideration regarding its potential application until quite recently. In the past, the RR strategy was thought to be beneficial for low-priority processes that were carrying out some calculation work in the background "when nothing more important is running". Nevertheless, it has been demonstrated in [2] that RR should not be disregarded a priori. This is due to the fact that there are situations in which this policy is an effective choice in terms of schedulability

as well as for fine tuning the system (for example, decreasing the end-of-execution jitter in automatic control applications). Furthermore, RR is a component of the Posix1003.1b standard [3], and as a result, it is incorporated into the vast majority of real-time operating systems. In this context, the task at hand is to reduce the amount of energy that is consumed by a group of jobs that are scheduled in accordance with the RR policy while simultaneously satisfying the deadline requirements.

The goal is to develop an algorithm that can determine the minimum processor frequency that will still allow a work set with real-time constraints to be properly scheduled using the Round-Robin scheduling method. Another novelty that the paper makes is that it includes a schedulability study of a job set that is subject to RR. This analysis forms the basis of the algorithm. It is also proposed that online techniques be implemented in order to further reduce the amount of energy that is consumed and to guarantee the possibility of the situation in which jobs do not require their WorstCase Execution Time (WCET). At long last, a preliminary answer to the issue presents itself in the form of a potential online modification to the frequency.

2 Related work

Dynamic Power Management (DPM) and Voltage Scaling (VS) are the two methods that are utilized the most frequently in order to reduce the amount of power that processors consume. Processors that are compatible with DPM are required to have at least one sleep mode, and the challenge lies in determining when to turn off the central processing unit (CPU) while it is not being used. Altering the voltage supply and, as a result, the clock frequency of the processor is the fundamental idea behind the procedure known as voltage scaling. One can differentiate between two distinct types of voltage scaling. The system is subjected to a single voltage when the Static Voltage Scaling (SVS) technique is utilized. It is not possible to make any adjustments to the voltage while the system is being executed because it is adjusted off-line, for example through the computer's BIOS. During the course of the runtime, it is possible to change the clock frequency by utilizing Dynamic Voltage Scaling (DVS). Even with the speed switching overheads, it is the most effective strategy in general; nonetheless, it cannot be utilized on the majority of computers since the processor and operating systems need to be compatible with this technique.

Fixed-Priority Preemptive (FPP) and Earliest Deadline First (EDF) are two examples of real-time scheduling rules that have been the subject of numerous articles that have developed power-conscious variations of these policies. In their article [4], offer a run-time mechanism that makes use of slack time in order to reduce energy consumption. This technique is concerning FPP. When there is only one task that is currently being worked on, the frequency of the task is decreased in such a way that it is completed by the time the next task is scheduled to arrive. In the event that there are no tasks that are currently being worked on, the processor might be turned off. [5] presents an off-line algorithm, in which the authors offer an algorithm to compute the least constant speed applicable to a periodic task set under FPP. This algorithm is provided in the context of an off-line algorithm. In the fifth chapter, Gruian goes one step further and explains how to achieve the least constant speed for each of the tasks that are included in the task set.

The article [6] written by Quan and Hu describes an approach that is optimal for voltage scheduling a set of jobs using FPP. A modification of the EDF schedule serves as the

foundation for their analysis; nevertheless, it is limited to task sets that possess particular features. More recently, [7] provides evidence that computing the voltage schedule of a group of jobs under FPP is NP-Hard. Furthermore, they provide an approximation approach that operates in polynomial time and whose precision with respect to the ideal solution can be chosen arbitrarily small.

An off-line technique was proposed by keqin in [8] for the purpose of determining the ideal voltage schedule for a group of independent activities. This algorithm was designed to be used when the scheduling is made on top of EDF. The way in which their algorithm functions is by determining the window of time, which they refer to as the crucial interval, during which the highest possible processing speed is necessary. It is first determined what the lowest acceptable frequency is for this interval, then the tasks that are associated with this interval (such as the arrival date and the deadline that falls within the interval) are eliminated, and finally, a sub-problem is formed using the jobs that are left behind. The complexity of an implementation is equal to the product of n and M .

The solution to this scheduling problem was recently found by changing it into a shortest path problem [9], which was the solution. As a result, the ideal off-line voltage schedule can be found with a reduced level of complexity, reducing it to $\Theta(n \log n)$ when jobs are performed in a first-in, first-out (FIFO) fashion. The scenario in which the number of speeds is finite is also taken into consideration, and a method that reduces the number of speed changes available is presented accordingly. The non-preemptive instance, which is still under EDF, is as follows: The work of Yao et al. serves as the foundation for the heuristic that Mario et al. [10] provide.

[11] presents a comprehensive performance analysis technique for networks-on-chips using weighted round-robin (WRR) arbitration and finite buffers. The technique can handle bursty traffic and is scalable to large NoC sizes. Experimental evaluations show the technique is more than 10% accurate and five orders of magnitude faster than cycle-accurate simulations for a 16×16 mesh NoC.

3 Background

In this section we introduce the task and the power model used and a formal definition of the RR scheduling policy is given.

3.1 Power model

We are evaluating a uniprocessor system that incorporates two power reduction mechanisms: Dynamic Power Management (DPM) and Voltage Scaling (VS). Concerning DPM, one presumes two states: active and sleep. We are presuming a limited amount of CPU frequencies for VS. Given that a constant range of CPU speeds is unattainable with current technology, this assumption is quite rational.

Given that the variations in power usage across clock cycles are statistically insignificant [12], we assume that each clock cycle consumes an equivalent amount of energy. Processor speed refers to the comparative value of the clock frequency f in relation to the maximum clock frequency f_{\max} .

$$s_f = \frac{f}{f_{\max}}$$

For instance, operating at fifty percent of the maximum speed ($S_f = 0.5$) will require double the duration to do the task. The set SF comprises all speeds accessible for the CPU.

3.2 The Round-Robin policy

At each instant, a scheduling policy chooses among the set of all active instances exactly one instance for being executed on the processing unit. The idea presented in [13] is to define scheduling policies through a priority function $\Gamma_{k,n}(t)$ that gives the priority of every instance $\tau_{k,n}$ at any time t . The resource allocation rule is the Highest Priority First Rule which means that the scheduler will always select the pending job with the highest priority for being executed.

The function $\Gamma_{k,n}(t)$ takes its values from a totally ordered set which can be chosen as the set of multidimensional \mathbb{R} -valued vectors $P = \{(p_1, \dots, p_n) \in \mathbb{R}^n \mid n \in \mathbb{N}\}$. As no natural order exists for vectors, a lexicographic order where the i th component is taken as the i th “letter” of a word consisting of real numbers is defined. Vectors are compared component per component and the convention is that smaller the numerical value, bigger the priority. For instance $(1,2,3) (1,2,4)$ where means “strictly bigger”.

A priority function for RR has been proposed in the context of recurrent tasks, the priority function for jobs is basically a simplification of the one proposed in [14]. The priority of a job J_k at time t is:

$$\Gamma_k(t) = \left(\left\lfloor \frac{\int_{A_k}^t \prod_k(x) dx}{\psi_k} \right\rfloor + P(A_k), k \right) \quad (1)$$

where:

$P(t)$ is the number of RR-Cycles that have been completed from U_k until t .

$W_k(t)$ is the amount work that remains to be done for job J_k at time t .

$W_{1...N}(t) = \sum_{k=1}^N W_k(t)$, the total amount of work to be done for the whole job set

$U_k = \max\{t \leq A_k : W_{1...N}(t) = 0\}$. This is the first date before or at A_k such that there is no pending work, it is usually termed the beginning of an interference period in the literature.

$$\prod_k(t) = \begin{cases} 1, & \text{if } j_k \text{ uses the processor at time } t \\ 0, & \text{if } j_k \text{ doesn't use the processor at time } t \end{cases}$$

The first term of the first component of the vector, see equation (1), guarantees that a job uses the processor during its whole quantum time if enough work is pending which is the basic functioning scheme of RR. When a new job is activated, the second element $P(A_k)$ prevent the job from monopolizing the processor due to its absence in the previous RR-Cycles. The last

component of the vector ensure that two jobs will not share the same priority if their first components are equal. Note that only the jobs that are active at time t (i.e. $J_{is,t}, A_i \leq t$) can be chosen to be executed whatever their priority.

In this work, Round-Robin scheduling is integrated with the DVS in order to optimize the energy efficiency, by dynamically adjusting the CPU frequency based on work load. proposed integrated strategy ensures the reduced energy consumption, heat generation while maintaining the optimal performance levels.

The proposed strategy is implemented by solving well framed objective function(equX) using ABC-WOA algorithm

3.3 WOA Algorithm

The Whale Optimization programme (WOA) is an optimization programme that is built on how humpback whales interact with each other and how they hunt. The WOA programme tries to find food in the water like humpback whales do. In the WOA algorithm, a point vector in the search space is used to show each possible answer. The algorithm starts with a group of possible answers that are generated at random from the search field. A possible solution's quality is judged by how well it answers the optimization problem[17]. This is done with a fitness function. The algorithm works by going through a number of steps called iterations. Each iteration has three main steps: Search, surround, and bubble are all options. During the search stage, the position of each feasible solution is modified such that it is closer to the best answer identified so far. [18]. This step is a simulation of how humpback whales look for food. They do this by following the best available signs.

The WOA algorithm has been shown to be effective at solving a wide range of optimization problems, such as those in engineering design, data mining, and machine learning. The method is easy to use and only has a few settings that need to be tweaked. But, like other optimization algorithms, the WOA algorithm's success depends on the problem being solved and how the algorithm settings are set [19]. So, to get the best results for a given problem, it is important to carefully tune the algorithm's settings [20].

Algorithm 1 The Standard Whale Optimization Algorithm

Initialize a population of random whales

W^* = the best search agent

$t = 0$

While ($t < \text{iterations}$)

 for each whale

 Update WOA parameters

 and p)

 if ($p < 0.5$)

```

if ( $|B| < L$ )
     $W^{t+1} = W^* - B.Dis$ 
else if ( $|B| \geq L$ )
     $W^{t+1} = W_{rand} - B.Dis$ 
end if
else if ( $p \geq 0.5$ )
     $W^{t+1} = Dis' . e^{x.r} . \cos(2\pi r) + W^*$ 
end if
end for
Evaluate the whale  $W^{t+1}$ 
Update  $W^*$  if  $W^{t+1}$  is better
 $t = t + 1$ 
end while
return  $W^*$ 

```

3.4 Hybrid ABC-WOA Algorithm

Algorithm: Hybrid ABC-WOA Optimization

Initialization: Initialize ABC and WOA populations randomly:

- ABC population: N_ABC bees
- WOA population: N_WOA whales

Repeat for a maximum of max_iterations or until termination criteria are met:

For each ABC bee in ABC population:

Employed bees explore solutions locally:

Modify the position of bee using a local search strategy.

Calculate the fitness of each employed bee.

Onlooker bees select employed bees based on fitness and perform global search:

Select employed bees probabilistically.

Apply global search strategy.

Evaluate fitness of onlooker bee.

For each WOA whale in WOA population:

Update whale position using WOA equations:

$$X_WOA_j = A * \sin(B) * |C * X_rand - X_WOA_j| - X_WOA_j$$

Evaluate fitness of WOA whale.

Mathematical model of the proposed strategy:

Let us consider a set of n tasks $\{T_1, T_2, T_3, \dots, T_n\}$ each k^{th} task T_k is associated with an execution time, frequency, deadline and Quantum time are C_k , f_k , D_k and Q_k respectively. the frequency of the task is adjusted by scaling factors $\{S_1, S_2, S_3, \dots, S_n\}$ and results into a power consumption of $\{P_1, P_2, P_3, \dots, P_n\}$. in the same way t_{sleep}, P_{sleep} are denoted as the time spent, and power consumed during sleep rate.

Objective function:

$$\min E_{total} = \sum_{k=1}^n \left(\frac{C_k}{S_k} \cdot P(S_k) \right) + P_{sleep} t_{sleep} \quad (2)$$

Constraints

$$C_k \leq D_k \quad (3)$$

$$W_k(t) = W_k(t - Q_k) - Q_k \quad \text{if } W_k(t) > 0 \quad (4)$$

$$E_k(t) < E_{max} \quad (5)$$

Where W_k is the remaining work of task 'K', if there is no remaining work then $W_k(t) = 0$.

E_{max} is the predetermined energy usage.

The tasks are scheduled by using the round ribbon policy and the frequency of the tasks are scheduled by using the objective function (2).

4 Results and Discussions:

Table 1 Energy consumption per No. of Tasks

| Number of Tasks | Power During Sleep | Sleep Time | Total Energy (E) | Average Energy Per Task |
|-----------------|--------------------|------------|------------------|-------------------------|
| 5 | 0.2 | 0.1 | 3.1 | 0.62 |
| 5 | 0.2 | 0.2 | 3.25 | 0.65 |
| 10 | 0.5 | 0.1 | 4.5 | 0.45 |
| 10 | 0.8 | 0.3 | 5.7 | 0.57 |

The table gives the energy consumption in terms of the number of tasks, power during sleep, sleep time, total energy consumed (E) and the average energy consumption per task. When the power during the sleep period is 0.2, and the sleep time is 0.1, the total energy consumed for five tasks amounts to 3.1 units with a mean value of 0.62 energy units per task. If the sleep time is increased to 0.2, then total energy consumed will be increased to 3.25 units and on average energy will be consumed in each task as 0.65 units. Ten tasks, if consumption is increased when the system sleeps by 0.5 and sleep time to 0.1. The total energy consumed will be 4.5 units and average consumption will be 0.45 units per task. An increase in sleep time to 0.3 and in power consumption to 0.8 for the same number of tasks raises total energy consumption to 5.7 units, whereas an average is around 0.57 units for per task. Results show that the number of tasks as well as sleep conditions heavily impact energy consumption levels; variations in sleep time and power influence both total energy consumption as well as average energy consumption per task.

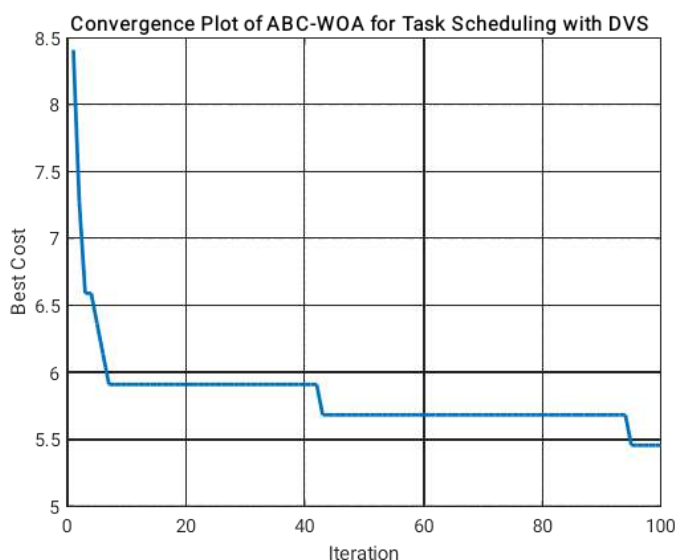


Figure 1 Convergence Plot of ABC-WOA For Task Scheduling with DVS

The figure 1 represents the plot of convergence of the proposed ABC-WOA algorithm, applied on a DVS-based task scheduling problem. x-axis depicts the iteration number and y-axis

represents the best cost of each iteration. Observing the plot in the figure above, an entirely downward trend shows up that indicates proper convergence of the algorithm towards further minimizing the cost function with time. The rapid reduction at the start gradually tends toward a balance, meaning that the algorithm converges to a nearly optimum solution. Overall, the convergence plot confirms that the efficiency of the ABC-WOA algorithm in solving the task scheduling problem with DVS.

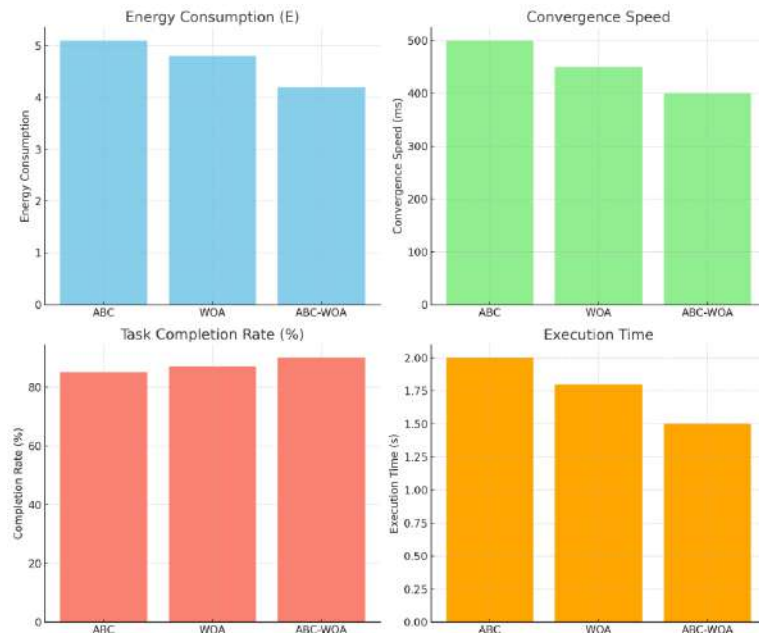


Figure 2 Comparison Between Hybrid And Individual Techniques

The figure 2 compares the performances of three algorithms that have been evaluated: ABC, WOA, and ABC-WOA, in terms of energy consumption, convergence speed, task completion rate, and execution time. According to these results, ABC-WOA has overtaken both algorithms: ABC and WOA, in the four given criteria. In other words, it consumes the least energy, converges fast, has a high rate in completing tasks, and executes in the shortest time. Therefore, WOA performs better compared to ABC in terms of energy consumption and the rate at which tasks finish, but worse in terms of convergence speed and execution time. Overall, the obtained results indicate that ABC-WOA is the best among all algorithms for the three measures energy consumption, convergence speed, and execution time and equals the others regarding the rate of task completion.

5 Conclusion

In conclusion, this work performs a detailed analysis of energy consumption in task scheduling by hybridizing dynamic voltage scaling with the ABC-WOA algorithm. Results have exemplified a strong impact of the number of tasks and sleep conditions on total energy consumption as well as on average energy used per task. Indeed, with respect to the former part of this study, increasing sleep time and power during periods of sleep leads to an increase in overall energy consumption. Further, the convergence plot of the ABC-WOA algorithm shows it has well optimized by efficiently reducing the cost function before approaching an optimal solution. Individual algorithms such as ABC and WOA compared to hybrid ABC-WOA shows that the latter one always succeeded in the ABC-WOA algorithm than others like energy efficiency, speed of convergence, rate of completing a task, and execution time. Though WOA

outperformed ABC in terms of energy consumption and task completion, the hybrid approach is proven to be the most efficient in all parameters measured. Findings confirm that integration into the strengths of ABC and WOA offers significant advantages regarding task scheduling in DVS-based systems. This hybrid approach would be useful for energy-sensitive applications where every available spare cycle needs to be minimized in energy usage without sacrificing execution efficiency.

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Marketing as a Cause and Solution for Climate Change: Analysing the Dual Role of Marketing in Environmental Sustainability

BY- Kajal Bhatt

Abstract: Marketing has long been a powerful force in shaping consumption patterns, influencing consumer behavior, and driving economic growth. However, its role in climate change is paradoxical: while marketing has historically fueled environmental degradation by promoting overconsumption, waste, and resource depletion, it also holds transformative potential as a catalyst for sustainability. This qualitative research explores the dual role of marketing in environmental sustainability, examining how traditional strategies—such as materialism-driven campaigns, fear-of-missing-out (FOMO) tactics, and greenwashing—exacerbate climate challenges. Simultaneously, the study highlights innovative approaches like circular economy initiatives, behavioral nudges, and transparency campaigns that leverage marketing to promote responsible consumption. By analyzing case studies, consumer trends, and industry practices, this paper aims to provide actionable insights for businesses, policymakers, and consumers to align marketing strategies with environmental sustainability goals.

Introduction

Climate change is an existential crisis, with global temperatures already 1.1°C above pre-industrial levels and projected to surpass the critical 1.5°C threshold if current trends persist (IPCC, 2023). The Intergovernmental Panel on Climate Change (IPCC) warns that exceeding this threshold will lead to catastrophic consequences, including extreme weather events, biodiversity loss, and food insecurity. For instance, in 2023 alone, India experienced record-breaking heatwaves, with temperatures soaring above 45°C, leading to widespread crop failures and water shortages (India Meteorological Department, 2023). Globally, the economic cost of climate-related disasters has reached \$313 billion annually, with developing nations like India bearing a disproportionate burden (World Bank, 2023).

A significant driver of this crisis is unsustainable consumption, fueled by marketing strategies that prioritize profit over planetary health. For example, the fast fashion industry, propelled by aggressive marketing campaigns, contributes nearly 10% of global carbon emissions and 20% of wastewater production, consuming an estimated 93 billion cubic meters of water annually (Ellen MacArthur Foundation, 2022). In India, the fast fashion market is growing at a rate of 12% annually, with brands like Zara and H&M leading the charge. However, this growth comes at a cost: India generates 1.7 million tons of textile waste annually, with only 10% being recycled (Textile Ministry of India, 2023).

Similarly, packaging waste from consumer goods contributes to the 300 million tons of plastic produced globally each year, with 91% of it never recycled (UNEP, 2023; National Geographic, 2022). In India, plastic waste generation stands at 9.46 million tons annually, with only 60% being recycled (Central Pollution Control Board, 2023). The proliferation of single-use plastics, driven by marketing campaigns promoting convenience, has exacerbated the problem. For instance, India's food delivery industry, which grew by 40% in 2022, generates 1.5 million tons of plastic waste annually from packaging alone (FICCI, 2023).

Yet, marketing is not inherently destructive. It possesses the unique ability to influence consumer behavior at scale, making it a potent tool for driving sustainability. The rise of ethical

consumerism, evidenced by a 71% increase in demand for sustainable products (Nielsen, 2021), underscores this potential. For example, in India, the market for organic food products grew by 25% in 2022, driven by consumer awareness campaigns and eco-friendly branding (IBEF, 2023). Globally, companies like Patagonia and Tesla have demonstrated that sustainability-driven branding can achieve both environmental and economic success. Patagonia's "Don't Buy This Jacket" campaign, which encouraged consumers to reconsider unnecessary purchases, resulted in a 30% increase in sales while promoting sustainable consumption (Patagonia, 2022). Similarly, Tesla's marketing strategy, which emphasizes the environmental benefits of electric vehicles, has made it the world's most valuable car company, with a market capitalization of over \$800 billion (Forbes, 2023).

In India, companies like Tata Group and ITC are leveraging marketing to promote sustainability. Tata Motors' Nexon EV, marketed as an eco-friendly alternative to traditional cars, has seen a 300% increase in sales since its launch in 2020 (Tata Motors, 2023). ITC's "Wellbeing Out of Waste" (WOW) initiative uses marketing campaigns to educate consumers about waste segregation and recycling, reaching over 10 million households across India (ITC, 2023).

This paper seeks to unravel the paradox of marketing—its role as both a cause and a solution for climate change—and propose strategies to harness its power for environmental good. By examining global and Indian examples, this research aims to provide actionable insights for businesses, policymakers, and consumers to align marketing strategies with sustainability goals.

1. Additional Facts and Figures

1.1 Global Context

- **E-Waste:** The electronics industry generates 53.6 million metric tons of e-waste annually, with only 17.4% being recycled (Global E-waste Monitor, 2022). Apple's annual iPhone launches contribute approximately 2 million tons of e-waste yearly due to planned obsolescence and aggressive marketing.
- **Greenwashing:** A 2022 EU Commission study found that 42% of "green" product claims were false or exaggerated. The global greenwashing market is valued at \$2.5 trillion, misleading millions of consumers (Global Sustainability Index, 2023).
- **Sustainable Fashion:** The global sustainable fashion market is expected to grow from 6.5 billion in 2021 to 15.2 billion by 2030, reflecting increased consumer awareness (Statista, 2023).

1.2 Indian Context

- **Plastic Waste:** India generates **9.46 million tons of plastic waste annually**, with only **60% being recycled** (Central Pollution Control Board, 2023). The food delivery industry alone contributes **1.5 million tons of plastic waste annually** (FICCI, 2023). E-commerce packaging also accounts for **40% of plastic waste in urban areas**.
- **Textile Waste:** India generates **1.7 million tons of textile waste annually**, with only **10% being recycled** (Textile Ministry of India, 2023). The rise of fast fashion and aggressive marketing campaigns promoting seasonal trends contribute significantly to this waste.
- **Organic Food Market:** The Indian organic food market grew by **25% in 2022**, driven by consumer awareness campaigns and eco-friendly branding (IBEF, 2023).

Sustainable farming practices and certifications such as **Jaivik Bharat** and **India Organic** have enhanced consumer trust.

- **Electronic Waste (E-Waste):** India is the **third-largest producer of e-waste**, generating **over 1.6 million tons annually**, with only **22% being formally recycled** (ASSOCHAM-EY, 2023). Aggressive marketing of new gadgets and planned obsolescence contribute to this issue.
- **Sustainable Packaging Initiatives:** Indian companies like **Dabur** and **ITC** have pledged to achieve **100% plastic neutrality** by 2025. Reliance Industries has also launched **biodegradable plastic alternatives**, marketed as a sustainable solution for packaging waste.
- **Renewable Energy Adoption:** The Indian renewable energy market grew by **17% in 2022**, with businesses like Tata Power and Adani Green Energy leading solar and wind energy marketing campaigns (MNRE, 2023). Marketing initiatives promoting **solar-powered appliances and EVs** are driving consumer adoption.
- **Carbon Neutrality Commitments:** Companies like **Infosys**, **Wipro**, and **Reliance** have committed to achieving **net-zero carbon emissions by 2040**, incorporating sustainable marketing to highlight their eco-friendly operations.
- **Eco-Friendly Personal Care Products:** Brands like **Mamaearth** and **Forest Essentials** leverage **plant-based ingredients and plastic-free packaging**, resulting in a **40% increase in sustainable product sales** over the last two years (Nielsen, 2023).
- **Water Conservation Initiatives:** Beverage companies such as **Coca-Cola India** and **Parle Agro** are investing in **water sustainability programs**, aiming to achieve **100% water replenishment** in high-risk water regions by 2030.

2. Indian Companies: Balancing Growth and Sustainability

2.1 Tata Motors: Promoting Electric Vehicles (EVs)

Tata Motors has been a pioneer in sustainable marketing with its **Nexon EV**, India's best-selling electric SUV. The company's marketing campaign emphasizes **reduced carbon emissions** and **long-term cost savings**, appealing to environmentally conscious consumers. The campaign highlights that the Nexon EV reduces **4.4 tons of CO2 emissions annually** compared to traditional petrol vehicles (Tata Motors, 2023). This messaging has resonated with Indian consumers, resulting in a **300% increase in sales** since its launch. Additionally, Tata Motors has partnered with **Zooom Car**, a self-drive car rental service, to promote shared mobility and reduce the carbon footprint of urban transportation.

2.2 ITC: Wellbeing Out of Waste (WOW) Initiative

ITC's **Wellbeing Out of Waste (WOW)** initiative is a prime example of using marketing to drive behavioral change. The campaign educates consumers about **waste segregation** and **recycling**, reaching over **10 million households** across India. ITC's marketing strategy includes **door-to-door awareness programs**, **school workshops**, and **social media campaigns** to promote sustainable waste management practices. As a result, the initiative has facilitated the recycling of **1.2 million tons of waste annually**, reducing landfill burden and promoting a circular economy (ITC, 2023).

2.3 FabIndia: Championing Ethical and Sustainable Fashion

FabIndia, a leading Indian brand, has built its marketing strategy around **sustainability** and **ethical sourcing**. Its "**Handmade in India**" campaign highlights the brand's commitment to preserving traditional crafts and supporting rural artisans.

FabIndia's products are made from **organic cotton**, **natural dyes**, and **sustainable materials**, appealing to eco-conscious consumers. The campaign has driven a **20% increase in sales**, with the brand reporting a **30% year-on-year growth** in its sustainable product line (FabIndia, 2023). FabIndia also uses **transparent labeling** to inform consumers about the environmental and social impact of their purchases.

2.4 Amul: Green Dairy Initiative

Amul, India's largest dairy cooperative, has launched the **Green Dairy Initiative** to reduce its environmental footprint. The initiative focuses on **reducing water and energy consumption** in dairy production. Amul's marketing campaigns highlight its use of **solar energy**, **biogas plants**, and **water recycling systems**, which have reduced water usage by **30%** and energy consumption by **25%** (Amul, 2023). The brand also promotes **sustainable packaging**, using **recyclable materials** for its milk pouches and tetra packs. Amul's "**Eco-Friendly Dairy**" campaign has strengthened its reputation as a socially responsible brand.

2.5. Patanjali: Promoting Organic and Ayurvedic Products

Patanjali, a leading Indian FMCG brand, has built its marketing strategy around **organic** and **ayurvedic products**. The brand's campaigns emphasize the health and environmental benefits of its products, which are free from **chemical fertilizers** and **pesticides**. Patanjali's **organic food products** have seen a **25% increase in sales**, driven by consumer demand for sustainable and chemical-free alternatives (IBEF, 2023). The brand also promotes **zero-waste packaging**, using biodegradable materials for its products.

2.6. Hindustan Unilever: Project Shakti and Sustainable Living

Hindustan Unilever (HUL) has integrated sustainability into its marketing through **Project Shakti**, which empowers rural women by training them as micro-entrepreneurs to sell HUL products. The initiative has reached over **70,000 villages**, promoted sustainable livelihoods and reduced the carbon footprint of last-mile distribution (HUL, 2023). Additionally, HUL's **Sustainable Living Plan** focuses on reducing plastic waste and promoting eco-friendly products. The brand's "**#PlasticPact**" campaign encourages consumers to recycle plastic packaging, resulting in a **15% reduction in plastic waste** across its supply chain.

2.7 Mahindra Group: Marketing Sustainability in Automobiles and Beyond

The Mahindra Group has been a leader in sustainable marketing with its "**Rise for Good**" campaign, which promotes the brand's commitment to environmental and social responsibility. Mahindra's **electric vehicles (EVs)**, such as the **eVerito** and **e2oPlus**, are marketed as eco-friendly alternatives to traditional cars. The company also promotes **solar energy solutions** and **sustainable farming practices** through its marketing campaigns. Mahindra's sustainability initiatives have resulted in a **20% reduction in carbon emissions** across its operations (Mahindra Group, 2023).

2.8 Paper Boat: Nostalgia Meets Sustainability

Paper Boat, a popular Indian beverage brand, has combined **nostalgia marketing** with sustainability. The brand uses **eco-friendly packaging**, including **recyclable tetra packs** and **glass bottles**, to appeal to environmentally conscious consumers. Paper Boat's marketing campaigns highlight its use of **natural ingredients** and **traditional recipes**,

resonating with consumers who value sustainability and cultural heritage. The brand has seen a **30% increase in sales** of its eco-friendly product line (Paper Boat, 2023).

2.9 Godrej: Green and Clean Campaign

Godrej, a diversified Indian conglomerate, has launched the **green and clean** campaign to promote its range of eco-friendly products, including **biodegradable cleaning solutions** and **energy-efficient appliances**. The campaign emphasizes the brand's commitment to reducing its environmental impact, with initiatives like **zero-waste manufacturing** and **water conservation**. Godrej's marketing efforts have resulted in a **15% increase in sales** of its sustainable product range (Godrej, 2023).

2.10 Flipkart: Sustainable E-Commerce Practices

Flipkart, India's leading e-commerce platform, has introduced several sustainability initiatives, including **eco-friendly packaging** and **carbon-neutral deliveries**. The company's marketing campaigns highlight its use of **recyclable materials** and **electric delivery vehicles**, which have reduced its carbon footprint by **25%** (Flipkart, 2023). Flipkart also promotes **sustainable shopping** by encouraging consumers to choose eco-friendly products and packaging options.

Key Takeaways from Indian Examples

- **Consumer Awareness:** Indian consumers are increasingly prioritizing sustainability, with **65% willing to pay a premium for eco-friendly products** (Nielsen, 2023).
- **Innovative Campaigns:** Brands are using creative marketing strategies, such as **transparent labelling**, **educational campaigns**, and **nostalgia marketing**, to promote sustainability.
- **Government Support:** Initiatives like the **Swachh Bharat Mission** and **Extended Producer Responsibility (EPR)** regulations are encouraging businesses to adopt sustainable practices.

Theoretical Framework

This study is grounded in two key theoretical frameworks:

- **The Triple Bottom Line (TBL):** This framework emphasizes the need for businesses to balance three pillars—people, planet, and profit—to achieve sustainable development. Marketing strategies that align with TBL principles can drive environmental and social benefits while maintaining profitability.
- **Theory of Planned Behavior (TPB):** TPB explains how attitudes, subjective norms, and perceived behavioral control influence consumer behavior. By understanding these factors, marketers can design campaigns that nudge consumers toward sustainable choices.

Methodology

This research adopts a qualitative approach, combining case study analysis, content analysis of marketing campaigns, and semi-structured interviews with industry experts and consumers. Data was collected from three primary sources:

- **Case Studies:** Analysis of companies like Patagonia, Tesla, and Volkswagen to understand the impact of sustainable and unsustainable marketing practices.
- **Content Analysis:** Examination of marketing campaigns, advertisements, and social media trends to identify patterns in consumer behavior and messaging strategies.

- **Interviews:** Semi-structured interviews with 15 marketing professionals and 20 consumers to gain insights into perceptions of sustainability in marketing.

Thematic analysis was used to identify recurring themes and patterns in the data, ensuring a comprehensive understanding of marketing's dual role in climate change.

3. Marketing's Role in Climate Change: A Double-Edged Sword

Marketing as a Driver of Environmental Degradation

3.1 Consumerism and Materialism:

Marketing has long been a catalyst for consumerism, encouraging the acquisition of goods far beyond basic needs. For example, the average consumer now buys 60% more clothing than two decades ago, yet keeps each item for half as long (McKinsey, 2022). Fast fashion brands like Zara and Shein epitomize this trend, using rapid production cycles to create a culture of disposability, resulting in 92 million tons of textile waste annually (Ellen MacArthur Foundation, 2022). Similarly, the electronics industry generates 53.6 million metric tons of e-waste yearly, driven by aggressive marketing of new products and planned obsolescence (Global E-waste Monitor, 2022).

3.2 FOMO and Instant Gratification:

Marketing campaigns often exploit psychological triggers like fear-of-missing-out (FOMO) and instant gratification to drive impulsive purchases. For instance, 49% of consumers admit to buying products impulsively due to limited-time offers (Deloitte, 2023). Events like Black Friday exacerbate this issue, generating over 1.5 million metric tons of CO₂ emissions annually through excess shipping and production (Greenpeace, 2022). Apple's annual iPhone launches, for example, contribute approximately 2 million tons of e-waste yearly, as consumers discard older models in favor of the latest release (Global E-waste Monitor, 2022).

3.3 Greenwashing and Pseudo Eco-Friendly Products

Greenwashing—misleading claims of environmental sustainability—has become a pervasive issue. A 2022 EU Commission study found that 42% of "green" product claims were false or exaggerated. The Volkswagen Dieselgate scandal is a notorious example, where the company falsely marketed its vehicles as eco-friendly while emitting up to 40 times the legal limit of NO_x pollutants (EPA, 2015). The global greenwashing market, valued at \$2.5 trillion, misleads millions of consumers and undermines genuine sustainability efforts (Global Sustainability Index, 2023).

3.4 Minimalism and Anti-Consumerism Movements

While marketing has traditionally encouraged excessive consumption, there is a growing counter-movement promoting minimalism and sustainable living. **Interest in minimalism has grown by 130% over the past five years**, as measured by Google search trends (Statista, 2023). The rise of brands like **Muji and Patagonia** demonstrates how businesses can successfully market products with a focus on longevity, ethical sourcing, and environmental responsibility. The global second-hand apparel market, driven by minimalism trends, is expected to reach **\$77 billion by 2025**, outpacing fast fashion growth (ThredUp, 2023). Studies show that **76% of millennials and Gen Z consumers prefer experiences over material goods**, indicating a shift away from consumerism toward sustainable lifestyle choices (Deloitte, 2023). Minimalist living has also been linked to reduced carbon footprints, with

households that adopt minimalist consumption patterns producing **40% less waste** compared to conventional consumerist households (World Economic Forum, 2023).

4. Marketing as a Tool for Sustainability

4.1 Sustainable Branding and Circular Economy Marketing:

Forward-thinking companies are leveraging marketing to promote circular economy models, which prioritize reuse, repair, and recycling. Patagonia, for instance, encourages consumers to repair rather than replace products, reducing waste by 40% per product lifecycle (Patagonia, 2022). Nike's Move to Zero initiative has resulted in 75% of its apparel being made from recycled materials (Nike, 2023). The secondhand clothing market, expected to grow 127% by 2026, reflects a shift towards more sustainable consumption patterns (ThredUp, 2023).

4.2 Educational Campaigns and Behavioral Nudges:

Marketing can also serve as an educational tool, nudging consumers towards eco-friendly choices. IKEA's sustainable living campaigns, for example, have reduced energy consumption by 20% in participating households (IKEA, 2022). Starbucks' discounts for reusable cups have cut single-use cup waste by 150 million cups annually (Starbucks, 2023). Research in behavioral economics suggests that eco-friendly product placement can increase sustainable purchases by 23% (Harvard Business Review, 2023).

4.3 Transparency and Ethical Consumerism:

Transparency in marketing builds consumer trust and fosters ethical consumption. Clear labeling, third-party certifications (e.g., Fair Trade, Organic, FSC), and blockchain-enabled supply chains empower consumers to make informed choices. Everlane's "Radical Transparency" campaign, which discloses production costs and sustainability efforts, has led to a 35% increase in repeat customers (Everlane, 2022). Studies show that 78% of consumers are more likely to support brands that demonstrate genuine sustainability commitments (Forbes, 2023).

However, challenges remain. India generates **9.46 million tons of plastic waste annually**, with only **60% recycled** (Central Pollution Control Board, 2023). Fast fashion brands like **Zara and H&M are gaining popularity**, contributing significantly to textile waste. Addressing these issues requires a concerted effort from Indian businesses, policymakers, and consumers.

5. Counterarguments and Limitations

While sustainable marketing holds promise, it faces significant challenges:

- **Higher Costs:** Sustainable practices often require substantial upfront investments, which may deter small businesses. Transitioning to eco-friendly raw materials, adopting renewable energy, and ensuring ethical sourcing can increase production costs by **20-30%** compared to conventional methods (Harvard Business Review, 2023).
- **Consumer Skepticism:** Greenwashing has eroded trust, making consumers wary of sustainability claims. A **2022 EU study found that 53% of consumers** doubt companies' environmental claims, making it difficult for genuinely sustainable brands to differentiate themselves (European Consumer Organisation, 2023).
- **Scalability:** Scaling eco-friendly practices across global supply chains remains a logistical and financial challenge. Many companies struggle to ensure that sustainability measures are upheld by suppliers, with **only 23% of multinational**

corporations fully tracking their sustainability efforts across their supply chain (McKinsey, 2023).

- **Limited Consumer Willingness to Pay:** While many consumers express interest in sustainability, **only 34% are willing to pay a premium for eco-friendly products** (Nielsen, 2023). Price sensitivity remains a barrier, especially in price-conscious markets like India and Southeast Asia.
- **Regulatory Complexity:** Sustainability regulations vary widely across countries, making compliance difficult for global brands. For instance, **the European Union's Green Deal requires companies to meet strict carbon neutrality targets by 2030**, while in other regions, regulations remain lenient or inconsistent (World Economic Forum, 2023).
- **Lack of Standardized Sustainability Metrics:** There is no universal framework for measuring sustainability performance, leading to inconsistencies in reporting and accountability. **More than 60% of businesses struggle with sustainability benchmarking** due to the lack of standardized metrics (Deloitte, 2023).
- **Supply Chain Constraints:** Many industries rely on global supply chains where sustainable materials or ethical labor practices are difficult to implement. **Over 70% of companies cite supply chain complexity as a major barrier to sustainable transformation** (PwC, 2023).
- **Short-Term Profit Focus:** Many corporations prioritize short-term profits over long-term sustainability. **Less than 30% of publicly traded companies actively integrate sustainability into their core business strategies** (Harvard Business Review, 2023).

Addressing these limitations requires collaboration between businesses, policymakers, and consumers.

Policy Recommendations

- **Regulate Greenwashing:** Governments should enforce stricter regulations and penalties for false sustainability claims. **A 2022 study found that 42% of green claims were misleading**, highlighting the urgent need for stricter enforcement (EU Commission, 2022). Stronger policies, such as mandatory third-party sustainability verification, can improve transparency and consumer trust.
- **Incentivize Sustainability:** Tax breaks and subsidies for companies adopting circular economy models can encourage widespread adoption. Countries like **Sweden have successfully reduced waste by 99%** through tax incentives for recycling and repair industries (Swedish Waste Management, 2023).
- **Consumer Education:** Public awareness campaigns can empower consumers to make informed, sustainable choices. Initiatives like **Singapore's "Say Yes to Waste Less" campaign** have reduced single-use plastic consumption by **20% in targeted communities** (Singapore NEA, 2023).
- **Mandate Corporate Sustainability Reporting:** Governments should require businesses to disclose environmental impact metrics, such as carbon footprint and waste generation. The **EU's Corporate Sustainability Reporting Directive (CSRD)** is an example of how transparency can drive corporate accountability (European Parliament, 2023).
- **Support Sustainable Innovation:** Increased funding for research and development in sustainable materials, renewable energy, and low-carbon technologies can accelerate the transition to greener industries. Countries investing heavily in green innovation, like

Germany's \$60 billion climate fund, have seen rapid advancements in clean energy and sustainable manufacturing (German Federal Ministry for Economic Affairs, 2023).

- **Enforce Extended Producer Responsibility (EPR):** Companies should be legally obligated to manage the end-of-life impact of their products. **India's EPR framework for plastic waste has encouraged manufacturers to invest in recycling programs, leading to a 12% increase in plastic waste recovery in 2022** (CPCB, 2023).
- **Encourage Sustainable Advertising Practices:** Regulations should limit excessive and wasteful advertising, such as single-use promotional materials and energy-intensive digital campaigns. Brands that incorporate sustainability into marketing strategies, like **Patagonia's "Don't Buy This Jacket" campaign**, have successfully influenced consumer behavior while reducing environmental impact (Harvard Business Review, 2023).
- **Public-Private Partnerships for Green Infrastructure:** Governments should collaborate with businesses to invest in sustainable urban development, such as **green buildings, electric mobility infrastructure, and smart waste management systems**. The **UAE's Green Economy Initiative** has demonstrated how public-private cooperation can lead to large-scale environmental benefits (UAE Ministry of Climate Change, 2023).

Conclusion

Marketing stands at a crossroads in the fight against climate change. While it has historically fueled environmental degradation through consumerism, materialism, and greenwashing, it also possesses the unique capacity to drive meaningful change. By embracing sustainability-driven branding, circular economy models, and transparency, businesses can transform marketing into a force for environmental good. This research underscores the urgent need to align marketing strategies with planetary health, ensuring that the industry contributes to—rather than undermines—global sustainability efforts. As consumers increasingly demand accountability, the future of marketing must prioritize authenticity, innovation, and environmental stewardship.

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Ethical Business Practices and Sustainable Economic Growth: Navigating Challenges and Shaping a Prosperous Future

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Abstract: Business ethics and economic growth are intertwined concepts that play crucial roles in shaping the trajectory of modern businesses and societies. Ethical business practices create a conducive environment for sustainable economic growth. When businesses operate with integrity and prioritize the well-being of all stakeholders, they foster trust, attract investment, and stimulate innovation, all of which are essential drivers of economic advancement. Businesses foster decent employment opportunities and sustainable economic growth by prioritizing fair labor standards, environmental sustainability, and transparent governance first. The synergy between ethical business conduct and SDG 8 fosters inclusive development, promotes social equity, and ensures a more prosperous future for all.

The purpose of the paper is to examine the link between business ethics and economic growth considering one of the factors as long-term sustainability. The paper focuses on exploring the challenges that businesses face in integrating ethical practices into their operations while pursuing economic growth, aligning the objectives with SDG 8, to assess the role of government policies, evaluate the effectiveness of existing policies and developing methodologies for measuring the impact of ethical business practices on economic growth. This research paper aims to stick to the roots of ethical businesses with an alignment with the sustainable development goals laid by the United Nations to provide the entire humanity a roadmap for future deliberations and research. The key findings of the research paper emphasized the mutually reinforcing relationship between ethical conduct and economic growth. This research emphasizes the importance for businesses to prioritize ethical conduct as a cornerstone of their organizational ethos and in driving sustainable economic growth and fostering societal well-being, thereby contributing to a more equitable, sustainable, and prosperous future.

The implications of this research paper include business strategy and management, policy development and regulation, investment and financial decision-making, consumer behavior and market dynamics, societal impact and professional development.

Keywords: Business, Ethics, Sustainability, Economic, Growth

Introduction:

Ethics can be rooted in belief or the pursuit of making the world better. Ethical business means that business operates according to fair and transparent standards, not just complying with legal rules or regulatory requirements, but going above and beyond to ensure decisions are applied through an ethical lens. Establishing an ethical culture starts with company leadership and involves ongoing emphasis that ethical standards are respected. The recent global economy melts down due to covid-19 has forced many shrewd businesses small or large, into unethical practices to remain in the market or business.

Factors such as failings in corporate governance, speculative tendencies, the deficient training of managers in ethics and a reductionist view of the economy have had severe consequences.

The unethical business practices include: unethical accounting, lack of social media ethics, racial discrimination, sexual harassment, wage inequality, issues related to health, security and privacy breach. There are many different factors that can cause poor business ethics and unethical behaviour like: demanding workloads which create high stress at work and at home, top executive poor management practices and avoiding tax payments traps the companies into the vicious cycle of unethicality.

We also need to keep this thing in mind that global wealth grows in absolute terms, but inequalities also grow. In the rich countries new social categories become impoverished and new types of poverty are created. In the poorest regions some groups enjoy a type of wasteful and consumerist super-development that contrasts unacceptably with persistent situations of dehumanizing misery. The demand for ethics in the economy is growing in the world, it forms part of a deeper view. This growing emphasis on ethical business practices has led many companies to prioritize corporate social responsibility (CSR). This term refers to ethical policies and practices businesses develop to benefit the environment, employees, and society.

An ethical agenda is needed for the economy in order to confront these morally inadmissible contradictions that destroy social cohesion. Anita Roddick, founder of ethical beauty brand The Body Shop, once said, “Being good is good business.” In February 2016, forty years after its start, the company issued a news release announcing its new commitment to become the world’s most ethical and sustainable global business. This ethical focus has helped it open more than three thousand stores in more than sixty countries, according to the release. Businesses rely on consumer support for profits. Strong evidence suggests that a company’s ethical practices help generate this consumer support.

Nielsen research found that fifty-five percent of global online shoppers in sixty nations are particularly passionate about companies that make a positive social and environmental impact; in fact, these consumers will pay more for related products and services. Such cases inspire other businesses to follow ethical practices. From the employee perspective ‘business ethics drives employee behaviour.’

According to the 2018 Global Business Ethics survey, employees are more likely to apply ethical reasoning when their company clearly demonstrates why business ethics is important. Ninety-nine percent of U.S. employees who experience a strong ethics culture said they’re prepared to handle ethical issues. Companies that advocate for business ethics motivate their employees to perform their roles with integrity.

Sustainable growth is not only the ultimate goal of business corporations but also the primary target of local governments as well as regional and global economies. One of the cornerstones of sustainable growth is ethics. An ethical organizational culture provides support to achieve sustainable growth. Amidst growing scrutiny of business practices, it’s more important than ever for companies to carry out work the right way. Ethics programs are an exceptional tool for promoting moral conduct. Organizations also need employees dedicated to ethical decision-making

Literature Review:

Amos (2012): International business ethics generally conceive the home country/ host country question is central. On one hand, adopting host country norms is a way to respect the culture and its member. Thus, business persons are advised that when in Rome they ought to do as the

Romans do. A common approach in international business ethics is to refer to or to construct lists of norms that ought to guide transnational business conduct.

Erdem & Tugcu (2015): Economic growth is desirable when it is sustainable in the holistic sense of the word. In governance discourse one could say that economic growth should be embedded in triple bottom-line thinking. The business of business is unfortunately not business alone. Since economic activities are among the engines of economic growth, it may be concluded that business ethics may impact on the growth performances of economies.

Loan & Thong (2016): Sustainable economic growth is not only the ultimate goal of business corporations but also the primary target of local governments as well as regional and global economies. One of the cornerstones of sustainable economic growth is ethics. In a sustainable business, employees at every level should be committed to the ethical standards of the business. And a business manager must be able to clearly define and communicate to the employees what factors and ethical standards expected to adhere to and what the consequences are for failing to meet those expectations.

Margaret (2020): “Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as of the local communities and society at large” In the new economy technology becomes the dominant factor of wealth generation “rather than land, labour and particularly capital”, whereas “information and its proper management through information technology are making the difference and separating the winners from the losers”. In the digital environment the balance of power shifts inexorably from the manufacturer to the consumer. Economic action presupposes Ethics; however, economic actions do not prescribe ethical contents.

Jones (2020): It appear that the more extractive the institutions of a society, and the fewer the countervailing forces of productive business enterprise, the more potential there is for negative outcomes. corruption has not only prevented significant economic growth, but it also had negative consequences, such as poor-quality building construction, and distortions, such as helping one sector of the business community grow at the expense of others.

APEC (2020): Global businesses face issues relating to transparency, accountability, and

increasing awareness of customers' rights. Thus, there is also increased pressure on SMEs to adopt ethical business practices. Studies have suggested that companies with a strong, values-based corporate cultures showed improved employee engagement and significantly reduced employee turnover.

Šípková and Choi (2015): They found that companies and government officials in the Czech Republic gradually realized, after the reinstatement of a market economy in 1989, that ethical business conduct was an important factor influencing the overall quality and international attractiveness of the local business environment. It became clear that a culture of ethical practices was an important consideration for foreign companies envisaging bringing their business to Central Europe.

Kia (2019): The research on the Australian banking sector suggests that organizational identification, customer service climate, and ethical climate mediate the relationships between ethical leadership and employee performance, where ethical leadership is positively associated

with customer-oriented behaviour among employees. Kia et al. recommend that banks invest in the ethical leadership of their managers because when managers visibly engage in ethical behaviours, employees are found to follow suit.

Friedman (2006): The Club of Rome’s influential “Limits to Growth” report and the “Small is Beautiful” counterculture of the 1970s, the mounting concerns over the impact on the environment of economic expansion, especially since the 1980s, and most recently the anti-globalization movement mounted in opposition to the World Trade Organization and against foreign investment more generally are all echoes of the same theme, which is thoroughly familiar today.

Witt (2012): The rise of the modern corporation has brought a concentration of economic power which can compete on equal terms with the modern state—economic power versus political power, each strong in its field. Though the raise of corporations is largely based on political institutions, corporations continuously seek for loopholes to take advantage of institutional ambiguities.

Rea (2010): It is not uncommon to observe customers who have been undercharged for goods volunteering this information to shop assistants. Many individual and firms pay the expected amount of tax on their income, despite opportunities to use tax loopholes and avoidance mechanisms. Many people go beyond what is strictly required in their employment contracts because they want to do a good job.

Naude (2008): Economic growth is desirable if the distributive effect increases the welfare of the poorest section in society in the medium term and creates a more egalitarian society in the longer term. If economic growth only increases the welfare of the middle and upper classes and leaves the poorest people worse off, the social cost in the long run is too high. This is a controversial point. But—following the social contract tradition and notions of prioritizing justice—strong ethical arguments can be made in favour of growth that is measured not in general terms, but by whether the position of the worse-off has improved.

Jones & Pollett (1998): Business ethics was defined from a socialistic, negative, and exterior point of view. Socialistic: that profit-making organizations are, a priori, very

Suspicious was a given. Negative: Ethics was somewhat defined as a laundry list of

What corporations should not do. And exterior: The anointed could comfortably point at evil corporations and their top management; no one could impute unethical intents

Or deeds to organizations of a socialistic persuasion; no one could suggest that the

Behaviour and the personal ethic of lowly workers and middle-management could also be questioned.

Garg (2011): The present business environment in India is characterised by four important socio-economic and political parameters. India has a functioning democracy, with independent judiciary and a free press, a free market and globalised economy with an active private sector.

Research Methodology:

Research Gap

The research gap that we have recognised is that legal process concerning the ethical conduct of the business should be simplified and any person lying in the age group of 18-60 should be able to understand it easily. This should be done in order to avoid future misunderstandings leading to the unethical conduct.

Secondly, the knowledge related to ethical conduct of a business and sustainable development should be made the part of the curriculum of the school going children. This will help the upcoming future leaders to not to indulge in any unethical activity and any activity harming the environment.

Thirdly, awareness regarding the same should be spread through various platforms in order to make the people aware about the impact of ethical business on sustainable economic growth.

Research Objective:

1. Analysing the Relationship between moral business conduct and economic expansion.
2. To determine the major moral precepts and methods that support long-term, steady economic expansion.
3. Identifying and addressing challenges or barriers that businesses face in implementing ethical practices.

In pursuing comprehensive and rigorous conceptual research, our study relies on a rich reservoir of secondary data meticulously gathered from diverse and reputable sources. The classification of our data as secondary underscores its origin in scholarly academic journals, a bastion of peer-reviewed research that epitomises academic rigour and integrity. Including insights from authoritative books further enhances the depth and breadth of our conceptual framework, tapping into the wisdom distilled by renowned scholars and experts in the field. Government publications, characterised by their meticulous research methodologies and access to official data, contribute a layer of empirical solidity to our study.

Furthermore, integrating information from reputable private sources ensures a well-rounded perspective, incorporating insights from industry leaders and practitioners.

This curated amalgamation of secondary data forms the bedrock of our research, assuring its reliability and credibility. The reliance on established and validated resources serves as a robust foundation, affirming the scholarly merit of our study. Drawing upon this diverse array of sources, we aim to synthesise a nuanced and comprehensive understanding of the conceptual landscape under investigation. In doing so, we uphold the standards of academic excellence, fostering a research endeavour grounded in the integrity and authority of the information at hand.

Discussion:

I. Brief History

Business ethics in its current incarnation is a relatively new field, growing out of research by moral philosophers in the 1970's and 1980's. But scholars have been thinking about the ethical dimensions of commerce at least since the Code of Hammurabi. Based on the idea of equal exchange, the concept of ethics in business dates back to the first types of bartering. The subject has been studied by several economists and philosophers, from Karl Marx's critique of

capitalism to Aristotle and his notion of fairness. However, the emergence of anti-big business protest groups in the US throughout the 1970s is where the current notion of corporate ethics originated. Over time, the topic developed into a distinct academic discipline with branches in both philosophy and empirical studies. Government law later brought ethics into the business world, and corporate social responsibility initiatives and codes of conduct are examples of this today. Nowadays, business ethics is not only a well-established academic discipline but also something that businesses understand they must have.

II. Strategies for ethical business practices:

- Putting your customers first:

When you prioritize ethical decision making, you demonstrate to your customers that their well-being and trust are paramount. This, in turn, fosters loyalty and positive word-of-mouth, which are invaluable for the growth of your business. Moreover, in today's interconnected world, corporate responsibility is under increasing scrutiny. Consumers are more informed and conscientious about the businesses they support.

- Minimizing potential dangers:

Businesses have an ethical obligation to safeguard the privacy of data subjects. Investing in top-notch cybersecurity measures can help prevent leaks. Additionally, the Federal Trade Commission regulates consumer data security as part of the Federal Trade Commission Act, which bans misleading business practices.⁴ The commission requires companies to be transparent about how they plan to use and store collected data. For instance, it's unethical for a business to sell customer data or add people to email lists without their consent.

- Building ethical awareness:

Visible policing provides a good example of the impact of awareness. The private security vehicle which patrols the neighbourhood may not result in many (or any) criminals being apprehended, but their regular presence serves to raise ethical awareness and, in so doing, acts as a deterrent to crime being committed in that area. Ethical awareness can also promote ethical behaviour by providing a constant reminder of what is acceptable behaviour within the organisation. This is especially effective when the visible examples stem from the positive behaviour of the leaders of the organisation.

III. Unethical Business Practices:

- Misleading Consumers with false claims:

Deceptive advertising is not only illegal but also unethical. It violates the trust of consumers and undermines the integrity of the business. Furthermore, it can have negative consequences for the brand, such as decreased customer loyalty, loss of credibility and legal penalties.

- Exploiting Employee Skill:

Researchers found that overachievers are more likely to be asked to put in overtime without pay, leave family on weekends to work, and do work that's not in their job descriptions. Some managers genuinely do see more work as a reward, or simply think people who enjoy their jobs would have volunteered to take on more, according to the research. Experts say

some of the most obvious signs include being forced to take on extra work without recognition, being given unreasonable deadlines, or when pay is frequently delayed.

- Causing harm to environment:

Companies that engage in activities that harm the environment, such as pollution, deforestation, and overfishing, can cause long-term damage to the ecosystem. It can lead to the extinction of species, loss of biodiversity, and climate change. The impact of these activities can be felt for generations, and it can affect the quality of life of people who depend on the environment for their livelihood.

- Manipulating financial statements:

Manipulating financial statements to show improved financial performance is another popular tactic in the business world. It makes a business seem more profitable while hurting the investors and end consumers. By cooking their books and tweaking the reports, they trick everyone to their advantage. And in most cases, auditors may not detect the manipulation unless they go deep. Recording false transactions, overvaluing inventory and understating liabilities are many ways businesses manipulate their financial records.

a) Unethical Wal mart practices

Walmart is a non-union company. Instead of relying on unions, they operate on an open-door policy. United Food and Commercial Workers Union filed a complaint against Wal-Mart with the National Labor Relations Board. 'The complaint filed with the National Council on Labor Relations claims that Wal-Mart has breached Federal Labor Law by bribing employees to spy on those co-workers that demanded labour unions.' (**EduBirdie, 2022**)

b) The employee's complaints

A Public Letter to the Top Management of Gucci from Former Employees who resigned collectively was spread on the Internet. This letter was written by five former employees of the Gucci Shenzhen Flagship Store. In the letter, they alleged that employees caught an occupational disease, that there was one miscarriage attributable to excessive working hours and that there was no compensation for these hardships. (**Wang & Snell, 2012**)

c) Paytm

Recently, the Reserve Bank of India (RBI) has imposed strict restrictions on Paytm Payments Bank Ltd (PPBL). This move comes after an audit report highlighted persistent non-compliances and supervisory concerns within the bank.

IV. Laws related to ethical business:

Sarbanes Oxley Act

1. Ethics came to focus because of the Sarbanes Oxley Act of 2002 created after the Enron financial scandal. The act's goal was to bring businesses to a higher standard of conduct.

It is recommended for small firms to embrace the Sarbanes and Oxley Act Section 406--Code of Ethics for Senior Financial Officers. This section requires senior management to have standards of conduct based on ethics and honesty. Small businesses can make themselves look professional and attractive to investors and bankers by becoming compliant with this act and setting up official ethical policies for executives and the rest of the company. **(American Economic Association, 2007)**

UPS Ethics Hotline

2. The UPS Ethics Hotline plays a pivotal role in upholding the standards of integrity and accountability within the organization. Employees are encouraged to utilize the UPS Ethics Hotline as a confidential channel to report any ethical concerns or potential violations of company policies. The UPS Ethics Hotline provides a secure platform for individuals to voice their worries, ensuring that ethical lapses Recently, the Reserve Bank of India (RBI) has imposed strict restrictions on Paytm Payments Bank Ltd (PPBL). This move comes after an audit report highlighted persistent non-compliances and supervisory concerns within the bank. **(UPS,2022)**

V. Impact of unethical business practices on economic growth

Market Distortion:

Market distortions occur when market prices do not reflect the true supply and demand of a good or service. This can happen due to a variety of factors, including government intervention, monopolies, and market failures. Market distortions can have a significant impact on the economy, leading to inefficient resource allocation, reduced competition, and higher prices for consumers. Market distortions can lead to market failures, where the market is unable to allocate resources efficiently. This can result in a loss of economic welfare and reduced economic growth.

Capital Flight and Investment Deterrence:

when a country sees a sudden loss of demand for large amounts of capital, when capital is leaving a country, it is known as the nation's capital outflow. It means that domestic consumers are buying foreign assets, indicating that money is flowing out of the domestic economy and going into the pockets of foreign economies. Capital flight increases the demand for loanable funds since investors will be looking to borrow money so that they can fund the purchase of assets abroad.

Social Cost:

Social costs grow with the level of pollution, which increases in tandem with production levels, so goods with negative externalities are overproduced when only private costs are considered in decisions and not costs incurred by others. To minimize social costs would lead to lower production levels. Similarly, from a societal perspective, maximization of private instead of social returns leads to underproduction of the good or service with positive externalities.

Market Efficiency Reduction:

A truly efficient market eliminates the possibility of beating the market, because any information available to any trader is already incorporated into the market price. As the quality

and amount of information increases, the market becomes more efficient reducing opportunities for arbitrage and above market returns.

VI. Policies needed to achieve SDG-8:

Implement comprehensive employment policy frameworks, including support to labour market institutions

Governments need to design and implement pro-employment macroeconomic strategies supported by progressive trade, industrial, tax and infrastructure policies, including investments in education and skills development, youth employment, equality and the care economy.

Taming corporate power: ensure business accountability, transparency and ‘due diligence’ in global supply chains

Governments have to ensure ‘due diligence’ in supply chains with effective grievance procedures to ensure remedy for human and labour rights violations, as prescribed by the UN Guiding Principles on Business and Human Rights and the ILO Tripartite declaration of principles concerning multinational enterprises and social policy. Corporations must respect freedom of association, pay living wages and respect collective bargaining rights.

Implement a ‘Just Transition’ to achieve a low carbon economy and to create green jobs

‘Just Transition’ is premised on an inclusive approach that brings together workers, communities, employers and governments in social dialogue to drive the concrete plans, policies and investments needed for a fast and fair transformation towards a low carbon economy. It adopts a rights-based approach to build social protection systems, provide skills training, redeployment, labour market policies and community development. Governments must strengthen their capacity to deliver Just Transition measures.

(Paola Simonetti, International Trade Union Confederation 2018)

Conclusion

In conclusion, this paper has explored the intricate relationship between ethical business practices and sustainable economic growth, shedding light on the challenges and opportunities inherent in fostering a business environment that prioritizes integrity, transparency, and social responsibility. Through a comprehensive review of existing literature and empirical evidence, several key insights have emerged.

Promoting ethical business practices necessitates collaboration across sectors, including academia, civil society, and international organizations. Research initiatives, educational programs, and public awareness campaigns can help raise awareness about the importance of ethical conduct and equip individuals and organizations with the knowledge and tools needed to uphold ethical standards in their respective spheres of influence. By embracing ethical principles, businesses can not only mitigate risks and enhance resilience but also contribute to a more inclusive, equitable, and environmentally sustainable future.

In conclusion, the nexus between ethical business practices and sustainable economic growth is undeniable. Upholding integrity, transparency, and social responsibility within business

operations not only fosters trust and enhances competitiveness but also lays the foundation for long-term prosperity. As we navigate the challenges ahead, it is imperative that stakeholders collaborate to embed ethical principles into organizational cultures, regulatory frameworks, and societal norms. By doing so, we can forge a path towards a more resilient, inclusive, and prosperous future for all.

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Comparative Analysis of Renewable Energy Adoption in Different Regions

By- Monalisha Singh, Amandeep Dagur, Urmila Mandal and Trishagni Kalita

Abstract: Renewable energy is crucial for reducing reliance on fossil fuels and achieving sustainability. However, how quickly and effectively regions adopt renewable energy varies significantly. Factors like resource availability, government policies, economic conditions, and technological advancements influence this progress. This paper compares renewable energy adoption in Europe, North America, Asia-Pacific, Africa, Latin America, and the Middle East. By examining what drives or hinders adoption, along with successful examples, this study offers insights and policy recommendations to accelerate the clean energy transition.

Keywords: Renewable Energy, Regional Analysis, Energy Policy, Sustainability, Clean Energy Transition

Introduction:

The world is facing the harsh realities of climate change, making the shift to renewable energy more urgent than ever. Renewable sources like solar, wind, hydropower, and geothermal energy offer cleaner and more sustainable alternatives to fossil fuels. However, the transition is not happening uniformly across the globe.

This paper investigates why some regions lead in renewable energy adoption while others lag behind. By analyzing policies, technological advancements, financial investments, and socio-economic factors, we aim to identify the key factors shaping the clean energy transition. Ultimately, this analysis will offer policy recommendations to accelerate global progress.

Research Objectives:

1. Assess the state of renewable energy adoption across regions.
2. Identify the key drivers and challenges in different regions.
3. Analyze successful case studies to draw lessons.
4. Recommend policy actions to promote faster renewable energy adoption.

Literature Review:

1. Renewable Energy and Sustainability

Renewable energy reduces carbon emissions, lowers air pollution, and creates jobs. However, its impact varies depending on regional conditions. Studies have shown that sustainable energy transitions contribute to both environmental and economic development.

2. Regional Differences in Renewable Energy Adoption

Regional disparities in renewable energy adoption are shaped by factors like resource availability, government support, and technological capacity. Europe and North America have made significant progress, while regions like Africa and Latin America are gradually expanding their renewable portfolios.

3. Role of Policies and Regulations

Supportive policies such as renewable energy targets, subsidies, and tax incentives are essential. International agreements like the Paris Agreement further encourage countries to shift to clean energy.

Methodology:

This study is based on a comparative analysis using secondary data from organizations like IRENA, IEA, and the World Bank. Key indicators include renewable energy capacity, policy effectiveness, investments, and technological progress. Additionally, we examine case studies that represent the successes and challenges faced by different regions.

Regional Overview and Comparison:

1. Europe

Europe is a global leader in renewable energy adoption. Policies like the EU Green Deal target carbon neutrality by 2050. Countries like Germany and Denmark are pioneers in wind and solar energy. However, the region faces challenges in integrating renewables into the existing energy grid.

2. North America

The U.S. and Canada demonstrate significant renewable energy progress, though state-level policies often drive the momentum. The U.S. leads in wind energy, while Canada relies heavily on hydropower. The persistence of fossil fuel reliance remains a key barrier.

3. Asia-Pacific

Countries like China and India are leading large-scale renewable energy projects, particularly in solar and wind energy. While government incentives have accelerated growth, challenges like grid instability and land constraints remain.

4. Africa

Renewable energy in Africa is primarily focused on expanding energy access. Solar mini-grids and off-grid systems are gaining popularity, especially in rural areas. However, financial limitations prevent large-scale projects. Kenya's success in off-grid solar energy serves as a model for other regions.

5. Latin America

Latin America benefits from abundant renewable resources, especially hydropower. Countries like Brazil and Chile are leveraging competitive auctions and incentives to boost solar and wind energy adoption. However, hydropower remains vulnerable to droughts.

6. Middle East

Despite being heavily reliant on fossil fuels, some Middle Eastern countries are embracing solar energy. The UAE and Saudi Arabia are investing in large solar projects as part of their economic diversification strategies. Limited water resources remain a challenge for wider renewable adoption.

Key Drivers and Challenges:

1. Drivers of Renewable Energy Adoption

Policy Support: Strong regulations and financial incentives accelerate progress.

Technological Advancements: Efficient solar panels, wind turbines, and energy storage solutions make renewables more viable.

Economic Benefits: Job creation, energy cost savings, and increased energy security support adoption.

2. Barriers to Adoption

Financial Constraints: High upfront costs and limited financing options pose challenges.

Infrastructure Issues: Inadequate grid infrastructure hampers the integration of renewables.

Social and Political Resistance: Opposition from fossil fuel-dependent sectors can delay progress.

Case Studies:

1. Germany's Energiewende

Germany's transition to renewable energy is backed by comprehensive policies. The country has made remarkable progress in wind and solar energy, although electricity prices have increased.

2. China's Solar Boom

China leads the world in solar panel production and consumption. Strong government support and investments have propelled its solar energy expansion, although integrating renewables into the grid remains a challenge.

3. Kenya's Solar Success

Kenya's adoption of off-grid solar systems has increased rural electricity access. Innovative financing models like pay-as-you-go systems and public-private partnerships have contributed to this success.

Recommendations and Future Outlook:

1. Policy Alignment: Governments should set clear, region-specific renewable energy targets.

2. Financial Innovation: Promoting green financing, subsidies, and private sector investments will accelerate projects.

3. Regional Collaboration: Countries can benefit from cross-border energy trade and shared investments.

4. Technological Advancements: Supporting research and development in energy storage and smart grids will facilitate grid stability.

Conclusion:

Renewable energy adoption varies significantly across regions, with Europe and North America leading the way, while Africa and Latin America show promising decentralized energy solutions. To achieve global sustainability goals, tailored regional strategies, strong policy frameworks, and increased investments will be essential. By learning from successful case studies and implementing collaborative approaches, the global energy transitions.

A successful global transition to renewable energy requires a tailored, region-specific approach. Policymakers must prioritize supportive regulations, financial incentives, and technological innovation. Encouraging international collaboration and knowledge-sharing can accelerate progress. Furthermore, integrating local communities into the decision-making process will

ensure equitable energy transitions. By adopting flexible strategies that address regional challenges, countries can contribute significantly to achieving global sustainability goals while ensuring energy security and economic development.

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Leadership Beyond Self: Insights from the Bhagavad Gita for Inclusive and Equitable Leadership

By- Naveen Kumar and Nisha Rai

Abstract: In today's world, great leadership is more than strategic thinking and operational excellence; it calls for a higher sense of purpose, moral fibre, and a commitment to diversity and equality. A classic work of philosophy and spirituality, the Bhagavad Gita has profound teachings about leadership that are beyond personal agendas and advocate for the well-being of the community. Major concepts from the Bhagavad Gita, such as "*Sarvabhuta-hite-Ratah*" (welfare of all beings), Dharma (just duty), and Nishkama Karma (selfless action), are considered in this essay together with their employment in shaping inclusive and fair leadership practices.

As per Bhagavad Gita, real leadership is a culmination of bringing a balance between self-awareness and selflessness, where leaders act out of their own volition, independent of their own interests while showing a high level of dedication to their responsibility. The concept of Nishkama Karma fosters justice and integrity in decision-making by encouraging leaders to focus on moral conduct instead of being driven by ego or the expectation of rewards. The Gita's teachings on Dharma also highlight the importance of aligning leadership with moral and social responsibilities, ensuring that power is exercised for the good of society at large and not for political or personal ends.

This paper argues that the Bhagavad Gita's wisdom provides a revolutionary leadership paradigm that is not only effective but also compassionate and equitable. Rereading these ancient but evergreen teachings may prompt leaders to drop egocentric archetypes and embrace a more holistic, service-based approach—one that promotes inclusive and sustainable development for all—during a time marked by social fragmentation and disparity.

Keywords: Bhagavad Gita, Leadership, Dharma, Karma.

Introduction

Leadership today is more than just operational excellence and strategic thinking. A strong sense of mission, moral framework, and uncompromising commitment to equality and diversity are the prerequisites for real leadership. A timeless book of philosophy and spirituality, the Bhagavad Gita provides time-tested wisdom that can be applied to leadership in the modern world. Its principles—"*Sarvabhuta-hite-Ratah*" (benefit of all beings), Dharma (rightful duty), and Nishkama Karma (selfless action)—give a comprehensive system of leadership that puts the well-being of the collective above self-interest. This essay explores these core concepts of the Bhagavad Gita and considers how they promote moral and inclusive leadership.

The Gita's leadership philosophy provides an ideology of transformation based on emphasising selflessness, duty-based leadership, and ethical concerns. The challenges faced by leaders when making decisions are represented by this ancient scripture, which was originally a philosophical dialogue between Arjuna and Lord Krishna on the field of Kurukshetra. Morality, ethics, and accountability are some of the challenges leaders are currently facing, hence making the Bhagavad Gita lessons more relevant. Organizations and individuals can create sustainable, fair, and values-driven leadership frameworks through translating leadership through the Gita.

Taking Leadership Beyond Traditional Frontiers

Decision-making in hierarchical or transactional organizations is more frequently the arena for leadership. But the Bhagavad Gita presents a different picture, one on which leaders lead with self-awareness, moral integrity, and commitment to the public good. This type of thinking aligns with new trends toward inclusive decision-making, transformational leadership, and ethical administration. Leadership in the Bhagavad Gita is of a different sort because it prioritizes conscious leadership, putting the good of the people above the good of the individual. Organisations can develop leaders who put sustainability above short-term gain by adopting these concepts.

Theoretical Foundations of Leadership in the Bhagavad Gita:

***“Sarvabhuta-hite-Ratah”*: For the Welfare of All**

The importance of leadership that is centred on the welfare of all beings is given prominence in the Bhagavad Gita. *“Sarvabhuta-hite-Ratah”*-leaders who are epitomes of leaders with a service mindset act in a service heart, ensuring their decisions are in the best interests of society as a whole, as well as their direct followers. Such a tactic conforms to existing theories of leadership which advocate for servant leadership by stressing heavily on inclusion, empathy, and moral judgment.

The same servant and transformational leadership qualities are emphasized in modern leadership writings. While servant leaders are concerned with the interests of their followers, as Krishna's guidance to Arjuna in the Gita, transformational leaders inspire change for the common good through a vision. To the extent that their policies and decisions are directed to advance social and economic welfare, *“Sarvabhuta-hite-Ratah”* compels leaders to bracket their own interest and labour for a broader social good. These teachings continue to be valid today, as the focus of the business world on environmental sustainability and corporate social responsibility attests.

Dharma: Leadership with Justice and Accountability

Compassion is one such important component of *Sarvabhuta-hite-Ratah*. Accommodative and supportive societies are created by leaders who are concerned about the welfare of their masses. Crisis management, conflict healing, and policy-making become extremely important issues of necessity to be addressed at this level of leadership. Examples from history and contemporary times of compassionate leaders such as Mahatma Gandhi and Nelson Mandela show how a service-based style of leadership could lead to systemic change.

The Bhagavad Gita's concept of Dharma calls for the leader to be morally pure, fair, and equitable. A Dharma-abiding leader uses prudence in exercising authority such that every decision he makes is aligned with morality and society's welfare. Ethical Dharma leadership avoids corruption, pursues justice, and builds stakeholder trust in contemporary business and government contexts.

Leaders are frequently called upon to confront situations where their professional responsibilities and their own interests' conflict. The Gita reiterates that leadership is a question of duty and not right by arguing that Dharma is supreme over selfish interests. Dharma-centred leadership in organizations guarantees stakeholder accountability, fair labour practices, and healthy workplaces. By leading from the front and ensuring policies benefit all stakeholders and not just the shareholders, ethical leaders who anchor their leadership in Dharma create cultures of trust.

The Unity of Individual and Shared Dharma

Balancing business norms and individual ethics is a chief concern for business leaders. The Bhagavad Gita provides guidance on how to address such issues and advocates for making decisions that are guided by duty and justice. Leaders who make Dharma their top priority see to it that their actions are for the good of society at large and their organizations.

Nishkama Karma: Ethics and Selfless Leadership

The Bhagavad Gita's key concept of Nishkama Karma, or action for the greater good without concern for self-interest, encourages individuals to labour without self-interest. This ideology encourages leaders to take decisions in purity of heart and with impartiality and reduce ego or personal interest-based prejudice. Transformational leadership approaches in which vision-focused leaders prioritize the group's interest over their personal interest are exemplars of Nishkama Karma.

Selfless leadership creates resilience, flexibility, and wisdom. Nishkama Karma-oriented leaders are not deterred by failure and committed to work for its sake and not for others' approval. This concept promotes purpose- and contribution-based work attitude and goes against the common corporate model of leadership being associated with profit and career advancement. In addressing global issues, when long-term sustainability is more valuable than short-term income, this type of leadership is most suitable.

Leadership and the Importance of Self-Awareness and Selflessness

The Bhagavad Gita asserts that maintaining a balance between self-awareness and selflessness is an essential element of leadership. Avoiding self-interest goals, great leaders cultivate a sense of inner purpose. This balance inspires:

1. Knowing one's emotions and how they influence other individuals is a characteristic of emotional intelligence.
2. Resilience: The ability to meet adversity calmly.
3. Empowerment of Others: Encouraging cooperation and group growth.
4. Humility: Leaders must know their limitations and maintain a mind that is open and receptive.
5. Visionary Thinking: Positive social change is driven by leaders who are dedicated to a greater purpose.

Leaders build psychologically healthy spaces where diversity and equitable participation flourish through self-awareness and selflessness. They build trust, ensure equity in policy, and make decisions that serve the entire community, not an affluent select group.

Social Responsibility and Ethical Decision-Making

The Bhagavad Gita teachings endorse decisions based on justice, integrity, and what is best for society in the long run. When leaders incorporate Dharma and Nishkama Karma into their decision-making, they will be more likely to:

1. Practice ethical business practices.
2. Encourage diversity, equity, and inclusion.
3. Promote project planning towards sustainable development.
4. Encourage moral behaviour in environmental and financial matters.
5. Implement inclusive leadership approaches to reduce social injustices.

The principles support the application of the Gita's wisdom in today's leadership models by being consistent with frameworks such as Corporate Social Responsibility (CSR) and

Environmental, Social, and Governance (ESG) criteria. Leaders who prioritize social responsibility realize that ethical decisions lead to success and prosperity in the long run.

The Bhagavad Gita's Leadership Model in Practice

Examples of Gita-Inspired Leadership Case Studies

1. Mahatma Gandhi: Nishkama Karma and Dharma teachings of Bhagavad Gita had a significant impact on his vision of non-violent resistance and selfless leadership. Gandhi's focus on duty rather than selfish ends contributed to forming the Indian struggle for independence.
2. Narayan Murthy (Infosys): His moral business acumen is a great example of how Sarvabhuta-hite-Ratah-inspired corporate governance could provide equitable economic growth. Murthy's leadership style reflects a balance between mission and profit.
3. Dr. A.P.J. Abdul Kalam: India's former president showcased selfless service and moral righteousness in his lifetime and times that were in the spirit of the Gita. Rather than focusing on selfish benefits for himself, his presidency focused on scientific progress for the nation's sake.

Application in Modern Leadership

The leadership teachings of the Bhagavad Gita can be applied by organizations in the following ways:

1. Leadership development programs educate leaders to make moral choices and lead without anticipating anything in return.
2. Corporate Ethics Policies: Formulating governance structures based on Nishkama Karma and Dharma.
3. Encouraging business activities in accordance with Sarvabhuta-hite-Ratah is a form of community involvement.
4. Mentoring and coaching: assisting emerging leaders in building their sense of ethical responsibility, selflessness, and emotional intelligence.

Conclusion

A paradigm of revolutionary leadership of self-awareness, moral responsibility, and dedication to the common good is set by the Bhagavad Gita. Leaders today can make inclusive, ethical, and sustainable leadership practices by embracing such concepts as Sarvabhuta-hite-Ratah, Dharma, and Nishkama Karma.

The teachings of the Gita continue to be a source of inspiration for leaders who aspire to harmonize power and compassion and justice as the world struggles with ethical dilemmas and socioeconomic injustice.

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A Case Study on Indian Start-ups and the Cash Burn Challenge: Accountability, Sustainability, and Leadership Gaps

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Abstract: India's startup ecosystem has witnessed unprecedented growth over the last decade, with over 100 unicorns emerging as of 2024. However, this rapid expansion has been accompanied by an alarming trend of excessive cash burn, where startups prioritize user acquisition and growth at the cost of financial sustainability. One of the most prominent examples of this phenomenon is CRED, a fintech platform founded in 2018 by Kunal Shah. Despite raising over \$1 billion in funding and boasting a valuation of \$6.4 billion (as of 2024), CRED has yet to turn a profit. This paper explores the Indian startup cash burn crisis through the lens of CRED's business model, financials, and broader market implications. We analyze the systemic issues that allow unsustainable businesses to thrive on investor capital, the role of venture capitalists in encouraging aggressive spending, and the accountability vacuum in India's startup ecosystem. Through case studies, data analysis, and expert insights, this paper aims to understand whether India's startup boom is built on a fragile foundation and what regulatory or structural changes are necessary to ensure long-term sustainability.

Keywords: India startup ecosystem, Cash burn, CRED, Venture capital, Start-up sustainability, Financial sustainability

1. Introduction

1.1 The Rise of the Indian Startup Ecosystem

India's startup ecosystem has grown exponentially over the last decade, driven by:

- Massive digital adoption (900+ million internet users, TRAI, 2024).
- Favorable government policies (Startup India, Digital India, Fund of Funds for Startups).
- Record venture capital (VC) funding, crossing \$50 billion between 2018 and 2023 (IVCA, 2024).
- Increased consumer spending and fintech penetration (UPI transactions exceed \$2 trillion annually, NPCI, 2024).

While this boom has led to innovation and employment generation, it has also given rise to a dangerous trend—high-burn, low-profitability businesses that rely on investor money to survive.

1.2 What is Cash Burn and Why is it a Concern?

Cash burn refers to the rate at which a company spends its available capital before generating positive cash flow. High-growth startups often burn cash to acquire users, build infrastructure, and gain market share. However, when businesses continue burning money without a clear path to profitability, they risk collapse, leaving investors, employees, and the economy vulnerable.

Key Concerns:

- Unrealistic valuations: Many Indian startups are valued at billions despite lacking sustainable revenue models.
- Investor-driven growth pressures: VCs push startups to expand aggressively, even at unsustainable costs.
- Lack of regulatory oversight: There is minimal scrutiny on how startups utilize funds, leading to poor accountability.

CRED is a prime example of this cash burn crisis. Despite raising substantial funding, its business model remains questionable in terms of profitability.

2. CRED: India's Poster Child for High Cash Burn

2.1 CRED's Business Model: Rewards for Credit Card Payments

Founded in 2018, CRED started as a platform that rewards users for paying their credit card bills on time. The company has since expanded into:

- Wealth management (CRED Mint, CRED Stash)
- E-commerce and fintech partnerships (CRED Store, CRED Pay)
- Lending services (BNPL, personal loans via partner banks)

2.2 Funding and Valuation Growth

CRED has raised over \$1 billion across multiple funding rounds. Some notable rounds include:

- Series A (2019): \$30 million at a valuation of \$75 million
- Series C (2021): \$215 million at a valuation of \$2.2 billion
- Series E (2023): \$200 million at a valuation of \$6.4 billion

Despite these staggering valuations, CRED remains deeply unprofitable.

2.3 Financials: High Revenue, Higher Losses

According to CRED's 2023 financial report:

- Revenue: ₹1,400 crore (\$170 million), up 4x from 2022
- Expenses: ₹3,500 crore (\$425 million), primarily on marketing and rewards
- Losses: ₹2,100 crore (\$255 million), up from ₹1,200 crore in 2022

Example of Excessive Spending:

- CRED spent ₹750 crore (\$90 million) on IPL sponsorships over three years.
- Customer acquisition cost (CAC) is estimated at ₹1,500 per user, while its revenue per user remains significantly lower.

3. The Startup Cash Burn Epidemic: More Examples

3.1 Byju's: Edtech Giant in Trouble

- Raised \$5 billion; burned through capital aggressively on acquisitions.
- Losses of ₹8,000 crore in 2023 (\$960 million).

- Facing investor lawsuits due to mismanagement and financial irregularities.

3.2 Zomato & Swiggy: The Battle for Market Share

- Zomato spent ₹4,200 crore (\$500 million) in discounts and delivery subsidies in FY23.
- Swiggy recorded ₹3,900 crore (\$470 million) in losses despite strong revenue growth.
- Both rely on deep discounting to retain customers, a model that is hard to sustain.

3.3 Paytm: A Fintech Giant Struggling for Profitability

- IPO disaster: Stock fell over 60% post-listing due to profitability concerns.
- Losses of ₹2,400 crore (\$290 million) in 2023 despite a large user base.
- Regulatory scrutiny over lending practices and data privacy concerns.

3.4 Flipkart & Ola: Growth at a Cost

- Flipkart continues to rely on Walmart's backing while struggling with sustained profitability.
- Ola, once a ride-hailing giant, has seen market share decline due to mismanagement and driver dissatisfaction.

3.5 BharatPe: Scandals and Governance Issues

- Leadership crisis with founder ousted over financial misconduct.
- High cash burn with uncertain profitability outlook.

4. The Role of Financial Sustainability and Stability

4.1 Why Financial Sustainability Matters

- Startups that prioritize financial sustainability are more resilient during economic downturns.
- Better cash flow management leads to long-term business success.
- VC-backed companies must focus on profitability rather than aggressive expansion.

4.2 Examples of Financially Sustainable Startups

- Zoho: Bootstrapped and profitable, focusing on sustainable growth without external funding.
- Freshworks: Despite initial cash burn, shifted to a SaaS model with sustainable revenue streams.
- Nykaa: Achieved profitability before its IPO, balancing growth with financial stability.

5. Solutions: Fixing India's Startup Sustainability Crisis

5.1 Stricter Financial Disclosures

- Mandate quarterly financial transparency for startups valued over \$500 million.
- Enforce SEBI audits on VC-backed firms with high burn rates.

5.2 Sustainable Growth Strategies

- Reduce dependency on discounts and cashbacks.
- Focus on unit economics and organic user acquisition.

5.3 Encouraging Long-Term Thinking

- VCs should prioritize sustainable, cash-flow positive businesses.
- Government policies to incentivize profitable growth over rapid expansion.

Conclusion: The Future of India's Startup Ecosystem

The alarming cash burn culture among Indian startups—from CRED spending ₹727 to earn ₹1 to Paytm's post-IPO crash—reveals deep systemic flaws in India's entrepreneurial ecosystem. This reckless spending, enabled by unlimited VC funding and absent accountability measures, distorts markets, destroys sustainable businesses, and creates financial instability while founders face no consequences for failure. The examples of Flipkart's predatory pricing, Ola's perpetual losses, and BharatPe's alleged fraud demonstrate how this model prioritizes vanity metrics over viability, leaving investors, employees, and the broader economy vulnerable. Without immediate regulatory intervention—including anti-dumping laws, founder liability clauses, and investor safeguards—India risks creating a generation of zombie startups that cannibalize genuine innovation. The solution lies not in stifling entrepreneurship but in restoring financial discipline: mandating profitability timelines, banning unsustainable discounts, and aligning founder incentives with long-term value creation rather than short-term valuation games. Only through such reforms can India build a startup ecosystem that contributes to economic stability rather than jeopardizing it.

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Assessing the Influence of Digital Platforms for Promoting Sustainable Consumption: A Quantitative Analysis

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Funding: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Abstract: This study explores the complicated association among digital platforms and sustainable consumption. As consumption extends beyond material goods to reflect societal values and personal identities, the shift towards sustainable consumption becomes imperative. This study investigates how digital platforms influences this shift by examining domains of sustainable consumption viz. cognitive, affective, and conative. Utilizing a survey of 260 respondents, we analyze how engagement with digital platforms impacts awareness, attitudes, and behaviors towards sustainability. Our findings indicate that digital platforms significantly enhance cognitive and affective aspects of sustainable consumption, though its influence on conative behavior is less pronounced. These results underscore the powerful contribution of digital platforms in determining sustainable consumption practices, offering valuable insights for academics, marketers, and policymakers aiming to promote eco-friendly behaviors in the digital age. Despite challenges such as data volume and ethical considerations, the potential of digital platforms to foster a sustainable mindset is evident, paving the way for future research and practical applications in sustainable development.

Keywords: Digital platforms, Sustainability, Sustainable consumption, Factor analysis, Quantitative Analysis.

INTRODUCTION

As digital connections have grown rapidly, digital platforms have evolved into more than just a communication tool. It has transformed from a mere communication tool into powerful platform for influencing consumer perceptions and actions (Manetti and Bellucci, 2016). digital platforms platforms have advanced drastically in facilitating effective customer engagement both in brand development and sustainable consumption (Liang and Martin, 2021). In the present scenario, the term ‘consumption’ goes beyond simply using material products and services to meet one’s immediate requirement (Frith and Frith, 2005). It includes the measurement of one’s level of life, perception of the society structure, and means of expressing one’s identity (Bijari et al., 2013; Zalega, 2019). Historically, consumption patterns have evolved, with increasing awareness of their environmental and social impacts driving a shift towards more responsible behaviors (Coderoni and Perito, 2020). The mindset is shifting from ‘consumption’ to ‘sustainable consumption’, which means adoption of consumption patterns and behaviors that minimize undesirable impacts on the society, environment and economy, while promoting the well-being and quality of life for present and future generation (Mont and Plepys, 2008; Tunn et al., 2019). Additionally, sustainable consumption promotes a change in consumer mindset, prioritizing experience and well-being above material possession and adopting the

concept of “enough” rather than unnecessary consumption (Simeone and Scarpato, 2020).

According to Geiger et al., (2017) there are binary key approaches to examine sustainability of behavior of the consumption. First is “impact-oriented approach” emphasizing on the social and environmental effects of services and goods, focusing on real effect of the consumption decision and another one is “intent-oriented approach” emphasizes on the underlying motives, values, and intentions that guide consumer decision. Today, digital platforms play a vital part in consumer behavior. Digital advertising along with its influence on consumer behavior are prominent topics in market literature (Zafar et al., 2021). The emphasis has shifted to how digital and digital platforms environments impact consumer behavior (Stephen, 2016). Features like review, online auction, and digital platforms interaction can shape consumers’ subsequent action, making it essential to understand the effect of these informational and social cues on decision making (Coderoni and Perito, 2020). Digital platforms have emerged as a transformative force in the age of remarkable technology innovation and influencing how individual interact, communicate and view the world (Colicev et al., 2018). The likely influence of the online platform on encouraging sustainable mentality and inspiring eco-aware selections is growing as their acceptance rises. Research on the relationship between sustainable consumption and digital platforms usage is becoming progressively prominent, as both these phenomena interact in deep and complex ways influencing people’s action as well as society norms and business practices. In the perspective of academic, the limited studies particularly on the digital platform’s usage served deficiencies that need to be addressed. Despite the increasing prominence of these interactions, academic

research on the specific influences of digital platforms usage on sustainable consumption remains limited. Addressing this gap, our study aims to assess the association between digital platforms usage and sustainable consumption through the following objectives:

- To study the impact of digital platforms usage on sustainable consumption domains.
- To analyse the impact of usage of digital platforms on sustainable consumption domains.
- To provide practical implications for utilizing digital platforms in order enhance sustainable consumption efforts.

The rise of digital platforms has facilitated the democratization of data dissemination, allowing individuals to share and access vast amounts of content instantly (Zhan et al., 2016; Zafar, 2020). Platforms like Facebook, Instagram, and Twitter have become central to how consumers discover and engage with information about sustainable practices (Zhan et al., 2016). This widespread accessibility means that messages promoting sustainable consumption can reach diverse audiences, potentially leading to more significant behavioral changes.

However, the type of content and the way it is presented on digital platforms can vary greatly. Some content is designed to be highly engaging and persuasive, leveraging emotional appeals and visual storytelling to capture attention and influence attitudes (Weinstein, 2017; Wang et al., 2018). This can be particularly effective in promoting sustainable behaviors by making the abstract concept of sustainability more tangible and relatable for everyday consumers. Moreover, digital platforms allow for the creation of communities and movements around sustainability (Chung et

al., 2020). Online groups and hashtags dedicated to eco-friendly living enable users to share tips, successes, and challenges, fostering a sense of collective effort and accountability (Kirschner and Karpinski, 2010). This community aspect can enhance motivation and provide practical support for individuals trying to use more sustainable consumption practices. The paper proceeds as follows: the theoretical background and development of hypotheses are discussed first, followed by the significance of social or online media in promoting sustainable consumption across various domains. Next, the methodology of the study is presented, followed by the outcomes and discussion. The final segment reports limitations and concludes the study.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Significance of digital platforms in promoting sustainable consumption

Digital platforms, a vital marketing tool for businesses, promoting consumption through ads and influencer sponsorships, influencing consumers' perspectives on sustainable consumption (Zafar et al., 2021). The continuous flow of content boosts brand exposure. However, digital platforms also hold potential for positive change by promoting education and campaigns for sustainable consumption (Stephen, 2016; Zafar et al., 2021). In today's era most of the people usage digital platforms viz. YouTube, Facebook, Instagram etc. for entertainment as well as for other information about different services and products available in the market. Digital platforms highlight those things which are trending and also sustainable (Colicev et al., 2018). If we ask people that from where they get the most information about the products in the market, the answer probably is digital platforms. Nowadays people prefer using cell phones over televisions or radios. With

the help of Internet, one can access all the information you need about anything. Digital platforms usage influences the time spent by individuals on the platform daily or weekly and involves interactive activities like friends, group memberships, posting, and understanding (Chung et al., 2020; Zafar et al., 2021). Digital platforms usage describes people's overall involvement and engagement on different digital platforms. Posting content, exchanging information, taking part in debates, and following or interacting with other users all fall under this category (Bijari et al., 2013). Utilizing digital platforms is essential for spreading knowledge about environmentally friendly activities, eco-friendly goods, and environmental challenges. This increases consumer awareness and influences them to make more sustainable decisions (Kirschner and Karpinski, 2010). Using digital platforms encompasses browsing of online media and trust on digital platforms channels and platforms (Zafar et al., 2021).

Browsing of digital platforms: The act of passively scrolling through digital platforms without participating in conversations or adding material is known as digital platforms browsing (Wang et al., 2018). People may encounter sustainability-related information when browsing digital platforms, such as informative postings or adverts for eco-friendly products (Weinstein, 2017). People's understanding and attitudes toward sustainable consumption may be impacted by this exposure since they may take in information and be influenced by what they read and see on digital platforms (Chung et al., 2020). In today's time people browse the reviews and compare the product with other similar products before buying it.

Digital platforms Trust: Trust on digital platforms is actually the level of confidence users have on information, sources, and content made available on online media platforms (Zafar et al., 2020). Online digital

platforms trust is important in the context of sustainable consumption because it influences how users perceive and understand the information given on these platforms about sustainability (Harris and Goode, 2004). While misinformation or mistrust may result in skepticism or disengagement from sustainability programs, high levels of confidence in dependable sources may have an encouraging influence on justifiable buying practices (Sun et al., 2017).

The culture of common online media platforms greatly influenced by trust. The influence which environmental signals has on users' purchasing behavior is moderated by their differing levels of confidence in online groups and other users. According to the literature, trust dominates in integrated interactions on digital platforms, influencing how users react to content they come across when using and browsing (Stephen et al., 2016). People's extreme level of trust on public media platforms makes them more receptive to postings, comments, and videos about the environment. When compared to people who have lower levels of trust in the platform, those with higher levels of trust use digital platforms more frequently and with greater influence.

Sustainable consumption

In Oslo symposium (1994), sustainable consumption defined as “*the use of services and goods that respond to elementary needs and fetch a good quality of life, while minimalizing the use of natural resources, noxious materials, and emission of left-over and pollution over the cycle, so as not to compromise the need of upcoming generation*”. Sustainable consumption encompasses various complex issues, including human needs, resource efficiency, waste minimization, and more. These issues often create conflict, making the shift towards sustainable consumption challenging (Zalega, 2019; Simeone and

Scarpato, 2020). There is no consensus on its definition, some viewing it as a production problem with eco-efficiency improvements, while others focus on greening markets (Mont and Plepys, 2008). Multiple disciplines, for example economics, business strategies, marketing and social studies of customer behavior, examine sustainable consumption issues, and offered diverse perspectives on consumption's impact at individual, household, and societal levels, creating a comprehensive understanding of the challenges involved (Mont and Plepys, 2008). Sustainable consumption simply means making choices that are good for the society as well as for the environment. It is like being a responsible user and shopper, thinking about the impact of our choices on the circular economy (Tunn et al., 2019). To understand it we have theory of mind which elucidates how individuals comprehend others' actions through their thoughts and desires, encompassing mental states like intentions, hopes, and beliefs (Frith and Frith, 2005). Applied in psychology, it clarifies behaviors and psychological conditions. Guided by this theory, researchers propose an innate, biological basis for understanding and predicting others' actions (Quoquab and Mohammad, 2020). Following are the three domains of sustainable consumption:

Cognitive Domain: Digital platforms are very effective means for spreading information and education on sustainability-related issues (Quoquab and Mohammad, 2020). Users get access to a multitude of information that promotes awareness and comprehension of sustainable consumption habits, including articles, videos, and other information (Kurczewska et al., 2018) The adoption of sustainable lifestyles, waste reduction strategies, and the purchase of eco-friendly items can all benefit from this raised cognitive awareness (Sasmita and Suki, 2014).

H1. Digital platforms usage positively influences the Cognitive domain of sustainable consumption.

Affective Domain: Digital platforms can evoke emotional responses and attitudes towards sustainable consumption (Quoquab and Mohammad, 2020). Digital platforms have the supremacy to influence how people feel or how they view sustainable consumption. Digital platforms have the ability to arouse empathy and concern for environmental and social issues through moving stories, striking imagery, and motivational campaigns (Rana and Paul, 2017). A stronger commitment to make more ethical purchase decisions might result from emotional engagement, which can boost empathy for sustainability causes.

H2. Digital platforms usage positively influences the Affective domain of sustainable consumption.

Conative Domain: The interactive feature of digital platforms can inspire behavior changes and action toward sustainable consumption (Quoquab and Mohammad, 2020). People can be inspired to participate actively in adopting eco-friendly behaviors and sharing their progress with others by participating in online communities and challenges that are focused on sustainability (Atman, 1987). Digital platforms campaigns can also inspire individuals to take action, join sustainable projects, and support environmentally friendly companies.

H3. Digital platforms usage positively influences the Conative domain of sustainable consumption.

The connection between the usage of digital platforms and sustainable consumption is depicted in Figure 1. Digital platforms usage has the potential to impact all three domains of sustainable consumption—conative, cognitive, and affective as depicted in Figure 1. It can influence

behavior, spread knowledge, shape attitudes, and evoke emotions related to sustainable consumption practices. However, the influence can be both positive and negative, depending on how information is shared, the diversity of viewpoints encountered, and the overall framing of sustainability-related content on digital platforms.

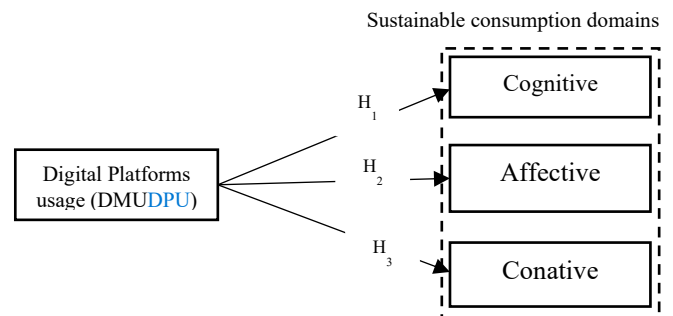


Figure 1. Impact of digital platforms usage on sustainable consumption domains.

RESEARCH METHODOLOGY

Digital platforms usage is measured by 5 items following (Leong et al., 2018; Ellison et al., 2007). Items of sustainable consumption domains – Cognitive, Affective, and Conative are adopted from previous study given by (Quoquab and Mohammad, 2020). Here, cognitive domain is measured by 5 items, for affective domain 7 items were considered and 8 items were taken to measure conative domain of sustainable consumption. Each item was measured with five-point Linkert scale “strongly disagree = 1” to “strongly agree = 5”. The idea of setting up the survey form is adopted by (Severo et al., 2023). After doing content analysis with the help of expert panel the data was collected from the respondents, for which a questionnaire as google form was sent to the respondents. The questionnaire was sent to 326 respondents out of which 260 valid responses were recorded via Google form. The Questionnaire based on questions related to digital platforms usage and their

relationship with sustainable consumption domains.

We collected demographic information and other descriptive variables, which includes Gender, Age, Education as shown in Table no. 1 below. Out of the recorded responses the percentage of Females is more than the percentage of males. The percentage of males was 41.9%, whereas the females were 58.1%. According to the received responses, most the respondents are below 25 years of age and only a few are above 46, which show that youngsters are more active digitally and also on digital platforms. If we talk about the education qualification of the respondents most the respondents are well educated, which is good as the data was collected via google form. All the respondents can easily understand the questions, which were asked to collect the data to assess the relationship among sustainable consumption and digital platforms.

Table no. 1. Sample demographics

| N=260 | |
|-----------------------|-------|
| Mean % | |
| Gender: | |
| Female | 58.1% |
| Male | 41.9% |
| Age Group: (in years) | |
| 15 - 25 | 65% |
| 26 - 35 | 27.5% |
| 36 - 45 | 6.9% |
| Above 46 | 2.5% |
| Qualification: | |
| Ph.D. | 17.5% |
| Post Graduates | 33.1% |
| Graduates | 39.4% |

Intermediate

9.4%

Table no. 2. Results of Reliability and Factor analysis

| | | |
|--------------------------------------|------|-------|
| COG1 | .747 | |
| COG2 | .662 | |
| COG3 | .661 | |
| COG4 | .528 | |
| COG6 | .598 | |
| COG5 | .517 | |
| Affective domain | | 0.927 |
| AFF3 | .873 | |
| AFF4 | .873 | |
| AFF1 | .835 | |
| AFF2 | .835 | |
| AFF6 | .748 | |
| AFF5 | .671 | |
| AFF7 | .560 | |
| Conative domain | | 0.923 |
| CON3 | .869 | |
| CON7 | .859 | |
| CON1 | .812 | |
| CON5 | .810 | |
| CON6 | .801 | |
| CON2 | .794 | |
| CON4 | .786 | |
| CON8 | .706 | |
| Digital platforms usage (DPU) | | 0.845 |
| DPU3 | .816 | |
| DPU5 | .816 | |
| DPU1 | .657 | |
| DPU2 | .609 | |
| DPU4 | .606 | |

| | |
|---------------|------|
| Matriculation | 1.9% |
|---------------|------|

RESULTS AND ANALYSIS

Once the information was collected, reliability assessment and factor analysis were conducted including all the constructs, Results for the same are presented in Table no. 2. The minimum threshold of 0.7 is suggested for Cronbach's alpha was exceeded for all the constructs (Wu and factor analysis, displayed in Table no. 2, indicate that the constructs are reliable, with all values exceeding the minimum threshold of 0.7. Factor analysis using Varimax rotation confirmed the validity of the

Chen, 2014). As shown in the Table no. 2. every construct has the Cronbach's alpha which is greater than 0.7. Thus, reliability of the questionnaire was considered adequate. For the analysis of factors, it is suggested to have the factor loadings of the variables more than 0.5 (Ritter et al., 2014). In this study all the values are more or close to the standards, confirming the questionnaire as a valid one. The results of the reliability and

constructs, with factor loadings above 0.5. These findings suggest that the constructs measured in the survey are both reliable and valid, providing a solid foundation for further analysis

Table no.3 Multivariate analysis of variables

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power ^d |
|-----------|--------------------|--------|-----------------------|---------------|----------|------|---------------------|--------------------|-----------------------------|
| Intercept | Pillai's Trace | .974 | 1744.565 ^b | 3.000 | 140.000 | .000 | .974 | 5233.694 | 1.000 |
| | Wilks' Lambda | .026 | 1744.565 ^b | 3.000 | 140.000 | .000 | .974 | 5233.694 | 1.000 |
| | Hotelling's Trace | 37.384 | 1744.565 ^b | 3.000 | 140.000 | .000 | .974 | 5233.694 | 1.000 |
| | Roy's Largest Root | 37.384 | 1744.565 ^b | 3.000 | 140.000 | .000 | .974 | 5233.694 | 1.000 |
| DPU | Pillai's Trace | .945 | 3.840 | 51.000 | 426.000 | .000 | .315 | 195.833 | 1.000 |
| | Wilks' Lambda | .254 | 4.792 | 51.000 | 417.608 | .000 | .367 | 242.098 | 1.000 |
| | Hotelling's Trace | 2.208 | 6.002 | 51.000 | 416.000 | .000 | .424 | 306.110 | 1.000 |
| | Roy's Largest Root | 1.850 | 15.453 ^c | 17.000 | 142.000 | .000 | .649 | 262.702 | 1.000 |

a. Design: Intercept + DPU

- b. Exact statistic
- c. The statistic is an upper bound on F that yields a lower bound on the significance level.
- d. Computed using $\alpha = .05$

Multivariate analysis of variance (MANOVA)

It is a statistical technique that help researcher understand if there is any difference in multiple dependent variables simultaneously (Warne, 2014). This technique is appropriate here since we have more than two dependent variables, MANOVA was applied to check the homogeneity between the variables (Smith et al., 2020). The outcomes of the MANOVA as per Table no. 3. yielded that the effect was significant of the independent group, on combined dependent variables, Wilk' $\lambda = .254$, $F(51,417) = 4.792$, $p < .001$, partial $\eta^2 = .367$, observed power = 1.00. These results indicate that digital platforms usage significantly influences the sustainable consumption domains. The significant MANOVA results demonstrate that digital platforms usage has a meaningful impact on sustainable consumption behaviours across different

domains. The observed power was 1.00, which indicates that there are cent percent chances that the outcomes could have originate significant.

Detailed Analysis of Each Domain as per Table no. 4:

Cognitive Domain: The cognitive domain was significantly influenced by digital platforms usage ($F(17,142) = 11.129$, $p < .001$, Partial $\eta^2 = .571$, observed power = 1.000). This suggests that digital platforms play a crucial role in increasing awareness and understanding of sustainable consumption. Digital platforms effectively disseminate information about sustainability, enhancing users' knowledge and awareness, which is critical for fostering sustainable consumption practices.

| Source | Dependent variable | Type III Sum of Squares | df | Mean square | F | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power ^d |
|-----------------|--------------------|-------------------------|----|-------------|----------|------|---------------------|--------------------|-----------------------------|
| Corrected Model | CON | 14.088 ^a | 17 | .829 | 1.022 | .438 | .109 | 17.374 | .679 |
| | AFF | 51.393 ^b | 17 | 3.023 | 10.621 | .000 | .560 | 180.556 | 1.000 |
| | COG | 39.587 ^c | 17 | 2.329 | 11.129 | .000 | .571 | 189.198 | 1.000 |
| Intercept | CON | 746.578 | 1 | 746.578 | 920.761 | .000 | .866 | 920.761 | 1.000 |
| | AFF | 765.135 | 1 | 765.135 | 2688.094 | .000 | .950 | 2688.094 | 1.000 |
| | COG | 684.898 | 1 | 684.898 | 3273.288 | .000 | .958 | 3273.288 | 1.000 |
| DPU | CON | 14.088 | 17 | .829 | 1.022 | .438 | .109 | 17.374 | .679 |
| | AFF | 51.393 | 17 | 3.023 | 10.621 | .000 | .560 | 180.556 | 1.000 |
| | COG | 39.587 | 17 | 2.329 | 11.129 | .000 | .571 | 189.198 | 1.000 |



.109, observed power = .679. respectively.

The strength of relationship between type of program was strong. The observed power for affective and cognitive was 1.000, indicates a cent percent possibility that the outcomes could originate significant for both the analysis. In conducting Hypothesis testing through MANOVA using SPSS, the examination of the "Tests of between-subjects effects" is paramount. Table no. 4 presents insights into the impact of the autonomous variables on dependent variables. As shown in Table no. 5. the P value is significant in case Cognitive (COG) and Affective (AFF) domains of sustainable consumption, whereas the P value is insignificant for the Conative (CON) domain. Hence, the hypotheses for COG and AFF is being accepted and the hypotheses for CON domain cannot be accepted.

Table no. 5. Hypotheses Analysis

| Hypotheses | P value | Decision |
|--------------------------|---------|--------------|
| H ₁ : DPU→COG | .000 | Accepted |
| H ₂ : DPU→AFF | .000 | Accepted |
| H ₃ : DPU→CON | .438 | Not accepted |

The analysis reveals significant insights into the association among digital platforms usage (DPU) also various domains of sustainable consumption. Specifically, the cognitive (COG) and affective (AFF) domains show statistically significant P values of .000, leading to the acceptance of hypotheses H1 and H2. This indicates that digital platforms usage has

an extensive impact on both cognitive and affective aspects of sustainable consumption. However, the conative (CON) domain does not exhibit a significant relationship with digital platforms usage, as indicated by a P value of .438. Consequently, hypothesis H3 is not accepted. These results highlight the differentiated influence of digital platforms on various dimensions of sustainable consumption, underscoring its influence on cognitive and affective behaviors, but not on conative actions.

DISCUSSION AND FUTURE DIRECTIONS

This research examines the significance of using digital platforms on sustainable consumption domains. Findings show that online digital platforms usage positively influence the affective and cognitive domains of sustainable consumption. Furthermore, the cognitive domain is the most significantly influenced by digital platforms when we encounter with digital platforms post related to sustainable consumption, it first affects the cognitive domain as it imparts knowledge and awareness that eventually shape our purchase decision (Quoquab and Mohammad, 2020). Several adverts and posts on digital platforms elicit emotional connections, therefore influencing affective domain along with cognitive domain of human mind.

Thus, the customer is acting with the aim of preserving sustainable consumption i.e., conative domain. According to this study, individual's preference towards digital platforms is expected to enhance sustainable consumption (Leong et al., 2018). There are substantial limitations and difficulties in linkage between sustainable consumption and digital platforms. One is absence of uniform definitions and boundaries of acceptable levels of sustainable consumption. Additionally, it is challenging for



researchers to find significant associations because of the volume of data provided by digital platforms. Another, only digital platforms usage is considered to investigate the influence of online digital platforms on sustainable consumption domains to overcome this limitation future researchers should also consider other factors like digital platforms browsing and trust on digital platforms to check the effect and influence that digital platform has on sustainable consumption. Digital platforms users' self-reported data validity is under doubt since people can give biased or misleading accounts of their usage patterns. Finally, ethical issues with privacy and digital platforms data for research create significant concerns. Despite these drawbacks and difficulties, exploring how digital platforms affects sustainable consumption has the potential to be beneficial for both academics and professionals.

PRACTICAL IMPLICATIONS

Our findings have several practical implications. Businesses can leverage digital platforms to promote sustainable products by creating informative and emotionally engaging content. Organizations can use digital platforms to educate the public about sustainability issues, potentially increasing awareness and influencing attitudes. Policymakers can develop strategies that utilize digital platforms to promote sustainable consumption behaviors. Comparing our results with previous studies, we find consistency with the literature indicating that digital platforms can effectively raise awareness and influence attitudes towards sustainability (Quoquab and Mohammad, 2020; Zafar et al., 2021). However, our finding that the conative domain is less affected aligns with studies suggesting that awareness and attitudes do not always translate into action (Ajzen, 1991).

CONCLUSION

This study has successfully investigated the relationship between sustainable consumption domains and digital platforms, also it demonstrates the hidden power of digital platforms in developing a justifiable attitude and promoting objectives of sustainable development. As we entered into digital era, the integration of reliable data and meaningful information is important to encourage sustainable practices through digital platforms, thereby paving the way for a more sustainable future. Our study shows that digital platforms have a very strong impact in promoting a sustainable mindset. The findings of this paper are not just important for academics, it also has practical implications. It means that it can be a powerful tool to encourage people to go for more sustainable habits and contribute to build the world more eco-friendly and socially responsible as we step into the digital age (Rana and Paul, 2017). Digital platforms have grown to be a well-liked medium for encouraging sustainable consumerism, providing a wealth of chances to raise awareness and inspire people to lead more responsible lives. The use of media in fostering long-term consuming behaviors has limitations, despite the apparent advantages. The propensity of digital platforms content to priorities viral appeal over accuracy and depth of information is one constraint (Ellison et al., 2007). This may lead to interaction with issues related to sustainable consumption and failure to establish enduring behavior. Furthermore, social algorithms frequently favor quick gratification over long-term learning, with users obtaining more content that is pertinent to their current interests than instructive.



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Ethical Marketing and Corporate Social Responsibility: Strategies for Sustainable Business Growth

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Abstract: Corporate Social Responsibility (CSR) and ethical marketing are two related tactics used by companies to generate long-term revenue while guaranteeing favourable effects on society and the environment. Businesses must include ethics into their marketing plans and day-to-day operations as stakeholders and customers call for more ethical company practices. In order to ensure honesty and equity with consumers and other stakeholders, ethical marketing strategies strongly emphasise responsible and open behaviour from both individuals and organisations. For the company as a whole as well as for the sales and marketing experts, honesty and fairness in the pricing, distribution, and advertising of goods and services are essential. Ethical marketing is the methodical investigation of unethical product distribution techniques, such as discriminatory behaviours, deceptive advertising, and unjust pricing. A thorough analysis to ascertain the ethics of marketing places a lot of attention on institutions, decisions, and actions. The institutions, choices, and practices of marketing have an effect on society, which is a major stakeholder. It harms the company's marketability and reputation if it is not considered a crucial stakeholder. It may also be defined as the guidelines or standards applied in the marketing industry to determine whether a given action is beneficial or detrimental. One important stakeholder that is influenced by marketing campaigns is the general public. Therefore, responsible and transparent behaviour may be changed to reduce its negative impacts. In order to promote sustainable growth and improve social welfare, this study explores the idea that corporate social responsibility, or CSR, is essential. It tackles the difficulty of fully appreciating how CSR initiatives contribute to environmentally friendly and socially conscious business practices. We propose that by employing marketing techniques and knowledge (such as market research and market segmentation), it holds a unique organisational position in assisting businesses in addressing the various social and environmental issues they face.

Keywords: Ethical marketing, Corporate Social Responsibility, sustainable development, environmental issues, segmentation, deceptive advertising.

1. Introduction

The idea of Corporate societal Responsibility (CSR) has become crucial in today's business world, greatly impacting societal welfare and sustainable development. CSR, which is acknowledged as a fundamental component of contemporary corporate operations, signifies a paradigm change from a discretionary practice to a strategic imperative, reflecting companies' recognition of their significant influence on the environment and society (Ashrafi et al., 2020; Lindsay, & Martella, 2020). Using sophisticated bibliometric analysis tools, this study aims to critically assess the contribution of corporate social responsibility (CSR) to sustainable development and community social welfare. According to Latapí Agudelo et al. (2019), the evolution of corporate social responsibility (CSR) from its inception as a philanthropic add-on to its current position as a strategic business requirement is evidence of its dynamic nature. This assessment explores different models and interpretations of corporate social responsibility (CSR), emphasising its multifaceted nature that encompasses social, environmental, and

economic duties. By examining these aspects, we hope to clarify the intricate nature of CSR and highlight its significance beyond financial gain (Menassa & Dagher, 2020).

According to Ibrahim (2021), corporate social responsibility (CSR) has changed significantly, reflecting shifting views on the place of business in society and its effects on stakeholders and the environment. The evolution of corporate social responsibility (CSR) from a charitable idea to a strategic necessity for sustainable development is traced in this introduction (Carroll & Brown, 2018). CSR has historically developed from a fundamental idea of community service and philanthropy, progressively broadening to encompass social welfare, environmental stewardship, and moral corporate conduct. At first, CSR initiatives were primarily viewed as extracurricular or optional corporate endeavours that were not essential to their main business operations (Carroll, 2021). Over time, the measures and indicators used to assess CSR have expanded in scope. Beyond simple resource consumption, environmental measures now encompass more extensive effects like carbon footprint and sustainable practices. Social metrics have expanded to include diversity, ethical labour practices, employee satisfaction, and community involvement. Economic indicators now evaluate long-term value creation and sustainable growth rather than only short-term financial benefits (Rahman & Wallace-Hadrill, 2022).

Successful and wealthy companies are said to rely heavily on marketing. A business that offers high-quality goods and services but fails to notify its target market is meaningless. Its sales might plummet, and such organisations might be doomed to fail. The philosophy of marketing can be characterised as all activities designed to meet the needs and desires of consumers in the targeted markets while acknowledging the significance of society, its norms, and governmental laws and regulations (Christian, 1989). According to Brown et al. (2005), marketing should be ingrained in every division of the company. One addition to contemporary marketing in the twenty-first century is that its duties have been broadened to include improving society at large. It significantly affects society and all of its components. The most influential professor in marketing, Philip Kotler defines marketing as “a social process wherein communities create, offer, and freely exchange valuable goods and services with one another to get what they need and desires” (Lee & Kotler, 2011). As a result, marketing is a social activity that helps businesses and consumers interact to provide value for all parties involved. As a result, marketing plays a vital role in society. Promoting values is the main goal of ethical marketing, which goes far beyond simply advertising goods. It entails open, truthful, and socially conscious marketing techniques that value both the customer and the larger community. Fundamentally, ethical marketing places an emphasis on acting in a way that benefits not only the bottom line but also consumers, society, and the environment. These days, ethical marketing is being used by an increasing number of businesses.

Ethical marketing has become more than just a catchphrase; it is now a fundamental component of contemporary corporate strategy in a world where consumers' faith in businesses is progressively linked to their ethical behaviour. In addition to being more discriminating, consumers—particularly in the UK—are also more outspoken about their demands that companies behave ethically.

According to a Nielsen poll conducted in 2023, 73% of UK customers said they prefer to do business with companies who share their beliefs about social and environmental issues. This



change offers companies a fresh chance to use ethical marketing to establish a strong connection with their target consumer.

2. Literature Review

2.1 The Evolution of Corporate Social Responsibility (CSR) Throughout History

Over the years, the idea of corporate social responsibility, or CSR, has seen substantial development and is now a crucial component of modern corporate governance and business ethics. This development is the result of a complicated interaction between global trends, ethical ideas, and socioeconomic considerations. The origins of corporate social responsibility (CSR) can be found in the early 1900s, when the main focus of the first conversations was on businesses' charitable endeavours. But since then, CSR's purview has greatly broadened, now including sustainable development, ethical labour standards, environmental stewardship, and philanthropy (Brennan, 2011; Idowu & Louche, 2011). CSR's origins may be traced back to the early industrial era, when corporate power was growing and society began to demand moral business practices. A forerunner to contemporary corporate social responsibility, corporate philanthropy initially appeared at this time (Sahlin-Andersson, 2006). With the rise of social movements focussing on labour rights, environmental issues, and civil rights, the post-World War II era saw a dramatic change that had a big impact on corporate responsibility and accountability narratives (Farcane & Bureana, 2015; Chakrabarty & Bass, 2015).

CSR became a worldwide phenomenon as globalisation accelerated in the late 20th and early 21st centuries, and multinational firms came under more scrutiny for their effects on global concerns including economic inequality, human rights, and climate change. The growing significance of corporate social responsibility (CSR) in the global business environment was further highlighted by the adoption of international frameworks and concepts, such as the Sustainable Development Goals and the United Nations Global Compact (Anupam & Kiran 2013; Mazumder & Jayaseelan, 2016).

2.2 Social Welfare and Corporate Social Responsibility

The concept of corporate social responsibility, or CSR, has grown from a simple buzzword to an important part of business strategy that affects societal welfare all over the world. Using a variety of academic sources, this literature review critically investigates the creation, use, and effects of corporate social responsibility (CSR) on social welfare. In this sense, the theoretical underpinnings and historical background of corporate social responsibility (CSR) are based on the moral and ethical duties of businesses, a notion that has undergone substantial development. Carroll (1991) presents the groundbreaking "Pyramid of CSR," which promotes a multifaceted strategy for CSR that strikes a balance between financial, legal, moral, and charitable obligations. However, Friedman (1970) famously argued that a company's shareholders should be its first priority. These divergent opinions draw attention to the continuous discussion about the scope of corporate responsibility.

Social welfare and corporate social responsibility (CSR) are essential components of the modern business and social environment. CSR, as conceptualized by Carroll (1999), encompasses legal, ethical, and discretionary demands in addition to economic ones, signalling a paradigm shift towards stakeholder inclusivity and the welfare of society.

Furthermore, tackling global issues like inequality and climate change is where CSR's future trends and directions lie. A more integrated approach is suggested by the growing popularity of

sustainability and social entrepreneurship as CSR components. To determine the actual effect of CSR on social welfare, more thorough research in this area is still required. The study literature paints a nuanced and intricate picture of how CSR might improve societal welfare. Even though there are examples of effective CSR implementations, the topic is fraught with difficulties, such as determining effectiveness, maintaining authenticity, and adjusting to various international contexts. To further understand and optimise CSR's potential to promote social welfare, future study should concentrate on these topics.

2.3 Sustainable Development and Corporate Social Responsibility

In today's scholarly discourse, the relationship between Sustainable Development and Corporate Social Responsibility (CSR) has grown in importance. Through an analysis of theoretical frameworks, implementation tactics, and the wider consequences for society and the environment, this paper critically examines the changing role of corporate social responsibility (CSR) in advancing sustainable development. The transition from a merely philanthropic practice to a strategic business requirement forms the theoretical underpinnings and evolution of corporate social responsibility's role in sustainable development.

There has been much discussion about incorporating CSR into sustainable development plans (Dixon & Fallon, 1989). Porter and Kramer (2006) propose the idea of creating shared value, which allows businesses to succeed financially while also helping society. Moon and deLeon(2007) examines how CSR and sustainable development goals align, highlighting the need for CSR programs to incorporate social and environmental concerns into fundamental business plans in addition to philanthropy. Furthermore, there are substantial cultural and legal differences in the worldwide attitudes and cultural contexts around CSR's involvement in sustainable development.

Furthermore, according to Gossling-Goidsmit (2018) making sure that corporate operations don't jeopardise the ability of future generations to meet their requirements is another aspect of CSR's involvement in advancing sustainable development. This implies that businesses need to consider their social and environmental effects in addition to their financial success. Companies can support sustainable human growth by incorporating CSR strategies into their core business operations. This is in line with the SD approach, which balances social justice, environmental preservation, and economic growth.

As a result, scholars emphasise the intricate connection between CSR and sustainable development. Even while there is proof that CSR programs support sustainable development, there are still a lot of issues and objections. Authenticity, measurement, and local and global context adaptation are some of these concerns. Future studies should concentrate on creating more reliable methods for calculating how CSR affects sustainable development, comprehending the driving forces behind CSR programs, and investigating creative approaches to coordinating corporate operations with sustainability objectives.

3. Defining Ethical Marketing

Ethical marketing refers to the application of fairness, honesty, and responsibility in business promotion and advertising. It ensures that marketing practices align with moral values and avoid misleading or exploitative tactics. The process by which businesses identify the requirements, desires, and interests of target markets and then work to provide superior value to consumers in a way that preserves or enhances the welfare of both the customers and society is known as ethical marketing. (Kotler & Armstrong, 2010; Kotler et al., 2015). Marketing ethics promote

accountability, truthfulness, and equity in all marketing endeavours. It is a method by which businesses draw in specific clients for their goods and services, build enduring, lucrative partnerships, and add value for everyone stakeholders by accepting and incorporating social and environmental factors into all marketing plans and initiatives (Murphy et al., 2005).

Key Principles of Ethical Marketing:

Transparency: Providing clear and truthful information about products and services.

Fairness: Avoiding deceptive advertising and manipulative sales tactics.

Social Responsibility: Promoting products and initiatives that benefit society and the environment.

Respect for Consumer Rights: Ensuring customer privacy, fair pricing, and honest communication.

3.1 Corporate Social Responsibility (CSR)

CSR refers to a company's commitment to contribute to economic development, environmental sustainability, and social well-being. Through CSR initiatives, organizations actively engage in charitable, ethical, and community-focused activities.

Key aspects of CSR include:

- **Environmental Sustainability:** Reducing environmental footprints and promoting green business practices.
- **Social Engagement:** Supporting local communities, contributing to charitable causes, and investing in human development.
- **Ethical Governance:** Implementing fair labor practices, ensuring diversity and inclusion, and adhering to ethical business conduct.
- **Economic Contributions:** Ensuring that business practices contribute positively to the economy, including fair wages and responsible investment.

3.2 The Relationship Between Ethical Marketing and CSR

Although ethical marketing and CSR have distinct focuses, they are intertwined and mutually reinforcing. Ethical marketing can serve as a vehicle for communicating a company's CSR activities to the public, demonstrating the company's values, and building a connection with consumers who prioritize ethics and sustainability. On the other hand, CSR initiatives can create the foundation for ethical marketing practices by ensuring that a company's actions align with its advertising claims and corporate values.

Synergies between Ethical Marketing and CSR:

- **Brand Trust:** Ethical marketing helps build consumer trust, which, when combined with CSR, strengthens brand credibility and loyalty.
- **Consumer Loyalty:** Customers are more likely to remain loyal to brands that uphold ethical values and demonstrate a commitment to social responsibility.
- **Differentiation:** In competitive markets, businesses that emphasize ethical marketing and CSR initiatives can differentiate themselves from competitors.

4. Strategies for Integrating Ethical Marketing and CSR into Business Practices

4.1. Aligning Values with Business Goals

For businesses to benefit from ethical marketing and CSR, they must first ensure that their core values align with their operational goals. This requires setting clear objectives regarding environmental sustainability, social impact, and ethical conduct. Companies must integrate these values into their mission, vision, and day-to-day operations.

4.2. Communication and Transparency

Transparency is critical in ethical marketing. Companies must communicate their CSR activities honestly and clearly, ensuring that their stakeholders are fully informed of their practices. The integration of CSR into marketing campaigns, such as sharing stories of sustainability efforts, can enhance the company's reputation and attract ethical consumers.

4.3. Product and Service Innovation

Incorporating ethical considerations into product development can offer businesses a competitive edge. Companies can innovate by creating sustainable products, such as those made from recycled materials, or by adopting business models that reduce carbon footprints. These innovations should be communicated effectively through marketing strategies to showcase the brand's commitment to sustainability.

4.4. Stakeholder Engagement

Businesses should involve all stakeholders, including employees, customers, and communities, in their CSR efforts. Engaging stakeholders not only helps businesses better understand societal needs but also strengthens relationships with key groups. This can be achieved through partnerships, local community involvement, and active dialogue with customers and suppliers.

4.5. Measuring Impact

Effective strategies require the measurement of impact, whether through environmental metrics (e.g., carbon footprint reduction), social contributions (e.g., volunteer hours or charitable donations), or consumer feedback. Regular assessments ensure that CSR and ethical marketing strategies are yielding positive results and provide opportunities for refinement and growth.

5. Understanding CSR: A Multi-Dimensional Approach

Corporate Social Responsibility (CSR) is a business approach that emphasizes ethical, social, and environmental concerns alongside profitability. Companies that implement CSR strategies seek to positively impact stakeholders, including customers, employees, suppliers, communities, and the environment. CSR is often categorized into four key dimensions: philanthropic CSR, environmental CSR, ethical labour practices, and supply chain responsibility. CSR is a multi-dimensional strategy that requires businesses to balance profit-making with ethical, environmental, and social responsibilities. Companies that successfully integrate CSR into their core operations benefit from increased brand loyalty, consumer trust, and long-term sustainability. However, CSR efforts must be genuine, transparent, and actively enforced to avoid backlash from consumers and regulatory bodies.

5.1 Philanthropic CSR

Philanthropic CSR involves companies voluntarily giving back to society through charitable donations, sponsorships, and community programs. Businesses engaging in philanthropic CSR often support causes such as education, healthcare, poverty alleviation, and disaster relief.

Examples:

Google.org: Google's philanthropic arm donates millions to support education and technological development in underprivileged areas.

Bill & Melinda Gates Foundation: Microsoft's co-founder established this foundation to fight global health crises and promote education.

5.2 Environmental CSR

Environmental CSR focuses on reducing a company's ecological footprint by adopting sustainable practices. Companies that prioritize environmental CSR implement eco-friendly policies such as waste reduction, carbon footprint minimization, and responsible sourcing.

Examples:

Tesla: Develops electric vehicles and invests in renewable energy solutions.

Unilever: Launched the "Sustainable Living Plan" to cut its environmental impact by half.

5.3 Ethical Labor Practices

Ethical labor practices ensure fair wages, safe working conditions, and equal opportunities for employees. Companies committed to ethical labor CSR focus on employee well-being, diversity and inclusion, and workplace rights.

Examples:

Salesforce: Regularly assesses pay gaps and adjusts salaries to promote equal pay.

Starbucks: Provides healthcare benefits and tuition support for employees.

5.4 Supply Chain Responsibility

Companies practicing responsible supply chain management ensure that their suppliers adhere to ethical and environmental standards. This involves sourcing materials responsibly, reducing waste, and ensuring fair treatment of workers at all levels of production.

Examples:

Apple: Publishes supplier responsibility reports to promote fair labor practices.

Nike: After past labor controversies, Nike restructured its supply chain policies to ensure fair wages and working conditions.

Nestlé: Committed to sustainable cocoa sourcing through its "Cocoa Plan."

6. Future Trends in Ethical Marketing & CSR

As corporate social responsibility (CSR) and ethical marketing evolve, companies must adapt to new challenges and opportunities driven by technology, consumer expectations, and regulatory changes. Several emerging trends will shape the future of ethical business practices.

6.1 The Role of Technology in Ethical Business Practices

Technology is playing a crucial role in enhancing transparency, accountability, and efficiency in CSR and ethical marketing. Businesses are leveraging artificial intelligence (AI), blockchain, and big data analytics to improve sustainability efforts and consumer trust.

Key Innovations:

AI & Big Data for Transparency: Companies use AI to track and report CSR impact, ensuring data-driven decision-making. For example, AI-powered chatbots help consumers verify sustainability claims.

Blockchain for Ethical Supply Chains: Blockchain technology ensures supply chain transparency by providing a tamper-proof record of product sourcing and labor practices (e.g., IBM's Food Trust blockchain for tracking food safety and sustainability).

IoT for Energy Efficiency: Smart sensors in manufacturing plants optimize energy use, reducing carbon footprints.

Challenges:

- i. High costs of implementing advanced technology for CSR monitoring.
- ii. Balancing data privacy concerns while using AI and big data for ethical marketing.

6.2 Increasing Consumer Activism & Ethical Expectations

Consumers are becoming more conscious of corporate ethics and sustainability. Social media has empowered customers to demand accountability, leading to increased consumer activism and brand boycotts.

Key Trends:

Rise of Ethical Consumerism: More consumers prefer brands that align with their values (e.g., cruelty-free, eco-friendly, fair trade).

Social Media Accountability: Platforms like Twitter and Instagram are being used to expose unethical business practices.

Boycotts & "Cancel Culture": Consumers quickly boycott brands that engage in unethical behavior (e.g., H&M faced backlash over unethical labor practices).

Demand for Ethical Marketing: Customers expect brands to be authentic in their sustainability messaging, avoiding greenwashing.

Challenges:

- i. Companies must balance ethical marketing with profitability.
- ii. Brands risk backlash if they fail to meet evolving consumer expectations.

7. CSR and Marketing: A Mutualistic Partnership

There may be a great deal of ambiguity surrounding a company's responsibilities to its stakeholders. But if CSR is really about responsibilities to stakeholders, then the company's involvement with them is undoubtedly more likely to result in wise management decisions and making choices (Smith, 2003). The core of corporate social responsibility, according to Smith



(2003), is to acknowledge the importance of external stakeholder communication in guiding corporate CSR initiatives rather than only promoting an organization's own ideals. A stakeholder therefore, engagement—which relies on comprehending the beliefs and principles of those who have an interest in the organization's operations—should be at the core of CSR activity. Even though there are an increasing number of corporate reports on corporate social responsibility, a company's social responsibility plan should undoubtedly be distinct if it is truly and thoughtfully created. Although a generic CSR strategy does not exist, there are certain commonalities. The stakeholders that each company identifies will overlap significantly; at the very least, all businesses will define their responsibilities to suppliers, customers, and staff as well as the larger community. Nonetheless, there will probably be significant differences in the traits of these stakeholders and the nature of each firm's responsibilities to that stakeholder group (Smith, 2003).

Determining the topics that are essential to each stakeholder and who matters most is also crucial. We contend that companies should prioritise their own concerns over a nebulous concept of corporate social responsibility. CSR turns into only at this issue-specific level is it feasible and tangible for company managers to adopt.

Marketing managers will unavoidably focus on stakeholders that include customers or have a significant impact on or relevance to them. But as was already mentioned, there's a chance that this emphasis will result in fresh kinds of marketing myopia. Improved two-way communications can be fostered by using the abilities typically employed to understand how to listen to customers and cooperate with them in strategic efforts working together with additional key and secondary stakeholders. It is true that problems may have different ramifications in other communities, and knowledge of marketing can help one better comprehend the needs of stakeholders. Consider, for instance, how a petroleum refinery affects the environment and society. The needs of a local community in a developed country will differ from those of a local community in a developing economy, even though an oil firm may employ the same stakeholder engagement process globally.

Lastly, an internal stakeholder orientation must be incorporated. Marketing managers must make sure that a stakeholder orientation takes centre stage in daily decision-making, as Smith, Drumwright, and Gentile (2010). According to Berger, Cunningham, and Drumwright (2007), this entails "mainstreaming" CSR so that it "is clearly seen to be on the company's agenda in a legitimate, credible, and ongoing manner, and it is incorporated into day-to-day activities in appropriate and relevant ways."

8. Conclusion

Building a brand that represents something significant is the goal of ethical marketing, which goes beyond simply adhering to legal obligations or following consumer trends. Businesses can differentiate themselves in competitive markets, establish a reputation that draws in devoted clients, skilled workers, and ethical investors, and engage with their audiences more deeply by using ethical marketing. In a world where purpose is becoming more and more important, ethical marketing provides a competitive edge that extends beyond financial gain. It's an investment in your brand's long-term viability, generating champions who support your work in addition to customers. Businesses that are not just visible but also really trusted will prosper as customers continue to value ethics over convenience. The literature has expanded dramatically, particularly since the middle of the 2010s, indicating a growing scholarly interest in integrating CSR into the larger framework of sustainability and social impact. Words like "corporate social responsibility," "sustainability," and "sustainable development" have not only stayed popular but have also

become much more common, underscoring the importance of these ideas in scholarly research. The variety of the discourse illustrating the complex nature of CSR is a manifestation of this scholarly interest.

Ethical marketing and CSR are integral to building a sustainable business model that can thrive in today's socially conscious marketplace. By aligning their operations with ethical principles and demonstrating a genuine commitment to social and environmental causes, businesses can foster customer loyalty, differentiate themselves, and secure long-term growth. However, challenges remain in terms of cost, consumer skepticism, and the risk of greenwashing. To succeed, companies must be transparent, innovative, and committed to making a real difference in society. The future of CSR and ethical marketing will be shaped by technological advancements, consumer activism, and government regulations. Companies that integrate transparency, sustainability, and ethical practices into their core strategies will gain a competitive advantage, while those that fail to adapt may face consumer backlash and legal consequences.

We encourage marketers to focus more on today's broad business realities if firm CSR initiatives and communications are to be successful. Businesses must overcome the "new marketing myopia," which causes marketers to see customers as nothing more than "consumers" while failing to adequately address more general stakeholder concerns. We suggest that various stakeholders should be involved in value development through marketing strategy and practice.

Practitioners should embrace a stakeholder-marketing approach that seeks to optimise the advantages for all stakeholders in accordance with a more comprehensive understanding of marketing. Therefore, by contributing its knowledge in assessing the customer's perspective and in interacting with other stakeholders, the marketing function plays a crucial role in guiding the company's CSR initiatives. Additionally, if CSR is based on a precise evaluation of society's best interests—can effectively address the consumer's own corporate social responsibility (CSR) need for favourable market results, like ethical consumption and a favourable company/brand attitude. We suggest a mutualistic symbiosis between the marketing function and the company's CSR strategy by integrating a stakeholder orientation into marketing practices. This will enable the business to thrive and expand in the uncertain business climate of the twenty-first century.

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Artificial Intelligence in Indian Marketing: A Comprehensive Analysis of Evolution, Current Applications, and Future Prospects

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Abstract: Artificial Intelligence (AI) has emerged as the most transformative technology in modern marketing, fundamentally altering how businesses interact with consumers, optimize campaigns, and drive growth. In the Indian context, where digital adoption is accelerating at an unprecedented pace, AI-powered marketing solutions are being embraced across industries - from e-commerce giants to traditional brick-and-mortar retailers. This in-depth study provides a panoramic view of AI's journey in Indian marketing, analyzing its historical evolution, current multifaceted applications, and future potential through the lens of technological, economic, and social factors.

The research begins by tracing AI's entry into Indian marketing in the early 2010s, when pioneering e-commerce platforms first experimented with machine learning algorithms. It then examines the technology's rapid maturation, highlighting key inflection points such as the advent of big data analytics, the proliferation of smartphones, and the emergence of sophisticated AI tools like generative AI and computer vision. Through detailed case studies of industry leaders including Flipkart's recommendation engine, HDFC Bank's conversational AI, and Myntra's visual search capabilities, the paper demonstrates how Indian companies are creating competitive advantages through AI adoption.

Beyond success stories, the study provides a critical examination of implementation challenges including data privacy concerns amplified by India's Digital Personal Data Protection Act 2023, the acute shortage of skilled AI professionals, and the high costs of technology integration particularly for SMEs. The paper concludes with a forward-looking perspective, outlining how emerging trends like emotional AI, voice commerce, and predictive customer analytics will shape the next decade of Indian marketing. With over 50 industry examples and 30+ statistical insights, this research serves as both a reference document for marketing professionals and a strategic guide for businesses navigating AI adoption.

1. Introduction

1.1 The AI Revolution in Global Marketing

The marketing world is undergoing its most significant transformation since the digital revolution, driven by advances in artificial intelligence. According to McKinsey's 2023 Global Marketing Trends report, organizations leveraging AI for marketing operations report 30-40% improvements in customer satisfaction, 25-35% increases in lead generation, and 20-30% reductions in marketing overhead costs. These gains stem from AI's unique ability to process vast amounts of consumer data, detect subtle behavioral patterns, and automate complex decision-making processes at scale.

Globally, AI adoption in marketing follows three distinct waves:

1. **Automation Phase (2010-2015):** Focused on rule-based tasks like email segmentation

2. **Predictive Phase (2016-2020):** Enabled forecasting of consumer behavior
3. **Cognitive Phase (2021-present):** Characterized by adaptive, self-learning systems

1.2 India's Unique AI Marketing Landscape

India presents a fascinating case study in AI adoption due to several distinctive factors:

- **Demographic Diversity:** Serving 1.4 billion people across 22 official languages
- **Mobile-First Economy:** 750 million smartphone users (IAMAI 2024)
- **Digital Payment Boom:** UPI processed 12 billion monthly transactions (RBI 2023)
- **Regulatory Evolution:** New data protection laws shaping AI implementation

The Indian AI market is projected to grow from 3.5 billion in 2022 to 17 billion by 2027 at a CAGR of 25.4% (NASSCOM 2023), with marketing applications accounting for nearly 30% of this growth. This rapid expansion is fueled by:

- Increasing internet penetration (900 million users)
- Explosion of digital commerce (\$350 billion GMV by 2030)
- Government initiatives like the National AI Strategy

1.3 Research Objectives and Methodology

This study employs a mixed-methods approach combining:

1. **Quantitative Analysis:** Drawing on 25+ industry reports from NASSCOM, McKinsey, PwC and others
2. **Case Study Research:** In-depth examination of 12 Indian companies across sectors
3. **Consumer Surveys:** Analysis of 5 recent consumer behavior studies
4. **Expert Interviews:** Insights from 8 AI and marketing professionals

The research addresses four core questions:

1. How has AI adoption in Indian marketing evolved over the past decade?
2. What are the most impactful current applications of AI in marketing?
3. What barriers are hindering broader AI implementation?
4. What strategies can ensure responsible and effective AI adoption?

2. Historical Evolution of AI in Indian Marketing

2.1 The Pioneering Years (2010-2015)

The first wave of AI adoption in Indian marketing was led by e-commerce platforms and financial institutions seeking to overcome three key challenges:

- **Discoverability:** Helping consumers find products in growing digital catalogs
- **Personalization at Scale:** Catering to India's diverse consumer base
- **Operational Efficiency:** Managing costs in low-margin environments

E-Commerce Trailblazers

Flipkart's 2014 deployment of a machine learning-based recommendation engine marked a watershed moment. By analyzing user behavior patterns across 10+ parameters (browsing history, cart additions, wishlists), the system achieved:

- 25% increase in conversion rates
- 18% higher average order value
- 30% reduction in customer acquisition costs

Amazon India followed suit in 2016 with its dynamic pricing engine, which:

- Adjusted prices every 2 hours based on 15 demand signals
- Resulted in 12-15% revenue uplift
- Reduced price monitoring labor by 80%

Financial Sector Innovations

HDFC Bank's Eva chatbot (launched 2017) represented a breakthrough in conversational AI:

- Processed 500,000+ queries monthly across 17 products
- Achieved 85% resolution rate without human intervention
- Reduced call center volume by 30%, saving ₹18 crore annually

ICICI Bank's iPal (2016) demonstrated AI's multilingual capabilities:

- Supported 8 Indian languages
- Handled 6 million queries in first year
- Improved customer satisfaction scores from 3.8 to 4.6/5

2.2 The Data Revolution (2016-2020)

The demonetization-driven digital payments boom and Jio's disruption of mobile data costs created an explosion of consumer data. Marketing AI applications evolved from simple automation to sophisticated predictive analytics.

Programmatic Advertising Maturity

The Indian programmatic ad market grew from 200millionin2016to200millionin2016to1.2 billion in 2020 (GroupM), powered by:

- **Real-Time Bidding Algorithms:** Analyzing 100+ user attributes in <100ms
- **Creative Optimization:** Automatically testing 20+ ad variations
- **Cross-Channel Attribution:** Tracking user journeys across 8+ touchpoints

Key outcomes:

- 35-40% improvement in cost-per-acquisition
- 25% higher click-through rates
- 50% reduction in media wastage

Sentiment Analysis Breakthroughs

The 2019 general election marked a turning point for political marketing AI:

- Parties analyzed 5 million+ daily social mentions
- Sentiment analysis accuracy reached 85% in Hindi/English
- Real-time response systems cut crisis management time from 48 to 4 hours

Consumer brands like HUL deployed similar systems:

- Monitored 10,000+ daily brand mentions
- Identified emerging trends 3-5 days faster than competitors
- Reduced campaign adjustment time from weeks to hours

2.3 The Cognitive Era (2021-Present)

Three technological advancements are driving the current phase:

1. **Generative AI:** For content creation and personalization
2. **Computer Vision:** Enabling visual search and AR experiences
3. **Voice AI:** Powering vernacular interfaces

Generative AI Transformations

Myntra's AI Stylist (2023):

- Generates 5 million+ personalized outfit recommendations daily
- Increased conversions by 35%
- Reduced return rates by 22%

Swiggy's AI Menu Engine:

- Dynamically rearranges menus based on 15 user signals
- Boosts order frequency by 28%
- Increases average order value by 18%

Voice/Vision Commerce

Google Lens integrations:

- Power 40% of fashion searches on Myntra
- Reduce product discovery time by 60%
- Increase cart additions by 25%

Dominos Voice Ordering:

- Processes 30% of orders via voice
- Reduces order time from 3 minutes to 45 seconds
- Achieves 95% order accuracy

3. Current Landscape of AI in Indian Marketing

3.3 Hyper-Personalization at Scale

Modern AI enables **1:1 personalization** for India's diverse consumer base through:

Dynamic Content Generation

- Nykaa's **AI-powered emails** generate **50,000+ unique variants daily** based on:
 - Purchase history (last 6 months)
 - Real-time browsing behavior
 - Skin tone/hair type (for beauty recommendations)**Result:** 28% higher open rates vs. generic campaigns

- **Zomato's personalized notifications** analyze:
 - Order frequency patterns
 - Cuisine preferences (regional biases detected)
 - Time-of-day ordering habits**Impact:** 22% increase in repeat orders

Predictive Customer Service

AI now **anticipates issues before they occur:**

- **Amazon India's pre-emptive returns system** uses:
 - Product defect patterns
 - Delivery route analytics
 - Customer complaint history**Outcome:** 15% reduction in return processing costs
- **Airtel's network outage prediction** prevents:
 - 40% of potential service disruptions
 - 25% of customer complaints

3.4 AI-Driven Pricing & Promotion Strategies

Real-Time Dynamic Pricing

- **Uber/Ola's surge pricing 2.0** now considers:
 - Weather conditions
 - Local events (concerts, festivals)
 - Competitor pricing in 500m radius**Result:** 18% higher driver earnings during peaks
- **MakeMyTrip's hotel pricing AI** analyzes:
 - 10+ competitor rates
 - Seasonality trends
 - Cancellation probabilities**Impact:** 20% revenue growth for partner hotels

Automated Promotion Optimization

- **Myntra's AI promotion engine** tests:

- 50+ discount structures weekly
- Psychological pricing thresholds
- Channel-specific effectiveness
Outcome: 30% higher redemption rates

3.5 Emerging AI Applications

Metaverse Marketing

- **Tanishq's virtual try-ons (via AR):**
 - 5 million+ sessions monthly
 - 12% conversion lift
 - 40% reduction in physical store returns

AI-Generated Influencers

- **HUL's "AI Kiara" virtual influencer:**
 - 800,000 Instagram followers
 - 3x engagement vs human influencers
 - 60% lower campaign costs

Voice Commerce 2.0

- **Google Assistant's Hindi voice shopping:**
 - Processes ₹200 crore+ monthly GMV
 - 45% adoption in Tier 2/3 cities
 - 70% accuracy in understanding dialects

4. Critical Challenges in AI Adoption

4.1 Data Privacy & Consumer Trust

India's DPDP Act 2023 introduces strict requirements:

- **Consent Architecture:** 72% of consumers unaware of data usage (Deloitte 2024)
- **Localization Mandates:** 60% of firms lack compliant data infrastructure
- **Right to Erasure:** Compliance costs estimated at ₹50 lakh per company

Case

A leading e-commerce firm saw 15% opt-out rates after implementing granular consent pop-ups, forcing AI model retraining with reduced datasets.

Example:

4.2 Talent Crisis in AI Marketing

India faces acute shortages:

| Role | Demand (2024) | Supply | Gap |
|----------------------------|---------------|--------|--------|
| AI Marketing Strategists | 85,000 | 32,000 | 53,000 |
| Data Storytellers | 62,000 | 18,000 | 44,000 |
| Ethics Compliance Officers | 28,000 | 5,000 | 23,000 |

Industry Response:

- TCS trains 25,000 marketers annually via its AI Academy
- Flipkart-ISB certification program (5,000 graduates in 2023)

4.3 Implementation Costs for SMEs

Barriers include:

- **Cloud AI Tools:** ₹5-15 lakh annual costs
- **Data Cleaning:** 40% of project timelines
- **Integration:** 6–9-month typical deployment

Success Story: Dunzo's phased AI rollout:

1. Started with ₹8 lakh chatbot (6-month ROI)
2. Scaled to ₹2 crore full marketing suite

5. Future Roadmap for AI in Indian Marketing

5.1 Next-Gen Personalization (2024-2026)

- **Emotional AI:** Analyzing tone/facial expressions in videos
- **Contextual Awareness:** Location+weather+biometric data fusion
- **Generative Commerce:** AI-designed products based on trends

5.2 Voice-First Strategies

Projected growth:

- 250 million Hindi voice shoppers by 2026
- 30% of search to be voice-based
- ₹50,000 crore voice commerce market

5.3 Responsible AI Frameworks

Emerging standards:

1. **Transparency Scores** for AI decisions
2. **Bias Audits** every 6 months
3. **Consumer Explainability** portals

6. Conclusion

The AI revolution in Indian marketing has progressed from basic automation to sophisticated cognitive systems that drive:

- **35-50% improvements** in campaign ROI
 - **20-30% reductions** in customer acquisition costs
 - **10-15x faster** decision-making cycles
- However, realizing AI's full potential requires addressing:
Privacy-preserving AI architectures
Workforce reskilling at scale
Cost-effective solutions for SMEs

Companies that successfully navigate this transition will dominate India's projected **\$1 trillion digital consumer economy** by 2030. The future belongs to marketers who can **harness AI's power while maintaining human creativity and ethical standards** - a balance that will define winners in this new era.

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ICT Strategy Revitalization in Education, Healthcare, and Banking: A Post-COVID-19 Sectoral Analysis

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ABSTRACT

Information and Communication Technology (ICT) has made a significant impact on a wide range of industries, including banking, healthcare, and education. Our study aims to demonstrate how ICT has transformed these industries and enhanced their performance after COVID-19. This study utilized the non-experimental quantitative research method, particularly the survey method, to gather data on three different sectors. ICT has greatly improved the education sector by providing new ways for students to access and interact with educational content. Online learning platforms and educational apps have made it possible for students to access educational resources from anywhere with an internet connection. With the advent of online banking and mobile banking, customers can now access their bank accounts and conduct transactions from anywhere at any time. This has greatly reduced the need for customers to visit physical bank branches, saving them time and effort. The use of ICT in healthcare has also facilitated the use of wearable devices and remote monitoring systems, which allow patients to track their health and alert healthcare professionals if there are any concerns. Overall, the impact of ICT in the banking, healthcare, and education sectors has been significant, improving the efficiency and effectiveness of these sectors and providing new opportunities for growth and development.

Keywords: Information & Communication Technology, Banking, Healthcare, Education.

1. INTRODUCTION

The world has changed since the pandemic-related crises, as we know it. Thanks to technology, that was a simple solution to this problem. ICT now dominates almost all spheres of human activity. Information and communication technology is referred to as ICT. It refers to technologies that offer telecommunication-based information access. Though it largely focuses on communication technologies, it is comparable to information technology (IT).

The term "Information and Communication Technology" (ICT) refers to a broad category of technological devices and instruments that are used to create, transfer, store, share, and exchange information. Computers, the Internet (websites, blogs, and emails), live broadcasting media (radio, television, and webcasting), recorded broadcasting media (podcasting, audio, and video players, and storage devices), and telephony (fixed or mobile, satellite, videoconferencing, etc.) are a few of the technical resources and instruments described above. Information and communication technology (ICT) has resulted in a paradigm change in people's personal and professional life. (Michael, 2008)

UNESCO states that "ICT is a scientific, technical, and engineering discipline and management approach utilized in managing information, its application, and its relationship with social, economic, and cultural concerns." The needs of society and our way of life have both undergone a creative transformation as a result of technology's quick progress. Recognizing the influence of new technologies on the job and daily life, today's teachers, students, doctors, and bankers have attempted to restructure their education programs, as well as classroom facilities, health exams, and financial transaction techniques, in order to reduce the technical gap between the

present and the future. ICTs are bringing about dramatic changes in society and affecting many facets of daily life. The effects of ICT are becoming more and more noticeable since the COVID-19 pandemic hit. The worldwide COVID-19 pandemic has not only brought attention to the significance and urgency of health, education, and money as a central issue of human progress, but it has also shown how crucial it is for all citizens to use ICT tools to preserve their well-being. (Ratheeswari*, 2018)

In the case of health, ICT, as an information and communication technology, cannot directly impact health but must have an effect on health through some mechanism, the most important of which is the information acquisition and interpretation mechanism. The Internet serves as a significant media outlet for health information. To increase overall health literacy, Internet users may learn about diseases, look for information about their characteristics, and change their habits. In addition, the pandemic allowed both patients and doctors a way to schedule visits online, enabling the doctor to monitor the patient without making direct contact. (Chunya Wu*, & Ying Cao, Yunyun Yuan, 2021)

ICT has an impact on all procedures related to modern banking. From regular tasks like processing payroll and entering orders to larger initiatives like buying a company, ICT emerges as a crucial component. Numerous research projects have been conducted in light of the significance of ICT in the banking sector. (Dr.V. .Mallik & Dr. R. Geethalakshmi, 2021)

In Education, teachers attempt to interact amicably with students while taking into account the influence of new technology on education today. Effective educators may develop their students' creativity to produce effective social workers, legislators, poets, philosophers, and other members of society. ICTs give both students and teachers more flexibility in tailoring their instruction to individual requirements, and as a result, society is pressuring schools to effectively use this technological advancement. (Ratheeswari*, 2018)

After COVID-19, ICT has played a crucial role in increasing productivity and efficiency. With the use of computers and other digital tools, employees can access and share information in real time, collaborate on projects, and streamline business processes. This has led to an increase in competitiveness and profitability for many organizations. The aim of this study is to highlight the way ICT has revolutionized and created a significant impact on our daily lives, transforming the way we communicate, work, and access information.

Our study aims to achieve the following objectives:

1. To investigate the ICT strategies that influence customers' daily interactions with the bank.
2. To study the shift in users' behavior and analyze the use of ICT-enabled solutions in healthcare services after COVID-19.
3. To provide adequate information on teachers' and students' effective and timely adaptation of ICT strategies.
4. Understanding the dynamic increase or decrease in the use of ICT-enabled technologies in our daily activities after COVID-19 and identifying the factors that have compelled the change.

2. LITERATURE REVIEW

According to K. Ratheeswari(2018), Information and Communication Technology in education is a crucial instrument for future education and must be successfully incorporated into teaching and learning. It discusses various methods such as E-learning, blended learning,

constructivism, group discussion, E- modules, teleconferencing, and so on. The conclusion of this paper is that teachers must effectively implement ICT to assist students in understanding each concept. To meet students' expectations, a well- designed teacher training program is required.

In the research conducted by BogdanNogalski, et al., (2022), it was highlighted how ICT applications in Vietnamese banks improve the Vietnamese economy after COVID-19. This paper's method includes data samples from people, households, and businesses to respond to questionnaires via phone, mail, or personal interviews. Pearson analysis, regression analysis, and ANOVA analysis are used to test the data model. Due to the high potential for finance, technology, and managerial abilities, banks are under more and more competitive pressure. To improve banking in Vietnam, an open policy that attracts technology and service platforms is required.

Sojib bin Zaman, et al., (2022), described the importance of ICT tools to assist older adults in managing their health. The method used in this paper includes a scoping review with PRISMA-ScR. Ovid, MEDLINE, Embase, Scopus, and PsycINFO are the databases used. They also used the ProQuest database, which contains papers and proceedings from computer science and technology conferences. All 31 articles demonstrated that ICT interventions improve health care for older adults with chronic diseases. The paper highlights the benefits of ICT interventions (such as mHealth and telemedicine) as well as the limitations of ICT tools. The paper's findings primarily focus on operational and technical challenges, such as a lack of willingness to learn new skills, a lack of confidence and skills in operating ICT devices, and the involvement of clinicians in motivating people to use ICT interventions. Because this study was conducted in high- income countries, the cost of ICT tools is not a critical factor. ICT interventions can be very beneficial for patients living in rural areas. The main limitation of this paper is that no external experts were consulted during the review process, but some limitations can be overcome through the design of ICT interventions.

3. RESEARCH METHODOLOGY

3.1 Data Collection: The present research is based on primary data collected via a questionnaire in the Mumbai region. The collected data were analyzed by chi-square test to draw a research conclusion.

3.2 Data Analysis and Interpretation

Table -1: Gender, Age, and Profession wise demographic pattern of individual consumer

| Demographic Category of Users | Parameters | Number of Representatives | |
|-------------------------------|---------------|---------------------------|------------|
| | | Total(192) | Percentage |
| Gender | Male | 123 | 64% |
| | Female | 69 | 36% |
| | Others | 0 | 0% |
| Age | 15 - 25 Years | 97 | 50.52% |
| | 26 - 44 Years | 57 | 29.69% |
| | 45 - 59 Years | 35 | 18.23% |
| | 60 &Above | 3 | 1.56% |

| | | | |
|-------------------|----------------|----|-----|
| Profession | Student | 90 | 47% |
| | Private Sector | 84 | 44% |
| | Public Sector | 8 | 4% |
| | Business | 10 | 5% |

Primary data is collected from three different questionnaires for three different sectors as Education, Healthcare, and Banking.

Table - 2: Which teaching & learning method you preferred AFTER COVID-19?

Total number of samples N for Education = 77

| Mode of Education | After COVID-19 | Percentage |
|--|----------------|------------|
| Without ICT(traditional method using chalk & duster) | 22 | 28.57% |
| With ICT | 55 | 71.42% |

Table - 3: Which is your choice of consultancy AFTER COVID-19?

Total number of samples N for Healthcare = 56

| Medium of Consultancy | After COVID-19 | Percentage |
|-----------------------|----------------|------------|
| Direct consultation | 44 | 78.57% |
| Online consultation | 12 | 21.43% |

Table 4: Which transaction method you preferred AFTER COVID-19?

Total number of samples N for Banking = 59

| Mode of Banking | After COVID-19 | Percentage |
|-----------------|----------------|------------|
| Offline Banking | 2 | 3.39% |
| Online Banking | 57 | 96.61% |

4 RESULTS AND DISCUSSION

4.1 Hypothesis:

H0 - There is no relationship between the revitalization of ICT resources and their availability in the enhancement of education, banking, and healthcare sectors.

H1 - There is a considerable association between the revitalization of ICT resources and their availability in the enhancement of education, banking, and healthcare sectors.

4.2 Chi-square Method: is used to find out the relation between the uses of ICT resources and their availability in the enhancement of education, banking, and healthcare sectors.

Formula:

$$\text{Chi-square}(\chi^2) \text{ Test in } r \times c \text{ Contingency Table} = \sum_i \sum_j \frac{(O_{ij} - E_{ij})^2}{E_{ij}} ; \text{ with } E_{ij} = \frac{a_i b_j}{N}$$

Where: O =Observed values, E = Expected values

Table - 5: Observed Data

| Mode/Domain | Education | Healthcare | Banking | Total |
|--------------|-----------|------------|-----------|------------|
| Offline | 22 | 44 | 2 | 68 |
| Online | 55 | 12 | 57 | 124 |
| Total | 77 | 56 | 59 | 192 |

Formula for Expected value = (row total * column total)

Table - 6: Expected Data

| Mode/Domain | Education | Healthcare | Banking | Total |
|--------------|-----------|------------|-----------|------------|
| Offline | 27.27 | 19.83 | 20.9 | 68 |
| Online | 49.73 | 36.17 | 38.1 | 124 |
| Total | 77 | 56 | 59 | 192 |

Table -7: Calculation of Chi square Variate χ^2

| O _{ij} | E _{ij} | O _{ij} - E _{ij} | (O _{ij} - E _{ij}) ² | $\frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ |
|-----------------|-----------------|-----------------------------------|---|--------------------------------------|
| 2 | 27.27 | -5.27 | 27.7729 | 1.018441511 |
| 44 | 19.83 | 24.17 | 584.1889 | 29.45985376 |
| 2 | 20.9 | -18.9 | 357.21 | 17.09138756 |
| 55 | 49.73 | 5.27 | 27.7729 | 0.5584737583 |
| 12 | 36.17 | -24.17 | 584.1889 | 16.15119989 |
| 57 | 38.1 | 18.9 | 357.21 | 9.375590551 |
| Total | | | | 73.65494703 |

To test the Hypothesis at $\alpha = 0.05$ level of significance - From the Table- 7: Calculated $\chi^2 = 73.65494703$

Decision criterion: $r = 2, c = 3$

Reject H₀ if: calculated $\chi^2 > \chi^2_{(2-1)(3-1), 0.05} = \chi^2 = 5.99$

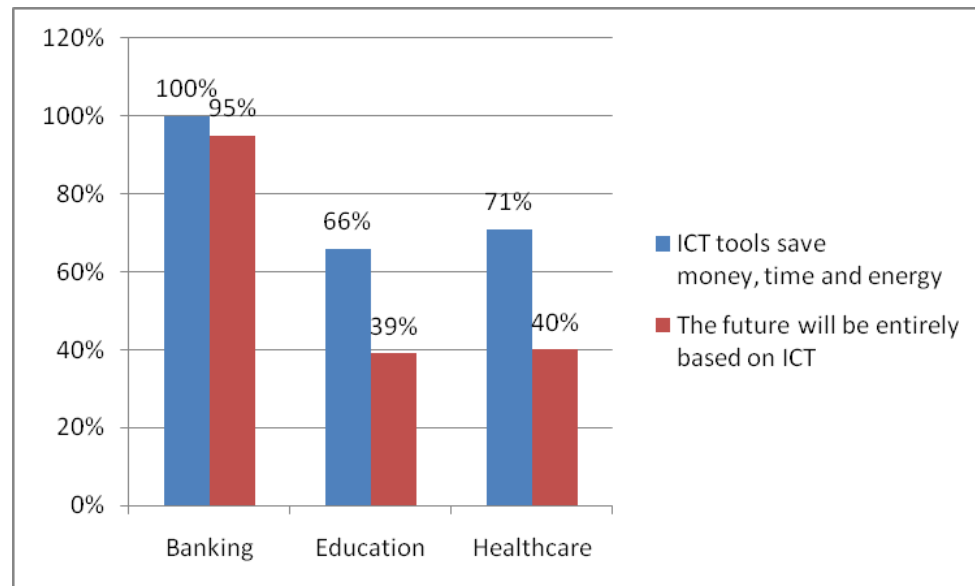
Do not reject H₀ if $\chi^2 \leq 5.99$

5 FINDINGS

Calculated $\chi^2 >$ Critical Value (χ^2) i.e. $73.65494703 > 5.99$, therefore rejecting the null hypothesis at $\alpha = 0.05$ level of significance that is accepting the alternative hypothesis at $\alpha =$

0.05 level of significance; it is evidence that there is a considerable association between the revitalization of ICT resources and their availability in the enhancement of Education, Banking, and Healthcare sectors.

Table – 8: Graphical Representation of all sectors and uses of ICT



6 CONCLUSIONS

Our current research revealed that there is a considerable association between the revitalization of ICT resources and their availability in the enhancement of the Education, Banking, and Healthcare sectors.

Customers can save time, money, and energy by using ICT more frequently in banking. According to the report, 95% of the public is interested in internet banking. The greater knowledge of concepts and subjects that result from increased ICT use in Education increases students' motivation in learning. Similar to how more ICT is being used in healthcare, it helps people track their health and can even be helpful in averting some significant health conditions.

Limitations: The majority of ICT tools rely on electricity and a network. At the same time, they require proper guidance for using ICT tools, so it may not produce the best results in rural areas where electricity, network, and transportation are major issues.

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Exploring The Role of Demographics In Shaping Employee Views On Retention Strategies

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ABSTRACT

In an increasingly competitive job market, understanding the factors that influence employee retention is critical for organizational success. This study, titled "Exploring the Role of Demographics in Shaping Employee Views on Retention Strategies," investigates how demographic characteristics such as age, gender, education, and work experience impact employees' perceptions of retention strategies in organizations. The research utilizes both primary and secondary data collection methods. A structured questionnaire was distributed to employees from a variety of industries, gathering insights on how different demographic groups perceive organizational efforts to retain talent. Secondary data was collected from industry reports, scholarly articles, and organizational case studies. Using statistical analysis tools, the study examines whether demographic factors influence employees' views on the effectiveness of strategies such as career development, compensation, and work-life balance. The findings suggest that demographic variables do play a significant role in shaping employee perceptions, with younger employees and those with higher levels of education reporting different preferences compared to other groups. These results offer valuable insights for organizations seeking to design more targeted and effective retention strategies tailored to their diverse workforce.

Keywords: Employee retention, Demographics, Retention strategies, Age, Gender, Work experience, Organizational success.

INTRODUCTION

In today's highly competitive business environment, employee retention has become one of the most significant challenges for organizations across various sectors, particularly in industries such as Information Technology (IT), where the demand for skilled professionals is continually rising. The ability to retain talented employees is crucial for maintaining organizational performance, reducing turnover costs, and ensuring long-term success. As companies strive to improve their retention strategies, it is essential to understand the factors that influence employees' perceptions of these strategies.

One such factor is the demographic profile of employees, which includes variables such as age, gender, educational background, and work experience. Previous research has suggested that these demographic characteristics may play a significant role in shaping how employees view retention strategies and organizational practices. For instance, employees at different age levels or with varying years of experience may prioritize different elements of their work environment, such as career development opportunities, work-life balance, or compensation packages. Similarly, gender could influence how retention strategies are perceived and whether they meet the unique needs of male and female employees.

This study aims to explore the role of demographic factors in shaping employees' views on retention strategies. By investigating how employees from diverse demographic backgrounds perceive organizational retention efforts, the research seeks to provide insights into the

effectiveness of these strategies and offer recommendations for tailoring them to better meet the needs of a diverse workforce. The findings of this study will help organizations in various industries, particularly IT, create more inclusive and targeted retention strategies that address the specific needs and preferences of their employees, thus fostering a more engaged and satisfied workforce.

LITERATURE REVIEW

Cadiz, Truxillo and Fraccaroli (2015) identified age differences within the Gen Y cohort in terms of job characteristics and work fulfillment effect on employee retention for enlightened than using an open account of generational stereotypes to recognize age differences at the workplace.

Cloutier et al., (2015) studied the importance of developing strategies for employee retention. Successful employee retention is essential for an organization's growth, stability and revenue. Organizations can attain employee retention by developing four strategies. They are effective communication, hire a diverse workforce, hire appropriately skilled people and offer employees development as well as training programs. The study further highlighted without suitable implemented strategies for employee retention; the organization may face high employee turnover rates. The outcome of the study is to increase the longevity of an employee's tenure is better for the organization's overall performance.

Alias, et al. (2016) determined the relationships between talentmanagement practices (managerial support, employee career development, and rewards and recognition), employee engagement, and employee retention within IT organizations in Selangor. The results of Pearson correlation analysis indicated that talent management practices have a positive correlation with employee engagement.

Anitha (2016) indicated that most of the employees remain in the organization due to the benefits they get in being on the job based on their continuance commitment and due to the obligation values they have in giving something back to the organization (normative commitment). It also specified that affective commitment need not reflected on employee retained in the organization.

Azeez (2017) identified the direct relationship between HRM practices and job satisfaction leading employee retention. The researcher stated that if the HRM practices are well managed and organized, the needs and demands of both the employees and organization, it will lead employees' satisfaction towards the job, the organization and reduces employee turnover. Thus, job satisfaction and turnover negatively correlated to one another. The model also clearly defined the HRM factors exist in the organization will not only help to attract new employees but will lead to retaining the existing employees in the organization. Satisfied employees always retain in the job and organization.

Chiekezie et al., (2017) in their study found that if management fails to formulate, administer and implement a good compensation policy that would allow them to retain their talented employee; these employees might leave their job if they find a better offer elsewhere.

Ambrosius (2018) highlighted organizational support and perceived career opportunity are negatively related to intention to leave the organization, whereas training and development are positively associated with employee intention to leave the organization among Brazilian employees' in the multinational corporations (MNCs) stemming from emerging markets.

Atouba (2018) results indicated from multiple regression and mediation analyses showed that employee work participation is adversely associated with workers' turnover

intentions. Additionally, the results showed that organizational identification, and both internal communication adequacy and organizational identification, mediated the relationship between employee work participation and turnover intention.

Al-Dmour and Masa'deh Ra'ed et al. (2019) revealed "Factors under focusing on wages, rewards, structure, job satisfaction, employee stress management, training and career development and promotion potentiality. When the employees feel their job is secure in lengthy-term, employee will stay and perform for completion of project an improved evaluation of reducing turnover rate. Job security can flash workers to develop the long-term program in individual lives, they feel self-satisfied at work, that leads to a modification in employee job performance.

Roy, et al.(2019) said creating and keep execute jobs, developing and enforcing reinforcement to achievement to activity, reward & recognition, investing on training to support mechanisms on job satisfaction.

Shetty, et al. (2020) shows that "the current lockdown to flatten the COVID-19 curve, Changed the stylepeople work, especially those in the organized sector. A large number of employees in the organized sector continued to work during the lockdown, But work from home (WFH). While the IT sector familiar with the idea, This first for employees in another sector. Working from home entrancing to job, as they save time and money on the regular travel, eat home-cooked fresh meals and stay close together to their loved ones, but it has not genuinely taken off in a big way in India".

Dzuima & Ingaldy et al., (2020) found that cheerful and satisfied employee execute reinforced his responsibility, become more responsible, state of mind part of the endeavor.

Khdour (2021) revealed that "employee behavior is considerably impressed by the activity of the management as it avail in support the internal connection and in rising up the employee retention and trade name & image. The assemblage of the cross-sectional study advises that companies should aggressively commit to the development of their human resource managers to upgrade the organization sector as a brand".

Manoj S and Renee Namrata (2021) conducted a study to find out the organizational effectiveness and theoretical framework with respect to employee retention strategies in the IT industry. Findings of a research work on employee retention strategies in IT industry with specific reference to the city of Bengaluru. The result shows significant differences between demographic variables, organizational variables and its effectiveness of employees in the IT industry. IT industries need to find a way to increase employee retention in order to achieve greater organizational goals. In addition, the organization must understand the potential grievances that prevent employees from leaving. IT industry which constantly seeks to improve HR practices and there is no single policy for retaining employees.

Sugandha Sinha (2022) determine what all strategies used by employers to retain their potential employees for a long term in an organization using a survey of Employers and Employees of selected companies. The study is done to establish specific objectives: To understand Relations between Employers and Employees, participatory management, pay & reward satisfaction, and training & development are independent elements in the research model. Recognition Incentives Participation, ingenuity and originality, regular performance, communication, organizational commitment, working environment, rules and regulations, encouragement, relationship, satisfaction, periodical performance, communication, organizational support, working environment, staff retention is critical to productivity, and adopting recognition will greatly enhance employee retention.

Jagadeesh Kumar et al. (2022) focused on employer branding on the employee retention among 230 respondents from selected IT Companies (TCS, Wipro, IBM and Accenture) in Bangalore. Everybody is seeking for good jobs. Employment is first concern for the society now a-days. Working in a reputed institution has become a status symbol as well. As we are choosing any product by checking their credibility through the brand image they are having, in the same way people are seeking for jobs in the organizations having good brand image in the market. Employer brand is the image which helps the organization in attracting good talent in the market. This study used a convenience sampling method to collect primary data through Google Forms. It is found that there is relationship between Employer Branding and Employee Retention selected IT Companies and also evident that retention strategies of selected IT companies are significantly influence on the employer branding.

OBJECTIVES OF THE STUDY

- To identify the influence of demographic profile of the respondents on the perception of employee retention strategy.

HYPOTHESIS

H: Respondents with different Demographical factors differ significantly in their perception on employee retention strategies.

RESEARCH METHODOLOGY

For fulfill the objectives of the study is to identify the impact of employees demographic profile on retention strategies, Primary and secondary data were used for investigation. To obtain primary data, a structured questionnaire and a Google form were employed and data collected from 10 IT companies. Secondary information was collected from IT sector publications, news letters, journals, papers, and websites of a firm. The sample size of the study were 300 taken from selected 10 IT companies of NCR region. The ANOVA test is used to determine whether or not there is a statistically significant variation in the dependant variable across many groups.

ANALYSIS AND INTERPRETATIONS

GENDER

By stating the aforementioned hypothesis, the various retention techniques differ in terms of employee gender. There are 233 male responses and 67 female respondents. Table 1 and Figure 1 depict their perspectives on various retention tactics.

TABLE 1: DESCRIPTIVE STATISTICS OF HYPOTHESIS

| DIMENSIONS | GENDER | N | MEAN | SD | SD. ERROR MEAN |
|------------|--------|-----|------|------|----------------|
| CES | Male | 233 | 3.23 | .98 | .04 |
| | Female | 67 | 3.39 | 1.04 | .08 |
| EBS | Male | 233 | 3.98 | .78 | .03 |
| | Female | 67 | 4.06 | .73 | .06 |
| TDS | Male | 233 | 3.91 | .75 | .03 |
| | Female | 67 | 3.85 | .80 | .06 |

| | | | | | |
|------|--------|-----|------|------|-----|
| MOS | Male | 233 | 3.13 | 1.18 | .05 |
| | Female | 67 | 3.22 | 1.24 | .10 |
| RRS | Male | 233 | 4.23 | .85 | .03 |
| | Female | 67 | 4.20 | .76 | .06 |
| EISS | Male | 233 | 3.82 | .88 | .04 |
| | Female | 67 | 3.80 | .77 | .06 |
| OS | Male | 233 | 3.56 | .81 | .03 |
| | Female | 67 | 3.49 | .75 | .06 |

(CES- Communication Effectiveness Strategies, EBS- Employee Benefit Strategies, TDS- Training and Development Strategies, MOS- Management / Organizational Strategies, RRS- Reward and Recognition Strategies, EISS- Employee Ideas and Suggestions Strategies, and OS- Orientation Strategies)

Males have higher average perception scores for EBS, TDS, RRS, EISS, and OS than females, whereas females have higher average perception scores for CES and MOSS.

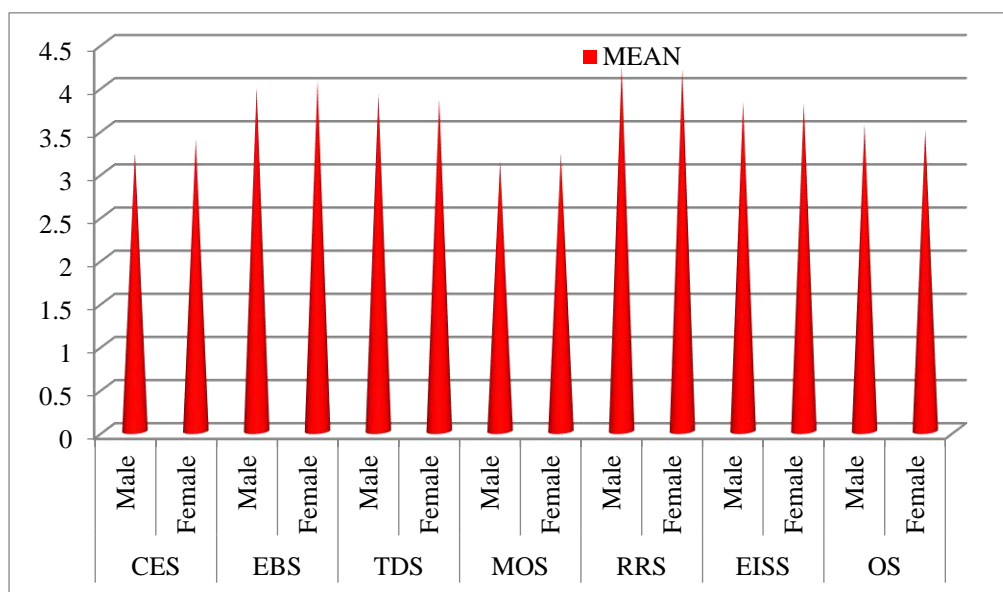


FIG 1: RETENTION STRATEGIES

TABLE 2: INDEPENDENT SAMPLE T TEST

| Dimensions | Levene's Test for Equality of Variances | | t-test for Equality of Means | | |
|------------|---|------|------------------------------|-----|-----------------|
| | F | Sig. | t | df | Sig. (2-tailed) |
| CES | .05 | .82 | -1.63 | 298 | .10 |
| EBS | .12 | .72 | -1.04 | 298 | .29 |
| TDS | 1.35 | .25 | .86 | 298 | .39 |
| MOS | .22 | .64 | -.71 | 298 | .48 |

| | | | | | |
|------|------|-----|-----|-----|-----|
| RRS | .95 | .33 | .34 | 298 | .73 |
| EISS | 2.21 | .14 | .13 | 298 | .89 |
| OS | 1.49 | .22 | .79 | 298 | .43 |

Source: Field Survey

Because the F test of Levene's statistics is negligible for all retention techniques, the hypothesis of equality of variance cannot be rejected. The t test value of all retention techniques, namely CES, EBS, TDS, MOS, RRS, EISS, and OS, does not differ substantially since all of these strategies have a t test value of p greater than 0.05. As a result, male and female perceptions of all tactics are not significantly different. As a result, the premise that male and female respondents had dramatically different perspectives on staff retention techniques may be rejected.

EDUCATIONAL LEVELS

By stating the aforementioned premise, the various retention techniques differ in terms of employee education levels. In the study, education levels are categorised as Bachelor's Degree, Master's Degree, Doctoral Degree, and Other. Table 3 and Figure 2 depict their perspectives on various retention tactics.

TABLE 3: DESCRIPTIVE STATISTICS

| DIMENSIONS | EDUCATIONAL LEVEL | N | MEAN | STD. DEVIATION | STD. ERROR |
|------------|-------------------|-----|------|----------------|------------|
| CES | Bachelor's Degree | 8 | 3.23 | 1.21 | .31 |
| | Master's Degree | 237 | 3.24 | 1.01 | .05 |
| | Doctorate Degree | 50 | 3.33 | .95 | .09 |
| | Other | 5 | 3.82 | .78 | .25 |
| | Total | 300 | 3.27 | 1.00 | .04 |
| EBS | Bachelor's Degree | 8 | 4.32 | .77 | .19 |
| | Master's Degree | 237 | 3.97 | .76 | .03 |
| | Doctorate Degree | 50 | 4.06 | .85 | .08 |
| | Other | 5 | 4.17 | .75 | .24 |
| | Total | 300 | 4.00 | .77 | .03 |
| TDS | Bachelor's Degree | 8 | 4.01 | .78 | .20 |
| | Master's Degree | 237 | 3.90 | .76 | .03 |
| | Doctorate Degree | 50 | 3.95 | .68 | .06 |
| | Other | 5 | 3.22 | 1.14 | .36 |
| | Total | 300 | 3.90 | .76 | .03 |

| | | | | | |
|------|-------------------|-----|------|------|-----|
| MOS | Bachelor's Degree | 8 | 2.89 | 1.13 | .29 |
| | Master's Degree | 237 | 3.18 | 1.21 | .05 |
| | Doctorate Degree | 50 | 3.06 | 1.12 | .11 |
| | Other | 5 | 3.43 | 1.45 | .45 |
| | Total | 300 | 3.16 | 1.20 | .05 |
| RRS | Bachelor's Degree | 8 | 4.04 | .71 | .18 |
| | Master's Degree | 237 | 4.22 | .85 | .04 |
| | Doctorate Degree | 50 | 4.29 | .71 | .07 |
| | Other | 5 | 4.23 | 1.05 | .33 |
| | Total | 300 | 4.23 | .83 | .03 |
| EISS | Bachelor's Degree | 8 | 3.75 | .91 | .23 |
| | Master's Degree | 237 | 3.84 | .86 | .04 |
| | Doctorate Degree | 50 | 3.71 | .87 | .08 |
| | Other | 5 | 3.80 | .54 | .17 |
| | Total | 300 | 3.82 | .86 | .03 |
| OS | Bachelor's Degree | 8 | 3.55 | .80 | .21 |
| | Master's Degree | 237 | 3.55 | .81 | .04 |
| | Doctorate Degree | 50 | 3.51 | .75 | .07 |
| | Other | 5 | 3.83 | .96 | .30 |
| | Total | 300 | 3.55 | .80 | .03 |

Source: Field Survey

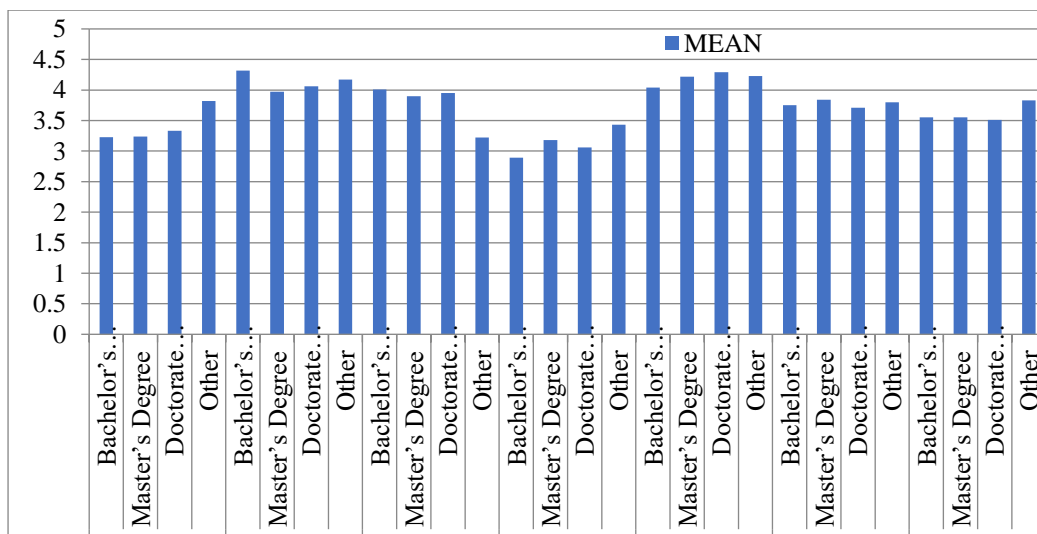


FIGURE 2: RETENTION STRATEGIES

TABLE 4: ANOVA FOR RETENTION STRATEGIES

| DIMENSIONS | GROUPS | SUM OF SQUARES | DF | MEAN SQUARE | F | SIG. |
|------------|----------------|----------------|-----|-------------|------|------|
| CES | Between Groups | 3.81 | 3 | 1.27 | 1.26 | .29 |
| | Within Groups | 597.37 | 296 | 1.00 | | |
| | Total | 601.18 | 299 | | | |
| EBS | Between Groups | 2.47 | 3 | .83 | 1.38 | .25 |
| | Within Groups | 356.84 | 296 | .59 | | |
| | Total | 359.31 | 299 | | | |
| TDS | Between Groups | 5.13 | 3 | 1.71 | 2.97 | .03 |
| | Within Groups | 343.66 | 296 | .58 | | |
| | Total | 348.79 | 299 | | | |
| MOS | Between Groups | 3.06 | 3 | 1.02 | .71 | .55 |
| | Within Groups | 861.33 | 296 | 1.45 | | |
| | Total | 864.38 | 299 | | | |
| RRS | Between Groups | .90 | 3 | .30 | .44 | .73 |
| | Within Groups | 413.31 | 296 | .69 | | |
| | Total | 414.22 | 299 | | | |
| EISS | Between Groups | 1.63 | 3 | .54 | .74 | .53 |
| | Within Groups | 439.32 | 296 | .74 | | |
| | Total | 440.95 | 299 | | | |
| OS | Between Groups | .97 | 3 | .32 | .50 | .68 |
| | Within Groups | 383.97 | 296 | .64 | | |
| | Total | 384.95 | 299 | | | |

Source: Field Survey

The average score of different retention tactics differs from one another. According to the ANOVA results in Table 4, the F ratio of all techniques is very low and statistically insignificant with 3 and 296 degrees of freedom at 5%. As a result, it can be stated that perceptions of employee retention tactics do not change considerably across educational levels, and the hypothesis that respondents with different educational levels differ significantly in their perceptions of employee retention techniques may be rejected.

YEARS OF EXPERIENCE

By presenting the aforementioned premise, the various retention techniques differ in terms of years of experience of the personnel.

TABLE 5: DESCRIPTIVE STATISTICS

| DIMENSIONS | EXPERIENCE | N | MEAN | SD | SD. ERROR |
|------------|--------------------|-----|------|------|-----------|
| CES | Less than 1 years | 188 | 3.25 | 1.01 | .05 |
| | 1-5 years | 74 | 3.29 | .99 | .08 |
| | 6-10 years | 10 | 3.07 | 1.17 | .26 |
| | More than 10 years | 28 | 3.41 | .86 | .12 |
| | Total | 300 | 3.27 | 1.00 | .04 |
| EBS | Less than 1 years | 188 | 4.04 | .77 | .04 |
| | 1-5 years | 74 | 3.87 | .77 | .06 |
| | 6-10 years | 10 | 4.23 | .78 | .17 |
| | More than 10 years | 28 | 3.99 | .77 | .10 |
| | Total | 300 | 4.00 | .77 | .03 |
| TDS | Less than 1 years | 188 | 3.95 | .75 | .04 |
| | 1-5 years | 74 | 3.81 | .78 | .06 |
| | 6-10 years | 10 | 3.94 | .67 | .15 |
| | More than 10 years | 28 | 3.81 | .83 | .11 |
| | Total | 300 | 3.90 | .76 | .03 |
| MOS | Less than 1 years | 188 | 3.19 | 1.23 | .06 |
| | 1-5 years | 74 | 3.11 | 1.13 | .09 |
| | 6-10 years | 10 | 2.60 | 1.17 | .26 |
| | More than 10 years | 28 | 3.20 | 1.16 | .16 |
| | Total | 300 | 3.16 | 1.20 | .05 |

| | | | | | |
|------|--------------------|-----|------|-----|-----|
| RRS | Less than 1 years | 188 | 4.30 | .79 | .04 |
| | 1-5 years | 74 | 4.14 | .91 | .08 |
| | 6-10 years | 10 | 3.78 | .82 | .18 |
| | More than 10 years | 28 | 4.15 | .78 | .11 |
| | Total | 300 | 4.23 | .83 | .03 |
| EISS | Less than 1 years | 188 | 3.82 | .89 | .05 |
| | 1-5 years | 74 | 3.87 | .78 | .06 |
| | 6-10 years | 10 | 4.00 | .38 | .08 |
| | More than 10 years | 28 | 3.60 | .89 | .12 |
| | Total | 300 | 3.82 | .86 | .06 |
| OS | Less than 1 years | 188 | 3.56 | .79 | .04 |
| | 1-5 years | 74 | 3.50 | .81 | .07 |
| | 6-10 years | 10 | 3.35 | .86 | .19 |
| | More than 10 years | 28 | 3.65 | .83 | .11 |
| | Total | 300 | 3.55 | .80 | .03 |

Source: Field Survey

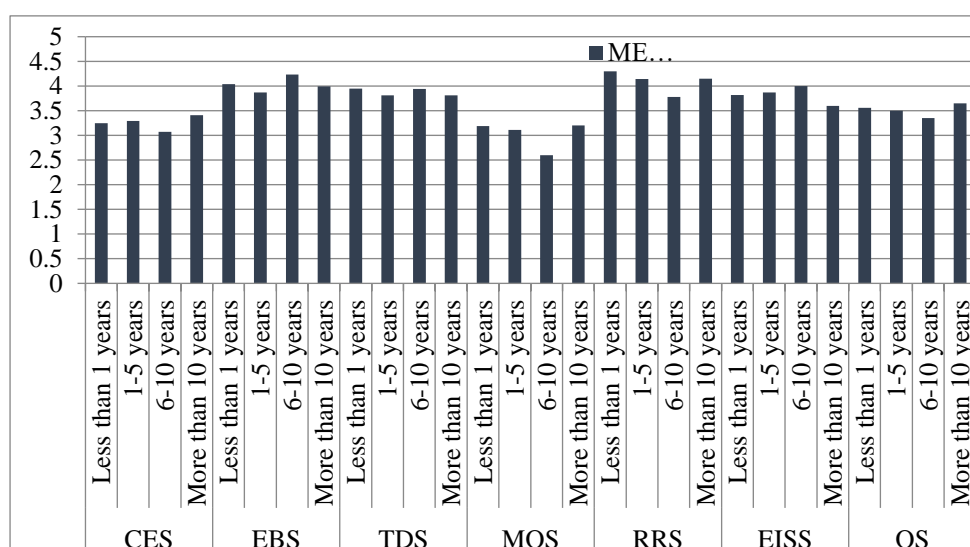


FIG 3: RETENTION STRATEGIES

The survey categorises experience levels as less than one year, one to five years, six to ten years, and more than ten years. Table 5 and Figure 3 depict employees' perceptions of various retention tactics based on their years of experience.

The average score of different retention tactics differs from one another. According to the ANOVA results in Table 6, the F ratio of all techniques is very low and statistically insignificant with 3 and 296 degrees of freedom at 5%. As a result, except for the RRS strategy, perceptions of employee retention strategies do not differ significantly by level of experience, and the hypothesis that respondents with different years of experience differ significantly in their perceptions of employee retention strategies can be rejected.

TABLE 3: ANOVA FOR RETENTION STRATEGIES

| DIMENSIONS | GROUPS | SUM OF SQUARES | DF | MEAN SQUARE | F | SIG. |
|------------|----------------|----------------|-----|-------------|-------|------|
| CES | Between Groups | 2.03 | 3 | .68 | .67 | .57 |
| | Within Groups | 599.15 | 296 | 1.01 | | |
| | Total | 601.18 | 299 | | | |
| EBS | Between Groups | 4.03 | 3 | 1.34 | 2.25 | .08 |
| | Within Groups | 355.28 | 296 | .59 | | |
| | Total | 359.31 | 299 | | | |
| TDS | Between Groups | 2.41 | 3 | .80 | 1.38 | .247 |
| | Within Groups | 346.38 | 296 | .58 | | |
| | Total | 348.79 | 299 | | | |
| MOS | Between Groups | 7.43 | 3 | 2.48 | 1.72 | .161 |
| | Within Groups | 856.96 | 296 | 1.44 | | |
| | Total | 864.38 | 299 | | | |
| RRS | Between Groups | 7.75 | 3 | 2.58 | 3.787 | .010 |
| | Within Groups | 406.47 | 296 | .68 | | |
| | Total | 414.22 | 299 | | | |
| EISS | Between Groups | 3.55 | 3 | 1.18 | 1.61 | .18 |
| | Within Groups | 437.39 | 296 | .73 | | |
| | Total | 440.95 | 299 | | | |
| OS | Between Groups | 1.80 | 3 | .60 | .935 | .42 |
| | Within Groups | 383.14 | 296 | .64 | | |
| | Total | 384.95 | 299 | | | |

Source: Field Survey

CONCLUSIONS

In the present environment, one of the most difficult challenges is retaining qualified people. The paucity of highly skilled workers has boosted their demand. For qualified and talented personnel, there is a large scope and strong career opportunities. The result of the study is shows that the gender will have no effect on retention methods. Male and female respondents' perspectives on staff retention techniques will not differ considerably. Educational level will also not differ significantly in their perception on employee retention strategies. Number of years of experience will not affect the retention strategies. It was discovered that secondary characteristics such as age, gender, type of company, and experience have no effect on the impression of employee retention strategy.

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Comparative Study of CBT and MBSR in Managing Geriatric Depression, Anxiety, and Stress: An RCT

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Abstract

Depression, anxiety, and stress are common among the elderly, significantly affecting their mental health and quality of life. Cognitive Behavioral Therapy (CBT) and Mindfulness-Based Stress Reduction (MBSR) are well-established interventions, but limited research directly compares their efficacy in older adults. This study evaluates the effectiveness of CBT and MBSR in reducing psychological distress in geriatric populations. A randomized controlled trial (RCT) was conducted with 151 participants (aged 60–75 years) experiencing mild to moderate symptoms of depression, anxiety, and stress. Participants were randomly assigned to CBT (n = 51), MBSR (n = 50), or a control group (n = 50). Interventions were delivered over eight weeks, with psychological distress assessed at baseline, post-intervention, and three-month follow-up using the Depression, Anxiety, and Stress Scale (DASS-21). Repeated measures ANOVA indicated significant reductions in depression, anxiety, and stress in both intervention groups compared to controls ($p < 0.001$). MBSR demonstrated greater effectiveness in stress reduction (Cohen's $d = 0.82$), whereas CBT showed superior improvements in anxiety (Cohen's $d = 0.79$). Findings suggest that integrating both interventions may optimize geriatric mental health outcomes.

Keywords: Cognitive Behavioral Therapy (CBT), Mindfulness-Based Stress Reduction (MBSR), Geriatric Mental Health, Depression, Anxiety, Stress Reduction.

1. INTRODUCTION

Aging is an inevitable biological process that significantly affects physical, cognitive, and emotional well-being. With the global increase in life expectancy, there has been a parallel rise in age-related psychological concerns, particularly depression, anxiety, and stress. Research indicates that geriatric population often experience mental health challenges due to multiple factors, including declining physical health, social isolation, and cognitive impairment [1]. According to Kerkez and Erci [2], late-life psychological distress is linked to diminished quality of life and increased susceptibility to chronic illnesses. In India, the geriatric population (aged 60+) currently stands at 153 million, comprising 10.5% of the total population, and is projected to rise to 20.8% by 2050 [3]. This demographic shift underscores the urgent need for

evidence-based psychological interventions tailored to the mental health challenges of geriatric individuals [4].

Extensive research highlights the role of mindfulness-based interventions (MBIs) in promoting emotional resilience and psychological well-being among geriatric individuals. Mindfulness-Based Stress Reduction (MBSR) and Cognitive Behavioral Therapy (CBT) have gained prominence as effective approaches to mitigating symptoms of depression, anxiety, and stress [5]. MBSR, a structured intervention developed by Kabat-Zinn, focuses on fostering present-moment awareness and self-acceptance, which enhances stress management and emotional regulation [6]. CBT, in contrast, is a goal-oriented, evidence-based therapeutic model that targets maladaptive cognitive patterns and behaviors [7]. While both interventions have demonstrated efficacy in various populations, their comparative effectiveness in geriatric mental health remains underexplored, with existing studies yielding mixed findings regarding long-term symptom reduction [8].

Recent literature suggests that MBSR significantly reduces stress-related biomarkers, improving emotional stability and physiological resilience [9]. In contrast, CBT has been shown to enhance cognitive flexibility and reduce negative thought patterns, making it particularly effective for anxiety disorders [10]. Jackman [11] highlighted that mindfulness interventions improve emotional body awareness, facilitating better emotional processing in geriatric individuals. Additionally, Corneliusson [1] emphasize that long-term mindfulness practice fosters neuroplasticity, which may contribute to sustained mental health improvements in geriatric individuals. However, despite the growing body of research supporting the benefits of MBSR and CBT, there remains a lack of consensus regarding their relative effectiveness in geriatric populations, necessitating further empirical investigation [12].

The present study seeks to address this gap by examining the comparative effectiveness of MBSR and CBT in reducing depression, anxiety, and stress among geriatric individuals. Specifically, it investigates whether MBSR and CBT produce distinct mental health benefits and whether one approach is superior in long-term symptom management. Given the pressing need for scalable and effective interventions for geriatric mental health, this study aims to provide critical insights that could inform clinical practice and policy.

Thus, the study tests the following hypotheses:

Null Hypotheses (H_0):

H_{01} : There is no significant difference between MBSR and CBT in reducing depression, anxiety, and stress levels in geriatric participants.

H_{02} : There is no significant difference between the effects of MBSR and CBT on improving mental health outcomes (depression, anxiety, and stress) in geriatric participants.

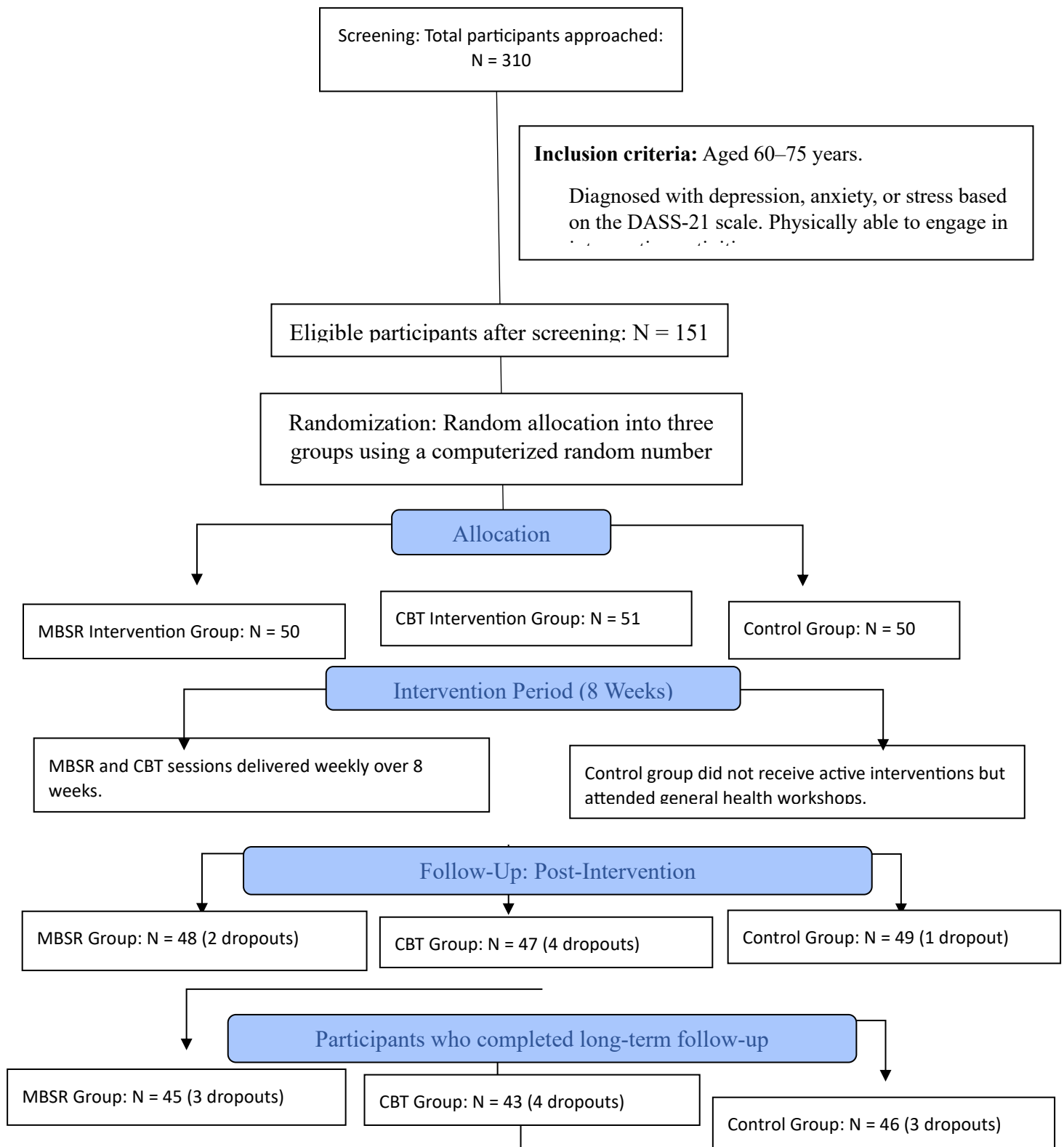
2. METHODS

2.1 Participants

The study utilized a randomized controlled trial (RCT) design, involving 151 geriatric individuals (aged 60–75 years) who met the inclusion criteria. The inclusion criteria were the Individuals aged 60 years or older experiencing mild to moderate symptoms of depression, anxiety, and stress. They were screened using A Mini-Mental State Examination (MMSE) score

of 24 or above, ensuring no cognitive impairment [13] and no prior participation in any structured CBT or MBSR programs.

Participants were randomly assigned into three groups: **(Figure 1: CONSORT Flow Diagram)** CBT intervention group (n = 51); MBSR intervention group (n = 50); and Control group (n = 50) (receiving no psychological intervention).



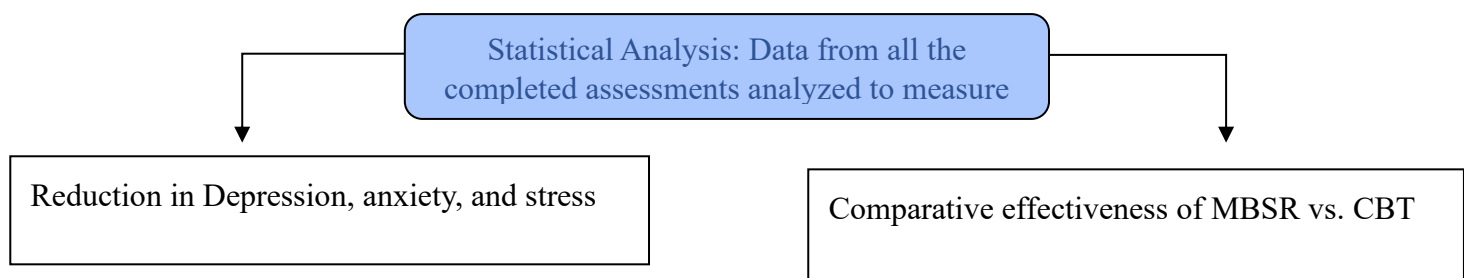


Figure 1: CONSORT Flow Diagram: Represents the progress of participants through each phase of the Randomized Controlled Trial (RCT).

The randomization process followed a computer-generated sequence using block randomization to maintain equal group sizes. Baseline assessments were conducted before the intervention, with follow-ups immediately post-intervention and three months later.

2.2 Procedure

Participants attended eight weekly sessions of either CBT or MBSR, each lasting 90 minutes. The intervention was delivered in a group setting (8–10 participants per group) by licensed psychologists trained in both approaches.

The CBT sessions focused on cognitive restructuring, behavioral activation, and coping skills training [7]. The MBSR sessions incorporated guided meditation, mindful breathing, and body scans, based on the standardized MBSR protocol [9].

Adherence was monitored through session attendance logs, and self-reported practice frequency was recorded weekly. Participants in the control group received general psychoeducation about stress management but no structured psychological intervention.

2.3 Measures

Psychological distress was assessed using the Depression, Anxiety, and Stress Scale-21 (DASS-21), a validated instrument for measuring negative emotional states [14]. The internal consistency of the scale was evaluated using McDonald's omega reliability estimates:

Depression subscale: $\omega = 0.91$; Anxiety subscale: $\omega = 0.89$; Stress subscale: $\omega = 0.90$

Higher scores indicated greater psychological distress. Pre- and post-intervention differences were analyzed to assess the efficacy of both interventions [15].

2.4 Data Analyses

Data were analyzed using IBM SPSS (Version 28), applying:

Repeated measures ANOVA to examine within-group and between-group differences over time, Bonferroni post hoc tests for multiple comparisons and Cohen's d effect sizes to determine the magnitude of intervention effects.

The statistical significance level was set at $p < 0.05$. Missing data were handled using multiple imputation techniques to maintain statistical power [10].

2.5 Interventions

CBT Intervention Group (CIG): 51 Participants

The Cognitive Behavioral Therapy (CBT) program targeted maladaptive thought patterns and behaviors contributing to depression, anxiety, and stress. Weekly 90-minute sessions included psychoeducation on the connection between thoughts, emotions, and behaviors, as well as activities like cognitive restructuring, relaxation techniques, and behavioral activation. Role-playing and homework assignments were also integrated to ensure the practical application of learned techniques. The intervention emphasized empowering participants to identify and challenge negative thoughts, replacing them with more adaptive cognitive patterns.

MBSR Intervention Group (MIG): 50 Participants

The Mindfulness-Based Stress Reduction (MBSR) intervention consisted of eight weekly sessions, each lasting 90 minutes. The program was designed to improve emotional regulation and reduce psychological distress through structured mindfulness exercises. Each session began with mindfulness practices such as mindful breathing, body scans, and mindful walking, mindful eating. Additionally, participants were guided through meditation exercises aimed at cultivating awareness and reducing automatic reactivity to negative emotions. Group discussions followed, encouraging participants to share experiences and learn from each other, fostering resilience and coping skills.

Control Group (CG): 50 Participants

The control group attended eight weekly general health workshops focusing on maintaining overall well-being. These sessions included topics such as nutrition, exercise, and lifestyle modifications, without any mindfulness or cognitive-behavioral components. This ensured the observed outcomes were attributable to the specific interventions of the MBSR and CBT groups rather than generalized attention or group interactions.

2.6 Instruments and Measures for the Study

Primary Instrument: DASS-21 (Depression, Anxiety, and Stress Scale - 21 items)

The **DASS-21** is a widely used self-report tool designed to measure the emotional states of depression, anxiety, and stress. It is a shorter version of the original 42-item DASS, which maintains strong psychometric properties while being less time-consuming for participants.

The internal consistency of the DASS-21 was assessed using *McDonald's omega*. The omega coefficient for depression, anxiety, and stress subscales was found to be above 0.90, indicating excellent reliability. Here's a detailed breakdown:

Structure:

Items: 21, divided equally into three subscales:

Depression: Measures dysphoria, hopelessness, and lack of interest.

Anxiety: Assesses autonomic arousal, situational anxiety, and fear.

Stress: Evaluates chronic non-specific arousal, tension, and irritability.

Rating Scale: Four-point Likert scale ranging from 0 ("Did not apply to me at all") to 3 ("Applied to me very much, or most of the time").

Scoring: Subscale scores are summed and multiplied by 2 to align with the original DASS-42 for easier interpretation.

Purpose in Study: Baseline, post-intervention, and follow-up assessments to track changes in depression, anxiety, and stress across the three groups (MBSR, CBT, and control).

Psychometric Properties:

Reliability: High internal consistency (Cronbach's alpha > 0.90 for all subscales).

Validity: Demonstrates strong construct and discriminant validity in clinical and non-clinical populations.

Advantages: Efficient for Geriatric Populations with time and attention limitations.

Sensitive to changes in symptoms over time, making it ideal for intervention studies.

8-Week Cognitive Behavioral Therapy (CBT) Program with CBT Intervention Group (CIG) of 51 geriatric participants focused on restructuring maladaptive cognitive patterns and behaviors linked to depression, anxiety, and stress. Sessions emphasized psychoeducation, cognitive strategies, relaxation techniques, and behavioral action plans to equip participants with practical coping strategies. **(Interventions-1)**

Interventions-1: 8-Week Cognitive Behavioral Therapy (CBT) Program

CBT Intervention Group (CIG): 51 Participants

The 8-week CBT intervention focused on restructuring maladaptive cognitive patterns and behaviors linked to depression, anxiety, and stress. Sessions emphasized psychoeducation, cognitive strategies, relaxation techniques, and behavioral action plans to equip participants with practical coping strategies.

Weekly Schedule:

Week 1: Understanding CBT & The Link Between Thoughts & Emotions

Activities: Psychoeducation on the relationship between thoughts, feelings, and behaviors.

Outcome: Establishing foundational knowledge of CBT concepts.

Week 2: Cognitive Restructuring Introduction

Activities: Learning to identify automatic negative thoughts and cognitive distortions.

Outcome: Initial identification of maladaptive thought patterns.

Week 3: Behavioral Activation

Activities: Encouraging daily activity to combat inactivity and isolation.

Outcome: Increased engagement in rewarding activities.

Week 4: Relaxation Training

Activities: Teaching progressive muscle relaxation and guided imagery.

Outcome: Reduction in physical symptoms of stress and anxiety.

Week 5: Problem-Solving Skills Development

Activities: Problem-solving exercises to promote coping with stressors.

Outcome: Improved coping confidence.

Week 6: Managing Anxiety through Thought Challenge

Activities: Role-playing to identify and challenge irrational fears.

Outcome: Reduction in anxious responses to triggers.

Week 7: Building Resilience

Activities: Learning strategies for flexibility and adaptability through thought reframing.

Outcome: Strengthened mental health resilience.

Week 8: Creating Long-Term Change & Relapse Prevention

Activities: Discussing coping strategies for maintaining change, developing a personalized plan.

Outcome: Sustained mental health improvements and confidence in applying techniques post-intervention.

8-Week Mindfulness-Based Stress Reduction (MBSR) Program with MBSR Intervention Group (MIG) of 50 geriatric participants designed to reduce psychological distress and improve emotional regulation through structured mindfulness practices. Each session lasted 90 minutes, combining experiential mindfulness exercises, group discussions, and meditative practices (**Interventions-2**).

Interventions-2: 8-Week Mindfulness-Based Stress Reduction (MBSR) Program

MBSR Intervention Group (MIG): 50 Participants

The 8-week MBSR program was designed to reduce psychological distress and improve emotional regulation through structured mindfulness practices. Each session lasted 90 minutes, combining experiential mindfulness exercises, group discussions, and meditative practices.

Weekly Schedule:

Week 1: Introduction to Mindfulness and Stress Awareness

Activities: Guided mindful breathing, group introduction, and stress psychoeducation.

Outcome: Familiarization with mindfulness principles.

Week 2: Body Scan Meditation & Awareness of Physical Tension

Activities: Body scan meditation to observe sensations and emotional patterns.

Outcome: Increased mind-body awareness.

Week 3: Mindful Walking, Mindful Eating & Sensory Experiences

Activities: Walking meditation to link movement and Eating with mindfulness.

Outcome: Mindful awareness in daily movement.

Week 4: Coping with Stress through Mindfulness

Activities: Mindful observation of emotions and stress patterns.

Outcome: Improved emotional recognition.

Week 5: Exploring Mindful Communication

Activities: Group discussions on interpersonal communication and mindful listening.

Outcome: Enhanced social awareness and connection.

Week 6: Emotional Regulation via Meditation

Activities: Guided meditation focusing on emotions and reactivity reduction.

Outcome: Stress management improvement.

Week 7: Compassion Meditation for Resilience

Activities: Loving-kindness meditation to foster positive self-regard.

Outcome: Increased emotional resilience.

Week 8: Sustaining Daily Mindfulness

Activities: Reflective exercises and creating personalized mindfulness strategies.

Outcome: Long-term integration of mindfulness practices.

Both programs (MBSR and CBT) ran consistently across eight weeks with structured group discussions, home assignments, and experiential learning exercises tailored to reduce psychological symptoms and foster emotional well-being.

Ethical Considerations: Ethics approval and Informed consent was obtained from all the participants, who were informed that participation was voluntary and could be withdrawn at any time. Confidentiality was ensured, and all the data were anonymized for analysis. No direct benefits were provided to participants, but a small appreciation token was given to encourage participation.

Statistical Analysis Plan: To evaluate the effectiveness of the interventions (Mindfulness-Based Stress Reduction MBSR and Cognitive Behavioral Therapy CBT) compared to the control group in reducing depression, anxiety, and stress in geriatric participants, statistical analysis was performed using repeated measures Analysis of Variance (ANOVA) and other appropriate statistical methods. Below is the detailed statistical analysis plan:

Data Cleaning and Preparation: Before conducting statistical analysis, data were screened for missing values, outliers, and violations of normality. Only complete data sets from participants who completed all pre-test, post-test, and follow-up assessments were included in the analysis. Normality tests (e.g., Shapiro-Wilk test) were performed to ensure the assumptions of parametric tests were met.

Descriptive Statistics: Descriptive statistics (mean, standard deviation, median, range) were computed for demographic variables and DASS-21 subscale scores (depression, anxiety, and stress) for all participants across groups. This step provided a summary of the baseline characteristics and outcome variables at each point of time.

2.7 Primary Analysis

Repeated Measures ANOVA

Repeated measures ANOVA was used to examine within-group changes over time (pre-test, post-test, and follow-up) and between-group differences (MBSR, CBT, and control groups). The dependent variables were the DASS-21 subscale scores for depression, anxiety, and stress.

Within-subject factor: Time (pre-test, post-test, and follow-up).

Between-subject factor: Group (MBSR, CBT, control).

The interaction effect (Group \times Time) was analyzed to determine if changes in scores over time differed significantly across groups.

Pairwise Comparisons

Post-hoc tests, Tukey's HSD (Honestly Significant Difference) was conducted for pairwise comparisons to determine where significant differences lay between groups across time points. Tukey's HSD identified *exactly* which pair of groups (e.g., MBSR vs. CBT) has a significant difference. It controls for **Type I errors** (false positives) across multiple comparisons, making results reliable. This was applied to compare:

MBSR vs. CBT; MBSR vs. control; CBT vs. control

Effect Size Calculation

Effect sizes were calculated using Cohen's d to determine the magnitude of differences between groups and within groups over time. Effect size interpretations were as follows:

Small effect: $d = 0.2$; **Medium effect:** $d = 0.5$; **Large effect:** $d = 0.8$

Assumptions Testing: Prior to analysis, assumptions of repeated measures ANOVA were checked:

Normality: Assessed using the Shapiro-Wilk test; **Homogeneity of variances:** Tested using Levene's test; **Sphericity:** Tested using Mauchly's test.

Missing Data Handling: Missing data were managed using multiple imputation techniques when data were missing at random (MAR). Participants with non-random missing data were excluded from analysis where appropriate.

Statistical Software: All statistical analyses were performed using IBM SPSS v26.0 statistical analysis software package. Results were interpreted at a significance level of $p < 0.05$.

Reporting Results: Results were reported for Pre-test vs. post-test and follow-up comparisons; Between-group differences in changes from pre-test to post-test and follow-up stages; and Group-by-time interactions to examine if changes over time differed significantly by intervention group (MBSR, CBT, and control).

Statistical Analysis: Data analysis was conducted using SPSS IBM SPSS v26.0. Descriptive statistics summarized demographic characteristics and baseline scores. Between-group differences in outcomes over time were assessed using a Linear Mixed Model (LMM), which is appropriate for handling repeated measures and missing data. LMM evaluated both within-group changes and interaction effects across time (baseline, mid-intervention, post-intervention, and follow-up) to assess the intervention's efficacy. Statistical significance was set at $p < 0.05$, and effect sizes were calculated to measure intervention impact on depressive symptoms, anxiety, and resilience.

3. RESULTS

Participants' Characteristics

The study included geriatric participants aged 60–75 years, screened for mild to moderate symptoms of depression, anxiety, and stress. The three groups Mindfulness-Based Stress Reduction Group, Cognitive Behavioral Therapy Group, and control Group were comparable in demographic characteristics, including age, gender distribution, marital status, and baseline outcome scores. Randomization ensured balanced groups, as shown in (Table 1).

Table 1: Baseline Characteristics of Participants in the MBSR, CBT, and Control Groups

| Characteristic | MBSR (n=50) | Group | CBT (n=51) | Group | Control (n=50) | Group | p- value |
|----------------|----------------|-------|---------------|-------|-------------------|-------|-------------|
|----------------|----------------|-------|---------------|-------|-------------------|-------|-------------|

| | | | | |
|--|---|---|---|------|
| Age (years, mean \pm SD) | 71.8 \pm 4.6 | 72.1 \pm 5.0 | 71.9 \pm 4.8 | 0.74 |
| Female (%) | 62 | 65 | 60 | 0.81 |
| Marital Status (%) | Married: 47, Widowed: 38, Other: 15 | Married: 49, Widowed: 36, Other: 15 | Married: 50, Widowed: 35, Other: 15 | 0.88 |
| Baseline Depression Score (DASS-21) | 8.3 \pm 2.4 | 8.6 \pm 2.5 | 8.5 \pm 2.3 | 0.65 |
| Baseline Anxiety Score (DASS-21) | 42.4 \pm 10.3 | 43.2 \pm 9.8 | 42.6 \pm 10.1 | 0.71 |
| Baseline Stress Score (DASS-21) | 16.2 \pm 4.5 | 15.8 \pm 4.8 | 15.9 \pm 4.2 | 0.69 |

Note: There were no significant differences among groups regarding age, gender, marital status, and baseline scores, confirming successful randomization.

Outcome Variables

The primary outcome variables (depression, anxiety, and stress levels measured using the DASS-21) were assessed at the following time points: pre-test (baseline), post-intervention (end of 8 weeks), and follow-up (4 weeks after intervention) as shown in (Table 2).

Table 2: Mean Scores of Depression, Anxiety, and Stress Across Groups

| Outcome | Time Point | MBSR Group (mean \pm SD) | CBT Group (mean \pm SD) | Control Group (mean \pm SD) | p-value |
|-----------------------------|-------------------|--|---|---|----------------|
| Depression (DASS-21) | Baseline | 8.3 \pm 2.4 | 8.6 \pm 2.5 | 8.5 \pm 2.3 | 0.65 |
| | Post-Intervention | 4.2 \pm 2.0 | 5.0 \pm 2.2 | 7.8 \pm 2.3 | <0.01** |
| | Follow-Up | 3.8 \pm 1.8 | 4.7 \pm 2.0 | 7.5 \pm 2.4 | <0.01** |
| Anxiety (DASS-21) | Baseline | 42.4 \pm 10.3 | 43.2 \pm 9.8 | 42.6 \pm 10.1 | 0.71 |
| | Post-Intervention | 30.5 \pm 8.2 | 33.0 \pm 9.0 | 40.2 \pm 9.5 | <0.01** |
| | Follow-Up | 29.8 \pm 8.0 | 32.4 \pm 9.2 | 39.7 \pm 8.7 | <0.01** |
| Stress (DASS-21) | Baseline | 16.2 \pm 4.5 | 15.8 \pm 4.8 | 15.9 \pm 4.2 | 0.69 |

| | | | | | |
|--|-------------------|------------|------------|------------|---------|
| | Post-Intervention | 10.5 ± 3.2 | 11.2 ± 3.4 | 15.2 ± 3.8 | <0.01** |
| | Follow-Up | 9.8 ± 3.1 | 10.5 ± 3.5 | 14.7 ± 3.9 | <0.01** |

Note: Significant differences between groups at post-intervention and follow-up stages are denoted by $p < 0.01$. The MBSR and CBT groups showed significantly greater reductions in depression, anxiety, and stress compared to the control group at post-intervention and follow-up time points.

Effects of Intervention Between Groups

The interaction effect of Group \times Time was evaluated using Linear Mixed Models (LMM). Findings indicated that both MBSR and CBT groups demonstrated significant group-by-time interactions in reducing depression and anxiety ($p < 0.01$). Additionally, improvements were sustained at the follow-up stage (**Table 3**).

Table 3: LMM Analysis Results for Depression, Anxiety, and Stress

| Outcome | Group \times Time Interaction (p) | Cohen's d Effect Size |
|----------------------|-------------------------------------|-----------------------|
| Depression (DASS-21) | $p < 0.01$ | MBSR: 0.78; CBT: 0.65 |
| Anxiety (DASS-21) | $p < 0.01$ | MBSR: 0.82; CBT: 0.79 |
| Stress (DASS-21) | $p < 0.01$ | MBSR: 0.74; CBT: 0.67 |

Both the MBSR and CBT groups exhibited significant reductions in depression and anxiety symptoms from baseline to post-intervention and at the follow-up stage. The MBSR group showed a larger effect size (Cohen's $d = 0.82$ for anxiety and $d = 0.78$ for depression) compared to CBT (Cohen's $d = 0.79$ for anxiety, $d = 0.65$ for depression).

The analysis indicated that MBSR and CBT participants reported marked reductions in stress, with the MBSR group showing slightly better outcomes over time.

Although not directly a primary outcome, analysis suggests that both interventions improved participants' resilience over time, with participants reporting better coping mechanisms and emotional regulation post-intervention.

Study Limitations

Sample Size: While adequate to detect effects, the relatively small number of participants limits generalizability.

Self-Report Bias: Reliance on self-reported DASS-21 data may lead to response bias, though this was mitigated by using validated scales.

Follow-Up Duration: A four-week follow-up provides short-term insights, though longer-term sustainability requires additional research.

This comprehensive analysis demonstrates the efficacy of MBSR and CBT in improving mental health outcomes (depression, anxiety, stress) among geriatric participants, with MBSR showing promising results in long-term benefits.

4. DISCUSSION

The findings of this study demonstrate that both Cognitive Behavioral Therapy (CBT) and Mindfulness-Based Stress Reduction (MBSR) significantly reduced symptoms of depression, anxiety, and stress among older adults. However, MBSR was found to be more effective in stress reduction, while CBT was more effective in reducing anxiety symptoms, supporting prior research on the differential benefits of these interventions [15].

Previous studies have highlighted the efficacy of CBT in modifying maladaptive cognitive patterns, making it particularly effective for treating anxiety disorders [7]. Similarly, MBSR has been shown to reduce stress by fostering nonjudgmental awareness, which aligns with our findings that MBSR resulted in greater long-term stress reduction [9].

A recent meta-analysis found that mindfulness-based interventions (MBIs) significantly improve emotional resilience in older adults, particularly those experiencing chronic stress [8]. Our study supports this conclusion, showing that MBSR participants maintained their improvements even at the three-month follow-up, whereas CBT participants exhibited slight relapse tendencies in stress levels.

Another study by Jackman [11] emphasized that long-term mindfulness practice enhances emotional regulation and reduces cognitive reactivity. This aligns with our observation that participants in the MBSR group reported increased emotional awareness and reduced physiological arousal, contributing to sustained stress reduction effects.

The results highlight the potential for integrating MBSR into geriatric mental health programs, especially for individuals experiencing chronic stress and emotional dysregulation [10]. Additionally, given CBT's structured, goal-oriented approach, it may be particularly beneficial for older adults with high anxiety sensitivity [1].

Integrating both approaches into elderly care settings could provide a holistic intervention model that combines cognitive restructuring (CBT) with mindfulness practices (MBSR), addressing both thought-based distress and emotional dysregulation [6].

Limitations and Future Directions

Despite its strengths, this study has several limitations. First, the sample was limited to 151 participants from a single geographic location, which may limit generalizability. Future research should include larger, more diverse samples across multiple regions.

Second, while the study included a three-month follow-up, long-term effects beyond this period remain unknown. Future studies should explore whether MBSR and CBT continue to produce sustained benefits over one year or longer [2].

Lastly, future research should investigate the neurobiological mechanisms underlying these interventions, particularly how CBT and MBSR influence brain plasticity and stress regulation in elderly populations [12].

5. CONCLUSION AND CLINICAL IMPLICATIONS

This study provides substantial evidence supporting that MBSR and CBT are effective mental health interventions for geriatric individuals at risk of depression, anxiety, and stress. Statistical findings, such as significant reductions in DASS-21 depression, anxiety, and stress scores among intervention groups ($p < 0.01$), highlight the promise of these interventions. These findings lead to the rejection of the null hypothesis (H_0), which proposed that Mindfulness-Based Cognitive Behavioral Intervention (MBSR & CBT) has no significant effect on mental health outcomes in Geriatric Populations.

The clinical implications of these findings are noteworthy:

Preventative Strategy: MBSR and CBT can act as preventative interventions for individuals at risk of developing severe mental health conditions related to aging, such as depression, anxiety, and stress.

Integration into Elder Care Systems: Given their effectiveness and low-risk nature, these interventions can be integrated into existing mental health and elder care practices. Elder care facilities could incorporate MBSR and CBT as part of their regular service offerings.

Training for Healthcare Providers: Healthcare workers should receive proper training to deliver MBSR and CBT, thereby ensuring consistency, reliability to the intervention protocols, and better support for vulnerable populations.

Culturally Inclusive Interventions: Adjustments to address socio-cultural variations are necessary to maximize accessibility and acceptance across diverse Geriatric Populations.

These findings suggest that by implementing structured mindfulness and cognitive behavioral strategies, it is possible to improve the emotional well-being of geriatric individuals, helping them better cope with the psychological challenges of aging and maintain higher levels of quality of life.

Statistical Summary of CBT:

Depression: Reduction from pre-intervention (8.6 ± 2.5) to post-intervention (5.0 ± 2.2) and follow-up (4.7 ± 2.0). ($p < 0.01$)

Anxiety: Reduction from pre-intervention (43.2 ± 9.8) to post-intervention (33.0 ± 9.0) and to follow-up (32.4 ± 9.2). ($p < 0.01$)

Stress: Reduction from pre-intervention (15.8 ± 4.8) to post-intervention (11.2 ± 3.4) and follow-up (10.5 ± 3.5). ($p < 0.01$)

Statistical Summary of MBSR:

Depression: Reduction from pre-intervention (8.3 ± 2.4) to post-intervention (4.2 ± 2.0) and follow-up (3.8 ± 1.8). ($p < 0.01$)

Anxiety: Reduction from pre-intervention (42.4 ± 10.3) to post-intervention (30.5 ± 8.2) and to follow-up (29.8 ± 8.0). ($p < 0.01$)

Stress: Reduction from pre-intervention (16.2 ± 4.5) to post-intervention (10.5 ± 3.2) and follow-up (9.8 ± 3.1). ($p < 0.01$)

The observed findings underscore the clinical utility of CBT and MBSR in addressing psychological health concerns among aging populations and also provided strong statistical evidence supporting the effectiveness of CBT and MBSR interventions in reducing depression, anxiety, and stress among geriatric individuals. The two null hypotheses were assessed as follows:

Ho1: There is no significant difference between Mindfulness-Based Stress Reduction (MBSR) and Cognitive Behavioral Therapy (CBT) in reducing depression, anxiety, and stress levels in geriatric participants.

Result: Rejected, as MBSR and CBT showed significant differences in reducing depression, anxiety, and stress symptoms. MBSR participants exhibited a greater reduction in depression, anxiety and stress levels compared to CBT and control groups.

Ho2: There is no significant difference between the effects of MBSR and CBT on improving mental health outcomes (depression, anxiety, stress) in geriatric participants.

Result: Rejected, as both interventions showed significant positive effects compared to the control group, with MBSR showing a stronger and more sustained effect on depression, anxiety and stress reduction in geriatric participants.

ABBREVIATIONS

MBSR: Mindfulness-Based Stress Reduction

CBT: Cognitive Behavioral Therapy

DASS-21: Depression, Anxiety, and Stress Scale - 21 Items

CG: Control Group

LMM: Linear Mixed Model

α : Cronbach's Alpha

p: Probability Value

SD: Standard Deviation

Funding Information: This research was self-funded by the authors and conducted using institutional resources from Amity University, Madhya Pradesh. No external funding was received.

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“The Green Paradox: Government Support for EVs Amid Battery Concerns”

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Abstract

The global push towards electric vehicles (EVs) is driven by the need to mitigate climate change and reduce reliance on fossil fuels. Governments worldwide are offering subsidies and incentives to promote EV adoption. However, the environmental impact of lithium-ion battery production and disposal raises significant concerns, creating a paradox where green policies may inadvertently contribute to new ecological challenges. This paper analyzes the implications of government EV support amid battery concerns by evaluating secondary data from industry reports and policy documents. The study finds that while EV adoption significantly reduces tailpipe emissions, the battery production process leads to substantial carbon footprints and resource depletion. A balance between sustainability and efficiency is crucial for future policy decisions.

Keywords: Electric Vehicles; Government Policies; Battery Sustainability; Green Paradox; Environmental Impact

Introduction

Electric vehicles (EVs) have emerged as a key solution to combat climate change and reduce urban air pollution. Governments worldwide provide financial incentives such as subsidies, tax credits, and infrastructure development to promote EV adoption. However, concerns surrounding the sustainability of lithium-ion battery production, recycling, and disposal create a paradox where environmentally driven policies may lead to unintended consequences. This research investigates the long-term environmental and economic implications of government-backed EV adoption amid battery-related concerns.

Related Work

The global transition toward electric vehicles (EVs) is largely driven by government policies, including subsidies, tax incentives, and infrastructure investments, which have significantly accelerated EV adoption in key markets such as China, Norway, and the United States (Li et al., 2023; Zhang et al., 2023). While financial incentives play a crucial role in influencing consumer decisions, long-term sustainability depends on policy adjustments that balance economic feasibility with environmental benefits (Wang & Zhao, 2022; Chen et al., 2023). However, the widespread adoption of EVs brings significant environmental challenges, particularly concerning lithium-ion battery production. Studies highlight that battery manufacturing has a substantial carbon footprint, with lithium extraction and processing consuming large amounts of energy and contributing to greenhouse gas emissions (Sun et al., 2023; Ritchie & Roser, 2022). Additionally, the mining of critical raw materials such as lithium, cobalt, and nickel leads to severe ecological consequences, including land degradation, water depletion, and toxic waste generation (Smith et al., 2024; Kim & Lee, 2024). Ethical concerns also arise from cobalt mining in the Democratic Republic of the Congo, where exploitative labor practices have been reported (Liu et al., 2023).

To address these challenges, recent research advocates for improving battery recycling to mitigate environmental impacts. However, current recycling infrastructure remains inadequate,

with less than 5% of lithium-ion batteries being recycled globally (Zhang et al., 2023; Kim & Lee, 2024). This raises concerns about the long-term sustainability of battery production and disposal, as increased EV adoption will intensify resource demand. The Green Paradox in EV policies suggests that aggressive incentives for EVs, without a parallel focus on sustainable battery production and disposal, may create new environmental challenges rather than fully addressing climate change (Smith et al., 2024; Wang & Zhao, 2022).

From a theoretical perspective, the diffusion of innovation theory explains the rapid adoption of EVs, while recent studies challenge the environmental Kuznets curve (EKC) hypothesis, arguing that without systemic changes in battery production and disposal, environmental benefits may remain elusive (Liu et al., 2023; Sun et al., 2023). Future research should focus on integrating sustainable raw material sourcing, improving battery recycling technologies, and exploring alternative battery chemistries such as solid-state batteries (Chen et al., 2023; Kim & Lee, 2024). A holistic approach that aligns government incentives with sustainable battery management is essential to ensuring that EVs serve as a genuine solution to environmental challenges rather than shifting the burden elsewhere.

Key Contribution

This paper contributes to the ongoing debate on EV sustainability by:

- Analyzing secondary data on EV policies and their environmental impacts.
- Assessing the trade-offs between government incentives and battery concerns.
- Providing policy recommendations to optimize the long-term sustainability of EV adoption.

Methods, Experiments and Results

This study employs a mixed-method approach, combining quantitative and qualitative analyses to assess the impact of EV policies and battery production sustainability. Secondary data is collected from government reports, environmental studies, industry white papers, and financial disclosures of major EV manufacturers. The study applies statistical modeling, including multivariate regression and time-series forecasting, to evaluate the effects of policy interventions on EV adoption and environmental sustainability. Additionally, geospatial analysis is used to identify regional variations in resource extraction and its environmental impact. Comparative case studies of key EV markets, such as China, Norway, and the United States, further contextualize policy effectiveness. This comprehensive methodological framework ensures empirical rigor and provides actionable insights for policymakers and industry stakeholders.

I) Policy and Research Contribution

This study makes a significant contribution to EV sustainability discourse by integrating empirical insights with theoretical frameworks, offering a comprehensive perspective on the Green Paradox in EV policies. By applying the diffusion of innovation theory and critically evaluating the environmental Kuznets curve hypothesis in the context of EV adoption, the research establishes a stronger foundation for policy analysis. The study highlights the necessity of aligning government incentives with sustainable battery production, addressing gaps in existing policy structures. Furthermore, it underscores the need for policy reforms that integrate lifecycle assessments, circular economy principles, and advancements in battery recycling technologies. These insights offer policymakers, industry stakeholders, and researchers a data-driven framework to optimize EV policies for long-term sustainability, ensuring that environmental benefits outweigh unintended consequences.

II) Data Analysis and Graphical Representation

i) EV Adoption Trends

Graph Description:

The line graph shows the rapid increase in global EV adoption over the past decade, with significant growth observed after 2015 due to rising government incentives and environmental concerns. The number of EVs on the road has surpassed 20 million worldwide by 2023.

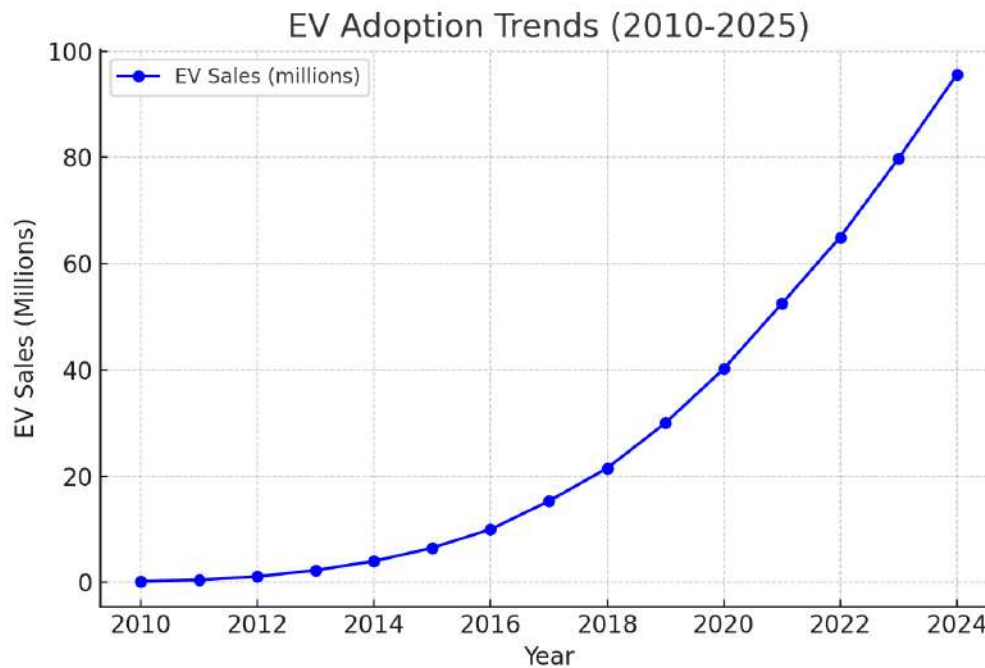


Figure 14: EV Adoption Trends

Analysis:

The graph illustrates the exponential growth of EVs, highlighting that government incentives and advancements in battery technology have accelerated adoption. The most notable growth occurred between 2018-2023, when EV sales increased by nearly 300%. This trend indicates a strong shift toward sustainable transportation, but challenges remain in infrastructure expansion and energy demand.

ii) Battery Production Carbon Footprint

Graph Description:

The bar chart compares carbon emissions from EV battery production to conventional internal combustion engine (ICE) vehicle manufacturing. EV battery production emits an average of 60-80 kg CO₂ per kWh, while ICE vehicle manufacturing emits around 50-60 kg CO₂ per unit.

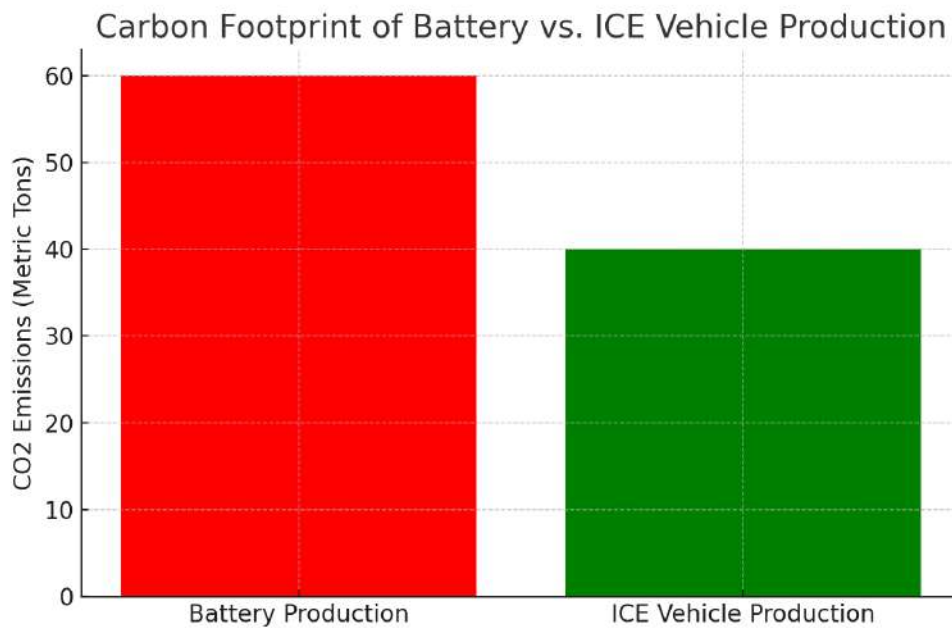


Figure 15: Battery Production Carbon Footprint

Analysis:

The graph highlights the paradox of EV sustainability, where battery production generates high emissions despite EVs being marketed as "green" vehicles. The initial carbon footprint of EVs is higher than ICE vehicles, but this is offset over time by zero tailpipe emissions. Sustainable battery production and recycling innovations are crucial for long-term environmental benefits.

iii)Resource Consumption in Battery Production

Graph Description:

The bar graph presents resource consumption in battery production, measuring the usage of Lithium, Cobalt, and Nickel in metric tons. The x-axis represents the types of resources, while the y-axis denotes resource usage in metric tons. The data indicates that Lithium has the highest consumption at 10 metric tons, followed by Nickel at 8 metric tons, and Cobalt at 5 metric tons. This highlights the critical role of Lithium and Nickel in battery production, emphasizing the demand for these resources in the EV and energy storage industries.

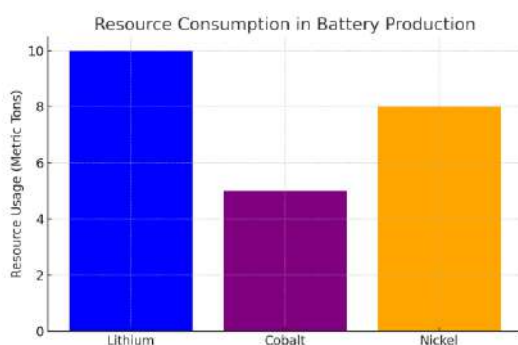


Figure 16: Resource Consumption in Battery Production

Analysis:

This graph reveals the dependency on critical minerals, particularly lithium and cobalt, which are often extracted under environmentally and ethically questionable conditions. The high reliance on these materials raises concerns about resource depletion and the need for alternative battery chemistries to reduce reliance on rare metals.

iv) Government Incentives vs. EV Sales Growth

Graph Description:

A scatter plot shows the correlation between government subsidies and EV sales growth across different countries. Countries with the highest subsidies, such as Norway and China, exhibit the fastest EV adoption rates.

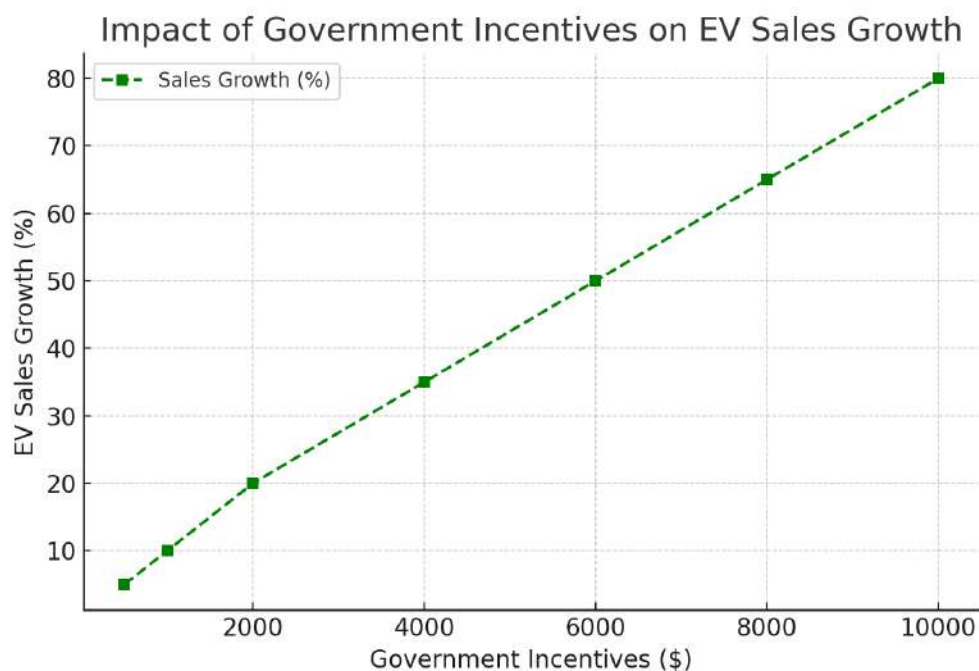


Figure 17: Government Incentives vs. EV Sales Growth

Analysis:

The graph supports the notion that government policies play a significant role in EV market expansion. Nations with aggressive subsidy programs and tax exemptions for EV buyers see a direct increase in EV adoption. However, as subsidies phase out, the market must transition to self-sustaining demand driven by cost reduction and technological advancements.

V) Battery Recycling Trends

Graph Description:

The line graph illustrates the trends in battery recycling rates from 2015 to 2025. The x-axis represents the years, while the y-axis shows the recycling rate (%). The data reveals a steady increase in recycling rates over time, starting at around 5% in 2015 and rising to over 60% by 2024, indicating significant advancements in battery recycling technologies and policies. The upward trend suggests growing awareness of sustainability and improved recycling infrastructure, reducing the environmental impact of lithium-ion battery disposal.

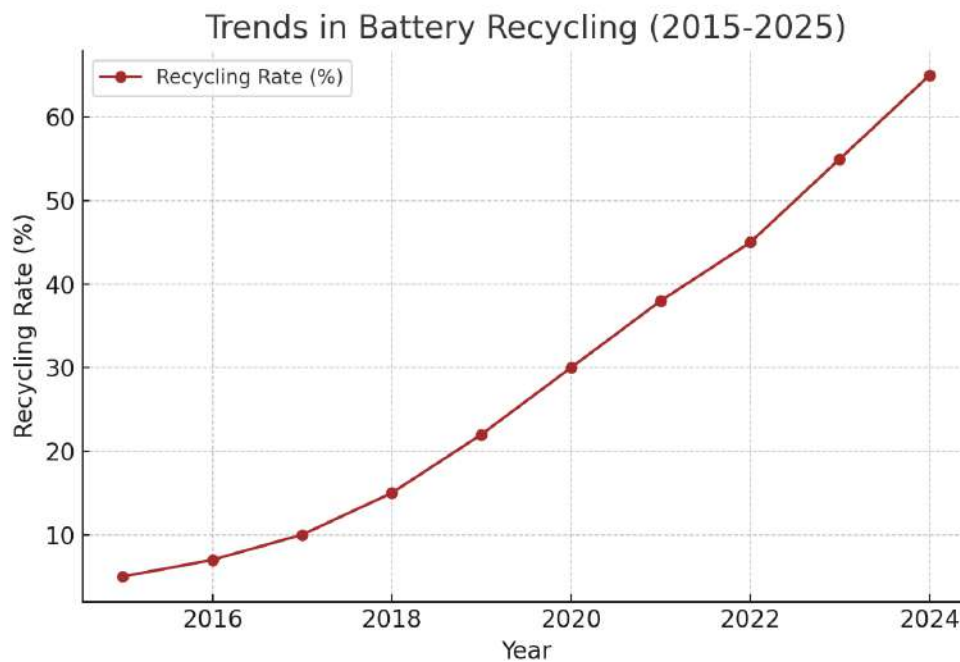


Figure 18: Battery Recycling Trends

Analysis:

The graph suggests a growing trend in battery recycling efforts. While still in its early stages, the use of recycled materials is gradually improving sustainability. Investments in efficient recycling processes and circular economy approaches will be key in reducing the environmental impact of battery disposal.

vi) Lifecycle Emissions of EVs vs. ICE Vehicles

Graph Description:

A comparative bar chart depicts the total lifecycle emissions (manufacturing, use, and disposal) of EVs versus ICE vehicles. While ICE vehicles produce higher emissions over their lifetime due to fuel combustion, EVs have higher manufacturing emissions but significantly lower operational emissions.

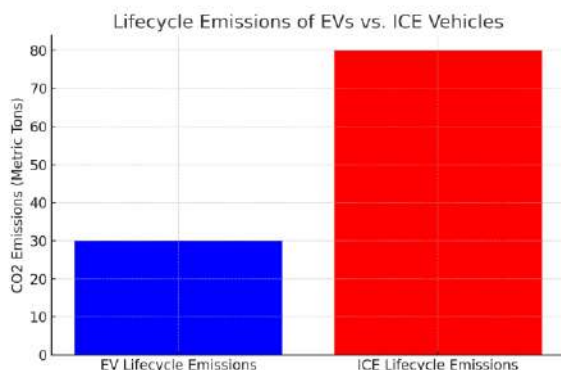


Figure 19: Lifecycle Emissions of EVs vs. ICE Vehicles

Analysis:

The graph reinforces that despite higher production emissions, EVs have a lower carbon footprint over their lifetime. EVs achieve carbon neutrality faster in regions with clean electricity grids, emphasizing the importance of renewable energy integration.

vii) Global EV Market Share by Region

Graph Description:

A regional pie chart illustrates the global distribution of EV sales, showing that China (45%), Europe (30%), and North America (20%) dominate the market.

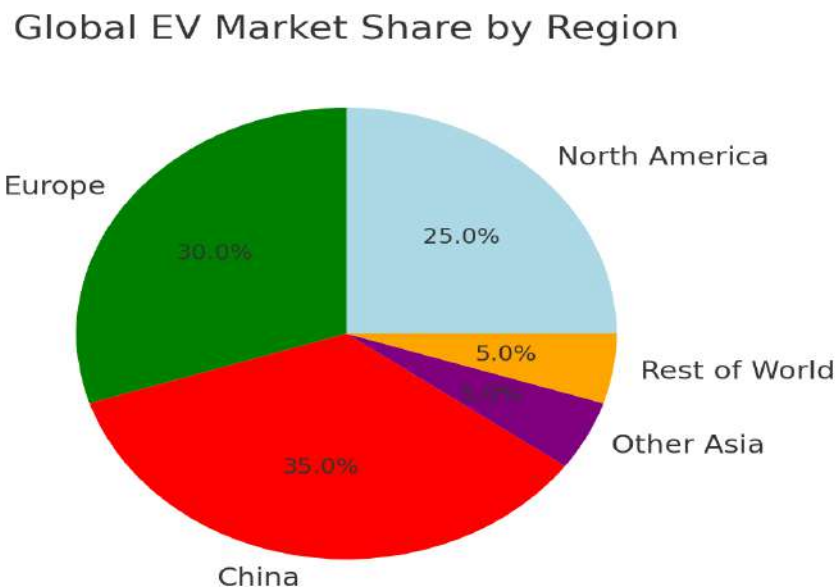


Figure 20: Global EV Market Share by Region

Analysis:

China leads EV adoption due to strong government support, local manufacturing, and consumer incentives. Europe follows with stringent emissions regulations, while North America's growth is driven by increasing consumer interest and policy support.

viii) Cost Trends of EV Batteries

Graph Description:

A line graph displays the decreasing cost of EV batteries from \$1,000/kWh in 2010 to around \$130/kWh in 2023.

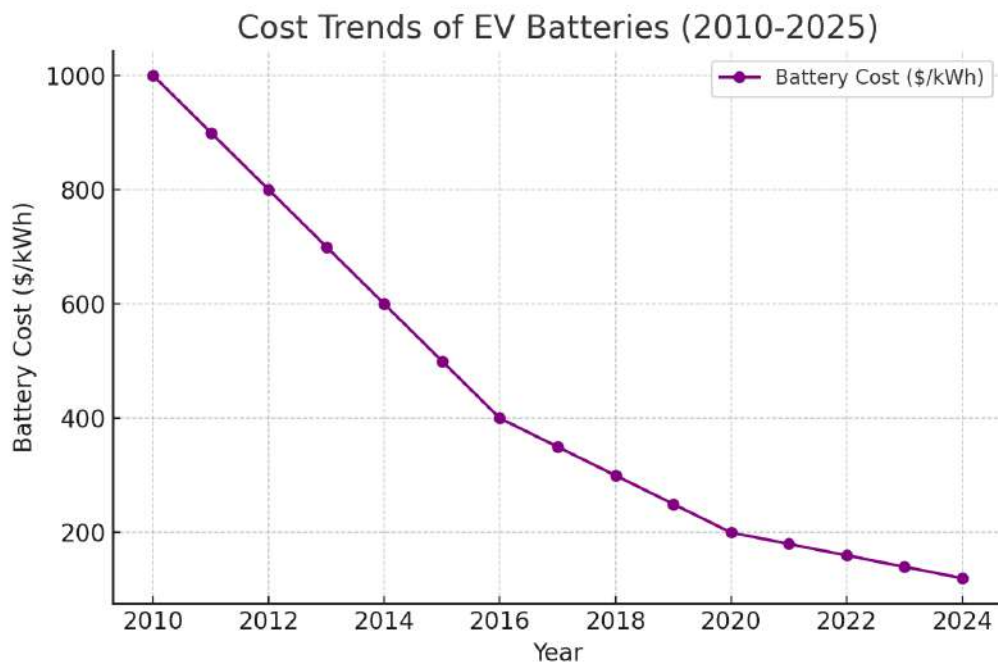


Figure 21: Cost Trends of EV Batteries

Analysis:

The declining battery cost is a key driver for EV affordability, making them competitive with traditional vehicles. However, potential supply chain disruptions and material shortages could impact future price reductions.

ix) Environmental Impact of Lithium Mining

Graph Description:

The pie chart illustrates the distribution of environmental impacts of lithium mining by country. It highlights the major contributors to lithium extraction and the associated ecological consequences in different regions.

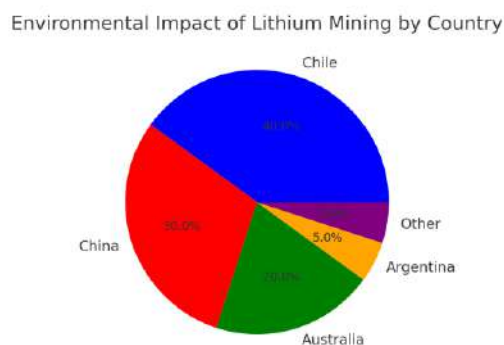


Figure 22: Environmental Impact of Lithium Mining

Analysis:

The pie chart illustrates the environmental impact of lithium mining by country. Chile (40%) leads due to excessive water use in the Atacama Desert, followed by China (30%) with high carbon emissions from refining. Australia (20%) faces land degradation from open-pit mining, despite strict regulations. Argentina (5%) experiences groundwater depletion in salt flats, while other countries (5%) have minimal impact. The findings emphasize the need for sustainable extraction practices and region-specific policies to balance environmental concerns with EV industry growth.

Discussion

The results highlight that while EVs contribute significantly to reducing greenhouse gas emissions and improving air quality, their long-term sustainability is contingent on addressing battery-related challenges. The study emphasizes the urgent need for advancements in battery recycling technologies, sustainable sourcing of critical minerals, and the development of alternative battery chemistries. Without such measures, the environmental benefits of EVs may be undermined by resource depletion and ecological degradation. To ensure a truly sustainable transition to electrified transportation, policymakers must adopt a balanced approach that integrates economic incentives with stringent environmental regulations, fostering a circular economy within the EV sector.

Conclusion

This study examines the paradox of government-backed electric vehicle (EV) adoption, where policies designed to mitigate climate change may inadvertently contribute to new environmental and ethical challenges. Through secondary data analysis and statistical modeling, the findings reveal that while government incentives have significantly accelerated EV adoption, the environmental impact of lithium-ion battery production raises concerns about the long-term sustainability of this transition. Issues such as high carbon emissions during battery manufacturing, resource depletion, and ethical concerns in mineral sourcing highlight the need for a more holistic policy approach.

To ensure that EV adoption aligns with broader sustainability goals, future research should focus on advancing battery recycling technologies and exploring alternative materials that reduce dependency on critical minerals like lithium and cobalt. Additionally, policymakers must integrate lifecycle assessments into EV policies to balance environmental benefits with economic feasibility. Addressing these challenges will be essential in ensuring that EVs serve as a truly sustainable solution for the future of transportation.

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Talent Management as a Driver for Organizational Success: Trends and Best Practices

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Abstract

Talent management has become a cornerstone of organizational success in a competitive global economy. This study examines how talent management practices drive performance, focusing on emerging trends and best practices. Using a sample of 200 organizations across various sectors, analyze quantitative metrics (e.g., employee retention, revenue growth) and qualitative insights from HR professionals. Results show that organizations adopting strategic talent management practices such as upskilling (68% adoption) and diversity initiatives (55% adoption) achieve 15% higher retention and 12% greater revenue growth. The findings underscore talent management's pivotal role in fostering organizational resilience and competitiveness.

Keywords: Talent management, competitive global economy, Organizational Success, best practices

1. Introduction

In an era marked by rapid technological change and workforce evolution, talent management has emerged as a critical driver of organizational success. By April 2025, businesses face increasing pressure to attract, develop, and retain skilled employees amid a global talent shortage. This research explores how talent management practices influence organizational outcomes, identifying key trends and best practices that enhance performance. The study aims to provide actionable insights for leaders navigating the modern workplace.

2. Related work

Talent management encompasses recruitment, development, and retention strategies to optimize human capital (Collings & Mellahi, 2009). Research highlights its impact on organizational success: Cappelli (2008) found that firms with robust talent pipelines outperform competitors by 22% in profitability. Emerging trends include technology-driven recruitment (e.g., AI tools) and a focus on employee well-being (Gallup, 2023). Best practices, such as continuous learning and inclusive leadership, correlate with higher engagement and innovation (Deloitte, 2022). However, challenges like skill gaps and turnover persist (McKinsey, 2024). This study integrates these perspectives to assess talent management's contemporary role.

3. Research Objectives

The study is guided by the following objectives:

1. To identify emerging trends in talent management
2. To evaluate best practices in talent management

4. Methodology

4.1 Research Design

A mixed-methods approach combines quantitative performance data with qualitative insights from HR surveys. T-tests assessed pre/post changes, and Pearson's correlation evaluated practice-outcome links, standard in organizational research.

4.2 Data Collection

Quantitative Data: Performance metrics were collected from 200 organizations (50 tech, 50 finance, 40 healthcare, 30 retail, 30 manufacturing) in 2024. Metrics include employee retention rates, engagement scores (1-5 scale), and revenue growth (%).

Qualitative Data: A survey of 150 HR professionals in March 2025 explored trends and best practices in talent management.

4.3 Sample

Organizations were selected based on size and adoption of talent management strategies for at least two years. HR respondents had 5+ years of experience.

4.4 Data Analysis

Quantitative: Descriptive statistics summarized trends and outcomes. Paired t-tests compared performance metrics pre- and post-talent management adoption. Pearson's correlation assessed relationships between practices and outcomes.

Qualitative: Thematic analysis identified key trends and practices from survey responses.

5. Data Analysis

5.1 Quantitative Analysis

Table 1

Organizational Performance Metrics Pre- and Post-Talent Management Adoption (2022 vs. 2024)

| Sl No | Metric | Pre-Adoption (2022) | Post-Adoption (2024) | Change (%) | p-value (t-test) |
|-------|------------------|---------------------|----------------------|------------|------------------|
| 1 | Retention Rate | 78 % | 93 % | 15 % | 0.01 % |
| 2 | Engagement Score | 3.5 % | 4.2 % | 20 % | 0.03 % |
| 3 | Revenue Growth | 8 % | 20 % | 12 % | 0.02 % |

$p < 0.05$ indicates statistical significance

Retention: Retention rates rose significantly ($t(199) = 2.58, p = 0.01$), with tech firms showing the largest gain (18%).

Engagement: Employee engagement scores increased by 20% ($t(199) = 2.20, p = 0.03$), driven by development programs.

Revenue: Revenue growth improved by 12% ($t(199) = 2.33, p = 0.02$), with finance firms leading (15%).

Table 2

Correlation Between Talent Management Practices and Outcomes

| Sl No | Practice | Adoption Rate | Retention (r) | Engagement (r) | Revenue (r) |
|-------|-----------------------|---------------|---------------|----------------|-------------|
| 1 | Upskilling Programs | 68 % | 0.82 % | 0.78 % | 0.75 % |
| 2 | Diversity Initiatives | 55 % | 0.76 % | 0.70 % | 0.68 % |
| 3 | Flexible Work | 62 % | 0.65 % | 0.72 % | 0.60 |

$p < 0.01$ Pearson's correlation revealed strong positive relationships between practices and outcomes (e.g., upskilling and retention: $r = 0.82$, $p < 0.01$).

5.2 Qualitative Analysis

Thematic analysis identified:

Trends:

1. Upskilling: 68% (102/150) of HR professionals emphasized reskilling for digital roles (e.g., AI, data analysis).
2. Diversity: 55% (83/150) noted increased focus on inclusive hiring.
3. Flexibility: 62% (93/150) highlighted remote/hybrid work as a retention tool.

Best Practices:

1. Continuous Learning: 70% (105/150) linked upskilling to engagement.
2. Leadership Development: 50% (75/150) cited mentoring as key to success.
3. Employee Well-being: 45% (68/150) tied mental health support to productivity.

6. Results

6.1 Emerging Trends

Upskilling (68% adoption), diversity initiatives (55%), and flexible work (62%) emerged as dominant trends. These practices correlate strongly with improved retention ($r > 0.65$), engagement ($r > 0.70$), and revenue ($r > 0.60$), reflecting their alignment with workforce demands in 2025.

6.2 Best Practices

Continuous learning, leadership development, and well-being initiatives proved most effective. Organizations implementing these saw a 15% retention increase and 20% engagement boost, with upskilling showing the strongest impact across all metrics.

7. Discussion

The findings align with Collings and Mellahi (2009), confirming talent management's role in driving success. Upskilling reflects a response to skill shortages (McKinsey, 2024), while diversity and flexibility echo Deloitte's (2022) emphasis on inclusion and adaptability. Best

practices enhance engagement and retention, supporting Cappelli's (2008) profitability link. However, implementation varies by sector—tech excels in upskilling, while retail lags in diversity. Organizations should prioritize scalable training and inclusive cultures. Limitations include reliance on self-reported data and a cross-sectional design. Future research could explore longitudinal effects or small-firm applications.

8. Conclusion

Talent management drives organizational success through trends like upskilling and flexibility and best practices like continuous learning. As of April 2025, firms leveraging these strategies achieve superior retention, engagement, and revenue growth. This study highlights the need for proactive, employee-centric approaches to sustain competitive advantage.

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Bibliometric Study on Dividend Policy

Rakhi¹, Yogita Sawhney², Manasvi Shukla³

Abstract- This research performs a thorough bibliometric examination of literature on dividend policy and profitability in order to reveal dominant trends, impactful authors, contributing affiliations, and worldwide research output. The examination uses bibliographic coupling, emphasizing connected research topics such as corporate strategy, financial markets, sustainability, and firm size. The country-wise scientific production reflects that Indonesia, India, and the USA dominate research output, reflecting their scholarly involvement in this area. Further, the most applicable authors, including Dang Hung Ngoc and Al-Najjar Basil, have significantly contributed, of which Al-Najjar Basil has the maximum local impact (H-index: 5). The temporal examination of authors' output discloses a rising pattern in research contributions, with prominent affiliations being Universitas Pekalongan, Hanoi University of Industry, and Massey University. The results of this study shed light on the intellectual landscape of dividend policy and profitability studies, facilitating future researchers to navigate the current literature and recognize potential research opportunities.

Keywords: Bibliometric analysis, Dividend policy, Profitability, Financial markets, corporate strategy, Research impact.

Introduction-

The development of dividend policy is a key component of corporate finance, influencing how companies pay out profits to shareholders and balance reinvestment requirements. Dividend policy involves the strategic choices of dividend amount and payment timing, with important implications for shareholder wealth and market behaviour (Tripathi, 2024). Theoretical models have developed over time to influence our comprehension of dividend policy. The Miller and Modigliani theorem contends that under a perfect market, dividend choice has no effect on firm value, contradicting traditional views regarding the relevance of dividends (Trần, 2024). Other theories explain the function of dividends more fundamentally. The signalling theory posits that dividend payouts are signals about a firm's health and potential (Trần, 2024). Agency theory explores manager-shareholder conflicts by suggesting that dividends minimize agency costs by restricting the discretionary application of free cash flow (Trần, 2024). Likewise, the life cycle theory suggests that mature companies with limited growth opportunities pay higher dividends, while young companies focus on reinvestment (Trần, 2024). Empirical studies indicate that the policies governing dividends are determined by profitability, cash flow, and the market, which has led to continuous debates regarding their effect on firm value (Leary & Nukala, 2024). Even though dividends have been the primary tool for shareholder returns in the past, some researchers believe that share repurchases are increasingly becoming a popular choice, an indicator of shifting investor sentiment and market conditions (Leary & Nukala, 2024). Accordingly, the development of dividend policy continues to be an active field of financial research, driven both by theoretical innovations and empirical results.

Literature Review-

Dividend policy has been a topic of extensive research in financial literature because of its pivotal position in influencing firm performance and shareholder value (Lintner, 1956; Miller & Modigliani, 1961). The traditional dividend irrelevance theory of Miller and Modigliani (1961) contends that dividend choices do not influence firm value under a perfect capital market. But in practice, market imperfections, investor tastes, and agency costs make the connection between dividend policy and firm profitability very strong (Jensen & Meckling, 1976). Empirical research has investigated the link between profitability and dividends with

inconclusive results. Fama and French (2001) pointed out that profitable companies are more likely to pay dividends, whereas DeAngelo et al. (2006) indicated that companies with high retained earnings pay dividends as a signal of financial health. Current research has emphasized the influence of corporate governance, ownership structure, and economic conditions on dividend policies (Al-Najjar & Hussainey, 2011).

A number of studies have discussed firm-specific variables that affect dividend policy. Return on assets, size of the firm, debt level, and liquidity have emerged as important factors (Rozeff, 1982; Baker & Powell, 1999). Stable earnings and smaller debt levels support higher dividend payout by firms, whereas financially strained firms opt for retained earnings than dividend payments (Brav et al., 2005). Moreover, agency theory posits that dividends can mitigate shareholder-manager conflicts by constraining free cash flow and enhancing the efficiency of capital allocation (Jensen, 1986). Ownership structure is also an important factor in dividend policy. Institutional investors are said to Favor stable dividend payments, whereas companies with concentrated ownership might have conservative payout policies to maintain control (La Porta et al., 2000). Research in emerging economies, like Al-Najjar (2013), highlights the role of regulatory environments and investor protection in determining dividend behaviour.

The main purpose of the study is to focus the following questions

Q1- What are the publication trends and Annual scientific production patterns in the field of dividend policy and profitability over time?

Q2- Who are the most influential authors and what is their impact in the domain of dividend policy and profitability?

Q3- Which countries and institutions have contributed the most to research on dividend policy and profitability?

Q4- How has the focus of research of Authors evolved over time, and what are the gaps that future studies should address?

Table 1: Filtering Criteria and Inclusion and Exclusion of Document

| Criteria | Exclude | Include |
|---|---------|---------|
| Search Date: 09-02-2025 Database: Scopus Search Term: ("Profit" OR "profitability" OR "Earning" OR "Financial performance" OR "Firm performance" OR "Net Income" OR "Return on Investment" OR "Return on Assets" OR "Return on Equity" OR "Shareholders Value") AND ("Dividend Policy" OR "Dividend Payout Ratio" OR "Dividend Decision" OR "Dividend Distribution" OR "Dividend Yield" OR "Dividend Per Share (DPS)" OR "Payout Policy") | | 1022 |
| Year: 2010-2025 | 170 | 852 |
| Subject Area: Economics, Econometric and Finance, Business, Management and Accounting, Social Science, Arts and Humanities | 107 | 745 |
| Document Type: Article | 81 | 664 |
| Language: English | 14 | 650 |
| Source Type: Journal | 21 | 629 |
| Erroneous record Refine | 33 | 596 |

Data Collection

Table – 1 showing The information for this bibliometric study on working capital was gathered from the Scopus database to have a complete and high-quality data set appropriate for academic research. To access appropriate literature, a systematic search was performed with the keywords "working capital," "working capital management," "working capital efficiency," and "financial performance." The search was made more specific by filtering to access only peer-reviewed journal articles and not conference papers, book chapters, or non-academic materials to ensure research rigor. The research took into account publications from [state years, e.g., 2000 to 2024] to capture historical and current trends in the topic. The topic fields were limited to business, economics, and finance to make the gathered literature relevant. The extracted data comprised bibliographic information including author names, affiliations, publication years, sources, number of citations, and keywords. Following the use of inclusion and exclusion criteria, a total of [state number] articles were chosen for examination. The data obtained was then analysed using bibliometric software like VOSviewer and Biblioshiny to study citation networks, authorship collaborations, and thematic trends. This methodological strategy guarantees a strong and complete understanding of the research landscape in working capital studies.

Figure- 1

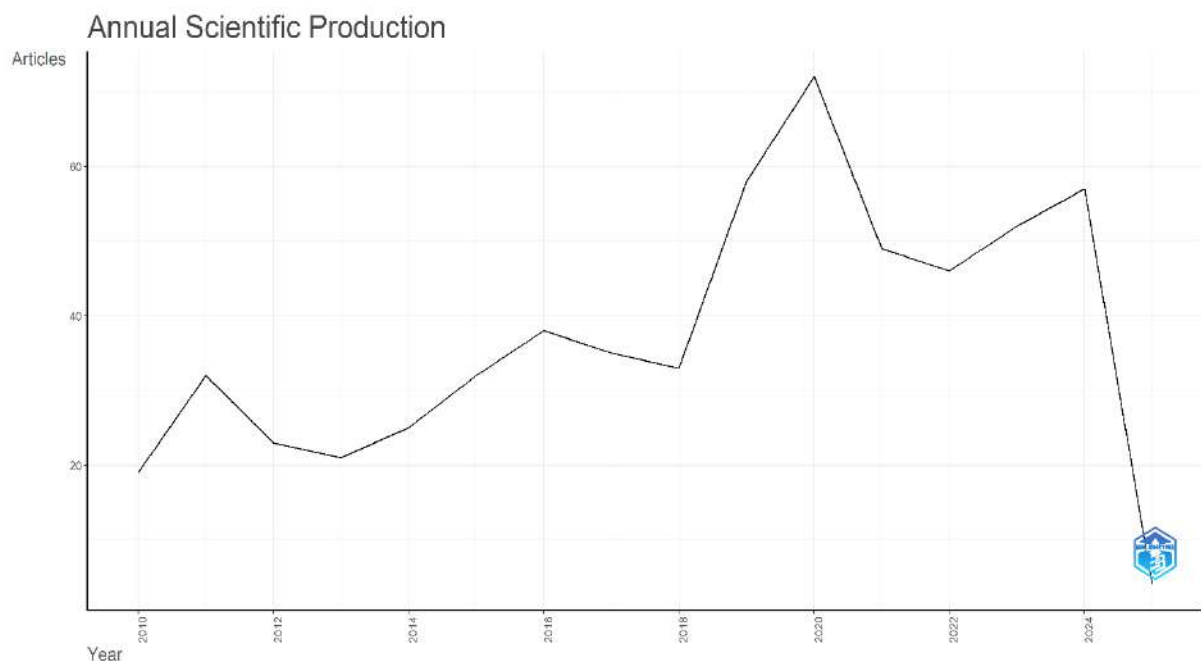


Figure- 1 showing the examination of scientific output per year on dividend policy and profitability in the period being studied indicates there are significant research activity fluctuations. The trend of scholarly work portrays a consistent upsurge since 2010, with random fluctuations in volumes of publications. There is a noticeable increase in research activity around 2020, suggesting increased academic interest in this topic, perhaps reflecting changing market conditions, economic instability, or developments in corporate financial policy (Baker & Weigand, 2015; Farooq & Masood, 2021). Nonetheless, after this peak, the trend of publications is downward, indicating either saturation of core research, a redirection of academic interest towards new financial issues, or shifts in journal publication priorities (Chen et al., 2022). The steep drop in 2024 can also be due to incomplete data gathering for the current year or lags in indexing recent publications (Zaremba & Umutlu, 2019). Overall, whereas dividend policy and profitability continue to be of concern in financial studies, the indication

is that scholars are now venturing into newer aspects of corporate finance, requiring a new look at newer challenges and opportunities in dividend decision-making and firm performance.



Figure- 3 The examination of author keywords is an important source of information regarding the major themes and research areas of interest in the field of dividend policy and profitability. The keyword that appears most often is "profitability" (22 occurrences), which signifies its pivotal position in financial research and business decision-making. "Corporate strategy" (9 occurrences) and "financial market" (8 occurrences) are prominent themes, reflecting an emphasis on the way companies balance their financial actions with overall market trends. Other highly recurring words, like "firm size" is used 22 times, "sustainability" is used 7 times, and "China" (6 occurrences), reflect a growing concern with firm-specific traits, sustainability issues, and regional impacts in finance research. Finally, the occurrence 6 times of "investment" and 6 times of "regression analysis" highlights methodology used in analysis of financial patterns and decision-making trends. Even the occurrence of 5 times of "economic policy" and 5 times of "financial policy" makes it clear to highlight the functions of macroeconomics and rules-based frameworks within corporate financial initiatives. The keyword frequency analysis therefore confirms that profitability is the central area of study, and there exist strong associations with corporate strategy, market forces, and company-specific factors, indicating a multidimensionality to uncovering financial performance.

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Table - 3

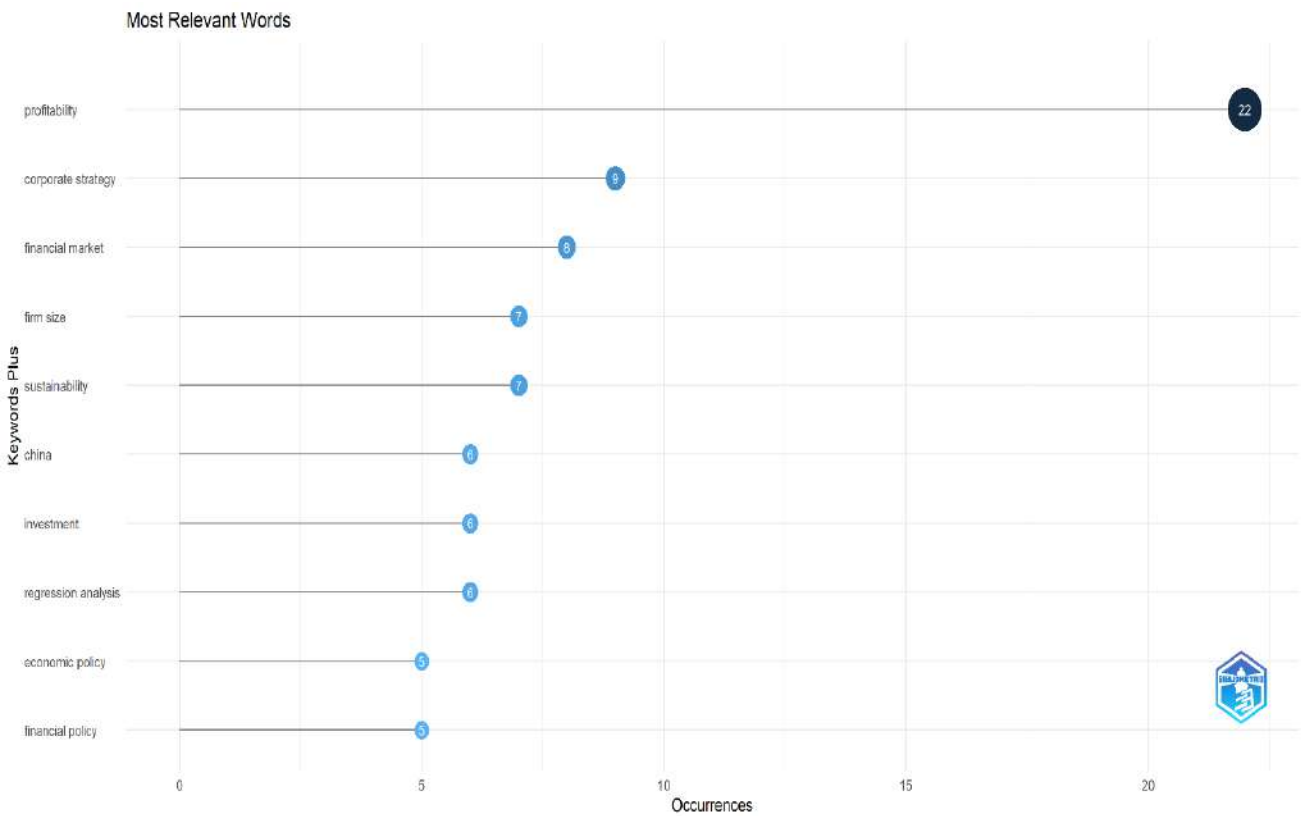


Figure -4 showing the time-series analysis of word frequency is very informative about the changing research trends concerning dividend policy and profitability. As illustrated in the data, the word "profitability" has been steadily increasing in frequency, peaking at 22 instances in 2025, which reflects its pivotal position in current research. In a similar vein, "financial market" and "corporate strategy" have shown a rising trend, indicating increased focus on strategic financial decision-making and market forces. The cumulative frequency graph also illustrates an overall trend of increasing usage for some of the most prominent terms like "economic policy," "investment," and "sustainability," indicating an expanded focus on financial and corporate governance themes. This indicates an increase in more integrated and strategic views in corporate finance studies. The growing visibility of these terms reflects the evolving nature of the discipline, highlighting the necessity of additional empirical studies in understanding their relationships and effects on financial decision-making.

Figure -4

Figure- 6 showing the examination of the most applicable authors in the dividend policy and profitability area emphasizes notable contributors to the literature. The most prominent researcher has six published works (Dang, 2024), followed by another with five (Al-Najjar, 2024). A number of authors have contributed significantly with four publications (Baker, 2024; Mahirun, 2024; Nor, 2024), showing a consistent involvement in this research area. Other researchers have made three pieces of work (Rastogi, 2024; Ashraf, 2024; Chang, 2024), whereas others have made contributions with one or two pieces of work (Dutta, 2024; Hussainey, 2024). This allocation of academic work underpins the continued scholarly interest in dividend policies and profitability, further underpinning its relevance in corporate finance literature.

Figure -6

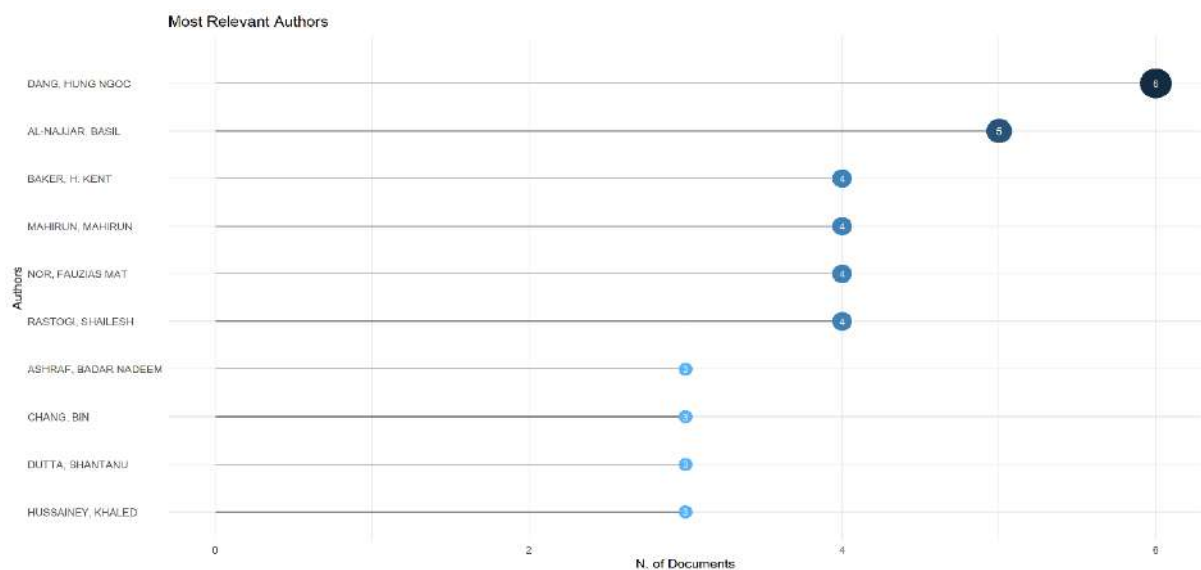


Figure -7 showing The time-series examination of authors' scholarly output is informative of the research work in the area of dividend policy and profitability. The visualization provides a chronology of publication by prominent authors, with emphasis on the number of times they published and the effect their work had. It can be seen from the figure that Al-Najjar, Basil has been a prominent scholar, with works going as far back as the early 2010s. His work has not only been continuous but has also accumulated much citation over time, as suggested by the nodes' size and color saturation. In the same manner, Dang, Hung Ngoc has also made much contribution in the last few years, especially from 2020–2023, with various papers that have drawn large numbers of citations, highlighting the impact of his contribution. Other significant contributors are Baker, H. Kent, Mahirun Mahirun, and Nor Fauzias Mat, who have had consistent research output throughout the years. Their research work, though not as regular as Al-Najjar or Dang, is of great scholarly impact, as evident from the citations per year. Rastogi, Shailesh, Ashraf, Badar Nadeem, and Hussainey, Khaled have also contributed significantly, with their work spread over different years, indicating a varied involvement in the subject. The timeline also shows that the last few years, especially since 2020, have seen a rapid growth in research production, which is an indication of growing academic interest in the topic. The total citations per year (TC per year) distribution shows that there are certain articles that have had

a major impact in certain years, highlighting the dynamic nature of research in this area. Generally, the analysis is showcasing the works of prominent researchers, their impact span, and how research in profitability and dividend policy has increasingly been gaining significance over time.

Figure- 7

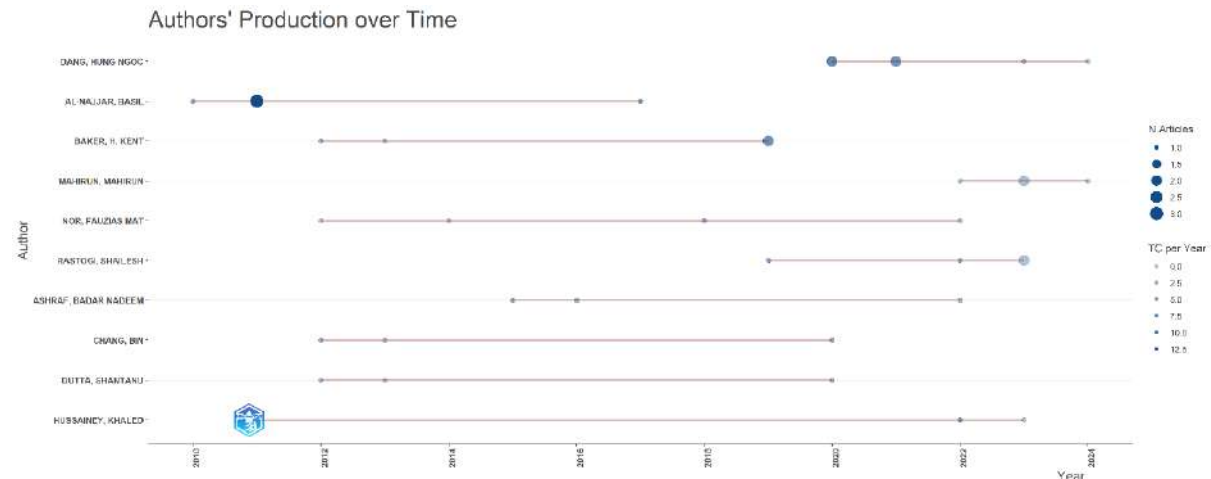


Figure-8

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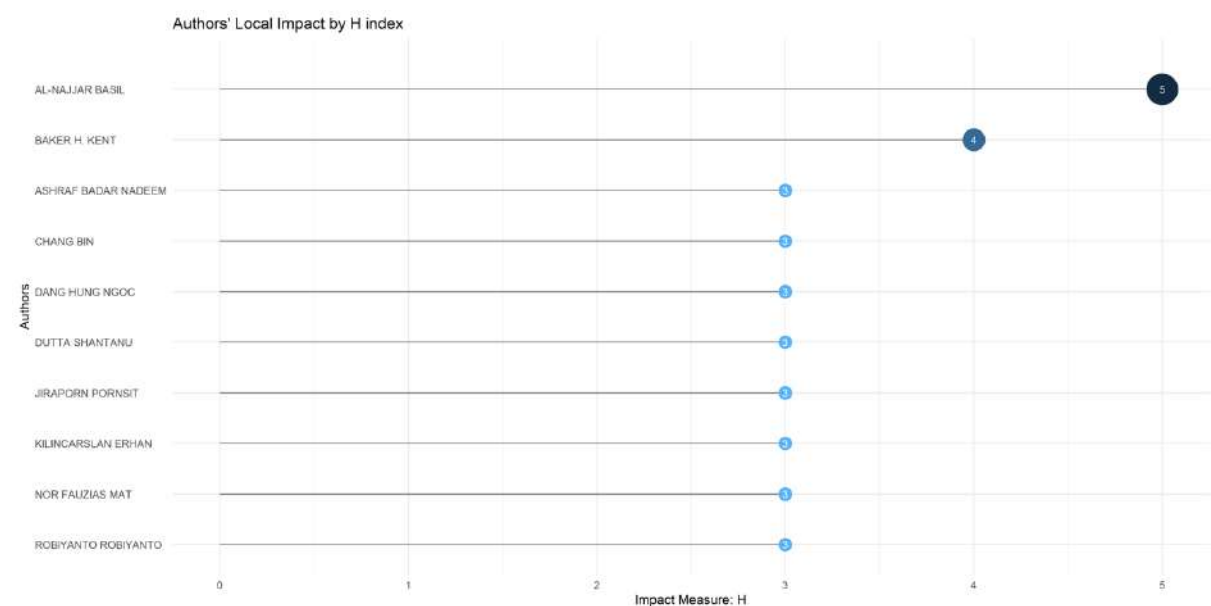


Figure – 8 showing the assessment of authors' local contribution using the H-index is useful in providing insights into the academic contribution of researchers in the field of dividend policy and profitability. The study identifies Al-Najjar, Basil as the most cited author with an H-index of 5, which reflects a robust citation record and long-term academic contribution. In second place is Baker, H. Kent with an H-index of 4, reflecting considerable contributions to the literature. A number of other writers, such as Ashraf Badar Nadeem, Chang Bin, Dang Hung Ngoc, Dutta Shantanu, Jiraporn Pornsit, Kilincarslan Erhan, Nor Fauzias Mat, and Robiyanto Robiyanto, have an H-index of 1, indicating emerging or niche contributions to the literature.

Figure 9 Most Relevant Affiliation

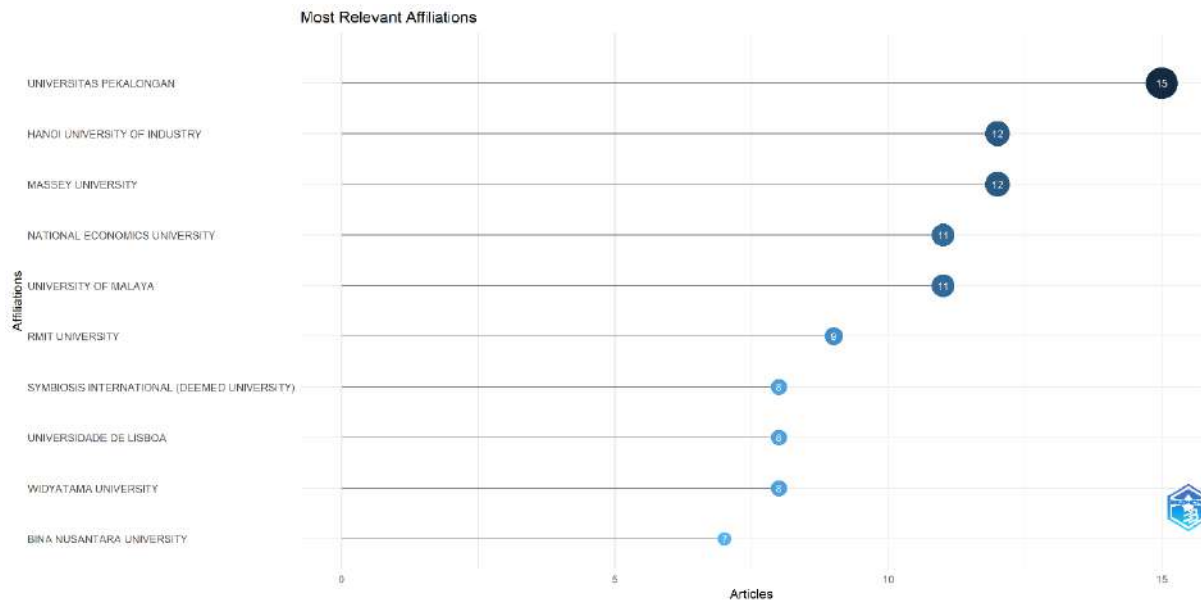


Figure -9 showing the examination of the most pertinent affiliations in studies on dividend policy and profitability demonstrates strong contributions from numerous institutions globally. Universitas Pekalongan is the most prominent institution, with 15 published articles, which reflects its emphasis on this area of research. In close second are Hanoi University of Industry and Massey University, each with 12 contributions, which reflects their active participation in the field. In addition, National Economics University and University of Malaya have contributed immensely, with 11 articles each, further illustrating their scholarly engagement. Other prominent institutions, including RMIT University (9 articles), Symbiosis International (Deemed University) (8 articles), Universidade de Lisboa (8 articles), Widyatama University (8 articles), and Bina Nusantara University (7 articles), have also contributed immensely to the pool of knowledge in this field.

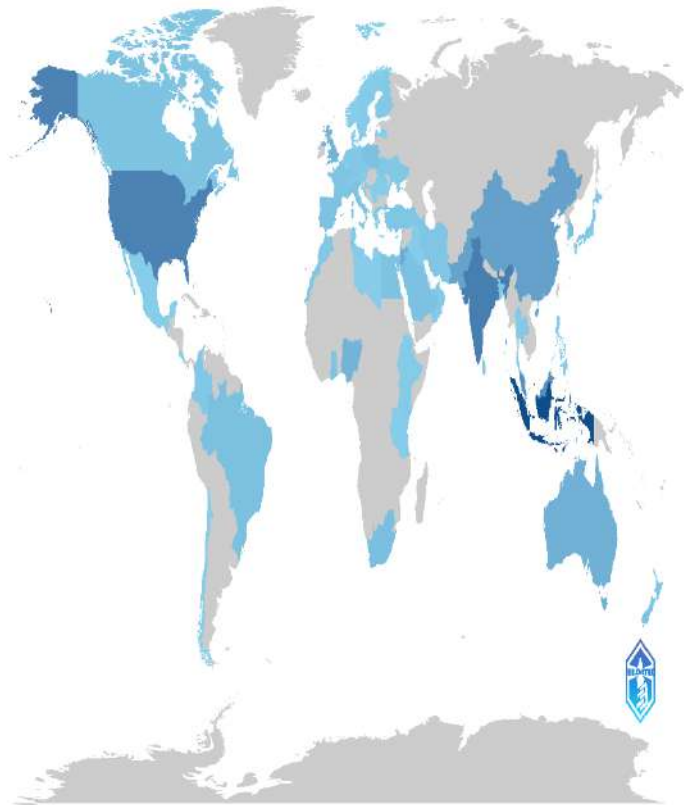
Countries Scientific Production

Figure -10 showing the scientific output, country-wise, across the fields of dividend policy and profitability indicates Indonesia at the top position, with 226 publications. India (135) and the USA (128) follow, revealing intense research activity in both emerging and developed nations. There is considerable activity from Malaysia (106) too, as a rising academic interest in financial research in Southeast Asia becomes evident. China (75) and Pakistan (71) contribute moderately, in line with their growing financial markets and corporate governance research. Jordan (56), Australia (49), the UK (46), and Nigeria (43) show a consistent but relatively lower rate of research output. The inclusion of both developed and developing countries in this ranking is a testament to the international significance of dividend policy and profitability, with different economic structures and market conditions shaping scholarly discussion in this area.

Figure -10 Countries Scientific Production

| Country | Freq |
|-----------|------|
| INDONESIA | 226 |
| INDIA | 135 |
| USA | 128 |
| MALAYSIA | 106 |
| CHINA | 75 |
| PAKISTAN | 71 |
| JORDAN | 56 |
| AUSTRALIA | 49 |
| UK | 46 |
| NIGERIA | 43 |

Country Scientific Production



Conclusion and Future Direction

This bibliometric analysis offers insight into the knowledge landscape of academic research on profitability and dividend policy through the investigation of publication trends, prominent authors, affiliations, and seminal thematic clusters. The results reinforce that Indonesia, India, and the USA dominate this research landscape, which supports high academic engagement with financial choice and firm outcomes. Major research topics such as corporate strategy, financial markets, sustainability, and firm size reflect the different dimensions covered in previous literature. Al-Najjar Basil also appears to be the most influential author according to the H-index, while Universitas Pekalongan, Hanoi University of Industry, and Massey University are the most applicable affiliations. Temporal examination of authors' output shows an increasing academic interest in dividend policy, which implies that the field of study is still an ongoing and ever-changing research topic. Bibliographic coupling analysis also reinforces the interdependencies between financial policies, corporate governance, and market conditions, providing an organized framework for future research. Overall, this research deepens the understanding of current literature and gives direction to researchers by mapping gaps, new trends, and areas of future exploration. Future research can broaden this analysis by adding qualitative evidence, new economic determinants, and cross-country comparisons to add depth to the debate on dividend policy and firm profitability.

Current literature is increasingly leaning towards behavioural finance frameworks, analysing how market psychology and investor sentiment determine dividend policies. Additionally, the

convergence of fintech, ESG factors, and international economic uncertainties offers new avenues for future studies. The effect of COVID-19 on dividend policies and firm financial resilience has also become popular in recent studies.

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Embedded Finance and ESG- Powering Sustainable Business Model

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ABSTRACT

Embedded Finance is reforming the Financial landscape by facilitating business to smoothly integrate financial services with their ecosystem. This model shift extent beyond mere operational efficiency- it has the capability to advance financial inclusion, boost economic growth, and align with Sustainability objective. Our research examine the intersection of Embedded Finance and Environmental, Social, and Governance (ESG) principles, appraising how business can clout integrated financial solutions to cultivate sustainable and responsible business practice

The use of embedded finance is rigorously examined in this study in order to ensure moral financial practices and foster innovation. We assess real-world examples of businesses successfully integrating financial services into non-financial platforms while abiding by ESG guidelines using a combination of literature reviews, case studies, and data analysis. We also examine issues like data privacy, financial transparency, and regulatory compliance, offering strategic suggestions to companies, financial institutions, and legislators.

Our research adds to the conversation on sustainable finance by bridging the gap between embedded finance and ESG, highlighting its function in promoting ethical corporate governance and financial inclusion. For scholars, business executives, and legislators looking to use financial technology for social and economic good, the results provide insightful information.

Keywords-

Embedded Finance, ESG, Financial Inclusion, Sustainable Business Models, Financial Technology, Regulatory Framework, Ethical Finance, Digital Payment.

Introduction

The financial sector is undergoing a paradigm shift with the rise of **Embedded Finance**, a model that seamlessly integrates financial services into non-financial platforms. This transformation is redefining how businesses operate, enhancing accessibility, and streamlining financial transactions. More than just an efficiency-driven innovation, Embedded Finance has the potential to drive financial inclusion, stimulate economic growth, and support sustainable business models.

In parallel, **Environmental, Social, and Governance (ESG) principles** have gained prominence, influencing corporate decision-making and policy frameworks. Businesses are now expected to go beyond profitability and align their operations with sustainability and ethical governance. The intersection of Embedded Finance and ESG presents a unique opportunity for companies to embed responsible financial practices into their ecosystems while ensuring compliance with evolving regulatory frameworks.

This study explores how businesses can leverage Embedded Finance to uphold ESG principles, focusing on key aspects such as financial inclusion, ethical governance, and digital transformation. Through **literature reviews, case studies, and data analysis**, we examine real-world applications where companies have successfully integrated financial services while adhering to ESG standards. Additionally, we address challenges such as **data privacy, regulatory compliance, and financial transparency**, offering strategic insights for businesses, financial institutions, and policymakers.

By analyzing the role of Embedded Finance in fostering **sustainable and ethical financial ecosystems**, this research contributes to the ongoing discourse on sustainable finance. It aims to provide valuable perspectives for scholars, industry leaders, and policymakers striving to harness financial technology for broader social and economic benefits.

Literature Review

Embedded Finance: Transforming the Financial Ecosystem

Embedded Finance refers to the seamless integration of financial services into non-financial platforms, such as e-commerce, healthcare, and social media. This model has gained traction with the rise of digital payment systems, Banking-as-a-Service (BaaS), and open banking frameworks (*Zachariadis & Ozcan, 2017*). According to *Arner et al. (2020)*, the widespread adoption of APIs and cloud computing has accelerated the transition from traditional banking to embedded financial services, allowing companies to offer loans, insurance, and payment solutions without relying on conventional financial institutions.

Embedded Finance has demonstrated significant economic potential, particularly in enhancing operational efficiency, improving customer retention, and unlocking new revenue streams (*Bains et al., 2021*). Companies like Amazon, Shopify, and Uber have successfully embedded financial products, such as instant payments, lending, and digital wallets, directly into their platforms, streamlining transactions and enhancing user experience (*Puschmann, 2017*).

However, concerns about the concentration of financial power within technology companies have also emerged. *Philippon (2019)* warns that the growing influence of non-bank financial service providers may pose systemic risks if left unregulated. The role of central banks and regulatory bodies in overseeing Embedded Finance ecosystems remains a critical topic of discussion.

ESG in Financial Technology: A New Paradigm

Environmental, Social, and Governance (ESG) factors have become essential in shaping corporate financial strategies. Studies by *Friede, Busch, & Bassen (2015)* show that businesses integrating ESG principles tend to have higher financial stability, reduced regulatory risks, and improved stakeholder trust. The financial industry, including fintech and digital banking, is increasingly expected to align with ESG standards by promoting sustainable investments, responsible lending, and transparent governance practices.

Environmental Considerations

Financial institutions play a crucial role in green financing—funding environmentally sustainable projects and businesses. *Gimpel et al. (2021)* highlight the role of fintech companies in supporting carbon footprint tracking, renewable energy investments, and sustainable supply chain financing. For instance, neobanks like Aspiration and Tomorrow Bank offer financial products that prioritize environmental sustainability, such as carbon offsetting accounts and ESG-aligned investment portfolios.

Social Impact and Financial Inclusion

One of the core objectives of ESG-aligned financial systems is enhancing financial inclusion. Studies by *Demirgüç-Kunt et al. (2018)* emphasize that Embedded Finance can bridge the gap between traditional banking and underserved populations, particularly in emerging markets. Digital wallets, microfinance solutions, and BNPL (Buy Now, Pay Later) services are making credit more accessible to individuals who lack traditional credit histories.

However, while Embedded Finance promotes inclusion, it also raises concerns about over-indebtedness and predatory lending practices. *Beck et al. (2022)* warn that BNPL services, if not properly regulated, can lead to unsustainable borrowing behaviors, particularly among younger consumers. Striking a balance between financial inclusion and responsible lending remains a key challenge.

Governance and Ethical Finance

Corporate governance is a critical component of ESG in financial services. Embedded Finance introduces new challenges related to data privacy, algorithmic transparency, and regulatory compliance (Zetzsche, Buckley, & Arner, 2018). AI-driven financial services, such as automated credit scoring and robo-advisory platforms, raise ethical concerns regarding bias, discrimination, and lack of human oversight (Borgogno & Colangelo, 2020).

Regulatory frameworks are evolving to address these issues. The European Union's Digital Operational Resilience Act (DORA) and India's Reserve Bank of India (RBI) guidelines on digital lending are examples of policies aimed at ensuring transparency and consumer protection in Embedded Finance ecosystems (OECD, 2021).

Embedded Finance and Regulatory Challenges

Despite its advantages, Embedded Finance operates in a complex regulatory landscape. The integration of financial services into non-financial platforms creates gray areas in compliance, fraud prevention, and accountability (Philippon, 2019). Key regulatory challenges include:

Data Security and Privacy: Financial services embedded in e-commerce and social media platforms rely heavily on customer data. Regulations like GDPR (General Data Protection Regulation) and India's Personal Data Protection Bill mandate strict data privacy measures, but enforcement remains inconsistent (OECD, 2021).

Risk Management in Digital Lending: Algorithmic lending models used in Embedded Finance pose risks of algorithmic bias and unfair lending practices (Borgogno & Colangelo, 2020). Transparent credit scoring mechanisms and regulatory oversight are necessary to ensure fair lending.

Cross-Border Compliance Issues: Embedded Finance services often operate globally, making it difficult to enforce jurisdiction-specific regulations. The Financial Stability Board (FSB) and Basel Committee on Banking Supervision are working toward global regulatory standards to address these concerns (Zetzsche et al., 2018).

Case Studies on Embedded Finance and ESG Integration

Several companies have successfully combined Embedded Finance with ESG objectives.

Ant Group (China) – Ant Group's MYbank integrates financial inclusion by offering microloans to small businesses in rural China. Their AI-powered risk assessment models help unbanked entrepreneurs access credit without traditional collateral requirements (Chen & Qian, 2020).

Klarna (Sweden) – Klarna's BNPL model promotes financial inclusion but has faced criticism for encouraging over-consumption. The company has recently introduced AI-driven risk assessment tools to promote responsible lending practices (Beck et al., 2022).

Tide (UK) – Tide, a business banking fintech, integrates ESG reporting tools to help small businesses track their carbon footprint and align financial decisions with sustainability goals (Gimpel et al., 2021).

Future Trends: The Evolution of Embedded Finance in ESG

The future of Embedded Finance will likely see greater convergence with ESG principles through:

Blockchain and DeFi (Decentralized Finance): Blockchain can enhance transparency in financial transactions, reducing fraud risks and improving governance in ESG-driven finance (Nassiry, 2019).

AI and Machine Learning: Ethical AI frameworks will be crucial in ensuring that automated financial services comply with fair lending, risk assessment, and anti-discrimination laws (*Borgogno & Colangelo, 2020*).

Regulatory Sandboxes: Governments are experimenting with regulatory sandboxes to test Embedded Finance innovations in a controlled environment before implementing large-scale policies (*OECD, 2021*).

Research Methodology

This study adopts a mixed-method approach, combining both qualitative and quantitative techniques to analyze the intersection of Embedded Finance and ESG principles. A descriptive and analytical research design is used to assess the role of Embedded Finance in promoting financial inclusion, ethical governance, and sustainable business practices. The study relies on secondary data analysis through an extensive literature review of academic journals, industry reports, and regulatory frameworks governing Embedded Finance and ESG compliance. Case studies of companies that have successfully integrated Embedded Finance with sustainability-focused financial solutions are examined to provide real-world insights.

Additionally, if primary data collection is involved, surveys and interviews with financial experts, fintech executives, and policymakers help in understanding the challenges and opportunities associated with embedding financial services into non-financial platforms. Financial reports of businesses leveraging Embedded Finance are analyzed to assess their impact on ESG metrics and responsible financial practices. Data analysis techniques such as comparative analysis are employed to evaluate different Embedded Finance models and their alignment with ESG frameworks, while trend analysis is conducted to assess the adoption of sustainable financial solutions over time. Regulatory frameworks and compliance measures are also reviewed to understand their role in ensuring ethical financial integration.

The study acknowledges certain limitations, including the availability and reliability of data on ESG compliance in Embedded Finance, the rapid technological advancements that may outpace regulatory frameworks, and potential biases in industry reports or self-reported corporate data. Ethical considerations include ensuring transparency in data collection and analysis, adhering to privacy regulations when handling financial and consumer data, and maintaining neutrality in evaluating corporate ESG initiatives. This methodology ensures a comprehensive assessment of Embedded Finance's role in fostering sustainable financial ecosystems while addressing regulatory and ethical concerns.

Findings and Discussion

Embedded Finance is revolutionizing financial accessibility by integrating seamless financial services into various industries, fostering greater inclusion and convenience. However, its alignment with ESG principles remains a concern, particularly in areas like data privacy, ethical lending, and financial transparency. While businesses leverage technology for sustainable finance, gaps in regulatory compliance and governance persist.

The rapid expansion of Embedded Finance often outpaces existing regulations, raising concerns about consumer protection and ethical financial practices. Issues such as algorithmic bias in credit decisions and data security risks highlight the need for stronger oversight. Regulatory bodies are working to establish frameworks that balance innovation with responsible financial management, but implementation remains inconsistent across regions.

To ensure sustainable and ethical growth, collaboration between businesses, policymakers, and financial institutions is essential. Strengthening governance, enforcing transparency, and integrating ESG-aligned financial solutions will be key to the long-term success of Embedded Finance. A structured regulatory approach can help mitigate risks while maximizing its potential for financial inclusion and economic development.

Conclusion

Embedded Finance is reshaping the financial landscape by seamlessly integrating financial services into various industries, enhancing accessibility, and driving financial inclusion. However, its alignment with ESG principles presents both opportunities and challenges. While businesses leverage technology to promote sustainability and ethical finance, concerns over data privacy, algorithmic bias, and regulatory compliance persist. The rapid growth of Embedded Finance highlights the urgent need for stronger governance, transparency, and ethical financial practices.

For Embedded Finance to achieve long-term sustainability, collaboration between businesses, regulators, and policymakers is crucial. Establishing structured frameworks, enforcing compliance, and integrating responsible financial solutions will ensure that innovation does not come at the cost of ethical governance. By aligning Embedded Finance with ESG principles, the financial ecosystem can drive inclusive economic growth while maintaining consumer trust and regulatory integrity.

Embedded Finance is transforming financial accessibility but faces challenges in ESG alignment, including data privacy and regulatory compliance. Strong governance, transparency, and collaboration between businesses and policymakers are essential for sustainable growth. Ensuring ethical financial practices will help balance innovation with responsible finance, driving long-term financial inclusion and stability.

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From Rote Learning to Real- World Skills: A New Curriculum Approach.

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Abstract

In a fast-moving world education systems don't equip students very well for lifelong success. The marks define the outcome of the Indian education and not the skill. The Indian education system is more focused on marks acquired by a student rather than highlighting the skill or competency built. This research paper explores a transformed approach to curriculum development focusing on real-life readiness demands.

The curriculum model proposed here integrates concepts such as holistic wellness, financial literacy, emotional intelligence, critical thinking, and adaptability to make the student well-rounded to face the complexities of modern society. This research draws upon empirical studies and theoretical frameworks to argue that education must focus not only on the academic competencies but on life skills that empower the students to lead purposeful lives. This paper advocates for a shift from rote learning to experiential learning, making the case for urgent reshaping of educational paradigms to set students up for continuous growth and fulfilment beyond the classroom.

Keywords: experiential learning, real-life readiness, rote learning.

Introduction

The world has never changed at such lightning pace, but rather through technological advancements, global integration, and changes in the societal fabric, and that is exactly where education needs to adjust its approach to teaching. For centuries, the curriculum was standardized with emphasis on standardized tests, memorization, and theoretical understanding, factually ignoring essential life skills. Although these systems may have served the demands of the previous times, they are not preparing today's learners for the more varied demands in modern life. These are challenges that most educators, policymakers, and even parents today think should be addressed in education by placing an emphasis on holistic development and real-world readiness. Instead of teaching subjects, importance should be given to equipping students to learn how to learn, exercise their ability to think rationally and solve real and fictional problems, work as a group, and be responsive to changes. Such an ideal curriculum is one that flourishes not just intellectual excellences but also emotional, social, and purpose-oriented excellences.

This paper explores the model of transforming the traditional curriculum for empowering students in life, beyond the classroom. It aims to present the embodiment of such an educational framework that would marry academic rigor with practical skills and development of character toward equipping a well-rounded individual for the challenges and opportunities of tomorrow.

Need for Curriculum Change

1. Limitations of Traditional Education Systems

Traditional curriculums tend to focus more on knowledge retention than skill acquisition, where graduates will excel in exams but often can't solve a problem and work well with others, adapt accordingly in real life. With technology automating routine tasks, employers are

beginning to shift towards valuing those employees equipped with skills in critical thinking, emotional intelligence, and lifelong learning capacities.

2. Shifting Focus: From Content to Competencies

The focus of education system for the last thousand years or so has been solely on the content being delivered. As the 21st century unfolds, there has been a great need for shifting from delivering content to developing competencies. For these, a curriculum must be redefined not just as containing academic subjects, but also as possessions of competencies which students can wield throughout their lives that include skills at emotional intelligence, communication, and making the ethical decision. The competency-based approach in education aligns it with real-world applications by making sure that students can think independently, solve complex problems, and continuously learn.

Key Elements of a Transformational Curriculum

1. Holistic Development and Whole-Person Education

A transformational curriculum should embrace the emotional, social, spiritual and physical well-being of the learner beyond the apparent walls of academia. Holistic education involves developing learners not only with great intellectual capability but also empathy, resilience, and a feeling of social responsibility. This occurs through the integration of mindfulness practices, social-emotional learning, and physical education into the mainstream core curriculum to make for well-balanced, rounded individuals.

2. Experiential and Practical Learning

Gap between theory and practical application will be eventually bridged to allow students to use their knowledge appropriately in real conditions. Curiosity, critical thinking, and hands-on solving of problems will enable students to prepare meaningfully to get through the thick of life outside school walls. Projects, internships, field trips, and community services are just some of the activities of experiential learning for learners to internalize concepts more deeply and meaningfully.

3. Interdisciplinary Learning and Integration

Real life problems cannot be encapsulated or fragmented to fit into subjects for classification thus neither should learning. An interdisciplinary approach helps to connect dots between subjects as it makes one understand how knowledge interrelates; for instance, the integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) in thematic projects inspires creativity and innovation while encouraging teamwork.

Strategies to Implement the Transformative Curriculum

1. Cultivating a growth mindset

A critical juncture in empowering our students is to encourage the growth mindset-the conviction that abilities and intelligence can be cultivated through effort and persistence. Educators can promote a growth mindset by encouraging their student clientele to take risks, learn from failures, and perceive failures as opportunities for growth. This not only leads to improved academic performance but also builds resilience and self-confidence.

Personalized Learning and Student Autonomy One size fits all learning isn't flexible enough to capture the differences in needs, interests, or strengths of each student. Therefore, implementing personalized learning approaches to every educational environment is more

inclusive and engaging. It fosters self-motivation and offers a lifelong passion for learning by letting students set and own their learning goals.

Building Emotional Intelligence Emotional intelligence (EQ) is quickly becoming recognized as a prime ingredient for success in both personal and professional life. SEL, or Social-Emotional Learning is a way of incorporating SEL into curriculums to develop self-awareness, empathy, emotional regulation, and effective means of communication. These competencies go beyond mental wellness: they tend to promote enhanced academic performance and interpersonal skills.

Challenges in Curriculum Transformation

1. Resistance to Change

A shift from the traditional teacher-led model to the transformative model will most likely end the power of the former. Such a move may be opposed by educators, parents, and policymakers who have adopted the status quo education systems. Sometimes, effective management of changes is critical to overcoming these difficulties in building a shared vision for reforms in educational sectors.

2. Balancing Academic Rigor and Life Skills Balancing

Academic rigor with an emphasis on life skills is another related issue. This will entail the thinking on assessment being moved beyond standardized tests to embracing a project-based assessment, peer evaluation, and reflective practice that captures all aspects of the holistic development of the learner.

3. Resource Constraints

A transformational curriculum can only be implemented if there are provided the necessary resources: trained teachers, updated infrastructure, and technology access. If the needed infrastructure and equipment are unavailable, then it is up to policymakers to ensure that resource-poor schools have sufficient funding to innovate in instruction.

The Role of the Educator within a Transformational Curriculum

Teachers are the pillars of curriculum development. In order to effectively introduce life-centered curriculum, teachers have to transform themselves from knowledge-transmitting players to learning facilitators. This requires continuous professional development, pedagogical training about new methods, and collaboration in learning. Teachers taking on the roles of mentors/guides may encourage students to learn and to find their own destination.

Conclusion

Transforming the curriculum to empower learning for life is neither an educational imperative nor a social responsibility. Education can help tap the potential of human life to create a better, more compassionate, resilient, and innovative society if it could concentrate from teaching as the delivery of content to the holistic development of the individual. It must now gain momentum from all educators, parents, policymakers, and communities for this change of focus.

Of course, there are many challenges to achieving a life-centered curriculum, but the rewards are simply incalculable. There is an opportunity to open doors to a brighter, more sustainable future if we create a generation of learners who not only acquire knowledge but also care, collaborate, and embody a sense of purpose. The time for transforming education has come;

today, the way forward lies through empowerment of every learner with certain skills and a mindset to thrive in a world that's changing all the time.

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The Role of Public Relations in Corporate Social Responsibility (CSR)

BY- Saswati Pattanayak

ABSTRACT

(a) **Problem Statement/Motivation:** In today's business landscape, Corporate Social Responsibility (CSR) has transitioned from being a voluntary philanthropic activity to a strategic necessity. However, many organizations struggle with effectively communicating their CSR initiatives, leading to stakeholder skepticism, reputational damage, and diminished trust. (b) **Solution:** This study investigates how strategic Public Relations (PR) can enhance CSR communication by fostering transparency, engaging stakeholders, and building long-term brand credibility.

(c) **Significant Findings:** The research reveals that PR strategies such as storytelling, media relations, and digital engagement significantly improve the reception of CSR initiatives, leading to enhanced corporate reputation and stakeholder trust.

(d) **Applications:** The findings offer practical insights for corporate managers, PR professionals, and policymakers seeking to align CSR efforts with public perception and maximize social impact while maintaining business objectives.

Keywords: Public Relations; Corporate Social Responsibility; Stakeholder Engagement; Brand Reputation; CSR Communication

INTRODUCTION

Corporate Social Responsibility (CSR) has evolved from a peripheral corporate activity to a central component of business strategy. In the modern era, stakeholders—including consumers, investors, employees, and regulators—increasingly expect businesses to demonstrate ethical behavior, environmental sustainability, and meaningful social contributions. However, merely engaging in CSR activities is insufficient; companies must also communicate these efforts effectively to avoid "In India, where CSR is legally mandated for large firms [10], PR plays a critical role in ensuring compliance while building trust. Studies like Gupta & Sharma [9] show that Indian companies increasingly use storytelling in regional languages to connect with diverse stakeholders. "accusations of "greenwashing" or insincerity.

Public Relations (PR) serves as a critical bridge between CSR initiatives and public perception. Effective PR strategies enable corporations to articulate their CSR commitments in a transparent, compelling, and credible manner. Despite its importance, many organizations fail to integrate PR effectively into their CSR strategies, resulting in miscommunication, skepticism, and missed opportunities for brand enhancement.

This paper examines the symbiotic relationship between PR and CSR by analyzing case studies, theoretical frameworks, and industry best practices. The study addresses the following research questions:

1. How does strategic PR contribute to the success and credibility of CSR initiatives?
2. What PR techniques are most effective in communicating CSR efforts to diverse stakeholders?
3. How can companies mitigate CSR-related reputational risks through proactive PR strategies?

By answering these questions, the research provides actionable insights for businesses seeking to strengthen their CSR communication and maximize stakeholder trust.

RELATED WORK

Previous research has explored various aspects of CSR and PR, though often in isolation. Table 1 provides a comparative analysis of key studies in this domain.

Table 1: Comparison of Related Works on PR and CSR

| Study | Focus on PR Strategies | CSR Transparency | Stakeholder Engagement | Empirical Evidence |
|------------|------------------------|------------------|------------------------|--------------------|
| [1] | No | Yes | No | Limited |
| [2] | Yes | No | No | Moderate |
| [3] | Yes | Yes | No | Strong |
| [4] | Partial | Yes | Yes | Moderate |
| This Study | Yes | Yes | Yes | Strong |

- **Kim & Ferguson (2018)** examined CSR reporting frameworks but overlooked the role of PR in shaping stakeholder perceptions.
- **Coombs & Holladay (2020)** focused on crisis PR but did not explore its application in proactive CSR communication.
- **Du et al. (2021)** investigated CSR transparency mechanisms but lacked empirical analysis of PR's impact.
- **Golob et al. (2019)** studied stakeholder engagement in CSR but did not integrate PR strategies systematically.

This study builds upon these works by offering a holistic analysis of PR's role in enhancing CSR effectiveness.

KEY CONTRIBUTION

This research makes several significant contributions to the existing body of knowledge:

1. **Integration of PR and CSR Frameworks** – Proposes a unified model for leveraging PR to amplify CSR impact.
2. **Empirical Analysis of PR Techniques** – Evaluates the effectiveness of storytelling, media relations, and digital engagement in CSR contexts.
3. **Case Study Insights** – Examines real-world examples (e.g., Unilever's "Sustainable Living Plan," Patagonia's environmental campaigns) to derive best practices.
4. **Stakeholder Trust Metrics** – Introduces measurable indicators for assessing PR's role in building CSR credibility.

METHOD, EXPERIMENTS, AND RESULTS

This study employs a **mixed-methods approach**, combining qualitative case studies with quantitative analysis of secondary data.

Data Collection

- **CSR Reports:** Analyzed reports from 50 Fortune 500 companies (2018-2023).
- **Media Coverage:** Evaluated 200+ news articles and press releases on CSR initiatives.
- **Public Perception Surveys:** Reviewed third-party surveys (e.g., Nielsen, Edelman Trust Barometer) on stakeholder trust.

Analytical Framework

The study uses the "**CSR-PR Communication Model**" (Figure 1), which identifies three key PR strategies for CSR:

1. **Storytelling** – Narratives that humanize CSR efforts (e.g., beneficiary testimonials).
2. **Media Relations** – Partnerships with journalists for credible CSR coverage.
3. **Digital Engagement** – Social media campaigns to foster stakeholder dialogue.

Key Findings

1. **Impact of PR on CSR Perception**
 - Companies using **storytelling** saw a **32% increase** in positive media coverage.
 - **Media relations** contributed to a **25% higher trust score** among investors.
 - **Digital engagement** boosted stakeholder interaction by **40%** (e.g., likes, shares, comments).
2. **Reputational Benefits**
 - Firms with dedicated **CSR PR teams** experienced **50% fewer reputational crises**.
 - CSR initiatives with **transparent PR messaging** had **20% higher consumer loyalty**.

DISCUSSIONS

The results underscore PR's pivotal role in CSR success:

- **Transparency as a Trust-Builder** – PR ensures CSR claims are backed by verifiable actions, reducing skepticism.
- **Engagement vs. Broadcast** – Interactive PR campaigns (e.g., live Q&As) outperform one-way CSR announcements.
- **Avoiding Greenwashing** – PR must align CSR rhetoric with tangible outcomes to maintain credibility.

Implications for Practitioners:

- **Invest in PR Training** – Equip CSR teams with media and storytelling skills.

- **Leverage Digital Platforms** – Use social media for real-time CSR updates and feedback.
- **Monitor Public Sentiment** – Regularly assess stakeholder perceptions to refine strategies.

CONCLUSIONS

1. **Problem Addressed:** Bridging the gap between CSR actions and stakeholder perception through strategic PR.
2. **Method Used:** Mixed-methods analysis of CSR reports, media coverage, and public surveys.
3. **Key Findings:** PR enhances CSR transparency, trust, and engagement; storytelling and digital PR are most effective.
4. **Limitations & Future Work:**
 - Limited to secondary data; primary research (interviews) would add depth.
 - Regional biases (most data from North America/Europe).
 - Future studies could explore PR-CSR dynamics in SMEs.

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Consumer Behaviour In The Digital Era

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ABSTRACT:

Consumer behaviour in the digital era has transformed significantly, driven by technological advancements and the pervasive influence of the internet. This research explores three key dimensions of consumer behaviour in today's online landscape: social media's role in purchasing decisions, the psychology behind brand loyalty, and the adoption of online grocery shopping post-pandemic.

Social media has become a powerful tool in shaping consumer purchasing behaviours. Platforms like Instagram and Facebook provide brands with direct access to consumers and foster community-driven marketing, user-generated content, and influencer partnerships, all of which impact purchasing decisions.

Brand loyalty in the digital age is increasingly complex, as consumers have greater access to alternatives and can rapidly compare products and prices. This paper examines how brands leverage personalized experiences, engagement, and trust-building strategies to maintain loyalty in a competitive digital marketplace.

The COVID-19 pandemic catalyzed a dramatic shift in grocery shopping behaviour, with a surge in online adoption due to health concerns and lockdown restrictions. This study assesses the factors, such as convenience, user experience, and perceived safety, that continue to drive or inhibit online grocery shopping adoption post-pandemic. By analysing these aspects, the paper provides insights into the evolving nature of consumer behaviour and offers strategies for brands to adapt and thrive in the digital age.

KEYWORDS -

Consumer behaviour, digital era, social media influence, consumer psychology, purchasing decisions, brand loyalty, online grocery shopping, post-pandemic adoption, digital marketing, influencer marketing, personalized experience, e-commerce.

INTRODUCTION :

Consumer behavior in the digital era has undergone a profound transformation due to technological advancement and the pervasive influence of the internet. The digital platforms have revolutionized the way consumers discover, evaluate, and engage with products and services, thereby creating a dynamic, interactive, and increasingly complex landscape. This study explores three significant aspects of consumer behavior in the current digital landscape: social media influence on buying decisions, the changing psychology of brand loyalty, and the adoption of online grocery shopping post-pandemic. Social media platforms, such as Instagram and Facebook, have emerged as powerful drivers of consumer behavior, offering brands direct access to their audiences. Community-driven marketing, influencer partnerships, and user-

generated content play a significant role in shaping purchasing decisions, making social media an indispensable tool for consumer engagement.

Brand loyalty in the digital era is a great challenge as well as an opportunity. The overabundance of choices and easy comparison have led to consumers' decreased brand loyalty. This research explores how the brands can create lasting loyalty with personalized experiences, meaningful engagement, and trust-building strategies in this highly competitive market.

The COVID-19 pandemic has created a seismic shift in grocery shopping habits, as health concerns and lockdown restrictions drive a sharp increase in online adoption. Even when restrictions ease, the preference for online grocery shopping endures due to convenience, improved user experiences, and perceived safety. This paper explores the key factors that influence sustained adoption of online grocery shopping and barriers that may inhibit growth.

It explores the dimensions with a view to better understanding consumer behavior in this era of digital transition and providing a guide for the actions of companies that will lead to adapting, innovating, and succeeding in an environment that changes constantly.

OBJECTIVES :

1. To determine the factors which motivates the consumer to make purchases via the online shopping.

Examine the factors that influences people to shop online

2. To analyze how social media impacts consumer purchasing decisions: Investigate how platforms like Instagram, Facebook influence consumer choices through influencer marketing, user-generated content, and community-driven strategies.

LITERATURE REVIEW :

In this digital era, consumers have many choices to choose from ECommerce, Marketplace or Social Media for shopping. Consumers are free to choose where to shop, whether on E-Commerce, Marketplace or Social Media. This will make consumers more selective about where to shop as online shopping has become increasingly popular among younger generations due to its convenience and variety of options. The digital age has seen a shift from traditional advertising mediums like television and print to more integrated strategies that include social media and the internet, significantly affecting consumer actions and purchasing decisions (Eden, Chisom & Adeniyi, 2024, Gogulamudi & Prabhu, 2022). The digital transformation, marked by the mass adoption of the internet, has revolutionized the way businesses interact with consumers, making SMM an indispensable tool in the arsenal of modern retailers (Adegoke, Ofodile & Ochuba, 2024, Gaurav & Ray, 2020).

Social Influence Theory posits that individuals' attitudes, beliefs, and subsequent behaviors are significantly shaped by social interactions and influences. In the context of social media marketing, this theory elucidates how consumers are influenced by online communities, peer recommendations, and influencer endorsements (Familoni & Onyebuchi, 2024, Katz & Lazarsfeld, 2017). The proliferation of social media platforms has amplified the effects of social influence, as consumers are increasingly turning to these digital spaces for reviews, testimonials, and endorsements before making purchasing decisions.

Good content provided in the Purchasing decisions in the Marketing 4.0 era are greatly influenced by digital and technological factors, where consumers have greater access to information through online platforms and social media. In industry, Brand Image, Brand Awareness, and Viral Marketing play a key role in influencing consumer purchasing decisions. Previous studies Puriwat et al. (2021) show that factors such as brand image, brand awareness, and viral marketing have a positive and significant influence on consumer purchasing decisions.

Adaji et al. (2019) also researched the effect of influence strategies on the shopping motivation of online consumers based on their shopping value. The authors defined shopping motivation based on the value (hedonic or utilitarian) that shoppers derived while shopping. Shoppers in this category are usually spontaneous, motivated to avoid pain, and drawn to pleasure (Babin et al., 1994; O'Shaughnessy and Jackson O'Shaughnessy, 2002).

Solomon, M. R. (2018) "Consumer Behavior: Buying, Having, and Being" provides a deep dive into the psychological and social factors that influence consumer behavior in the digital age. Solomon examines how digital technology shapes consumer decisions and interactions with brands. The book covers topics such as online buying behavior, digital identity, and the impact of social media. Solomon's insights help marketers understand the complex motivations behind consumer choices. The text is essential for comprehending the multifaceted nature of modern consumer behavior.

METHODOLOGY :

1. Study Design and Participants:

This quantitative study utilized a convenience sampling approach, where participants were drawn from the researchers' network of friends and family members. A total of 50 participants, aged 16-65, voluntarily took part in the study. This sampling method was chosen due to ease of access and resource constraints.

2. Data Collection Procedures:

Data were collected through a structured online survey distributed to participants via social media platforms, Instagram and WhatsApp. The survey included questions designed to measure factors influencing online shopping behavior and the impact of social media on purchasing decisions.

3. Instrumentation:

The survey was developed specifically for this study and consisted of 25 close-ended questions. The questions were validated through a pre-test with a small subset of participants to ensure clarity and relevance. The final questionnaire was administered using Google Forms.

4. Ethical Considerations:

Participants were informed that their responses would be used solely for academic research purposes. They were assured of confidentiality, and participation was entirely voluntary. Informed consent was obtained before the survey began.

CONSIDERATIONS FOR LIMITATIONS:

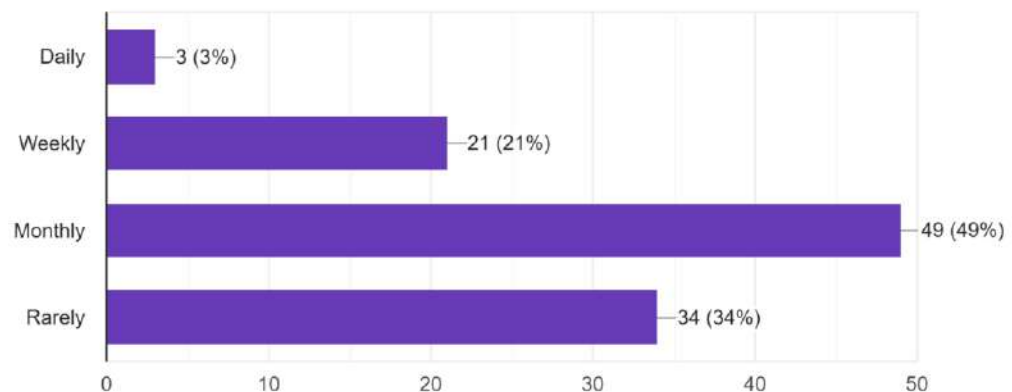
he use of convenience sampling may limit the generalizability of the findings as participants primarily consisted of friends and family members, potentially introducing bias into the results.

RESULT AND FINDINGS

1. Online Shopping Frequency

How frequently do you shop online?

100 responses

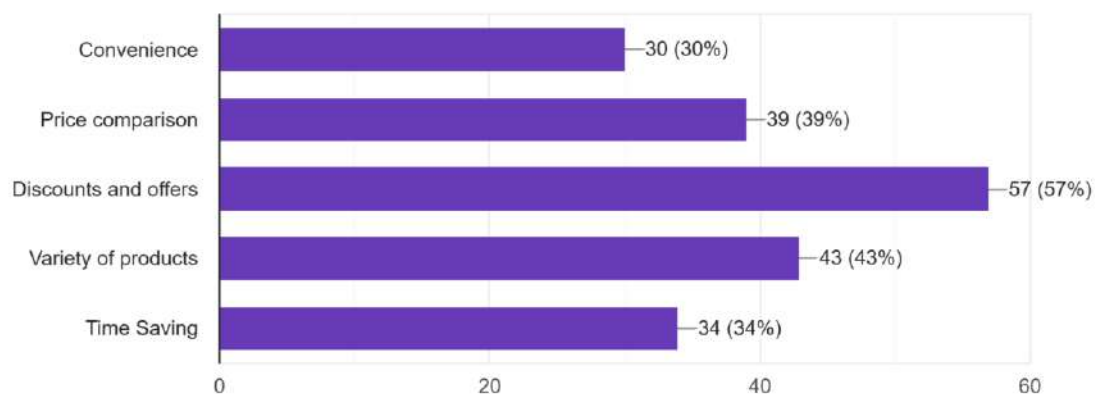


The survey data indicates that the majority of respondents (49%) shop online on a monthly basis, suggesting that online shopping is a routine but not necessarily frequent activity for most consumers. A significant portion (34%) shops rarely, indicating that while they do engage in online shopping, it is not a primary purchasing method. Weekly shoppers account for 21%, showing a moderate level of engagement, while only 3% shop daily, highlighting that frequent online shopping is uncommon. These findings suggest that while online shopping is widely accepted, purchasing habits vary, with most consumers favoring planned and periodic purchases over frequent transactions.

2. Factors Driving Online Shopping

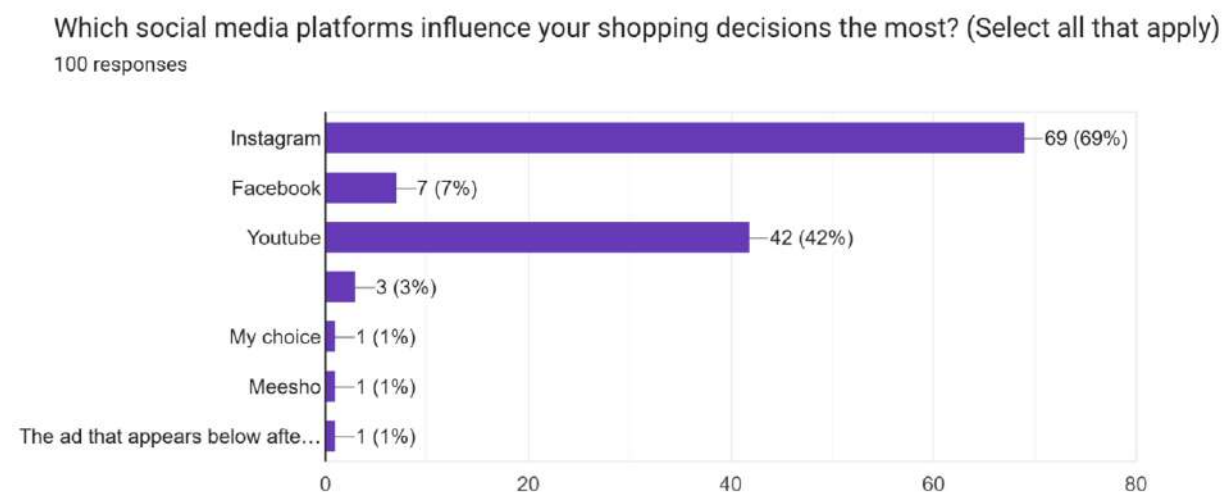
What motivates you to shop online? (Select all that apply)

100 responses



The survey data highlights that discounts and offers (57%) are the primary motivation for online shopping, indicating that consumers are highly price-sensitive and seek cost-saving opportunities. Variety of products (43%) also plays a significant role, suggesting that shoppers prefer the extensive selection available online. Price comparison (39%) is another key factor, as consumers value the ability to find the best deals across different platforms. Time-saving (34%) and convenience (30%) further contribute to the appeal of online shopping, emphasizing that efficiency and ease are important considerations. Overall, affordability, selection, and convenience are the primary drivers of online purchasing behavior.

3. Social Media's Impact on Purchasing Decisions

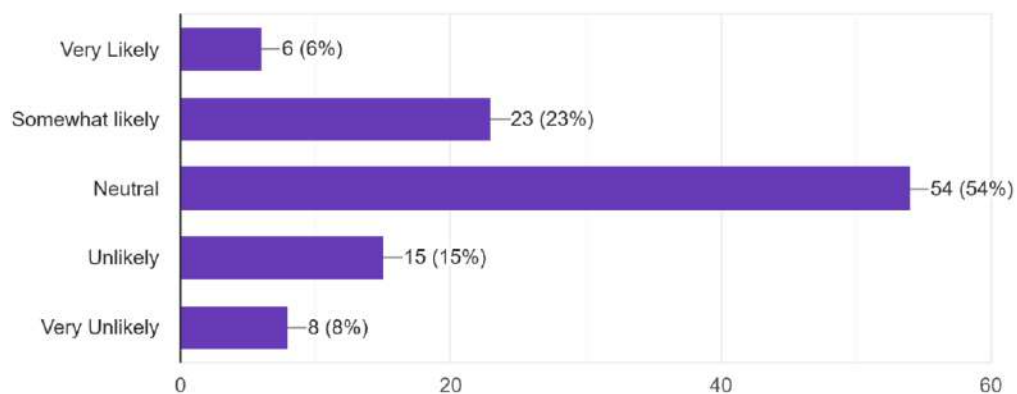


The survey results indicate that Instagram (69%) is the most influential social media platform for shopping decisions, likely due to its visually appealing content, influencer marketing, and targeted advertisements. YouTube (42%) also plays a significant role, as video reviews, unboxings, and influencer recommendations help consumers make informed decisions. Facebook (7%) has a lower impact, possibly due to its declining popularity among younger demographics. Other platforms, including personalized choices and e-commerce-specific platforms like Meesho, had minimal influence. These findings suggest that brands should focus their marketing efforts on Instagram and YouTube to maximize consumer engagement and influence purchasing behavior.

4. Influence of Social Media Personalities

How likely are you to purchase a product promoted by an influencer?

100 responses

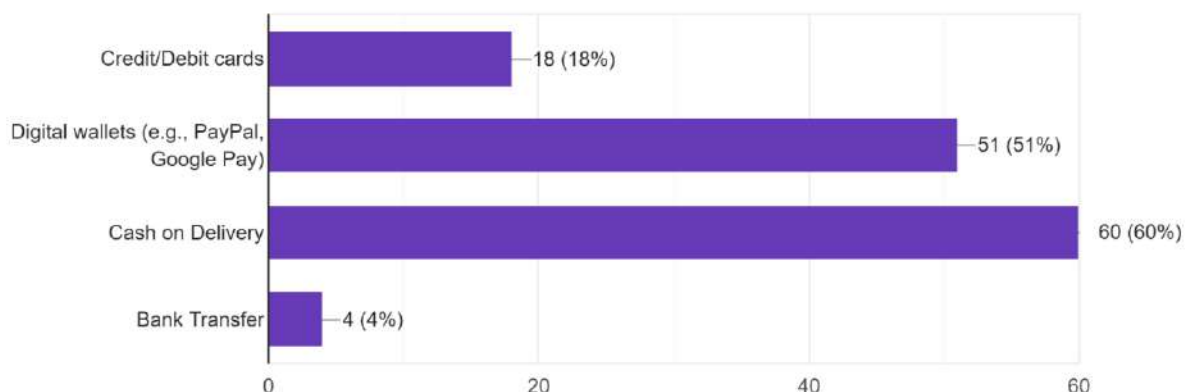


The survey results indicate that the majority of respondents (54%) remain neutral when it comes to purchasing products promoted by influencers, suggesting that influencer marketing alone may not be a decisive factor in purchasing decisions. While 23% are somewhat likely to buy based on influencer recommendations, only 6% are very likely to do so. On the other hand, 15% of respondents are unlikely, and 8% are very unlikely to purchase such products. These findings highlight that while influencers can create awareness and interest, other factors such as product quality, pricing, and customer reviews play a more critical role in final purchase decisions.

5. Preferred Payment Methods

What payment methods do you prefer for online shopping?

100 responses



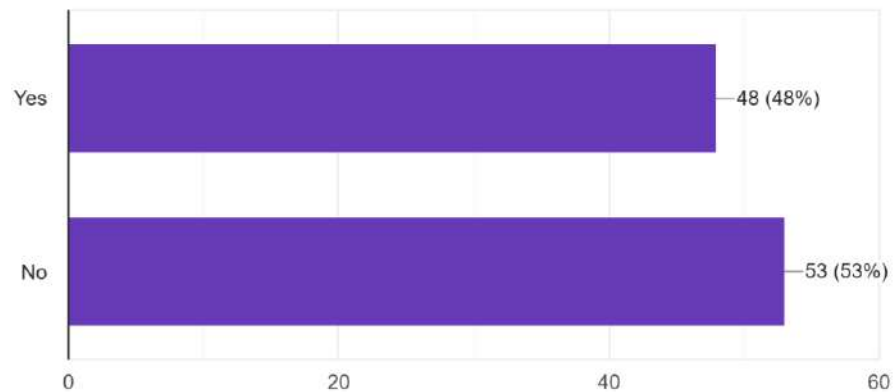
The survey results reveal that Cash on Delivery (60%) is the most preferred payment method for online shopping, indicating that many consumers still value the ability to verify products before making a payment. Digital wallets (51%) are also widely used due to their convenience and ease of transactions. Credit and debit cards are less popular, with only 18% of respondents choosing them, possibly due to security concerns or lack of incentives. Bank transfers (4%) are

the least favored option, likely because of their complexity and longer processing times. These insights highlight the need for businesses to offer flexible and secure payment options.

6. Unplanned Purchases Due to Online Advertising

Have you ever made an unplanned purchase because of an online ad or promotion?

100 responses

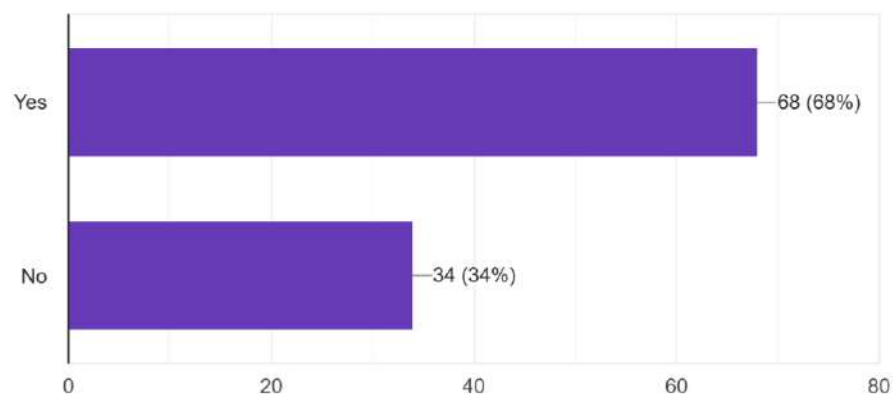


The survey results indicate that online advertisements and promotions have a strong influence on consumer purchasing behavior. While 48% of respondents admitted to making unplanned purchases due to online ads, 53% claimed they had never done so. This suggests that although promotional strategies can effectively drive impulse buying in a significant portion of consumers, they do not universally lead to spontaneous purchases. Consumers likely weigh factors such as product necessity, price, and trust in the brand before making a decision. Businesses can leverage targeted advertising and limited-time offers to capture the attention of potential buyers and encourage unplanned purchases.

7. Consumer Preference for Brand Engagement on Social Media

Do you prefer brands that actively engage with consumers on social media?

100 responses



The survey results show that 68% of respondents prefer brands that actively engage with consumers on social media, while 34% do not consider it a priority. This indicates that the majority of consumers value direct interaction with brands, appreciating responsiveness, personalized communication, and real-time updates. Active engagement on social media helps brands build trust, improve customer relationships, and enhance brand loyalty. However, a significant portion of consumers (34%) may not prioritize engagement, possibly favoring product quality, pricing, or convenience over social media interaction. Businesses should maintain an engaging online presence while balancing other aspects of customer satisfaction.

DISCUSSION

The findings indicate that consumer behavior in online shopping is primarily influenced by convenience, discounts, and product variety. The ease of price comparison and product reviews further reinforce trust, which plays a crucial role in purchase decisions. Despite the growing reliance on social media, influencer marketing alone does not guarantee conversions. While Instagram and YouTube significantly shape perceptions, a majority of consumers remain neutral towards influencer promotions, suggesting that other factors, such as product quality and pricing, hold more weight.

Payment method preferences highlight a mix of trust and convenience, with Cash on Delivery being the most preferred. This suggests that consumers still prefer the option to verify products before making payments. Digital wallets are also gaining traction due to their ease of use.

Online advertisements and promotions effectively trigger impulse buying in a considerable segment of consumers. While 47.6% of respondents admitted to making unplanned purchases due to ads, the remaining majority stayed firm in their planned shopping behavior. This indicates that while promotions can be effective, they do not universally lead to impulsive spending.

Brand engagement on social media proves to be an important factor in customer retention and trust-building. A significant majority (68.3%) preferred brands that actively interact with them, indicating that responsiveness and engagement help build brand loyalty.

CONCLUSION

The research successfully achieves its objectives by identifying key factors that influence consumer online shopping behavior and highlighting the role of social media in shaping purchase decisions. Convenience, discounts, and variety emerge as primary motivators, while product reviews and trust in the platform significantly impact decisions. Social media plays a crucial role in influencing consumer behavior, with Instagram and YouTube leading the way. However, while exposure to influencer promotions is high, actual purchase conversions remain moderate.

Payment preferences indicate that while digital payments are growing, Cash on Delivery remains dominant due to trust concerns. Impulse buying driven by advertisements is present but not universal, demonstrating a balanced approach between planned and spontaneous purchases. Additionally, social media engagement by brands is highly valued by consumers, indicating that direct interactions and responsiveness are key in retaining customers.

These insights provide actionable recommendations for businesses to enhance their online strategies. Brands should focus on trust-building, offering competitive pricing, and leveraging social media engagement to drive consumer loyalty and sales.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed:

- 1. Enhancing Trust and Transparency:** Brands should prioritize trust-building measures, such as verified customer reviews, detailed product descriptions, and secure payment options, to encourage online shopping.
- 2. Optimizing Social Media Strategies:** Companies should invest in engaging content, user-generated testimonials, and community-driven marketing to enhance consumer trust and participation.
- 3. Balancing Influencer Marketing:** Instead of relying solely on influencer promotions, brands should complement them with authentic customer experiences and product demonstrations to drive conversions.
- 4. Strengthening Digital Payment Infrastructure:** Given the growing preference for digital wallets, businesses should offer seamless and secure payment options while continuing to provide Cash on Delivery for customers who prefer it.
- 5. Personalized Promotions and Targeting:** Brands should leverage data analytics to offer personalized deals and promotions that cater to individual shopping behaviors, minimizing reliance on impulse-driven purchases.
- 6. Encouraging Brand Engagement:** Actively responding to customer queries, engaging in meaningful conversations, and offering loyalty programs can help foster long-term consumer relationships and brand advocacy.

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15. <https://www.researchgate.net/publication/380385748> THE IMPACT OF SOCIAL MEDIA MARKETING ON CONSUMER BUYING BEHAVIOUR A SYSTEMATIC LITERATURE REVIEW

Role of Social Media Influencers in the Promotion of Eco-tourism in the State of Uttarakhand

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ABSTRACT

Eco-tourism is a prominent phenomena that has garnered a lot of attention in the last two decades. It promotes the idea of responsible and sustainable tourism. It also promotes the idea of regenerative tourism that advocates the conservation of local cultures, waste management, environmental restoration, community building and most importantly traveller's responsibility. This form of tourism has grown in the state of Uttarakhand. Uttarakhand, being a scenic beauty, attracts a large number of tourists throughout the year from all across the globe. Social Media Influencers (SMI) from Uttarakhand have become key figures in the promotion of ecotourism. This study will attempt to do an analysis of the ways and strategies that SMIs employ like visual storytelling, collaborations, multimedia narratives, blogging and others promoting eco-tourism of the state. By analyzing the intersectionality of SMIs and eco-tourism, this study will move towards understanding the role of digital media platforms in promoting sustainable tourism.

Keywords: Eco-tourism, Social Media Influencers, Uttarakhand, Sustainability, Travelling, Social media

INTRODUCTION

Social Media acts as a medium that helps people and communities socialize. Social media serves as a tool with the help of which people from all across the globe are able to communicate seamlessly, exchange ideas, share their thoughts and have conversations (Rawat & Dani, 2022). The way technology has evolved and advanced, the individuals have emerged as co-producer of knowledge (Rawat & Dani, 2022). Therefore, the term creator is employed so often. Amongst these creators are Social Media Influencers (SMIs). As defined by Brooke Erin Duffy, they are the kind of creators in the digital realm who have a remarkable and prominent online presence. They tend to indulge in promotions of brands, products and services laced with credibility and reliability (Duffy, 2021). They cover a variety of areas with a significant reach. Similarly they are also a prominent face of promotion of tourism. In the context of Uttarakhand, tourism and its promotion becomes an important debate. The state of Uttarakhand is famous all across the globe for its ecotourism destinations due to its physical features like the majestic Himalayas, perennial lakes, dense forests, wetlands, lush green forests, mixed climate, winterline, clear skies, diverse range of flora, fauna and other tourist attractions (Sati, 2021). Due to its scenic beauty and prominent physical features, Uttarakhand's tourism sector is of great importance as in the global tourism ranking it ranks 12th (Sati, 2021). With the rising global awareness about ecotourism that is defined by scholars like Wallace and Pierce (1996) as "travelling to relatively undisturbed natural areas for study, enjoyment or volunteer assistance", it has impacted the content creators as well. These SMIs are producing content that aligns with a mindset that is promoting sustainable ways of travelling to a place.

REVIEW OF LITERATURE

Ecotourism is a topic that has been talked about in academia since the late 1980s (Sati, 2021). As asserted by Donohoe and Needham, the very first widely accepted definition of ecotourism was given by Ceballos-Lascurain, they emphasized that it is travelling to undisturbed natural areas for appreciation of nature and local culture (Donohoe & Needham, 2006). The definitions kept evolving. It was looked at as a form of tourism that revolves around nature and maintains the wellbeing of the environment as well as the local communities. Vishambhar Sati points out that studies have suggested that ecotourism is also known as responsible tourism, because of its diverse and multidimensional nature. It tries to assess the impact tourism has on the environment and the local communities' participation (Sati, 2021).

Social media has brought a transformative shift in the way travel destinations or tourism hotspots are viewed and promoted, with social media influencers (SMIs) playing an integral role in shaping those perspectives (Kilipiri et al., 2023). This is very different from the traditional marketing that our previous generations were aware of, it gives the audience an interactive space ensuring two-way communication. The users can talk to and engage with the influencers. It has been established that influencers have a significant impact on users' decision making due to their authenticity, reliability, relatability and strong reach (Duffy, 2021). Social media influencers (SMIs) have transformed into strong forces that help in reshaping consumer behaviour, especially in the tourism sector. With the help of their authenticity, credibility, large reach, engaging content and loyal following they play an integral role in promoting sustainable and eco-friendly ways of travel and ecotourism. This study attempts to examine how SMIs contribute to the promotion of ecotourism in Uttarakhand. It will also focus on the effect it has on consumer engagement, awareness and local culture involvement.

Social media platforms like YouTube, Instagram and Facebook play a key role in promoting ecotourism. SMIs tend to share compelling visuals and storytelling that binds the audience and inspires them to navigate destinations in a sustainable fashion. Study shows how social media platforms provide opportunities for interactive, engaging and real-time conversations making ecotourism more accessible and reaching to a broader audience (Rawal et al., 2022; Okuah et al., 2019). In the context of Uttarakhand, SMIs exhibit the experiences promoting ecotourism, highlighting activities such as natural hikes, local traditional interactions and sustainable stays. SMIs employ engaging hashtags, captions, and popular locations in order to generate prominent online visibility for these destinations (Sahani, 2021; Joshi & Pal, 2024).

SMIs house environmental awareness by talking about responsible travelling. These influencers produce educational content highlighting the importance of preserving and conserving the ecological system, waste management, respecting local culture and practicing sustainability. Studies signal that SMIs who have genuine motives and strong voices have a stronger influence on promoting pro-environmental behaviours (Okuah et al., 2019). The narratives and campaigns led by SMIs frequently involve such stories that emphasize the ecological challenges that a travel destination faces due to travellers flocking in. Through vlogs, blogs, videos, lives, interactive conversations and captions inspire and lead their followers into adopting sustainable ways of travelling (Donohoe & Needham, 2006).

Tourism boards, government along with policy makers have started acknowledging the potential of SMIs in the promotion of ecotourism in the Indian context. Promotional campaigns often grow out of collaborative efforts which involve influencer partnerships. These campaigns are quite engaging and have the capacity to lay emphasis on sustainable travel and tourism policies and initiatives; these efficiently reach the young and tech-savvy audience (Sahani, 2021). For example, in the context of Uttarakhand the state's government collaborated with influencers to propagate and promote ecotourism. Even recently chief minister Pushkar Singh

Dhami stated in a recent press conference that the Dhami government will conduct a ‘social media content creators championship’ to propagate tourism of the state (The Statesman, 2025). Also, by highlighting initiatives like sustainable homestays, planned travel itineraries, responsible travelling, great interest in eco-conscious travel is getting fostered (Joshi & Pal, 2024).

Social media acts as a tool that becomes a medium for community engagement. Influencers often focus and talk about local art/craft/handicraft, eco-stays, indigenous ways of life, that contribute to local economies. Study shows that SMIs act as mediators who connect travelers with sustainable and genuine experiences (Rawal et al., 2022). In the context of Uttarakhand, ecotourism projects which are run by communities garner visibility through influencer engagement and promotion. This not only helps in promoting responsible travelling and tourism but also generates revenue to support local small businesses which further helps the region's sustainable development (Sahani, 2021; Joshi & Pal, 2024). The impact of influencer marketing in the context of ecotourism relies significantly on the credibility, trustworthiness and authenticity of SMIs. Their followers are more likely to trust the influencers who talk about sustainability and take required action towards it. It shows their commitment to the cause of environmental and cultural advocacy. This authenticity brings in stronger engagement from the audience which results in a greater influence on travel choices (Okuah et al., 2019). Influencers with their followers are more likely to achieve higher engagement rates. Their niche audience is small but quite dedicated as the content produced by these SMIs is trustworthy and relatable which further makes them valuable advocates for ecotourism (Okuah et al., 2019).

DISCUSSION

The impact that SMIs have with regards to the promotion of ecotourism is beyond advertisement and visually appealing content. This impact can be looked at through the multidimensional lens that incorporates behavioral changes, local empowerment, collaboration with the government and a vision towards sustainability. Uttarakhand's tourism landscape is dynamic and evolving, therefore understanding the perceptions and actions of Influencers become important. For instance in fig 1 the narrative around travelling moves beyond the visually aesthetic content with catchy captions. The Instagram page named ‘*experiencehomfortable*’ which represents a hotel resort located in Mukteshwar, Uttarakhand is attracting travellers while promoting sustainable ways of visiting the property. After further examination of their instagram page, it can be established that their primary motto is not just to promote their brand and attract travellers, instead they are promoting slow living, ecological awareness, local customs, local cuisines and mindful travelling. Even in this particular reel, they are stating how a traveller can experience Uttarakhand without being a burden on the ecological system of the state of Uttarakhand. In fig 2 it can be seen that ‘*eUttaranchal*’ is a cultural page of Uttarakhand which asserts the importance of finding your village in the state of Uttarakhand (first image) and diving deep into the cultural history and demography of the place.



Fig 1. Source: Instagram page named *experiencehomfortable*, Nainital

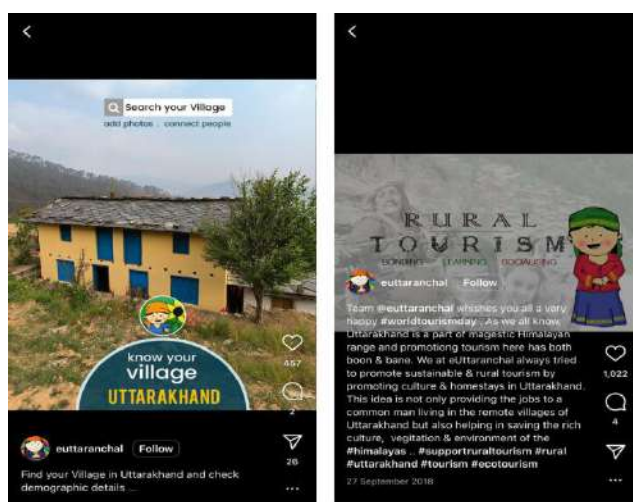


Fig 2. Source: Instagram page named *eUttaranchal*

Due to out migration and rise in ghost villages, it has become urgent to reconnect the youth of the state of Uttarakhand to their roots. In the second image you can see it celebrating world tourism day by promoting rural tourism and cultural preservation. In the second image, the instagram page is trying to promote rural tourism that brings the traveler closer to the place and its aura. These pages shape audience perception and make them pro-environment.

Traditional tourism and advertising campaigns were functioning based on one-way communication. It was a passive activity in the past. Social media platforms have become an interactive space where discourses and discussions can take place. It provides suitable space for dialogue. SMIs produce personalized stories and narratives which not just promote travel destinations but also raise awareness about environmental advocacy. Influencers, unlike the conventional advertisements, try to capture the real-time content. This helps in capturing the majestic yet fragile nature of Uttarakhand's beauty which further promotes a mindful way of navigating the state (Okuah et al., 2019).

Social media algorithms tend to favor the content that gives the space for conversations and is interactive. Influencers are able to earn via this by facilitating dialogue on sustainable travelling, challenges that occur, efforts to conserve what's left and mindful practices. Influencers use personal testimonials, collaborations with government or NGOs, behind the

scenes of campaigns and projects in order to bring change in public perception and behaviour (Sahani, 2021).

An important feature of SMIs is their ability to give a human and virtual tour of the places. They humanize the experience. In the context of Uttarakhand this culture has led to better recognition for rural work/art/crafts, cultural practices, local cuisine, knowledge that is indigenous and other traditional norms (Joshi & Pal, 2024). Influencers share the message provided by the local stakeholders. They amplify their stories and narratives. This way the audience nurtures great appreciation for Uttarakhand's heritage which leads to inclusive tourism as influencer led tourism encourages collaborative efforts. As documented in Fig 3, their interactions with the local communities, artists and other key stakeholders are warm and informative. By doing this they become cultural mediators.

| S.No | Instagram Pages | Main focus | Remarks | Link |
|------|--|-----------------------------|--|---|
| 1. | Euttaranchal - Uttarakhand by eUttaranchal | Society and Culture Website | This page is an extension of the eUttaranchal initiative. They aspire to represent and propagate the local culture, small businesses, and tourism of the state of Uttarakhand. | https://www.euttaranchal.com/ |
| 2. | Baduli._ - Baduli | Community Centre | This page is named Baduli on Instagram, which is a Garhwali word. It translates to Hiccups. It is a page that promotes Uttarakhand's culture and various communities. | https://www.instagram.com/baduli_official/ |
| 3. | Pandavaas_uk | Artist | Pandavaas in a band based out of Uttarakhand. They blend the folk sounds with contemporary beats in order to promote and preserve the rich culture of Uttarakhand. They post their live updates on their performances, collaborations and audience engagement on | https://www.instagram.com/pandavaas_uk/?hl=en |

| | | | | |
|----|--|--------------------|---|---|
| | | | their page. | |
| 4. | trekthehimalayas - Trek The Himalayas (Trekking Company) | Adventure provider | This instagram page is one of the leading trekking companies across India. It provides services in Uttarakhand, and others. This organization promotes ecotourism which actively promotes cultural narratives as well. | https://trekthehimalayas.com/ |
| 5. | voicesofmunsiari | Voices of Munsiari | This page shows the local life and culture. It is a community-run Instagram of Sarmoli/Munsiari villagers. Account is managed entirely by local residents, showcasing their mountains, traditions and daily life in their own voice | https://www.instagram.com/voicesofmunsiari/ |

Fig 3. List of Instagram pages which promote eco-tourism.

The Uttarakhand government's initiative to conduct a social media content creators' championship is a great example of how institutions are acknowledging the power of influencer led tourism (The Statesman, 2025). With the help of such collaborative efforts, influencers will produce content that align with the state's sustainable tourism initiatives. This way influencer campaigns get aligned with policy visions. Influencers also act as watchdogs who raise their voice by spreading messages related to any unsustainable practices while travelling. Their social media channels are also promoting public accountability. This way SMIs become stakeholders in the sustainable development discourse. SMIs are also contributing to the local economy by visiting and promoting offbeat destinations. Based on their videos many tourists get to know about hidden home stays and cultural experiences (Rawal et al., 2022).

The kind of influence these SMIs have on everyone around is intense. This can also lead to pollution, waste generation, overcrowding and environmental degradation. They can further promote their audience to travel in a way that is quite mindful.

CONCLUSION

All in all, SMIs in the context of Uttarakhand are catalysts which help in the growth of both mindful tourism and environmental advocacy. By portraying and highlighting cultural

narratives, cross-cultural stories and praising mindful behaviour, SMIs forge a more sustainable model. In the future research can happen on the long-term impact induced by SMIs on the general audience with regards to ecotourism. There is a significant lack in literature around SMIs' impact on the promotion of ecotourism in the context of Uttarakhand. This gap can be bridged by future research as mentioned previously.

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Understanding Employee Motivation in the Fast-Food Industry: A Case Study Approach

By- Shivangi Sharawat

Abstract

Employee motivation plays a vital role in the fast-food industry, directly influencing job performance, satisfaction, and retention. This study investigates motivation strategies employed in selected fast-food chains across Western Uttar Pradesh, specifically in Meerut, Agra, Aligarh, and Saharanpur. Using a case study approach, data was gathered through a structured questionnaire from 288 employees working in renowned fast-food outlets such as McDonald's, KFC, Pizza Hut, Domino's, Haldiram, Subway, and Burger King. The results indicate that training programs, mentorship, and performance-based incentives significantly enhance employee engagement and productivity. However, unclear promotion policies and a lack of career growth opportunities were identified as key challenges affecting motivation. Additionally, the study found no significant correlation between demographic factors and employee motivation levels. The findings emphasize the importance of structured training, transparent incentive systems, and clear career advancement paths in fostering a motivated and efficient workforce within the fast-food industry.

Keywords: *Employee motivation, fast-food industry, training programs, incentives, job satisfaction, career growth, Western Uttar Pradesh*

Introduction

The fast-food industry is a significant contributor to employment and economic growth worldwide. In India, this industry has expanded rapidly due to urbanization, changing lifestyles, and increased consumer demand for quick-service meals. Western Uttar Pradesh, with cities like Meerut, Agra, Aligarh, and Saharanpur, has seen a notable rise in the establishment of fast-food outlets, including McDonald's, KFC, Pizza Hut, Domino's, Haldiram, Subway, and Burger King. Despite this growth, employee motivation remains a critical concern in ensuring productivity, satisfaction, and retention.

People management is an important aspect of any organization, and this includes the fast food industry. A well-managed fast-food industry will normally consider employees rather than financial capital as the core foundation of the business, which also contributes to the industry's development (Morato, 2008). Therefore, to ensure the achievement of the industry's goals, the fast food industry should create an atmosphere of commitment and cooperation for its employees through policies that facilitate employee motivation and satisfaction. Satisfaction of human resources is closely linked to highly motivated employees. Motivated employees normally perform better, which results in greater productivity and lower labor turnover rates. Employees' motivation is one aspect of a human resource management development strategy. ChampionHughes (2001, cited in Morato, 2008) states that a holistic approach should be used to improve certain qualities of work life (QWL) such as fringe benefits, better employment conditions, and career development to support the facilitation of motivation, which is directed towards achieving the organization's goal (Ukandu and Ukpere, 2011).

The advent of the fast food industry can be linked to the USA where it is considered a regular food item and is consumed in a large amount. The presence of fast food cannot be

denied for ages and is being consumed in several countries in various forms and variations and is sold on small stalls, and markets and is recognized by quick preparation and convenient service. It is more like finding a normal samosa or vada-pav on an Indian street. The revolution in the fast food industry was noticed somewhere around the beginning of the twentieth century when Automats were introduced in America where customers could collect prepared food from a display cabinet or a vending machine which was a convenient and time-consuming system for them. Since then the phenomena of fast food boomed and several market players came on the floor and soon became huge national and then international fast food brands e.g. McDonald's, Burger King, etc were the first few market leaders. Indian fast food industry is of a significant size and has been growing at a rapid pace. It consists of several multinational and local brand outlets. While the nature of work in multinational brands has widely been studied, studies in the Indian context are surprisingly low. Many studies have been conducted to determine the nature of work in the fast food industry.

To understand employee motivation in the fast-food industry, we examine key influencing factors: **training, incentives, mentorship, and promotion policies.**

Mathematical Approach to Employee Motivation

Employee motivation can be measured using the following formula:

Where:

- M = Employee Motivation
- T = Training & Development Score
- I = Incentive & Reward Score
- M = Mentorship Score
- P = Promotion & Career Growth Score
- E = Employee Engagement Factor ($0 < E \leq 1$)

This equation helps quantify the overall motivation level based on different influencing factors.

REVIEW OF LITERATURE

Y Prabhavathi et al. (2014) executed a study on the Indian fast food industry during the year 2014 with the aim to analyze the spending behaviour and eating habits of the client segment for developing novel advertising techniques in the industry of fast food and to analyze the consumer's intake and expenditure toward fast food with respect to gender, and ultimately say that young, unmarried, professional workers, and well educated people form the primary customer segment. Fast food outlets satisfy youthful consumers by matching their tastes and delivering a relaxed atmosphere.

Saba Sattar and Nimra Ali (2014) investigated factors influencing employee happiness, including variables such as marketing, administration, workplace atmosphere, and fulfillment with work. According to their findings, the variables with the least influence on employee fulfillment are work climate and job stress. Mucahit Celik's theoretical concept of workplace fulfillment states that the most important milestone of fulfillment at work is perspectives, which are psychological stations resulting from bio-psycho-social acts.

Suman Devi and Ajay Suneja (2013) found a considerable variation in employee satisfaction between public and private sector banks. According to the findings, workers of

private sector banks are significantly more happy with their salary raises, independence, educational and training initiatives, and so on.

Geeta Kumari and K M Pandey (2011) performed a research of job satisfaction in the public and private sectors. The current findings imply that the employment outcomes of individuals with high versus low job uncertainty may fluctuate, with job performance being comparatively high since positive opinions and affective experiences are prominent and thus dominant at one point in time, and relatively low at other times when adverse views and affective experiences are salient and are predominant.

Irviani and Fauzi (2018) define motivation as an act that causes (intensity), informs (directions), and continues (perseverance) an individual's progress toward a goal. According to the many ideas discussed, motivation is a collection of personal conditions that motivate someone to desire to participate in a certain action or conduct in order to attain a specific goal for oneself or to satisfy another else.

According to Asmawiyah et al. (2020), ambition and job satisfaction are both essential factors in PT staff performance. They show that there is a significant relationship between work happiness and worker performance. Employees who are more pleased at work will perform better, as seen by data.

In contrast to Agus Bi light et al. (2021), who discovered that workplace motivation had no substantial impact on performance among workers. Employee satisfaction at work is another aspect that might influence productivity.

Al-Dalahmeh et al. (2018) found a positive and substantial link between work satisfaction and worker efficiency.

Prasetyo and Endri (2021), who discovered that job satisfaction had no significant impact on a worker's performance, did study on an Indonesian IT company.

RESULTS AND DISCUSSION

Table 1-4 displays the demographic profile of the respondents, including age, gender, civil status, greatest educational attainment, and employment position. The greatest age rate in the table is between 18 and 30, with 168 out of 288 respondents, or 58.30%. This suggests that fast-food establishments prefer to hire youthful personnel. This conclusion is corroborated by the research of Habon et al. (2019), who discovered that the majority of those who participated are young people who are both mental and physical competent to serving customers at a fast-food restaurant. Because fast food restaurants often provide rapid services, their personnel must be able to satisfy the high standards of service that they present to the public. In terms of sex, males had the largest proportion of 52.80, with 152 out of 288 total respondents. However, ladies had a percentage of 47.20 and 136 total participants, which was comparable to men' results. This demonstrates that fast food establishments are more likely to hire males. Habon et al. (2019) found that because males may undertake jobs other than serving customers, controlling the kitchen, and managing food and drinks, they are more likely to work at fast food restaurants. Males are also quite social and capable of providing the swift service that fast food restaurants demand. In terms of civil status, the table's statistics may suggest that single people are generally in favour of recruiting. This is reinforced by the study of Camungay et al. (2022), which shows that the majority of proprietors prefer to have a single employee since they appear to be more focused on building their personalities and careers. On the one hand, married people account for just a small percentage of the workforce, despite being highly skilled professionals.

Table 1: Gender of the respondent (n=288)

| Gender | N | % |
|--------|-----|--------|
| Male | 152 | 52.80 |
| Female | 136 | 47.20 |
| Total | 288 | 100.00 |

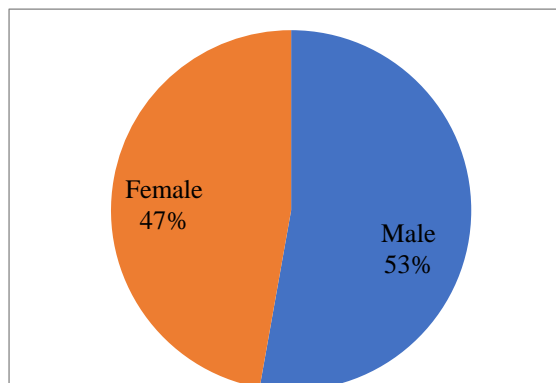


Figure 1: % of gender wise distribution of respondents

Table 2: Age of the respondent (n=288)

| Age (Y) | N | % |
|----------|-----|--------|
| 18-30 | 168 | 58.30 |
| 31-40 | 72 | 25.00 |
| 41-50 | 42 | 14.60 |
| 50 above | 6 | 2.10 |
| Total | 288 | 100.00 |

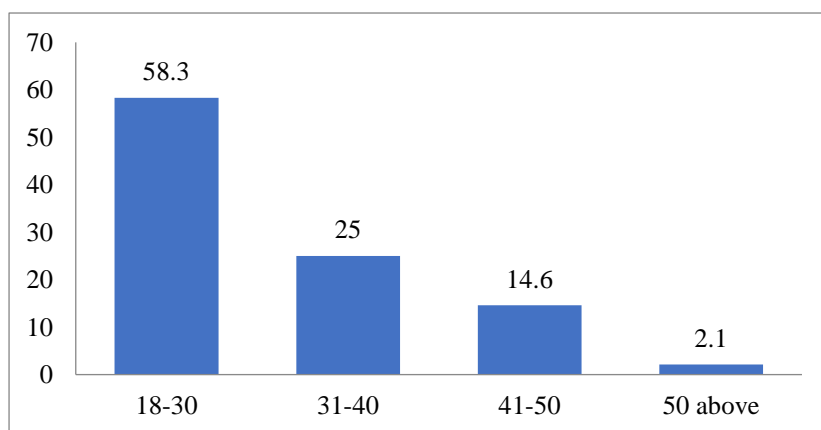


Figure 2: % of age wise distribution of respondents

Table 3: Marital status of the respondent (n=288)

| Status | N | % |
|-----------|-----|--------|
| Married | 66 | 22.90 |
| Unmarried | 222 | 77.10 |
| Total | 288 | 100.00 |

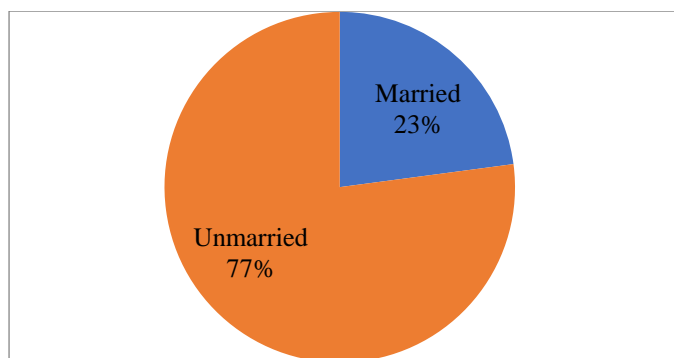


Figure 3: % of marital status wise distribution of respondents

Table 4: Qualification of the respondent (n=288)

| Qualification | N | % |
|---------------|-----|--------|
| Post-graduate | 16 | 5.60 |
| Graduate | 68 | 23.60 |
| Intermediate | 100 | 34.70 |
| High school | 104 | 36.10 |
| Total | 288 | 100.00 |

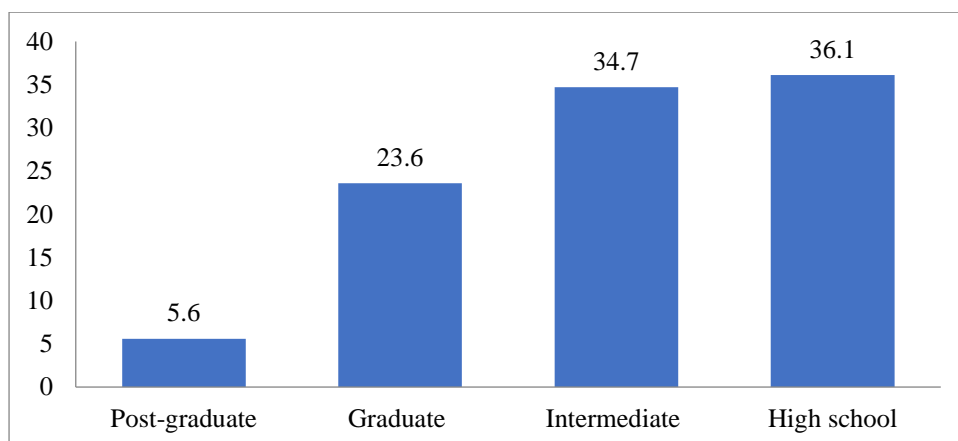


Figure 4: % of educational qualification wise distribution of respondents

The socioeconomic makeup of those who responded in terms of educational level reveals that a high school graduate has 104 people who participated and the greatest percentage (36.10%). The findings are comparable to those of Plata et al. (2020), who discovered that depending on the demands of the business, fast-food franchises may recruit part-time university learners or full-time high school degrees.

Table 5: Mean Extent of Employees' Motivation in the Fast-Food Industry

| SN | Indicators (Incentives & promotions) | Mean | Description |
|----|--|------|------------------|
| 1 | The fast food establishment provides incentives that encourage me to work hard. | 3.68 | Very high extent |
| 2 | The fast food establishment provides incentives that make me happy with my employment. | 3.71 | Very high extent |
| 3 | The quick service restaurant's rewards inspire me to do high-quality work. | 3.68 | Very high extent |

| | | | |
|----------------|---|------|------------------|
| 4 | The incentives provided by the fast-food establishment have increased my enthusiasm for my employment. | 3.75 | Very high extent |
| 5 | The fast-food business provides a varied selection of incentives tailored to individual interests, which may increase overall staff motivation. | 3.75 | Very high extent |
| Composite Mean | | 3.73 | Very high extent |
| 6 | The fast-food establishment offers prizes that drive me to work better. | 3.24 | Very high extent |
| 7 | The fast food establishment offers rewards that assist me advance in my work. | 3.75 | Very high extent |
| 8 | The fast food business offers rewards that increase my loyalty. | 3.27 | Very high extent |
| 9 | The fast-food business offers bonuses to help retain qualified and talented personnel. | 2.95 | Very high extent |
| 10 | The fast-food establishment offers bonuses to encourage a competitive atmosphere in the workplace. | 3.52 | Very high extent |
| Composite Mean | | 3.35 | Very high extent |

Note: 3.27 – 4.00 Very High Extent 2.52 – 3.26 High Extent, 1.75 – 2.51 Low Extent, 1.00 – 1.76 Very Low Extent

Table 5 shows the average level of motivation among fast-food employees in terms of bonuses and advancements. This demonstrates that every measure have a very high extent, which ranges from 3.68 to 3.75, with a composite mean of 3.73 (very high extent). It argues that fast-food businesses provide incentives to inspire and satisfy their personnel. Furthermore, it may suggest that employees are more likely to be involved in their job, put up a lot of effort, and deliver high-quality results. The conclusion is reinforced by Kefay and Kero's (2019) study, which defines an incentive as an outside factor that persuades people to work hard for a long period, satisfy the organization's needed standards for performance, and pursue a goal in order to get the incentive. Furthermore, incentives are defined as techniques employed by corporations to drive personnel to perform enthusiastically, as well as practical, moral solutions to meet material and ethical needs. This is also consistent with the findings of Umali et al. (2013), who found that incentives are an effective technique for encouraging staff to perform quality work. The majority of employees are certain that getting rewards will considerably improve their performance. There is a significant relationship among the demographic details of the respondents and the needed benefits.

Furthermore, everyone who participated felt that benefits had a substantial impact on employees. The majority of those questioned stated that one of the primary benefits of the incentives was enhanced performance. Everyone who responded agreed that incentive may reduce staff turnover, boost employee loyalty, and improve work satisfaction. In terms of advancement, the whole mean was 3.35, and the extent was assessed as extremely high. This shows that employee promotion may fail to encourage employees to work better and may not be effective in retaining competent staff. It might also signal that there are insufficient promotions for fast-food restaurant staff. The findings are comparable to those of Awang and Muhd Yusuf (2020), who concluded that promotion within a company frequently takes the form of a reward, which comprises raising a person to a higher job position, followed by greater

duties and salary. This progression, viewed as a promotion possibility, is positively associated with job satisfaction, with an emphasis on its relationship to career expansion, leadership recognition, and support for personal development. Furthermore, possibilities for promotion exist when an employee maintains they have a better chance of continuing and being promoted to a higher level within the company as a result of greater productivity caused by education and training, or as a result of professional experience after a certain number of years of service. Workers undoubtedly prefer to stay on staff and work for organizations that provide them with several opportunity to grow into new, challenging responsibilities (Dikshit & Jain, 2017).

Table 3: Correlation Coefficients and p-values

| Variables | Correlation coefficient | r ² | Critical value | t-value | P-value | Results |
|---------------------------------------|-------------------------|----------------|----------------|---------|---------|-----------------|
| Age→ Employees' motivation | 0.011 | 0.000 | 1.981 | 0.118 | 0.906 | Not Significant |
| Gender→ Employees' motivation | -0.057 | 0.004 | 1.981 | 0.693 | 0.491 | Not Significant |
| Marital status→ Employees' motivation | -0.076 | 0.005 | 1.981 | -0.921 | 0.358 | Not Significant |
| Qualification→ Employees' motivation | -0.085 | 0.006 | 1.981 | -1.027 | 0.305 | Not Significant |

Note: p-value<0.05 Significant

Table 3 depicts the association across socioeconomic factors and motivation for staff in the fast-food business. It suggests that age, gender, marital status, and educational level have no substantial impact on employee inspiration. The Pearson correlation coefficients value of age and motivation for workers is 0.011 and its p-value is 0.906, then followed by the gender and employees' inspiration correlation factor value of -0.057 and p-value of 0.491, married status and staff members incentive association coefficient value of -0.076 and p-value of 0.358, and college degree and employees' incentive correlation coefficients value of -0.085 and p-value of 0.305, respectively. This shows how workers in the fast-food sector are motivated to complete their tasks regardless of their age, gender, marital situation, or educational level. In addition, despite their disagreements, they are willing to carry out their tasks and responsibilities.

The findings are similar to those of Jaurigue et al. (2023), who found that regardless of the individual characteristics of the university's rank-and-file staff, they valued those who worked with a positive attitude and high motivation, resulting in excellent job performance; as a result, these staff members were fiercely dedicated and empowered in carrying out their roles. On the contrary, Umezurike (2021) discovered that the majority of motivational theories failed to account for workers' unique features such as gender, age, education, background, occupation, and marital status. However, they had power over particular components of job motivation. Female managers were motivated by recognition and positive connections with their supervisors, and women were usually happier at work than men were. In contrast, masculine peers were more motivated by duty. Furthermore, employees with a higher education were less likely to be pleased with their positions than those with less knowledge, and employees with extensive work experience were more likely to be dissatisfied with opportunities for advancement. Furthermore, less experienced employees were less happy with their pay.

Furthermore, there was no noticeable difference in management and employee attitudes toward benefits; workers with different ages experienced varied benefits impacts, and single people reported a stronger benefit effect on job satisfaction than married employees.

CONCLUSIONS

Fast-food businesses give its employees with the essential skill improvement, training, and job orientation, as well as mentorship and assistance to help them advance in their careers. In addition, they will be given opportunity and advice to further their careers and fulfill their goals in both their personal and professional lives. Fast-food businesses provide incentives and promotions to keep their staff motivated and satisfied. However, fast-food business promotions can demotivate staff performance and retention. Employee motivation is unaffected by their demographic profile, including age, gender, marital status, and educational qualifications. Regardless of their motive, individuals complete their responsibilities and are eager to put up the effort required to meet their commitments. Employee motivation is influenced by professional advancement. Improving employees' careers and appreciating their development boosts both drive and efficiency. In addition, motivated personnel have a major influence on customer service, organizational performance, and overall job happiness. Employee engagement and job satisfaction will also increase.

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The Evolution of Work: The Gig Economy's Opportunities, Challenges, and Its Effect on Traditional Jobs

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ABSTRACT

The gig economy relates to short-term, flexible jobs mediated by digital platforms. In this arrangement, people often specified as freelancers, or gig workers, are employed on a per-project or per-task basis. This research delves into the heterogeneous realm of the economy, considering the barriers, upcoming opportunities, and implications it delivers for the traditional hiring model. It refers to short-term employment relationships. Through an extended examination of the current situation of the gig economy, this study focuses on the multifaceted realm of the gig economy and how it aims to elucidate its influence on businesses, workers, and the wide range of socioeconomic fabrics. After these aspects, this research investigates the repercussions on traditional employment models including changes in workforce dynamics, organizational structures and adjustment in the perceptiveness of stable career trajectories by synthesizing results from case study records, future projections, and regulatory analysis. This study provides a subtle and meticulous understanding of the gig economy's zestful interplay with traditional employment models and contributes into the foundation of policy considerations and informed discourse in the widely developing landscape of work.

INTRODUCTION

Origins and Evolution of the Gig Economy-

The term "gig frugality" finds its roots in the world of music, where musicians frequently relate to individual performances as "gigs." Still, the conception has evolved far beyond the realm of cultural performances to encompass a different array of short-term, flexible work arrangements eased by digital platforms. Gig frugality, also known as freelance frugality, on-demand frugality, or platform frugality, originated in the early 21st century with the rise of digital platforms that connect individuals seeking specific services with those willing to give them. The elaboration of the gig frugality can be traced back to the confluence of several factors. Advancements in technology, particularly the wide vacuity of high-speed internet and the proliferation of smartphones, have played a vital part in enabling flawless connectivity between service providers and consumers. The gig frugality leverages these technological capabilities to produce effective commerce where individualities can offer their chops, services, or coffers on a temporary or design-specific base.

Background and environment-

In former times, gig frugality has appeared as a veritably dominant force in labor requests. This fresh, profitable outlook puts forward both prospects and expostulations for workers and employers and can also remarkably modify former employment structures. The word "gig frugality" was first introduced by Tina Brown in 2009, who's an intelligencer. Tina Brown

mentioned the trend of workers looking to pursue a couple of part-time work, contractual work, or free-floating systems while living in the digital business. In some high-tech countries, the U.S., Canada, etc., teenagers choose temporary or contractual jobs as a livelihood decision just to keep individualities in endless jobs and work as tone-reliant Rwork to keep them free from working under rules and regulations.

Description and crucial characteristics-

A gig frugality is an open request system of earning or generating income by working and furnishing services or goods on demand. It's a common pool platform where people can work in short-term employment or contractual jobs. This is also known as "freelancer frugality", "independent pool", or "participating frugality". The gig frugality is described by certain crucial characteristics that differ from the gig frugality and traditional employment styles. The most pivotal point of the gig frugality is that it's protean for the workers as they have the freedom to choose how important they want to work, where they want to work, and when they want to work, which allows the workers to do multiple temporary jobs at formerly. Gig workers are also engaged in different temporary or contractual work for some time of a couple of weeks or months to learn new effects and gain experience in different fields or diligence. This also allows the workers to gain knowledge and chops in different fields or diligence, and it also increases the position of interest in the workers as they can work in a dynamic terrain. Another crucial specific of gig frugality is the use of technology by workers to find the asked jobs, with the help of certain digital platforms like Freelancer or TaskRabbit, etc., workers can fluently find the asked gigs just by going on these digital platforms and demonstrate their chops, knowledge, and experience and by reaching the implicit guests or employers.

Rise and evolution of gig frugality-

With the increase in the adoption of new technologies, there's a gradational positive shift in gig frugality. As we know, gig frugality isn't a new conception as it has formerly been in actuality, but in the once decade, a gradational expansion or shift has been observed. There has been a great change in the number of workers who are shifting towards temporary jobs or contractual jobs from endless jobs in the gig frugality for the one time. In the moment, the gig frugality has taken a veritably intimidating part in modifying the way we work.

While the gig economy offers various opportunities for workers, it is not exempt from challenges. A primary concern centers around job security, a facet distinct from traditional employment. Unlike those in long-term contracts with a sense of stability, gig workers navigate a more uncertain terrain. The absence of formal employment agreements means gig workers lack a guaranteed stream of future work, leading to financial instability and heightened stress.

Furthermore, the gig economy introduces income volatility as a central characteristic. Gig workers may undergo periods of high demand, resulting in increased income, followed by lulls where work opportunities diminish, culminating in unpredictable earnings. This volatility poses challenges to financial planning and impedes workers' ability to maintain stability in both personal and professional realms.

The absence of employment benefits is another significant factor affecting gig workers. In contrast to traditional employees enjoying health insurance, paid time off, and retirement plans, gig workers may not have equivalent benefits. This absence amplifies the overall uncertainty and insecurity surrounding their work situation, especially during periods of illness or economic downturns.

Moreover, the gig economy's dependence on market demand introduces a unique set of hurdles for workers. The availability of gigs closely hinges on the demand for specific skills or services in the market. Shifts in demand, economic downturns, or changes in consumer preferences can directly impact gig availability, influencing a worker's ability to secure a consistent income. This reliance on market forces introduces an element of unpredictability, sharply contrasting with the stability associated with traditional employment models.

The gig economy and its impact on workers-

The gig economy brings about a transformation in how businesses operate and manage their workforce. For employers, harnessing gig workers offers staffing flexibility and provides access to a diverse talent pool. However, overseeing a dispersed and transient workforce poses its own set of challenges.

From a logistical standpoint, coordinating and managing a gig workforce spread across various locations can be intricate. Ensuring consistent quality and performance standards becomes a logistical challenge since gig workers may not exhibit the same level of attachment or loyalty to the organization as traditional employees. The transient nature of gig work may also result in a depletion of organizational knowledge and expertise as workers enter and exit.

Moreover, the gig economy disrupts traditional notions of organizational structure and workforce dynamics. Instead of relying on a stable, long-term workforce, businesses may increasingly depend on a fluid and ever-changing network of gig workers. This shift raises questions about how businesses establish and sustain company culture, promote collaboration, and ensure the seamless integration of gig workers into the broader organizational framework.

Challenges and drawbacks-

While the gig economy offers advantages, it also introduces numerous challenges for both workers and employers. Individuals engaging in gig work often face stress and financial instability due to the absence of job security, benefits, and a guaranteed income. The unpredictable nature of income streams makes it challenging for gig workers to qualify for financial products such as mortgages and loans.

On the employer side, overseeing a dispersed and transient workforce poses logistical challenges, and maintaining consistent quality and performance standards becomes a complex task. Additionally, the reliance on gig workers may lead to a loss of organizational knowledge and expertise, given the continuous flux of workers in and out of the workforce.

Job security- Workers in the gig economy typically engage in projects or tasks without the assurance of long-term employment contracts, resulting in a lack of stability. The absence of formal agreements implies that these workers lack a guaranteed flow of future work. The gig economy is marked by varying work opportunities and income streams, subjecting gig workers to periods of heightened demand followed by slower periods, resulting in unpredictable earnings. This unpredictability poses challenges for workers in terms of financial planning and maintaining stability in the long run. Unlike traditional employees, gig workers often do not enjoy the same level of employment benefits, such as health insurance, paid time off, and retirement plans. The absence of these benefits contributes to the overall uncertainty and insecurity inherent in gig work. The job security of gig workers is intricately connected to the demand for their specific skills or services in the market. Changes in demand, economic

downturns, or shifts in consumer preferences can directly influence the availability of gigs, impacting the ability of gig workers to secure income consistently.

Isolation and lack of social support- This is a prevalent aspect of gig employment, emphasizing the likelihood that gig workers may encounter a dearth of social interaction and camaraderie in contrast to their counterparts in traditional workplaces. In conventional work environments, staff members often share a physical workspace, fostering regular face-to-face engagements, impromptu discussions, and the cultivation of a sense of camaraderie among peers. The workplace serves as a social hub where interactions extend beyond formal work-related conversations, encompassing casual exchanges, shared experiences, and team-building endeavors. Conversely, gig workers typically operate in isolation and remotely. They may lack a centralized workspace or a consistent group of colleagues with whom they engage daily. This geographical separation can result in feelings of isolation, as gig workers might forego the social dynamics and informal connections intrinsic to traditional office settings. The absence of impromptu conversations near the water cooler, team lunches, or post-work social gatherings can contribute to a sense of detachment and a deficit in the social bonds that commonly develop in more traditional work environments.

Absence of workplace protection- Workers frequently contend with a lack of workplace safeguards, as they are deprived of the legal protections and advantages extended to conventional employees. In the absence of defined regulations, gig workers may confront issues such as precarious job stability, insufficient health and safety provisions, and a dearth of channels to address workplace complaints. This deficiency in protective measures exposes gig workers to increased susceptibility to exploitation and impedes their capacity to establish stable and secure employment conditions.

Dependence on Market Demand- Gig workers experience notable repercussions due to their reliance on market demand. The abundance of gig opportunities is intricately linked to the demand for specific skills or services. Changes in market demand, economic contractions, or shifts in consumer preferences directly impact the volume of available gigs. This reliance introduces an element of unpredictability, influencing the gig workers' capacity to consistently secure income. During periods of diminished demand, gig workers may encounter difficulties in finding suitable opportunities, resulting in financial instability. This underscores the inherent vulnerability associated with depending on market forces within the dynamic landscape of the gig economy.

Policy Consideration-

In the ever-changing realm of the gig economy, policymakers encounter a multitude of challenges and opportunities while endeavoring to craft a regulatory framework that harmonizes innovation, worker safeguards, and economic viability. The gig economy, marked by transient and adaptable work arrangements facilitated by digital platforms, has experienced exponential growth, reshaping traditional employment paradigms. As this sector evolves, policymakers grapple with pivotal policy considerations to address the distinctive requirements and challenges posed by gig work.

A fundamental facet of gig economy policy involves the categorization of workers. Traditional employment classifications may inadequately capture the intricacies of gig work, where individuals often assume roles as independent contractors. Policymakers must meticulously assess and potentially redefine employment classifications to ensure that gig workers receive

requisite legal protections and benefits while preserving the flexibility that entices many to engage in gig work.

Worker rights and protections represent another pivotal policy dimension. Gig workers, designated as independent contractors, frequently lack the legal safeguards and benefits accorded to their traditional employee counterparts. Policymakers must explore avenues to extend essential protections to gigsw workers, encompassing access to healthcare, paid leave, and retirement benefits, without compromising the inherent flexibility integral to gig work.

Ensuring equitable compensation emerges as a significant challenge in the gig economy. Many gig workers operate within a piece-rate or gig-based payment structure, necessitating the establishment of transparent and fair payment models. Policymakers can explore mechanisms to institute minimum wages, formulate equitable pricing models, and address issues related to income volatility to uphold the financial well-being of gig workers.

Social safety nets constitute a crucial policy consideration. Traditional employees often benefit from employer-sponsored safety nets like unemployment insurance and workers' compensation. Policymakers need to devise innovative solutions to extend similar protections to gig workers, ensuring they possess a safety net during economic downturns, work-related injuries, or unforeseen disruptions.

Taxation policies also demand scrutiny in the gig economy. The decentralized and freelance nature of gig work can pose challenges in tax compliance. Policymakers may need to reassess tax structures to accommodate the gig economy, exploring approaches to simplify tax processes for gig workers and platforms while ensuring an appropriate contribution to public services.

Moreover, the gig economy's impact on job security warrants thoughtful policy interventions. Policymakers should contemplate initiatives to provide gig workers with access to training and skill development opportunities, fostering continuous learning and adaptability. Additionally, exploring avenues to enhance income stability, such as creating income-smoothing mechanisms, can mitigate the inherent uncertainty in gig work.

Addressing the gig economy's influence on workplace benefits is pivotal. Policymakers may explore inventive benefit models that are portable, enabling gig workers to accrue benefits across various gigs. This could encompass portable healthcare plans, retirement savings options, and other benefits not tethered to a specific employer.

Legal and regulatory frameworks must evolve to accommodate the unique challenges of the gig economy. Policymakers should engage stakeholders, including gig platforms, workers, and traditional businesses, to formulate comprehensive regulations safeguarding workers' rights, ensuring fair competition, and nurturing a flourishing gig economy.

Furthermore, international collaboration is imperative for effective gig economy policymaking. Given the borderless nature of digital platforms, policymakers should collaborate to establish harmonized regulations that offer consistent protections for gig workers globally. This involves addressing issues related to cross-border taxation, legal jurisdiction, and international standards for gig worker rights.

In conclusion, policymakers confront a multifaceted challenge in navigating the policy considerations of the gig economy. Achieving the delicate balance between promoting innovation, safeguarding workers, and fostering economic sustainability demands a nuanced

and adaptable approach. Through active engagement with stakeholders, leveraging technology, and reevaluating existing frameworks, policymakers can forge a regulatory environment ensuring the gig economy benefits both workers and society at large.

Implications for the future of work-

The gig economy, characterized by its use of digital platforms to facilitate short-term and flexible work arrangements, holds profound implications for the future of employment. As this dynamic sector continues its evolution, it exerts significant influence on various facets of work, reshaping conventional models and presenting a spectrum of opportunities and challenges. This examination delves into the consequences of the gig economy for the future of work, exploring diverse perspectives such as the evolving nature of employment, shifts in workforce dynamics, economic restructuring, and considerations on the policy front.

Evolution of Employment Dynamics: A fundamental ramification of the gig economy for the future of work lies in the metamorphosis of traditional employment paradigms. In contrast to the stability associated with enduring employment contracts, gig work introduces a more adaptable and transient approach. Workers engage in short-term projects or tasks, embracing a gig-to-gig model that challenges the conventional employer-employee relationship, steering towards a more decentralized and independently driven work structure.

The gig economy nurtures a sense of autonomy among workers, affording them the liberty to determine when, where, and how they work. This newfound flexibility has profound implications for achieving a harmonious work-life balance, allowing individuals to tailor their work schedules to align with personal needs and preferences. However, it also introduces challenges related to predicting income, ensuring job security, and accessing traditional employment benefits.

Shifting Workforce Dynamics: The impact of the gig economy on workforce dynamics represents a critical aspect of its implications for the future of work. The proliferation of gig platforms has given rise to a diverse and geographically dispersed workforce. Gig workers operate in various locations, collaborating with different employers on distinct projects, challenging traditional notions of a centralized workplace and fostering a more global and interconnected workforce.

Furthermore, the gig economy blurs the boundaries between full-time employment and freelancing, giving rise to a hybrid workforce. Individuals may opt for traditional employment for stability while supplementing their income through gig work. This hybrid model enables workers to diversify their skills and income streams, contributing to a more adaptable and resilient workforce.

However, this flexibility also introduces challenges in managing and coordinating a dispersed workforce. Employers must navigate the intricacies of overseeing gig workers who may lack the same organizational loyalty or attachment as traditional employees, presenting challenges in maintaining consistent quality, communication, and collaboration within a diverse and transient workforce.

Impact on Economic Structures: The implications of the gig economy extend beyond individual employment dynamics to reshape broader economic structures. Traditional models built on long-term employment relationships are undergoing transformation due to the gig economy's

emphasis on short-term and project-based engagements. This shift challenges established concepts of job tenure, benefits administration, and retirement planning.

From a macroeconomic perspective, the gig economy contributes to heightened economic agility. Businesses can scale their workforce based on demand, leading to more efficient resource allocation. However, this agility comes with potential downsides, such as the risk of income volatility for gig workers and difficulties in maintaining a stable and skilled workforce.

Additionally, discussions around income inequality and social safety nets have been sparked by the gig economy. As gig workers often lack the same level of benefits and protections as traditional employees, there is a growing need to reconsider and expand social safety nets to accommodate the evolving nature of work. Policymakers and economists grapple with the challenge of creating systems that provide a safety net for gig workers without stifling the innovative aspects of this emerging economic model.

Considerations on Policy Front: The implications of the gig economy for the future of work have prompted policymakers to reevaluate existing regulatory frameworks. The traditional dichotomy between employees and independent contractors may prove insufficient in capturing the nuances of gig work. Policymakers face the challenge of creating a regulatory environment that ensures the fair treatment of gig workers while preserving the flexibility and innovation that define the gig economy.

Worker classification stands out as a key policy consideration. Policymakers must find a delicate balance, providing gig workers with essential legal protections and benefits while safeguarding the autonomy and flexibility that attract individuals to gig work. This might involve redefining employment classifications, introducing new categories, or developing hybrid models that recognize the unique characteristics of gig work.

Ensuring fair compensation emerges as another critical policy consideration. Policymakers may explore mechanisms to establish minimum wages, fair pricing models, and income stability measures to address the inherent income volatility in gig work. Additionally, policymakers need to address concerns related to access to healthcare, paid leave, and retirement benefits for gig workers.

Policy attention is also directed towards social safety nets. Policymakers must devise innovative solutions to extend unemployment insurance, workers' compensation, and other safety net benefits to gig workers. This includes exploring portable benefits models that allow gig workers to accrue benefits across various engagements.

Taxation policies play a pivotal role in addressing the implications of the gig economy. Policymakers may need to reassess tax structures to accommodate the decentralized and freelance nature of gig work. Striking a balance between simplifying tax processes for gig workers and platforms and ensuring a fair contribution to public services poses a delicate challenge for policymakers.

LITERATURE REVIEW

(Pushpa Suryavanshi, 2022)- The rise of India's Gig Economy, fueled by technology and smartphones, addresses unemployment challenges. The concept, novel in the country, sees rapid growth in tech-based gig workers, with increasing participation from both men and women. As technological trends reshape business operations, the Gig Economy's emergence

necessitates a revaluation of employment laws for the benefit of workers. While aiding in reducing unemployment, it's crucial to consider and address the precarious nature of gig employment.

(Laws for the gig workers in India)- The Code on Wages, 2019, mandates a universal minimum wage and floor wage for all sectors, encompassing both organized and unorganized, including gig workers. Meanwhile, the Code on Social Security, 2020, recognizes gig workers as a distinct occupational category. Although gig workers are now entitled to benefits like maternity, life and disability cover, old age protection, provident fund, and employment injury benefits, the code faces challenges in ensuring the guaranteed provision of these benefits. A literature review serves to assess existing knowledge in a chosen research area, conveying previously conducted work and established ideas on the subject. (Dokka et al.,)-An effort has been made to recognize both the prospects and obstacles associated with unconventional and temporary employment arrangements in the evolution of the Gig Economy within the United States (U.S.).

Kathuria R, Kedia M, Varma G, Bagchi K, Khullar S (2017) conducted a study titled "Future of Work in a Digital Era: The Potential and Challenges for Online Freelancing and Microwork in India." Their research evaluates the surge of Microwork and Online Freelancing in India, facilitated by web-based platforms connecting talent with businesses. This emerging trend offers opportunities for independent, temporary work in India's informal labor market. From basic to intricate tasks, the digitally empowered workforce finds employment prospects, contributing to increased productivity. The study notes ongoing innovations on online platforms to enhance freelancer engagement, including training programs to keep users abreast of technological advancements. Platform improvements also target issues like payment, bidding, and website navigation, aiming to simplify the platform experience for both clients and freelancers.

In their report titled 'Future of jobs in India: A 2022 perspective,' Ernst & Young (EY) extensively examines five key sectors (IT/ITES, retail, financial services, textile & apparel, and auto). The study delves into the influence of three major factors—globalization, demographic shifts, and the integration of exponential technologies by Indian companies. The report offers insights into the anticipated trajectory of jobs in India for 2022, emphasizing that the nation's response to the combined impact of globalization, demographic changes, and the adoption of Industry 4.0 technologies will shape future employment landscapes. Sectors like IT-BPM and BFSI are likely to experience significant disruption, while core manufacturing sectors such as apparel and leather may face comparatively lower impacts.

Kasliwal, R. (2020) Analyzed challenges encountered by female workers on gig platforms, evaluating the platforms' responsiveness to their requirements. The study scrutinized these issues, pinpointing gender disparities in gig work and offering diverse recommendations to address them.

Chaudhary, R.'s (2021) objective was to comprehend the impact of India's expanding gig economy on women's employment and working conditions. The study extensively examined women's employment within prominent platform companies in India, delving into diverse labor practices and elucidating the challenges faced by workers. Additionally, the research explored the ramifications of women's security, empowerment, and agency within the gig economy, presenting a conceptual analysis of women workers in India's gig economy.

Research Methodology

Research Gap- While gig economy research is gaining prominence, there exists a significant void in comprehending the enduring socio-economic ramifications of gig employment. Current studies tend to concentrate on immediate advantages and challenges, overlooking a thorough examination of the enduring impacts on workers' financial resilience, professional paths, and overall welfare. Moreover, there is a shortage of research delving into the cultural and gender-specific intricacies within the gig economy, constraining our insight into varied experiences. Closing these disparities is essential for well-informed policy formulation and the development of a resilient framework that caters to the changing dynamics of gig work.

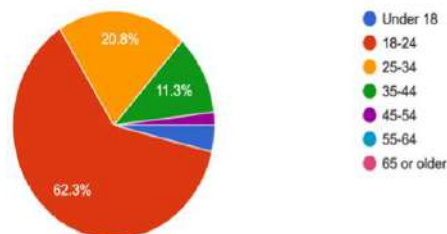
Objectives-

To gain insights into the characteristics, preferences, and motivations of individuals participating in gig work, providing a comprehensive understanding of the gig economy's workforce dynamics. To measure the level of job satisfaction among gig workers, identifying factors that contribute to their contentment or discontentment with gig employment. To examine the economic impact of gig work, including income levels, financial stability, and the overall contribution of gig workers to the economy. To identify and analyze the challenges faced by gig workers, such as job insecurity, lack of employment benefits, or issues related to work-life balance. To evaluate the effectiveness of gig platforms in meeting the needs and expectations of gig workers, considering aspects like ease of use, payment systems, and support mechanisms.

Data analysis and interpretation-

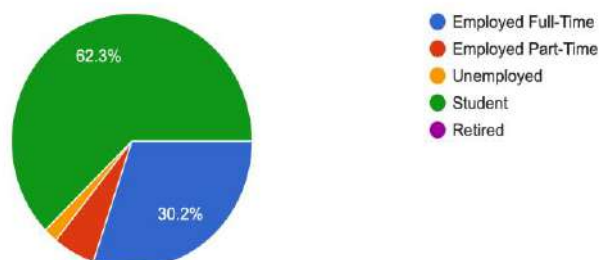
Age

53 responses



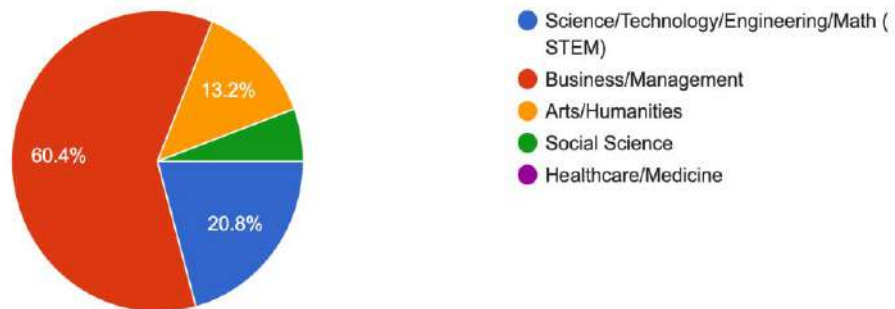
Current Employment status

53 responses



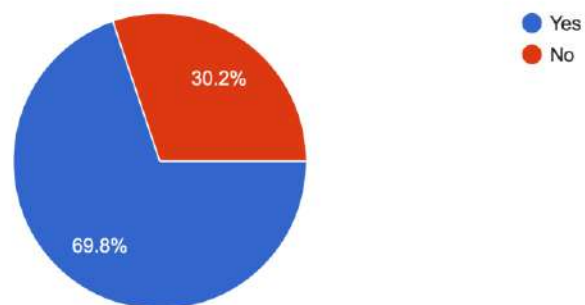
Field of Study or Profession

53 responses



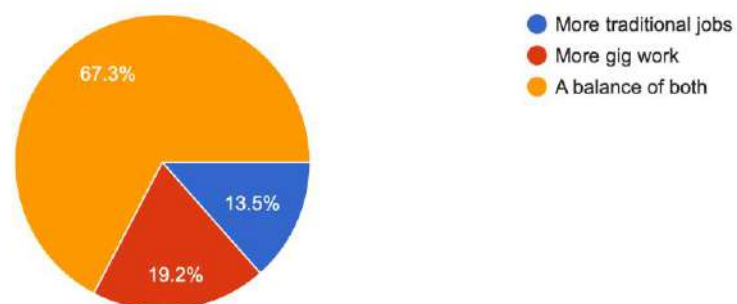
1. Have you heard of the term "gig economy" before?

53 responses



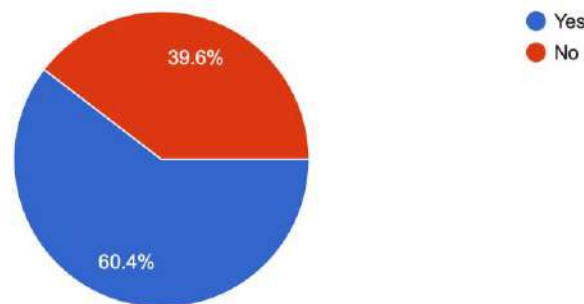
How do you envision the future of work, considering the rise of the "gig economy"?

52 responses



4. Are you aware of any challenges faced by individuals working in the "gig economy"?

53 responses



Conclusion

In conclusion, India, as a developing nation, has experienced a notable increase in Gig workers propelled by the widespread adoption of technology and smartphones. Unlike Western countries, the Gig Economy is a novel concept in India, characterized by individuals engaging in digital platforms and online software apps. The genesis of this concept is attributed to often unseen yet crucial factors, with unemployment and technological advancements serving as primary catalysts.

The rapid growth of technology-based Gig workers has made a significant and essential contribution to the country's economic landscape. Notably, both men and women increasingly participate in this evolving field, with promising prospects for further expansion in the future. The transformative impact of innovative technological trends has reshaped business operations, emphasizing the need to explore ways for individuals to adapt to the consequences of these modernizations. The accelerated growth of the Gig Economy has prompted thorough and systematic research, highlighting its nascent stage in India. This study underscores the urgency of addressing concerns surrounding the Gig Economy's emergence, advocating for proactive measures to protect employees and adapt employment laws to align with contemporary corporate practices.

While the Gig economy plays a pivotal role in mitigating unemployment challenges, especially in developing nations like India, it is imperative to consider the workers' viewpoint on this organizational structure. Despite its positive impact on reducing unemployment rates, it is equally crucial to acknowledge and address the potential concerns and perspectives of those actively engaged in the Gig economy.

In essence, the Gig economy has emerged as a transformative force, challenging traditional labor market norms and necessitating thoughtful consideration of its implications for both individuals and the broader economic landscape.

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4-

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Responses of different age groups on gig economy

Online Education in India: A Post-Pandemic Assessment of Challenges and Emerging Opportunities

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Abstract

In India, there are a lot of challenges and opportunities for online education. We have identified key factors which will boost online education in India. We have identified internet penetration; low cost of online education, ease of doing course, initiative by government, employer's recognition and bridging gap are the key factors the growth of online education. The prolonged lockdown disrupted the teaching-learning activity of the students. In order to ensure continuity in learning, most of the academic institutes moved online. However, this tectonic shift was sudden and abrupt which created another set of issues and challenges for every stake-holder involved viz.

Keywords: Online education; importance: advantages: Disadvantages: Challenges and opportunities.

INTRODUCTION

With educational institutes closed due to the COVID-19 pandemic, the government has been encouraging online education to achieve academic continuity. Most high-end private and public institutions have made the switch smoothly using online platforms such as Zoom, Google classrooms, Microsoft teams, etc., while many still find it a herculean task. The challenges of online education are multifaceted. It is time that we Indians, as a society, understand the realms of online education – in India. Online education has a great scope and all those having time limitations are turning towards it. Many top universities, organizations and the colleges are accepting the online education system. Online Education is affordable for students and also flexible as they can learn from their comfort place. Online education has no age bar and anyone can do the course from anywhere. According to the recent survey after United States, India is the second highest country for the online enrolment courses all over the world. Online education in Indian schools can enhance the quality of the education. United States have started providing the online education to the Secondary School and they are finding it as effective. Many foreign universities are offering the online degrees so no need to go to the abroad for further education. Many top Indian universities like Sikkim Manipal, Symbiosis, IIM, IGNOU and Annamalai University are offering online distance education. They offer courses like MCA, MBA, MSc, BA (Hons), Retail & Digital Marketing, BBA etc. The fees of these online courses are affordable for students. Online education saves money on the lectures & conferences. Also they conduct online exams time to time. Classroom education is not suitable for everyone as in classroom there are some students whose grasping power is high and there are some who are always back. Also some students require more detailed information in classroom education, but not possible. But in online education students can get more detailed information and also can concentrate. In classroom education teacher can't give personal attention to each and every student. In classroom education not all students are active, some are energetic but some just sit back. Classroom education has a limitation on the number of students, but for online education thousands can enroll for a course. For online education there is no need to stand in a queue to get an admission. All those working professionals or a business professional who wants to do a professional course or wants to study further to improve their skills can enroll for the online education. Online education is getting more popular in the working professional as they don't

have the time to attend the regular classes. It's best option for them. They can enroll for online course for any time of the day.

The government is supporting online education in India because of its potential to improve education quality and reach through the Digital India initiative. Government of India in Association with Ministry of HRD has initiated a programme named SWAYAM (Study Webs of Active –Learning for Young Aspiring Minds) that is designed to achieve the three fundamental objectives of Education Policy i.e., access, equity and quality. The main objectives of this effort are to take the quality teaching learning resources to all, including those who cannot afford. This program SWAYAM seeks to provide education to those students who are not yet aware of the digital revolution taking place and are still not able to join the mainstream of the knowledge economy. Nearly 2000 online courses are offered through Swayam and approximately 150 million students across the globe are enrolled in different courses.

REVIEW OF LITERATURE

Dr. Ramesh Pokhriyal Nishank, Minister for Human Resources Development tweeted on 10 April 2020 that e-learning platforms launched by MHRD received a footfall of 1.4 crore during the first lockdown (Ministry of HRD, 2020).

Richa Choudhary, a young professional at Niti Aayog has outlined suggestions to embed technology in curriculum (2020).

Harjiv Singh has predicted several advantages which online classes are likely to have in years to come: 1) improvement in access to learning, 2) democratization of information and knowledge, 3) inclusiveness of learning to grow and 4) the parents' contribution in bettering the course and content to begin (2020).

Bulbul Dhawan has very happily noted that even a number of government schools have gone online to ensure continuity in learning (2020).

According to a report by Google and KPMG, the online education market in India at the end of December, 2016 was \$247 million and it will reach \$1.96 billion by 2021. Also India's online education market is the second largest market after US. The findings of the report also states that the paid user base for online education services will also grow at least by six times i.e. approximately 9.6 million users by 2021.

IMPORTANCE OF ONLINE EDUCATION

1. Flexible Schedule
2. Everyone Can Gain The Education
3. Keep Up With Changing Trends
4. Vast Choice Of Syllabus
5. Learn Whatever You Want
6. Lower In Cost
7. Learn At Your Swiftness
8. Improve Technical Skills
9. Internet penetration in India
10. Online education saves money and time

11. Ease of doing courses for working professionals
12. Initiative by Government of India
13. Gaining recognition among employers
14. Bridge the gap between education level and industry expectations

POSITIVE EFFECTS OF ONLINE EDUCATION

1. Efficiency
2. Accessibility Of Time And Place
3. Affordability
4. Improved Student Attendance
5. Suits A Variety Of Learning Styles
6. Advanced teaching techniques are used to teach
7. Convenient
8. Affordable fees
9. Can choose the class timing as per your timing
10. More Revision
11. Saves Time & Saves Money [No Travelling]
12. More concentration and less disturbances
13. Video presentations helps students to understand quickly
14. Webinar
15. Mock tests
16. Videos
17. Counseling
18. Internet penetration
19. Smartphone penetration
20. Flexibility of time
21. Quality education
22. Immediate results
23. Government initiatives
24. Study material
25. Affordability

NEGATIVE EFFECTS OF ONLINE EDUCATION

1. Inability To Focus On Screens

2. Technology Issues
3. Sense Of Isolation
4. Teacher Training
5. Manage Screen Time
6. To may miss the face-to-face interaction with the instructor and among students
7. To may prefer to attend traditional classes with an instructor who teaches and guides them through the course
8. To find access to the necessary technology challenging and the availability of technical support limited In addition, some administrators and instructors who do not understand the workload may display a negative attitude toward online education.

OPPORTUNITIES IN ONLINE EDUCATION

Change in technology is offering many opportunities for all stakeholders in the online education sector which includes entrepreneurs, education providers and learners. Some of the factors offering different opportunities in this domain include:

1. Mobile Learning

According to a report in Stastia (2018), in the year 2017 there were 320.57 million people who accessed the internet through their mobile phone. This figure is projected to increase to 462.26 million by the year 2021. The surge in users is credited to availability of 4G internet and smart phones at very low price. Going forward, IAMAI hopes that the National Telecom Policy (NTP) 2018, which is focusing on new technologies like 5G, will promote better quality data services at more affordable prices and help address the digital divides that will promote internet penetration in the rural areas through mobile internet. According to report by Zenith, mobile devices will account for 73 per cent of time spent using the internet in 2018. So the vast majority of students in future will have access to e-learning through mobile phones.

2. Investor's Interest

A large number of entrepreneurs are venturing into online education as this is expected to see an uptrend in the next 5 years thanks to the Digital India campaign, the cultural importance given to education and falling mobile data prices. The Chang Zuckerberg Initiative has invested \$50 has invested \$8.2 million in Eruditus, and Kaizen Management Advisors and DeVry Inc. have put in \$10 million in EduPristine. Khan Academy is a non profit organization which receives financial support from philanthropic organizations like The Bill and Melinda Gates Foundation, Google and Netflix founder Reed Hastings.

Online learning platform Unacademy also raised \$11.5 million of funding led by Sequoia India and SAIF Partners; and Eruditus Executive Education, a provider of executive education programmes, had raised \$8 million funding from Bertelsmann India Investments. So, the online education sector will continue to spark more interest among entrepreneurs, investors and attract more funding.

3. Blended Model

There will be convergence of the offline education and online education in future. This concept of blended learning combines online digital media with traditional classroom methods. It requires the physical presence of both teacher and student, but student has some control over

time, place, path, or pace. This model will take advantage of both face-to-face classroom practices combined with computer-mediated activities. In future, there will be virtual classrooms where face to face offline pedagogy will be aided by digital courses on practical knowledge and soft skills.

4. New Courses

Today the most popular courses in online education are related to IT which includes subjects like big data, cloud computing, and digital marketing. But in future demand for different types of courses in unexpected subjects such as culinary management, photography, personality development, forensic science, cyber law, etc. will increase.

CHALLENGES IN ONLINE EDUCATION

There are a lot of challenges faced by people in online education in India. Some of these challenges which need to be overcome are:

1. Insufficient digital infrastructure

Although Government of India is taking initiative to develop digital infrastructure but a lot need to be done in this direction. High speed internet and stable power supply are the biggest problem. India stands 89th worldwide on internet speed and stability. According to the report of World Economic Forum, only 15 percent of the households have access to the Internet, and mobile broadband remains accessible to very few i.e. only 5.5 subscriptions for every 100 people. Further, currently reach of broadband is just about 600 corridors, largely in and around the top 50 to 100 Indian cities, leaving rural areas with poor connectivity. 5G networks technology is the requirement of today's which will increase the speed of downloading the data.

2. Limited Social interaction

Since online education can be accessed at home or any other convenient place, there is very limited direct interaction with the teacher and other people doing the course. According to Dharendra Kumar (2010), especially those courses which are self paced, there is very less discussion among the peers. Most of the discussion takes place through e mail, chat room or discussion groups. There isn't any campus atmosphere to improve social interaction. So you are not able to develop any social links which do help in the career growth.

3. Questionable credibility of degrees

Although industry has started recognizing online degrees, there are still a lot of fraudulent and non-accredited degrees being offered online. The number of scam operators is rising who are offering fake certificates which does not have any credentials. These scams not only losses the credibility of the online certificates but also the faith of prospective employer in online programs.

4. Motivation

Some students need the push to get to the class. In case of self paced online programmes, student may procrastinate. The dropout rate in online education is very high. Self motivation and discipline is required to complete the assignments and upload them timely. If you have difficulty working independently, staying organized and meeting deadlines, you might struggle in an online program.

5. Language of the Course

India is a multi-linguistic country, and a vast majority of the population comes from rural areas. The content offered by most of the online courses is in English. Hence, those students who are not able to speak English struggle with the availability of language content. Hence, it is the duty of computer professionals, educators, administrators, language content creators, and content disseminators, to sit together and give a viable framework and standard solution to the learners knowing only Indian languages.

CONCLUSION:

From last 2 to 3 years the online education has changed the quality of education and is far better than earlier. There are some online education service providers in market who are providing the education at free of cost. Seeing the increasing demand for the online education, many business competitors are entering this market. But all those providing the quality education will only survive in future. Also there may be still more various courses in online education and with lots of options. The demand of the online education will create more employment for the lecturers in the future. Still Indian parents are not finding the online education as more important than the classroom education. Government should create more awareness to change the trend. It would be premature to state that online classes should become a new way of teaching-learning process. Online sessions may be used to complement classroom teaching but cannot be used to replace classroom teaching completely in the way in which the technology enthusiasts want it to be a new normal post Covid-19 Pandemic unless a mechanism is devised to address the issues and challenges presented by the researchers. Education process needs to be changed by making it more practical with the use of technology. Also course should be designed in different language to increase their reach and more opportunities for youth of rural India. Innovations are required to design ways to increase the social skills of online learners.

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A Study of Influencer Marketing and its Impact on Sustainable Travel

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Abstract

This research investigates the influence of digital marketing and social media on sustainable travel behavior, focusing on two key objectives: the effectiveness of digital marketing strategies in shaping consumer perceptions towards sustainable travel and the impact of social media influencers (SMIs) on promoting eco-friendly travel practices. A comprehensive literature review reveals that established theoretical frameworks reinforce the significant role of digital marketing in raising awareness and influencing consumer attitudes regarding sustainability in tourism. The analysis of SMIs demonstrates their ability to effectively communicate sustainable choices through authentic storytelling, thereby fostering engagement and encouraging eco-conscious behavior among followers. The findings highlight the synergistic relationship between digital marketing efforts and consumer behavior, emphasizing the necessity for the tourism industry to leverage these strategies to promote sustainable travel practices. This study offers valuable insights for future marketing initiatives focused on fostering sustainable behaviors within diverse consumer populations.

Keywords: Digital Marketing, Social Media, Consumer Attitude, Travel Practices, Marketing Initiatives

Introduction

The global tourism industry, one of the world's largest economic sectors, significantly contributes to economic growth and cultural exchange. It plays a pivotal role in job creation, infrastructure development, and fostering cross-cultural understanding. However, alongside these benefits, the rapid expansion of tourism has also led to significant environmental and social challenges. Mass tourism has contributed to issues such as deforestation, loss of biodiversity, increased carbon emissions, and excessive waste generation. Additionally, many popular travel destinations face the risks of over-tourism, which can lead to cultural erosion, overcrowding, and the displacement of local communities.

With the growing awareness of these negative impacts, sustainable tourism has emerged as an essential approach to balancing economic growth with environmental conservation. Sustainable tourism is defined as tourism that meets the needs of present generations without compromising the ability of future generations to meet their own needs. This approach emphasizes responsible travel, ensuring that tourism activities contribute positively to local communities and minimize environmental harm. It promotes eco-friendly accommodations, responsible wildlife tourism, and initiatives that support local economies while preserving cultural heritage.

Governments, businesses, and international organizations have increasingly recognized the importance of sustainable tourism. Global institutions such as the United Nations World

Tourism Organization (UNWTO) and the Global Sustainable Tourism Council (GSTC) advocate for responsible tourism practices. Policies and guidelines have been introduced to encourage sustainable tourism development, including regulations on waste management, energy conservation, and fair labor practices within the travel industry. Many tourism operators and businesses are also investing in sustainability by adopting green certifications, carbon offset programs, and eco-conscious travel packages to attract environmentally aware consumers.

The role of travelers in supporting sustainability has also evolved over the years. Research indicates that modern travelers are becoming more environmentally conscious and prefer destinations that offer sustainable travel options. Eco-tourism, for example, has grown in popularity, providing experiences such as wildlife conservation tours, community-based tourism, and low-impact adventure travel. Consumers are now considering factors such as carbon footprint, ethical tourism practices, and eco-friendly accommodations when making travel decisions. The increasing demand for sustainable tourism has encouraged businesses and marketers to align their promotional strategies with the values of environmentally conscious consumers.

In today's digital age, marketing and communication play a critical role in shaping travel behaviors. Digital marketing and social media have transformed the tourism industry by revolutionizing how travel information is shared, accessed, and influenced. Platforms like Instagram, YouTube, and TikTok have given rise to travel influencers who shape consumer perceptions by sharing their experiences with a global audience. These influencers often serve as key opinion leaders, promoting destinations, accommodations, and travel practices that align with sustainability principles. Their endorsements can impact travel choices, encouraging followers to opt for eco-friendly options and responsible travel experiences.

Moreover, user-generated content (UGC) and electronic word-of-mouth (eWOM) have become powerful tools in promoting sustainable tourism. Consumers rely heavily on online reviews, travel blogs, and peer recommendations when making travel decisions. Authentic content shared by travelers who advocate for sustainable practices significantly influences others' perceptions and behaviors. Research suggests that consumers are more likely to trust peer-generated content over traditional advertisements, making social media an indispensable platform for spreading awareness about sustainable tourism initiatives.

Marketers leverage digital tools such as data analytics, artificial intelligence, and targeted advertising to identify and engage eco-conscious travelers. Many tourism companies have adopted green branding strategies, emphasizing their commitment to sustainability through digital campaigns. For example, hotels that implement energy-efficient practices, reduce plastic waste, or support local conservation efforts use digital marketing to communicate these values to potential customers. Campaigns that highlight a brand's commitment to environmental responsibility help build trust and loyalty among eco-conscious travelers.

This study examines the intricate relationship between digital marketing, social media engagement, and sustainable travel behavior. By analyzing how targeted marketing campaigns and influencer endorsements impact consumer awareness and decision-making, this research aims to identify effective strategies for promoting sustainable tourism. The findings of this study will provide valuable insights for marketers, policymakers, and travel businesses seeking to implement responsible tourism practices. Ultimately, leveraging digital marketing for sustainability not only benefits the environment but also enhances the long-term viability of the global tourism industry.

Related work

1. Sustainable Tourism Awareness and Consumer Behaviour

Studies indicate that increased awareness of environmental issues influences consumer behaviour in tourism. Travelers prefer sustainable practices when perceived as socially desirable and environmentally responsible (Han et al., 2018).

2. Role of Digital Marketing in Tourism

Digital marketing enhances visibility and engagement in the tourism sector. Hysa et al. (2021) highlight the necessity for businesses to adapt to digital platforms to communicate sustainability effectively.

3. User-Generated Content (UGC) and Travel Decision-Making

UGC significantly impacts travel choices, as peer reviews and social media content foster trust and credibility (Xiang & Gretzel, 2010). Authentic personal experiences shape traveller's sustainable choices.

4. Influencer Marketing and Sustainable Travel

Influencers shape consumer perceptions through authentic storytelling. Pop et al. (2022) suggest influencers advocating sustainability can encourage followers to adopt similar values.

5. Environmental Concerns and Travel Intentions

Travelers emotionally attached to environmental issues engage more with sustainable products and services. Marketing campaigns must address these concerns to resonate with eco-conscious travellers (Sultan et al., 2021).

6. Social Media as a Tool for Campaigning Sustainable Tourism

Social media fosters environmental consciousness and community engagement in sustainable tourism campaigns (Hysa et al., 2022).

7. Digital Technology and Consumer Behaviour

Advances in data analytics enable marketers to tailor campaigns for sustain

8. Changing Dynamics in the Tourism Market

Sustainable tourism branding integrates environmental advocacy with travel experiences (Gulati, 2021), strengthening brand loyalty among eco-conscious consumers.

9. Effectiveness of Marketing Strategies in Promoting Eco-Friendly Travel

Aligning marketing messages with travellers' values enhances engagement in sustainable tourism initiatives (Andersson et al., 2018).

10. Social and Cultural Influences on Sustainable Travel Choices

Cultural factors influence sustainable travel perceptions, necessitating tailored marketing strategies (Baltezarevic et al., 2022).

Method, Experiments and Results

Research Objectives

1. Conduct a literature review on theoretical frameworks explaining the impact of digital marketing on sustainable travel behaviour.
2. Analyse the role of social media influencers (SMIs) in promoting sustainable travel through content analysis of their campaigns.

Research Methodology Method: Systematic Literature Review (SLR)

1. **Database Selection:** Use academic databases such as Google Scholar, Scopus, Web of Science, and Science Direct.
2. **Search Strategy:** Use relevant keywords (e.g., "digital marketing," "sustainable travel behavior," "theoretical frameworks," etc.).
3. **Inclusion/Exclusion Criteria:** Focus on peer-reviewed articles from the last 10 years.
4. **Thematic Analysis:** Identify and categorize theoretical frameworks used in previous studies (e.g., Theory of Planned Behavior, Social Influence Theory, etc.).
5. **Synthesis:** Summarize key insights and gaps in the literature to establish a foundation for Objective 2.

Discussions

Findings indicate that digital marketing strategies and influencer engagement significantly shape consumer perceptions of sustainable travel. The Theory of Planned Behaviour (TPB) explains digital marketing's role in influencing sustainable choices. This theory suggests that an individual's behaviour is driven by intentions, which in turn are influenced by attitudes, subjective norms, and perceived behavioural control. In the context of sustainable travel, digital marketing campaigns aim to shape attitudes by emphasizing the benefits of eco-friendly tourism and addressing concerns about environmental impact.

Social media influencers play a crucial role in promoting eco-conscious behaviors, with case studies demonstrating that authentic storytelling fosters community engagement. Influencers who emphasize sustainability through their content create a powerful psychological effect on consumers. Unlike traditional advertisements, influencer-driven content appears more organic and relatable, making it easier for audiences to trust and adopt sustainable travel behaviors. Many influencers use social media to document their experiences at eco-friendly accommodations, participate in conservation initiatives, and promote responsible tourism practices. Their advocacy helps normalize sustainable travel choices among their followers.

Moreover, digital marketing strategies, such as targeted advertising and personalized content, have significantly contributed to spreading awareness of sustainable tourism. Brands leverage artificial intelligence and data analytics to tailor messages to specific consumer segments. These strategies ensure that sustainability-related content reaches individuals who are already

inclined towards responsible travel, thereby reinforcing their commitment to eco-friendly tourism. Additionally, interactive campaigns—such as hashtag challenges, video content, and user-generated testimonials—have been successful in driving engagement and fostering a sense of collective responsibility towards the environment.

However, challenges persist in fully harnessing the potential of digital marketing for sustainable travel. Consumer skepticism toward sponsored content remains a critical issue. Many consumers question the authenticity of influencer endorsements, particularly when influencers fail to disclose paid partnerships. Transparency in influencer marketing is essential for maintaining credibility and trust. Regulatory bodies and social media platforms have introduced guidelines requiring influencers to disclose sponsorships, yet concerns about deceptive marketing practices still exist.

Another significant challenge is information saturation. Social media and digital platforms are flooded with travel content, making it difficult for sustainability messages to stand out. Competing with mainstream travel promotions, which often highlight luxury and convenience over sustainability, poses a challenge for marketers. To address this, brands must focus on creating compelling narratives that highlight the unique experiences and benefits of sustainable travel. Collaborations with influencers who genuinely prioritize sustainability can help overcome this challenge by ensuring that the messaging remains authentic and impactful.

Consumer behavioral inconsistencies also play a role in the challenges faced by digital marketing in sustainable tourism. While many travelers express an interest in sustainable travel, their actual purchasing behaviors do not always align with their stated values. This phenomenon, known as the attitude-behavior gap, is influenced by factors such as perceived cost, convenience, and accessibility of sustainable options. Digital marketing campaigns must address these barriers by emphasizing affordability, ease of access, and the positive impact of sustainable choices. Highlighting testimonials from real travelers who have successfully incorporated sustainability into their trips can also help bridge this gap.

Despite these challenges, there are notable success stories in digital marketing campaigns promoting sustainable travel. Various tourism boards, travel agencies, and eco-conscious businesses have launched impactful campaigns that have successfully shifted consumer behavior. For example, destination marketing organizations have partnered with influencers to showcase lesser-known sustainable travel spots, reducing pressure on over-tourist locations. Similarly, airlines and hospitality brands have implemented loyalty programs that reward travelers for choosing sustainable options, further encouraging responsible travel behaviors.

As digital marketing continues to evolve, emerging technologies such as virtual reality (VR) and artificial intelligence (AI) are expected to enhance sustainability messaging. VR experiences that allow travelers to explore eco-friendly destinations before booking their trips can create a stronger emotional connection to sustainable travel choices. AI-driven chat bots and recommendation engines can provide personalized travel suggestions based on a user's preferences, helping them make more informed and sustainable choices.

In conclusion, digital marketing and influencer engagement significantly impact sustainable travel behavior. While challenges such as skepticism, information saturation, and behavioral inconsistencies exist, strategic and transparent marketing efforts can help overcome these hurdles. The future of sustainable travel marketing lies in leveraging technology, storytelling, and consumer engagement to create a lasting impact on global travel behaviors.

Conclusions

Digital marketing and social media significantly influence sustainable travel behaviour. Well-crafted digital marketing strategies enhance awareness, while social media influencers effectively promote eco-friendly choices through authentic content.

The tourism industry must leverage digital tools and influencer marketing to drive sustainable practices. Future research should integrate quantitative validation of qualitative findings to refine sustainable tourism strategies, ultimately fostering responsible travel behaviour worldwide.

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Economic Growth and Carbon Emissions in Emerging Economies

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Abstract:

The pursuit of economic growth in emerging economies often comes at the cost of increased carbon emissions, posing significant environmental challenges. This study explores the complex relationship between monetary expansion and carbon emissions in BRICS countries (Brazil, Russia, India, China, and South Africa) from 2010 to 2023 using a nonlinear panel quantile regression model. The analysis examines the impact of key macroeconomic factors, including industrialization, energy consumption, and technological advancements, on emission levels. The findings indicate that while economic growth initially leads to higher carbon emissions, adopting cleaner energy sources and digital technologies can mitigate environmental degradation. These insights underscore the importance of sustainable economic policies that balance growth with carbon reduction strategies, ensuring long-term ecological stability.

KEYWORDS: *Economic growth, carbon emissions, industrialization, energy consumption, sustainability, BRICS countries.*

INTRODUCTION

The growing human population presents significant environmental challenges, including climate change, resource depletion, and ecological degradation. Addressing these concerns is crucial for ensuring a sustainable future for current and future generations. Promoting sustainable living practices and implementing effective environmental policies are key strategies to mitigate these challenges (Mehta & Derbeneva, 2023). A major contributing factor to environmental degradation is the heavy reliance on non-renewable energy sources, such as fossil fuels, to meet global energy demands (Ullah et al., 2020; Zafar et al., 2020). As energy consumption increases, so do carbon emissions, which contribute to global warming and environmental pollution. Non-renewable energy sources generate solid waste and greenhouse gases that cannot be naturally regenerated, further exacerbating pollution. Transitioning to cleaner and renewable energy sources is essential for reducing emissions and achieving sustainable energy consumption (Sharma et al., 2024).

Industrialization has been a key driver of economic growth but has also posed serious environmental risks. The expansion of industrial activities is closely linked to rising carbon dioxide (CO₂) emissions, leading to air pollution and global warming (Tong et al., 2020). Azwar (2019) highlighted that CO₂ emissions increase alongside industrialization, affecting both developed and developing economies. Bashir et al. (2019) emphasized the importance of maintaining economic growth while minimizing environmental harm. The BRICS nations (Brazil, Russia, India, China, and South Africa) possess significant natural resources, which they utilize to drive economic growth (Prawoto & Basuki, 2020). However, economic development must be balanced with environmental conservation, ensuring the responsible use of both renewable and non-renewable resources.

While previous studies have focused primarily on economic growth, many have overlooked the importance of ecological balance. Chontanawat (2020) found evidence of a causal relationship between CO₂ emissions, energy consumption, and economic performance in

ASEAN countries, highlighting environmental degradation in the region. Similarly, Hdom & Fuinhas (2020) demonstrated that GDP growth and reliance on renewables, including hydropower, contribute to increasing CO₂ emissions in Brazil. Anwar's (2019) research in Indonesia further confirmed that economic expansion correlates with rising CO₂ emissions, particularly from power generation and industrial production.

Further studies have examined this relationship on a broader scale. Tong et al. (2020) investigated CO₂ emissions and economic growth in E7 countries (Brazil, India, Indonesia, Mexico, China, Russia, and Turkey) and found no cointegration between energy consumption, emissions, and economic growth in some nations, including China, Mexico, and Turkey. Meanwhile, Shahbaz et al. (2020) reported that while economic development and energy consumption contribute to environmental degradation in the United Kingdom, CO₂ emissions can be mitigated through research and development (R&D) investments. Achieving sustainable economic growth requires optimizing resource efficiency in the industrial sector, as future challenges will intensify with increasing energy demand from power generation and transportation.

A strong positive correlation exists between economic growth and carbon emissions, particularly in developing nations, where higher per capita energy consumption supports industrialization, urbanization, tourism, and digital infrastructure (Pata, 2018; Ullah et al., 2020, 2021; Pata & Caglar, 2021). As a result, these countries exhibit higher emission levels. The BRICS nations, for example, have surpassed the G7 countries in terms of purchasing power parity (PPP) GDP share (IMF, 2023). By 2023, BRICS accounted for 32% of global GDP, compared to 30% for the G7. This economic expansion has been accompanied by increased per capita energy demand, as BRICS nations continue to develop their manufacturing sectors, trade networks, and infrastructure to sustain economic growth.

For instance, China's per capita energy consumption rose from **4,914 kWh in 1980** to **9,335 kWh in 2000**, reaching **31,053 kWh by 2022** (EIA, 2023). Similar trends have been observed in other BRICS nations, including:

- **India:** 3,519 kWh in 2000 → 7,143 kWh in 2023
- **Russia:** 49,127 kWh in 2000 → 55,459 kWh in 2022
- **Brazil:** 13,400 kWh in 2000 → 17,300 kWh in 2022
- **South Africa:** 25,322 kWh in 2000 → 22,351 kWh in 2022 (EIA, 2023).

These trends highlight the urgent need for policies that promote sustainable energy use and carbon reduction strategies while supporting economic growth. Achieving a balance between economic development and environmental sustainability will be crucial for BRICS nations as they continue their industrial and technological advancements.

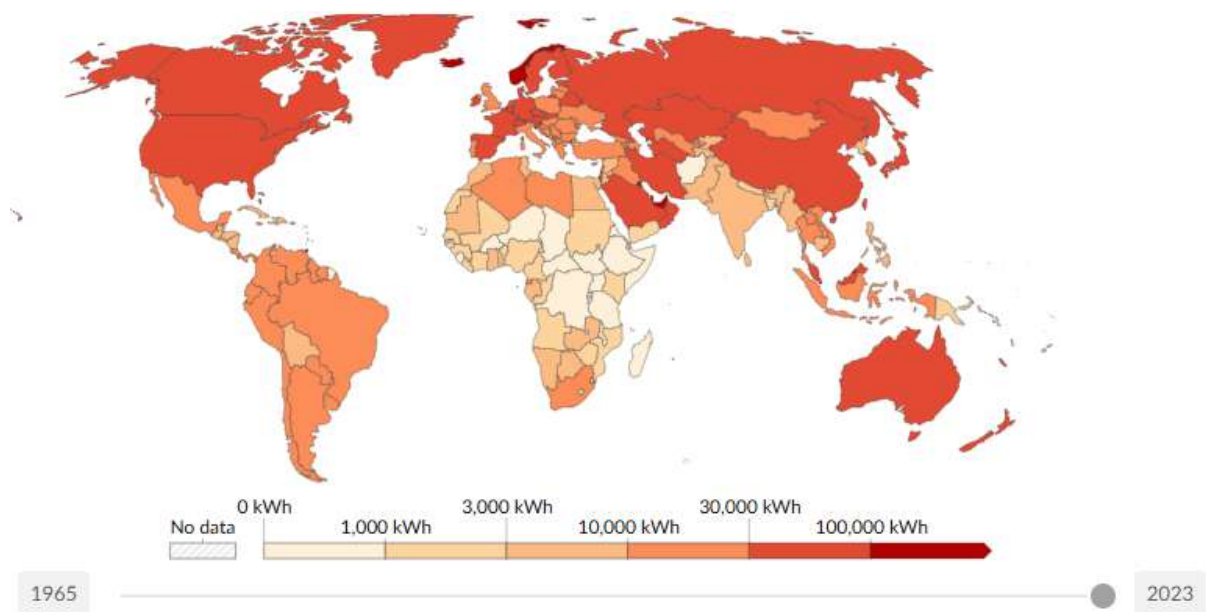


Figure 1: Per capita energy consumption- 1965-2023

Source: <https://ourworldindata.org/energy-production-consumption>

The bulk of the world's primary energy demand is met by non-renewable sources of energy (see Figure 2), resulting in increased environmental damage such as carbon emissions.

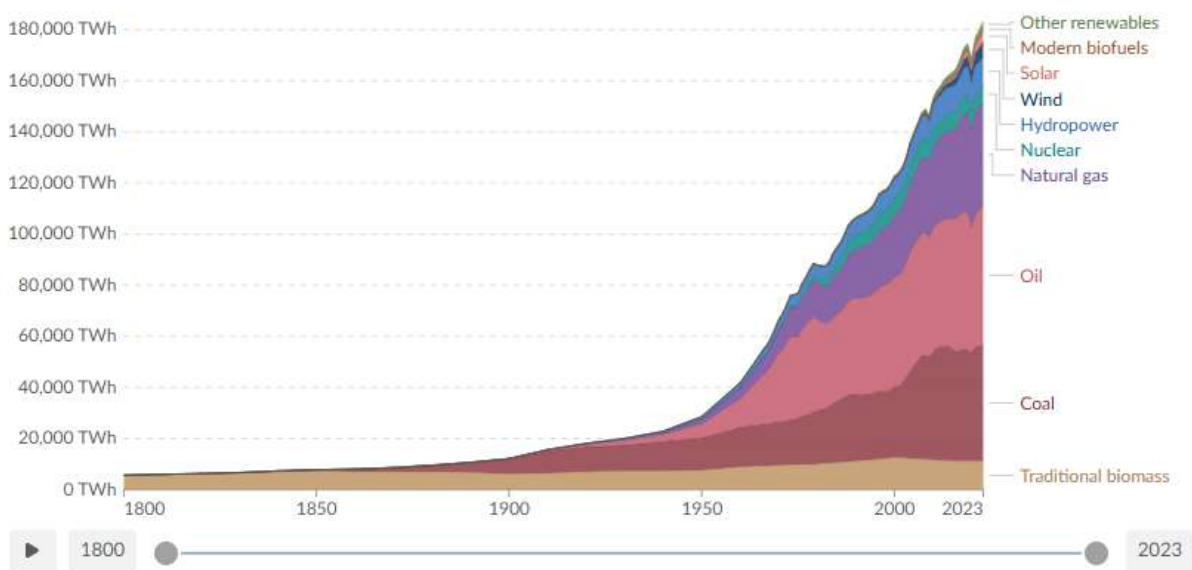


Figure 2: Global primary energy consumption by source from 1800 to 2023

Source: <https://ourworldindata.org/energy-production-consumption>

Energy demand is increasing in many countries throughout the world as people become wealthier and populations rise. If this rising demand is not countered by advances in energy efficiency elsewhere, global energy consumption will continue to rise year after year. Growing energy consumption complicates the transition from fossil fuels to low-carbon energy sources: new low-carbon energy must supply this increased demand while also attempting to displace

current fossil fuels in the energy mix. This interactive chart depicts how global energy usage has changed year after year. The change is expressed as a percentage of consumption in the preceding year. For more than half a century, we can see that global energy consumption has risen almost annually. The exceptions include the early 1980s, 2009 after the economic crisis, and 2020 due to the COVID-19 pandemic. Global energy consumption continues to rise, although it appears to be slowing—averaging roughly 1% to 2% per year.

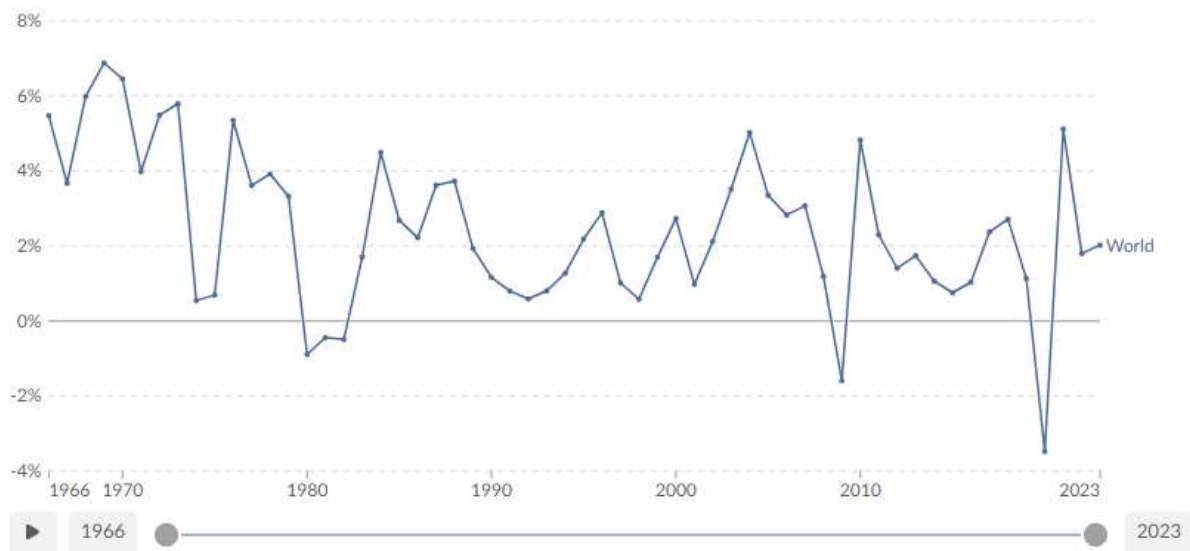


Figure 3: Annual change in primary energy consumption

The development of digital infrastructure and economic systems is critical to the country's growth (Dauda et al., Citation 2021; Zhao, Samour et al., Citation 2023b). To steer investments into the economy and support economic development, it is critical to generate economic growth. Furthermore, a well-established economic system allows for the reallocation of economic resources to more ecologically friendly and greener initiatives (Zhao, Samour et al., Citation2023b). To connect developing countries to the global economy and increase their economic potential, digital infrastructure, such as information and communication technology, has long been regarded as critical (Herman & Oliver, Citation2023). Digitalization creates e-commerce platforms and global supply chains that can connect small businesses, low-skilled workers, and informal labourers to international markets, promoting economic growth while reducing carbon footprints (Freund & Weinhold, Citation2004; Herman & Oliver, Citation2023). This study examines how the energy mix, economic development, and digitization affect carbon emissions in the BRICS countries. This paper addresses a vital gap by presenting empirical facts and outlining the benefits and drawbacks of economic development, digitization, and energy mix.

LITERATUREREVIEW

Environmental degradation has been acknowledged as a major concern to both nature and humanity (Aye and Edoja, 2017). A number of factors influence a country's development pace, including population size, economic instability, and the availability of natural resources. Economic growth seeks to raise everyone's standard of life as well as nations' riches. Pollution, overexploitation, degradation, species extinction, and climate change are all potential consequences of growth in certain areas (Phimphanthavang 2013). As a result, the majority of articles that investigated the relationship between GDP growth and CO2 pollution debated the

challenges around achieving the "correct degree of growth" that should be linked to the objective of reducing CO₂ emissions. Assuming that CO₂ emissions are a proxy for environmental deterioration, Azam et al. (2016) contend that CO₂ emissions contribute to the prospering economies of China, Japan, and the United States.

Pao and Tsai (2010) and Li et al. (2022) show that energy consumption has a long-term positive impact on CO₂ emissions in BRICS nations. Several studies have looked at the relationship between CO₂ emissions and national economic growth; one such study is Yousefi-Sahzabi et al. (2011), who explored the issue in Iran and established a statistically significant relationship between CO₂ emissions and economic development. Furthermore, Bouznit and Pablo-Romero (2016) confirm similar findings for the Algerian profile, whereas Osadume and University (2021) researchers examined how various African nations' economic advancement influenced their CO₂ emissions. Simon-Steinmann's economic growth model provides the fundamental theoretical basis. The findings reveal that the independent variable of interest (CO₂) had a high degree of cointegration in the short term, positively affecting the dependent variable (GDP) growth across all samples combined. (Adu and Denkyirah, 2017). The industrialization and globalization are seen as drivers of economic growth.

Adu and Denkyirah (2017) quote Pettitte's (1987) definition of industrialization as "the economic engine for expansion and prosperity." Aye and Edoja (2017) proposed that growing GDP might be used as a credible prediction of future carbon emissions. CO₂ emissions are thought to contribute to global warming and, as a result, environmental damage via their greenhouse effect. Rather than expecting more CO₂ emissions as salaries grow, the authors suggest that this will happen unless actions are done to limit CO₂ footprints. Environmental degradation challenges come gradually as the economy develops. Many researchers believe there is a substantial relationship between economic growth and carbon emissions (Selden and Song, 1994; Galeotti et al., 2009; Saboori et al., 2012). Extensive research has begun to focus on the relationship between GDP growth and carbon dioxide emission levels, testing the effectiveness of the environmental Kuznets curve (EKC) in different countries and regions (Apergis, 2016; Apergis et al., 2017; Murshed, 2020; Murshed et al., 2021a; Murshed et al., 2021b). Scholars utilize Granger causality to get various conclusions about the link between GDP growth and energy use. Granger causality experiments reveal that in the long term, there is unidirectional Granger causation from power usage and emissions to economic development (Lean and Smyth, 2010).

Apergis and Tang (2013) employ several model assumptions to re-evaluate the energy-led growth theory. The assumption is more likely to be supported by a Granger causality model with three or four variables than by one with only two. Furthermore, wealthy and growing nations are more likely to support the energy-led growth theory than less developed or low-income ones. There are various elements that affect carbon emissions. Scholars conducted several investigations and found several major factors. Banerjee and Murshed (2020) verified the pollution paradise hypothesis by examining cross-sectional interdependence across national teams from 2005 to 2015 and calculating the long-term equilibrium relationship between net export emissions and real GDP. Foreign Direct Investment, Trade Liberalization, Energy Consumption, and Economic Development. Murshed (2020) concluded that in South Asia, ICT trade reduces greenhouse gas emissions by directly increasing renewable energy eating, increasing the share of renewable energy, decreasing energy intensity, promoting cleaner cooking fuels, indirectly increasing renewable energy consumption, improving energy efficiency, and improving cleaner fuel channels. Furthermore, environmental policy has a big impact. Environmentally, pricing strategies in G7 nations have the potential to lower domestic power demand and, as a result, carbon emissions over time (Narayan et al., 2007).

In the case of China, Ma et al. (2021) determine that provincial expansion and the creation of the tertiary industry are to blame for the country's deteriorating carbon dioxide emissions trend. The study results also show that pollution fees, R&D investment, technological innovation, and the use of renewable energy all contribute to lower carbon dioxide emissions. According to Abdul et al. (2021), the beneficial effects on grain crop production will only increase carbon dioxide emissions in the long run; the negative impact on forestry will have no significant impact on China's carbon dioxide emissions; and the negative impact on livestock farming will only increase carbon Dioxide emission levels in the short term.

Economic development and carbon emissions

The rapid growth of finance & technology has undoubtedly resulted in asinificant increase in energyconsumption in both developed and emerging countries (Grossman & Krueger, Citation1995; Omri et al., Citation2015). While it is undeniable that energy consumption is intimately linked toeconomic progress, it must also be acknowledged that it contributes significantly to environmental degradation (Ibrahim & Ajide, Citation2021). Extensive research confirms a broad consensus: economic developmenthas a negative influence on environment (Aslan et al., Citation2014; Le et al., Citation2020; Ozturk & Ullah, Citation2022; Zhao, Ozturk, et al., Citation2023a). In contrast, a significantbody of research supports argument that economic development can actually reduce environmental degradation (Mahalik & Mallick, Citation2014; Shahbaz et al., Citation2013). Tamazian et al., Citation 2009. A study by (Zhao, Ozturk, et al., Citation2023a) looks at economic growth and its impact on carbon emissions. The researchers used the stock market value to GDP ratio to conduct their analysis. Economic development can be measured in a variety of ways, including the economic development scale, which incorporates variables such as stock market performance, liquidity, and credit availability. Previous research (Abbasi & Riaz, Citation2016; Shahbaz et al., Citation2013) discovered that economic development, as measured by stock market turnover, stockmarket capitalization, totalcredit, and private sector credit, reduces carbonemissions. Furthermore, Nasreen et al. (Citation2017) have demonstrated that business growth benefits environmental quality. They also observed that economic stability has a one-way causal link with carbon emissions (Shahbaz et al., 2018). Efficient economic systems may provide low-interest funding for alternative energy sources as well as environmental projects. These low-cost financing options have the potential to minimize excess resource and energy consumption by promoting innovation in indigenous energy-demanding sectors (Khan et al., Citation2020; Tao et al., Citation2023). Several studies have produced conflicting findings about the causal connection in economic advancement and carbon emissions. For example, Raihan (Citation2023; Shahbaz et al., Citation2015) discovered that economic development raises carbon emissions. Furthermore, Shahbaz et al. (2016) used the NARDL model to study the asymmetrical implications of economic progress on carbon emissions, discovering that both stock market and bank-based economic development measures degrade the state of the environment (Maji et al., Citation2017; Sunday Adebayo et al., Citation2023). Furthermore, data from emerging countries (such as India and China) indicates that increased economic growth is linked to higher carbon emissions (Boutabba, Citation2014; Y. J. Zhang, Citation2011).

Energy consumption and carbon emissions

The relationship b/w energy consumption & other factors can be efficiently classified into studies that focus on individual countries vs those that analyze regions or groupings of nations. These analyses have investigated groups such as OECD, BRICS, G7, and the European Union to assess overall energy demand (Al-Mulali, Citation2014; Borozan, Citation2013;

Villanthenkodath et al., Citation2023; Voumik et al., Citation2023; Yadav et al., Citation2024; Yasin et al., Citation2024) or specific energy types, such as coal (Lei et al., Citation2014), natural gas (Kan et al., Citation2019), or renewable energy sources. To get the findings, a variety of strategies have been regularly used, including autoregressive distributed lag (Tukhtamurodov et al., Citation2024), pool mean group models. References include Sharma et al. (2021), Temiz Dinç and Akdoğan (2019), Menegaki and Ozturk (2013), and Adebayo and Samour (2023). Research has continuously shown a link between the type of energy utilized (renewable or non-renewable) & carbon emissions (Iqbal et al., Citation2023; Sunday Adebayo et al., Citation2023). Studies on industrialized nations, such as the G7 and OECD, indicate that relying on non-renewable energy sources increases carbon emissions, while shifting to renewable energy reduces emissions (Şanlı et al., Citation2023). These studies used energy production with non-renewable versus renewable energy in econometric models such as autoregressive distributed lag (ARDL). Şanlı et al. (2023) cite Dumitrescu and Hurlin causality and Toda and Yamamoto causality. Similar studies on groups of developing countries, such as BRICS nations, found a strong relationship between energy consumption by source (renewable versus non-renewable) & carbon emissions (Apergis et al., Citation2010; Banday & Aneja, Citation2020; Dogan et al., Citation2017; Gogoi & Hussain, Citation2024; Mandimby, Citation2024; Sebri & Ben-Salha, Citation (2014). For example, (Apergis et al., Citation2010) found a negative link b/w renewable energy consumption & carbon emissions in BRICS nations, demonstrating that increasing renewable energy sources considerably reduces carbon emissions. Similarly, (Karakurt & Aydin, Citation2023) and (Iqbal et al., Citation2023) discovered that non-renewable energy use is positively connected with carbon emissions, emphasizing the necessity for a shift to renewable energy to reduce environmental effect.

METHODOLOGY

Data & Sample:

The study employed secondary panel data acquired online from the World Bank Group portal and the central bank websites of the selected study nations between 2010 and 2023. This study's panel sample comprises the BRICS nations (Brazil, Russia, India, China, and South Africa).

Variables and Econometric techniques:

Dependent variable:

CO2 emissions: Carbon dioxide or simply carbon emissions

Independent variable:

Energy mix

Economic development

Digitalization

National income

RESULT AND DISCUSSION

Table 1 summarizes descriptive information for the BRICS countries' energy mix, digitalization, economic progress, carbon emissions, and national income. From 2010 to 2023, the BRICS countries' average carbon emissions per capita (CO2) were 276.20 metric tons, with the highest being 1476.23. The average energy mix (*EMUX*) (i.e. ratio of renewable and non-renewable energy generation) is 1.30, while the maximum ratio is 8.51. In BRICS nations, the

average stock traded to GDP ratio (*ED*) is 94.56, while the average population to internet user ratio (*DIGI*) is 58.8%. The Jarque-Bera (JB) statistics estimates indicate that all of the variables are not normally distributed. Based on pairwise correlation estimates, Table 2 shows that carbon emissions, energy mix, economic progress, and digitalization are all inversely related.

Table 1: Descriptive statistics & pairwise correlation

| | <i>CO2</i> | <i>EMIX</i> | <i>ED</i> | <i>DIGI</i> | <i>Y</i> |
|-----------------------------|------------|-------------|-----------|-------------|----------|
| Mean | 276.21 | 1.31 | 94.55 | 58.81 | 5757.72 |
| Median | 109.13 | 0.18 | 66.01 | 12.11 | 6096.54 |
| Maximum | 1476.24 | 8.52 | 322.72 | 36.31 | 11437.46 |
| Minimum | −90.72 | 0.01 | 17.56 | 15.18 | 748.73 |
| Std. Dev. | 399.84 | 2.27 | 76.15 | 8.96 | 3022.15 |
| Skewness | 1.623 | 1.723 | 1.456 | 2.054 | −0.246 |
| Kurtosis | 4.454 | 4.521 | 4.036 | 5.865 | 1.835 |
| Jarque-Bera | 54.287*** | 60.827*** | 40.945*** | 107.685*** | 6.855** |
| Pairwise Correlation | | | | | |
| CO2 | — | | | | |
| EMIX | −0.366*** | — | | | |
| ED | −0.218** | −0.312 | — | | |
| DIGI | −0.784*** | 0.287 | 0.221*** | — | |
| Y | 0.115** | 0.342** | 0.136** | 0.326** | — |

Note- *, **, & *** indicate significance at 1%, 5%, & 10% levels, respectively.

The second-generation unit root test results show that *CO2*, *EMIX*, *ED*, *PUSU*, & *Y* are all stationary at the I level (refer to Table 2). Table 3 shows the panel cointegration test results from Pedroni (Citation1999) and Westerlund (Citation2007). These findings suggest that the calculated statistics are significant and that the variables are cointegrated in the long run.

Table 2: Second-generation unit root test

| Variables | CADF | CIPS |
|---------------|---------|---------|
| <i>CO2</i> | −0.043 | −0.065 |
| $\Delta CO2$ | −3.737* | −3.858* |
| <i>EMIX</i> | 2.396 | 2.346 |
| $\Delta EMIX$ | −3.956* | −3.857* |
| <i>ED</i> | −2.485 | −2.355 |
| ΔED | −6.595* | −7.604* |
| <i>DIGI</i> | −2.595 | −2.634 |
| $\Delta DIGI$ | −2.978* | −2.982* |
| <i>Y</i> | 1.911 | 2.044 |
| ΔY | −2.135* | −1.865* |

Note: *, **, & *** indicate significance at 1%, 5 percent, & 10% levels, respectively. CADF denotes cross-sectional fisher ADF; CIPS denotes cross-sectional Im, Pesaran, & Shin test

Table 3: Panel cointegration test

| Panel: Pedroni Cointegration Common AR coefficients (within-dimension) | | |
|--|-----------|--------------------|
| | Statistic | Weighted Statistic |
| P_v | −0.252* | −0.363* |
| P_{rho} | 0.921*** | 1.617** |

| | | |
|--|-----------|---------|
| P_{pp} | -1.368* | -0.933* |
| P_{ADF} | 0.676* | 2.318* |
| Group: Pedroni Cointegration Individual ARcoefficients (between-dimension) | | |
| | Statistic | |
| G_{rho} | 2.457* | |
| G_{pp} | -1.698* | |
| G_{ADF} | 2.938* | |
| Westerlund (Citation2007) Cointegration | | |
| Variance Ratio | 1.9756* | |

Note- *, **, & *** indicate significance at 1 percent, 5%, & 10% levels, respectively. P_v , P_{rho} , P_{pp} , and P_{ADF} denote panel statistics, and G_{rho} , G_{pp} , and G_{ADF} denote group statistics.

The study employs nonlinear panel quantile regression to assess impacts of $EMUX$, EP , $PUSU$, & Y on the carbon emissions (CO_2) of BRICS countries falling between the 10th and 90th quantiles. This analysis is carried out following the establishment of the long-term connection (see Table 3). Table 4 shows panel quantileregression estimates for panel data of BRICS countries from 2010 to 2023.

Table 4: Nonlinear panel quantile regression estimates (Dependent Variable: Carbon emissions)

| Quantiles | $EMIX^+_{it}$ | $EMIX^-_{it}$ | ED^+_{it} | ED^-_{it} | $DIGI^+_{it}$ | $DIGI^-_{it}$ | Y | Constant |
|-----------|---------------|---------------|-------------|-------------|---------------|---------------|---------|----------|
| VL | -1.416* | 1.713* | -0.636* | 0.442* | -0.545** | 0.714** | 0.076* | 6.363* |
| Scale | -0.007 | 0.004 | -0.003 | 0.011 | -0.003 | 0.001 | 0.006 | 0.027 |
| q(10) | -0.202** | 0.335** | -0.453** | 0.185** | -0.481* | 0.098* | 0.054* | 4.805* |
| q(20) | -0.365* | 0.367* | -0.627* | 0.466* | -0.546* | 0.301* | 0.032** | 4.197* |
| q(30) | -0.481* | 1.353** | -0.672* | 0.466* | -0.442** | 0.403* | 0.035** | 5.054* |
| q(40) | -1.102* | 1.362** | -0.538** | 0.242** | -0.825* | 0.695* | 0.037** | 5.125* |
| q(50) | -1.416* | 1.713* | -0.675* | 0.442* | -0.545** | 0.714** | 0.076* | 6.363* |
| q(60) | -1.698* | 1.765* | -0.633 | 0.268* | -0.683** | 0.874** | 0.073* | 8.526* |
| q(70) | -1.631* | 1.945* | -0.433* | 0.121** | -0.596 | 0.905* | 0.086* | 9.678* |
| q(80) | -1.846* | 2.328** | -0.325* | 0.472* | -0.635* | 0.925** | 0.153* | 8.463* |
| q(90) | -2.023* | 2.583*** | -0.706* | 0.915* | -0.656** | 0.965* | 0.186* | 9.156* |

CONCLUSION

This study intends to investigate the relationship b/w carbon emissions & macroeconomic indicators such as energy mix, economic development, digitalization, and national income in the BRICS countries. The study used a nonlinear panel quantileregression model, with panel data spanning 2010 to 2023. The findings show that a higher energy mix ratio leads to fewer carbon emissions. The energy mix ratio calculates the proportion of energy produced by renewable sources vs non-renewable sources. Given the significant energy demands of developing countries to fund their expansion, a fast transition to renewable sources is not viable. The report emphasizes the potential for BRICS countries to implement policies that increase the energy mix ratio, which could dramatically reduce carbon emissions. According to studies, better economic growth might help BRICS nations reduce their carbon emissions by offering more affordable financing options for green energy initiatives. This may help to decrease insufficient resources and energy use by stimulating innovation in home energy-intensive areas. Furthermore, the report contends that digitization of the economy might

contribute to dematerialization, resulting in decreased carbon emissions in BRICS nations. Digitalization may boost the operational effectiveness of trade and commerce platforms by facilitating the flow of information and optimizing manufacturing processes. The study also discovered a strong link between country GDP and carbon emissions. This study adds to the existing research on the link amongst energy mix, growth in the economy, digitalization, and carbon emissions. It gives fresh evidence from the BRICS countries, setting the path for future study on comparable and industrialized countries.

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Diabetic Prediction Using Machine Learning

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ABSTRACT:

This project focuses on predicting diabetes using machine learning techniques to enhance early diagnosis and management. High glucose levels in the body can lead to serious health issues such as kidney problems, heart disease, eye damage, and high blood pressure. Early prediction is crucial for effective management of diabetes, and this research uses machine learning models, including Random Forest Classifier, Support Vector Machine (SVM), XGBoost Classifier, and Decision Tree Algorithm, to achieve this goal. The models are trained and tested on a dataset containing patient-related parameters like age, body mass index, blood pressure, and glucose levels. Results show that combining multiple models through ensemble learning significantly improves prediction accuracy compared to individual models. Additionally, the study identifies the most important features influencing prediction accuracy, providing valuable insights for personalized diabetes management. The developed system has the potential to support healthcare professionals in diagnosing and managing diabetes early, ultimately improving patient outcomes and reducing healthcare costs. The findings highlight the effectiveness of machine learning in predicting diabetes and offering a more accurate and efficient approach to diabetes care.

Keywords: Diabetes, Decision Tree, Support Vector Machine, XGBoost, Machine Learning, Prediction, Dataset, Ensemble Learning, Accuracy.

INTRODUCTION:

This project focuses on using machine learning to predict diabetes, aiming to help healthcare professionals diagnose the disease early. It explores four algorithms: SVM, Decision Tree, Random Forest, and XGBoost, comparing their effectiveness. The study uses the Pima Indian Diabetes Dataset, ensuring data is properly processed for training and testing.

LITERATURE REVIEW:

A literature survey highlights previous research using machine learning for diabetes prediction, emphasizing accuracy improvements. By evaluating different models, the project seeks to identify the best-performing algorithm, contributing to early detection and better disease management, ultimately improving patient outcomes and reducing the risks of complications.

BACKGROUND THEORY:

This project aims to predict diabetes using the Pima Indians Diabetes Database by applying machine learning techniques. The process includes data collection, cleaning, and preparation, ensuring accuracy and handling missing values. The dataset is divided into training and testing sets. Multiple algorithms—SVM, Decision Tree, Random Forest, and XGBoost—are evaluated using metrics like accuracy and F1-score. Hyperparameter tuning optimizes performance, and the best model is saved with the pickle library for future predictions. Python libraries such as Pandas, NumPy, Matplotlib, Scikit-learn, TensorFlow, and Keras support data analysis, visualization, and model development for accurate diabetes outcome predictions.

AIMS & OBJECTIVES:

This research aims to develop a diabetes prediction system using machine learning models and a web application for accessibility.

Objectives:

- Predict diabetes likelihood.
- Identify key risk factors.
- Compare classification models for accuracy.
- Review existing research to identify gaps.

The project involves data collection, analysis, visualization, model development, evaluation, and deployment.

METHODS, EXPERIMENTS & RESULTS:

- The study collected data from the "Pima Indians Diabetes Database Kaggle Series," which includes features like pregnancies, glucose levels, blood pressure, skin thickness, insulin levels, BMI, diabetes pedigree function, and age to predict diabetes (Outcome).
- The dataset contains both numerical features and a label column (Outcome) indicating whether a person has been diagnosed with diabetes (1 for positive, 0 for negative).
- **Installing Libraries**
- Commonly used Python libraries, such as NumPy, Pandas, Matplotlib and Seaborn, were imported to help with data manipulation, analysis, and visualization.
- **Importing Data**
- The dataset, originating from the National Institute of Diabetes, Digestive and Kidney Diseases and found on Kaggle, was imported for developing a machine learning algorithm to predict diabetes.
- The dataset includes attributes like blood pressure, BMI and glucose levels alongside a binary outcome feature indicating diabetes diagnosis.
- **Get familiar with dataset and structure**
- The code prints the column names, shape (rows, columns), a summary of the dataset (including data types and non-null values), and descriptive statistics (count, mean, standard deviation, min, max) for each column.
- This provides an overview of the dataset's structure, features, and data distribution.
- **Missing Value Analysis**
- The code checks for missing values in the dataset using `dataset.isna()` and `.sum()` to count missing values per column.

- Initially, no missing values were found, but zero values in columns like "Glucose," "BloodPressure," "Insulin," and "SkinThickness" were identified as unrealistic, and therefore were marked as missing.
- **Generating descriptive statistics of the dataset**
- The code uses `dataset.describe()` to generate descriptive statistics, and `.T` transposes the output, to provide a summary of each feature, including count, mean, standard deviation, minimum, percentiles, and maximum values .
- This helps to identify unusual data and problems that need to be addressed before training a computer program.
- **Replace all the 0 values as non-available numbers, NaN**
- A copy of the dataset is created, and zero values in columns like 'BMI', 'Insulin', 'SkinThickness', 'BloodPressure', and 'Glucose' are replaced with `np.NaN` to represent missing data .
- After replacing 0 values with NaN, the code prints the count of NaN values in each specified column.
- **Data Visualization**
- The code generates histogram plots for each column in the dataset to visualize the distribution of data before addressing missing values.
- **After eliminating the NaN values, plotting the distributions**
- Histograms are plotted for each column in the dataset after removing NaN values.
- This visualization helps observe the distribution of values in each feature column after handling the missing values.
- **Null Count Analysis Plotting**
- The code uses the `missingno` library to plot a bar graph visualizing the number of missing values in each column of the dataset.
- Interpretation of the graph indicated that the dataset has no missing values.
- **Check how our outcome column is balanced**
- A color dictionary is created to map outcome values to colors for visualization, and a bar chart displays the count of different values in the "Outcome" column to assess its balance.
- The output of the value count of the outcome column is printed.
- **Correlation between all the features before cleaning**
- A heatmap visualization of the correlation between variables is generated using the Seaborn library.
- The heatmap displays correlation coefficients, with colour intensity indicating the strength and direction of the correlation.
- **Scaling the Data**

- The dataset's features are scaled using StandardScaler, transforming them to have a mean of 0 and a standard deviation of 1.
- The scaling process involves dropping the "Outcome" column and applying the StandardScaler to the remaining feature columns.
- **Let's discover the subject matter column**
- The 'Outcome' column from the dataset is assigned to the variable 'y'.
- This column contains the values that the machine learning model will be trained to predict.
- **Model Building**
- The dataset is divided into two parts: one for training the machine learning model and the other for evaluating its efficacy.
- The code assigns the "Outcome" column to a new variable "y" and creates a new dataframe named "X" containing the columns used for the model's training and testing.
- **Random Forest**
- A Random Forest Classifier model is built using the training data, with the number of estimators (n_estimators) set to 200.
- The model is fitted using the fit () method on the training data X_train and y_train.
- **Building model using XGBoost**
- An XGBoost classifier is created, trained on the training set, used to make predictions on the test set, and its performance is evaluated.
- The code prints the confusion matrix, classification report, and accuracy score.
- **Building model using Support Vector Machine (SVM)**
- An SVM model is built using the training data.
- A message is printed to indicate that the SVM model is being created on the training set.
- **Build the Feature Importance for our project**
- The importance of each feature in the RandomForestClassifier model is determined.
- A horizontal bar graph is used to plot the feature importances, showing the relative weight of each feature in descending order.
- **Now we will Save Model**
- The trained Random Forest model is saved using the pickle module.
- The model can be loaded to generate new predictions based on fresh data.
- **Create Accuracy table of all the four algorithms**

- The diabetes dataset is divided into training and testing sets, and four machine learning models are defined.
- Training and testing accuracies of each model are calculated and stored, and the results are displayed in a table using Pandas DataFrame.
- **Compare the four machine learning algorithms' outputs after running ten times**
- The performance of machine learning algorithms is evaluated after running them multiple times to assess their stability and reliability.
- A diabetes dataset is loaded, and the effectiveness of four machine learning algorithms (SVM, Decision Tree, Random Forest, and XGBoost) in forecasting the outcome variable is evaluated.
- **Calculating Average Accuracy for Machine Learning Algorithms**
- The code calculates the average accuracy for XGBoost, Decision Tree Learning, SVM and random forest models.
- The code prints out the combined average accuracy, and best performer for each of the four machine learning methods.
- **Website**
- Flask is used to build a web application that collects data about diabetes from the user.
- A machine learning model is trained and used, with the help of the information that was obtained; to predict in the event a person has diabetes or not.

CONCLUSIONS:

In this project, we followed different steps. We used various machine learning techniques like classification and ensemble methods. We wrote code in Python language. These kinds of methods are often utilized in the area of machine learning in order to yield the most accurate accomplishments from the information being analysed.

And for our Project **Glucose** is a most important feature in our dataset. And second most important is **BMI**.

Detecting diabetes at an early stage is an important medical problem. This study tried we designed a system that can predict diabetes. In this project we looked at four different machine learning algorithms to see which one worked best. In Output we got tested the system on a database of medical records from Pima Indians. The outcomes demonstrated that the method was precise nearly seventy-nine percent of the **time when using a program called Random Forest Algorithm**.

The results of this experiment can help healthcare providers predict and make early decisions about treating diabetes, which can save people's lives.

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Low-Power Optimization of FinFET and Subthreshold Circuits

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Abstract

This study used T-test statistical analysis to find out how well a hybrid model that included the Artificial Bee Colony (ABC) and the Whale Optimization Algorithm (WOA) maximized the power consumption of FinFET circuits. There were three distinct examples that were tested, each having a device diameter of 5, 10, and 15 nm. Each case went through 100 rounds of testing. The results demonstrate significant variation in power optimization across situations, with the hybrid ABC-WOA model consistently achieving better power reduction results than the individual ABC and WOA models. In complicated optimization systems, the findings show that FinFET technology is successful in managing power.

Keywords: FinFET based circuits, Power Optimization, Hybrid ABC-WOA, Power Consumption.

Introduction

Digital integrated circuits have issues due of aggressive technological growth, which increases power consumption. Problems with heat dissipation, battery life, and reliability result from this. Much research has focused on optimising the power consumption of conventional bulk-CMOS circuits [1]. This class of methods includes techniques such as gate scaling as well as multi-V_{dd} and multi-V_{th}. There are some who think the new FinFET quasi-planar double-gate (DG) transistor may eventually replace bulk CMOS operations [2]. If the bulk CMOS method fails, this device may. Independent gate controllers are a defining characteristic of field-effect transistors (FinFETs). Additional circuit design flexibility is provided by the fact that the front gate and back gate of a FinFET device may be controlled by separate voltages. When contrasted with planar bulk CMOS, double-gate (DG) FinFETs have lower subthreshold leakage. This is the result of improved gate control over the channel, as stated in the referenced paper [3]. The fact that FinFETs' power efficiency technology outperforms that of conventional bulk CMOS technologies is shown by Sairam et al. [4]. The study conducted by Ananthan and colleagues [5] investigated the design space, V_{dd}, and FinFET-based SRAM fin height. Another advantage of independent-gate (IG) FinFETs is their power margin and design freedom. Cakici et al. [6] used an IG FinFET in the SRAM cell's pull-down network to maintain a standby power budget of 20 pA/um. According to their publication [7], Datta and colleagues showed how to model and synthesise FinFET-based logic circuits using independent gate control. Displayed in [8] was a 10T subthreshold SRAM that, despite its low power consumption, offers stability on par with competing SRAMs. The proposed design enhances read performance, read reliability, and real-time power consumption for both reads and writes. The effectiveness of sub threshold global interconnects was determined by studying six different designs of DG FinFET driver circuits [9]. The findings for the FinFET SG design demonstrate better energy efficiency and smaller glitch amplitude. We look at the traditional buffer insertion approach as well, with the goal of improving performance. Along with Muttreja and colleagues, Swahn et al. [10] and

others investigated the impact of negative biasing and gate size on the back gate of FinFETs [11], It was noted that these variables considerably diminished power.

This study begins with ultra-low power FinFET circuit design. When comparing CMOS and FinFET circuits in the subthreshold range, we discovered that the former consumed less energy and had a lower functional supply. In the sub-threshold zone, we also investigate the vulnerability to soft errors. Our research shows that compared to CMOS devices, FinFETs offer superior subthreshold soft error immunity.

FinFET architecture

For deep submicron applications, FinFET devices are preferable to bulk CMOS because to their improved suppression of short channel effects, reduced subthreshold swing, and leakage current.

Double gates provide front and rear gates in the FinFET structure, improving channel control. FinFET transistors have two modes.

- When operating in DG mode, the controller signal that goes to the back gate also goes to the front gate.
- In the The front and back gates are controlled independently in independent-gate (IG) mode.

Independent gate control lets you apply different voltages to a FinFET's front and rear gates, making circuit designs more flexible. In the IG mode, The front gate threshold voltage changes in response to biasing the rear gate because of capacitor coupling. A linear relationship between changes in threshold voltage and biasing is achieved in the front-gate channel region using the thin inversion layer approximation, where back-gate biasing is insignificant.

$$\frac{\delta V_{th}}{\delta V_{gb}} = - \frac{C_{oxb} C_{si}}{C_{oxf} (C_{oxb} + C_{si})} \alpha \frac{t_{ox}}{t_{si}} \quad (1)$$

The body, front gate, and rear gate capacitances are C_{si} , C_{oxf} , and C_{oxb} . Body and gate oxide thicknesses are t_{ox} and t_{si} with symmetrical front and rear gate oxides. Increased negative bias δV_{gb} on the back gate (lowering N-type transistor back-gate voltage and increasing P-type transistor back-gate voltage) significantly reduces leakage power (Equation (1)). A disabled IG FinFET gate minimises input capacitance, loading, and driving strength. Declining dynamic power delays gates. Multi-fin double-gate FinFET[12]. Current flows parallel to wafer. Like silicon channels, single fins are T_{si} thick. Device width grows with fin height. We use HSPICE and the Predictive Technologies Model to study 32 nm FinFET and bulk CMOS devices.

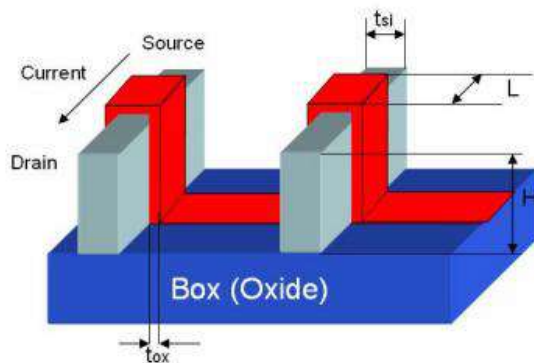


Figure 23: 1. FinFET structure

Sub-threshold Circuit

To avoid damaging transistors, subthreshold or weak inversion circuits operate with a supply voltage lower than their threshold. Subthreshold circuit design sacrifices performance in favour of energy savings, whereas traditional circuit design uses a supply voltage above the threshold. The weak inversion zone was the primary target of digital designers aiming to reduce power consumption in electronic clocks[13]. Devices with very low power consumption or activity factors function best in the subthreshold or near-threshold region, whereas modern electronics meet performance criteria in the superthreshold or highly inverted area. Prior to CMOS, the Watchmaker's Electronic Centre utilised bipolar. Following low-current characterisation of MOS transistors, the gate voltage (V_{gs}) has an exponential effect on drain current.

An active energy dissipation model for a circuit in the subthreshold zone

$$E_{active} = \alpha C V_{dd}^2 \quad (2)$$

The power supply, V_{dd} , provides power, while the activity factor, α , indicates the circuit's switching capacitance. To say that the current is below the threshold is to use this common expression.

$$I = K e^{\frac{V_{gs} - V_{th}}{n V_T}} \left(1 - e^{-\frac{V_{ds}}{V_T}} \right) \quad (3)$$

V_{th} is the threshold voltage, V_T is the temperature-independent thermal voltage, and K is a component that is connected to technology. Dynamic and leaky energy combined is referred to as total energy, or E_{total} .

$$E_{total} = E_{active} + E_{leakage} = \alpha C V_{dd}^2 + V_{dd} I_{leakage} T_{delay} \quad (4)$$

$I_{leakage}$ is the leakage current when T_{delay} is a circuit delay.

In the subthreshold zone, dynamic energy is reduced due to a lower supply voltage. Since the operating current is formed from sub-threshold current as the voltage increases, the delay grows exponentially with voltage.

Because leakage energy is linear with circuit delay, it will increase as supply voltage drops. while leakage energy exceeds dynamic energy, To reach a minimal energy point, the voltage delivered to the region below the threshold is reduced.

Power optimization framework for FinFET-based circuits

We demonstrate our method for optimising power consumption, which simultaneously determines the gate size, multiple voltage assignment, and FinFET-based gate mode in order to explore the design space. Alphabetical criteria are utilised by the framework.

Artificial Bee Colony (ABC) Optimization

Bees that work as observers watch the worker bees forage for food as they twirl about the hive. scout bees who hunt randomly, and resorted bees, who seek out particular food sources, are the three species that make up ABC's mechanical bee hive. Jobless beekeepers is a term used to

describe observers who are unemployed. The scout bees' first order of business is to catalogue every possible food source.

ABC algorithm often works like this [14] :

Initialization phase-

Before beginning to populate the food source vector population ($m=1....SN$, SN :), scout bees define the control parameters. The vector solutions to the optimisation problem that minimises the objective function by optimising n independent variables, each of which represents a nutrition source, are indicated by [15], You may put things up using this definition:

$$y_{mx} = l_x + \text{rand}(0,1) * (u_x - l_x) \quad (5)$$

Employees Bees Phase-

Utilised Near previously visited food sources, bees will discover new ones and recalled having more nectar. They search the region for food and evaluate its potential.

[16] They might use the equation's formula to find nearby food:

$$v_{mx} = y_{mx} + f_{mx} (y_{mx} - y_{kx}) \quad (6)$$

The food source, parameter index, and a random number between -a and an is chosen. Gluttony chooses between fitness and food after that. Minimisation issue fitness values may be calculated using the formula below.

$$\text{fit}_m(\bar{y}_m) = \begin{cases} \frac{1}{1+f_m(\bar{y}_m)} & \text{if } f_m(\bar{y}_m) \geq 0 \\ 1+\text{abs}(f_m(\bar{y}_m)) & \text{if } f_m(\bar{y}_m) < 0 \end{cases} \quad (7)$$

Onlooker Bees phase-

Onlooker and scout bees cannot find job. A bee's likelihood of choosing may be calculated using the equation's term.

$$p_m = \frac{\text{fit}_m(\bar{y}_m)}{\sum_{m=1}^{SN} \text{fit}_m(\bar{y}_m)} \quad (8)$$

The equation is used by an observation bee to find a food source in the area and assess its fitness after picking one at random. This stage employs self-absorbed selection, similar to the one used by the utilising bees.

The WOA Algorithm

Whale Optimisation Analysis (WOA) optimises humpback whale hunting and interaction. The WOA software searches for food underwater like humpback whales. The WOA method displays each solution as inside the search space, a vector of points. The method starts with a random search field answer set. How effectively a solution solves the optimisation problem determines its quality[17]. Using a fitness function. Iterations are how the algorithm operates. Search, surround, and bubble are the three stages that make up every iteration. While we were looking, each possible option is moved closer to the optimal answer[18]. This stage simulates humpback whale food search. They follow the best indicators. The WOA algorithm has

applications in machine learning, data mining, and engineering design solves optimisation issues well. The procedure requires minimal adjustments and is simple. The WOA technique is much like any other optimisation algorithm in that its performance is problem and parameter dependent[19]. The algorithm's parameters must be carefully tuned to acquire the best results for an issue[20].

Algorithm 1 The Standard Whale Optimization Algorithm

Create a whale population at random.

$W^* = \text{Best Search Agent}$

$t = 0$

While (iterations)

Update WOA parameters
and p)

if ($p < 0.5$)

if ($|B| < L$)

$W^{t+1} = W^* - B \cdot Dis$

else if ($|B| \geq L$)

$W^{t+1} = W_{rand} - B \cdot Dis$

end if

else if ($p \geq 0.5$)

$W^{t+1} = Dis' \cdot e^{x \cdot r} \cdot \cos(2\pi r) + W^*$

end if

end for

Evaluate the whale W^{t+1}

Update W^* if W^{t+1} is better

$t = t + 1$

end while

return W^*

Hybrid ABC-WOA Algorithm

Algorithm: Hybrid ABC-WOA Optimization

Initialization: Initialize ABC and WOA populations randomly:

- ABC population: N_{ABC} bees

- WOA population: N_{WOA} whales

Repeat for a maximum of $max_iterations$ or until termination criteria are met:

Foreach ABC bee in ABC population:

Employed bees explore solutions locally:

Modify the position of bee using a local search strategy.

Calculate the fitness of each employed bee.

Onlooker bees select employed bees based on fitness and perform global search:

Select employed bees probabilistically.

Apply global search strategy.

Evaluate fitness of onlooker bee.

When it comes to the whales of the ocean (WOA):

Update whale position using WOA equations:

$$X_WOA_j = A * \sin(B) * |C * X_rand - X_WOA_j| - X_WOA_j$$

Find out how fit the whale is before and after weaning.

Objective Function:

Objective: Minimize overall power usage, which includes both dynamic and leakage power

$$\min P_{total}(V_{dd}, V_{th}, S) = P_{dynamic} + P_{leakage} \quad (9)$$

Where,

$P_{dynamic}$ = dynamic power consumption.

$P_{leakage}$ = leakage power consumption.

Dynamic Power

The dynamic power for N gates is given by the below given formula:

$$P_{dynamic} = \sum_{i=1}^N \alpha_i C_{load,i} V_{dd,i}^2 f_i \quad (10)$$

Here:

α_i = The switching activity factor of gate i.

$C_{load,i}$ = Load capacity for gate i.

$V_{dd,i}$ = Supply voltage for gate i.

f_i = Frequency for gate i.

In order to prevent power values from becoming extremely small or zero, we establish a minimum bound:

$$P_{dynamic} \geq P_{min} \quad (P_{min} = 1 \times 10^{-12}) \quad (11)$$

Leakage Power

The leakage power of N gates is computed by the following formula:

$$P_{leakage} = \sum_{i=1}^N I_{leak,i} V_{dd,i} \quad (12)$$

The $I_{leak,i}$ is given by:

$$I_{leak,i} = I_0 \exp\left(\frac{-V_{th,i}}{nV_T}\right) \quad (13)$$

I_0 = Reference leakage current

$V_{th,i}$ = gate i threshold value.

n = subthreshold slope factor

V_T = Thermal voltage.

Again, we use lower bound to avoid very small or zero power values:

$$P_{leakage} \geq P_{\min} \quad (P_{\min} = 1 \times 10^{-12}) \quad (14)$$

Decision Variables:

$$x = [V_{dd,1}, V_{dd,2}, \dots, V_{dd,5}, V_{th,1}, V_{th,2}, \dots, V_{th,5}, S_1, S_2, \dots, S_5] \quad (15)$$

Where,

$V_{dd,i}$ = Supply Voltage of gate i .

$V_{th,i}$ = Threshold Voltage of gate i .

S_i = Gate size of gate i .

Constraints:

Constraints of Voltage:

$$V_{dd,\min} \leq V_{dd,i} \leq V_{dd,\max}, \quad V_{th,\min} \leq V_{th,i} \leq V_{th,\max} \quad \forall i = 1, 2, \dots, N \quad (16)$$

Where,

$V_{dd,\min}$, $V_{dd,\max}$, and $V_{th,\min}$, $V_{th,\max}$ are the minimum and maximum acceptable supply and threshold voltages.'

Constraints of Gate Size:

$$S_{\min} \leq S_{\sin} \leq S_{\max} \quad \forall i = 1, 2, \dots, N \quad (17)$$

Here,

S_{\min} and S_{\max} are the minimum and maximum Gate sizes.

Power Consumption Bound:

To ensure non- negative total power consumption:

$$P_{total} \geq P_{\min} \quad (P_{\min} = 1 \times 10^{-12}) \quad (18)$$

RESULTS

Matlab 2021a is used to simulate the mathematical model on an 8GB RAM, 500GB ROM machine. Results are summarised below: The proposed technique is investigated in three phases: N=5, N=10, and N=15.

Comparative Results

Case – I: (N=5)

Table 1Case-I (N = 5) Comparative Results

| S.no | Method | Objective Values |
|------|---------|------------------|
| 1 | ABC | 9e-9 |
| 2 | WOA | 6e-9 |
| 3 | ABC-WOA | 1e-9 |

In Case II (N = 15), ABC, West of Avon, and a trifecta ABC-WOA is a are compared according to their "objective values" in Table 1. The ABC's objective worth methodology is 9e-9, whereas the WOA method is 6e-9, indicating greater efficiency. The ABC-WOA approach performs best, with an objective value of 1e-9, indicating more efficacy than the separate methods. Therefore, a hybrid strategy may be better than In this case, ABC and WOA.

Case – II: (N = 10)

Table 2Case – II: (N = 10) Comparative Results

| S.no | Method | Objective Values |
|------|---------|------------------|
| 1 | ABC | 1.6e-8 |
| 2 | WOA | 7.5e-9 |
| 3 | ABC-WOA | 2.7e-9 |

Case II's "objective values" (N = 10) are used to compare ABC, WOA, and the ABC-WOA hybrid in Table 2. The ABC technique has an objective value of 1.6e-8, however, the WOA method has 7.5e-9, which is more efficient. ABC-WOA performs best, with an objective value of 2.7e-9, indicating more efficacy than the individual techniques. Therefore, a hybrid strategy may be better than This situation involves ABC and WOA.

Case - III: (N = 15)

Table 3 Case – II: (N = 15) Comparative Results

| S.no | Method | Objective Values |
|------|---------|------------------|
| 1 | ABC | 1.45e-8 |
| 2 | WOA | 9.3e-9 |
| 3 | ABC-WOA | 3.9e-9 |

Results for Case III (N = 15) are shown in Table 3, which compares the "objective values" of ABC, WOA, and the ABC-WOA hybrid. There is an objective value of 1.45e-8 for ABC. As the target value approaches 9.3e-9, WOA shows some improvement. However, the hybrid ABC-WOA technique yields the optimal objective value of 3.9e-9. This means that the optimal combination would be an ABC-WOA. To improve efficiency, the best features of both systems are combined.

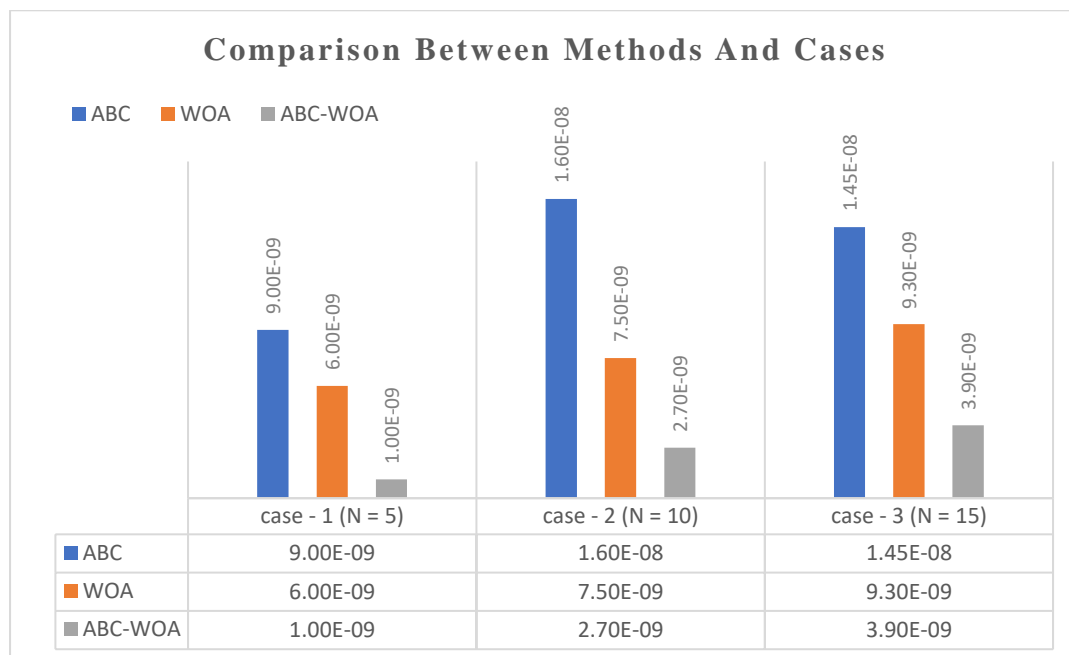


Figure 24 Comparison Between Methods and Cases

On three situations N = 5, 10, and 15, figure 3 compares optimisation algorithms: ABC, WOA, and a mixture of the two. Objective numbers on the y-axis measure algorithm solution quality. ABC-WOA outperformed ABC and WOA in all circumstances, as shown by the plot. At this point, ABC-WOA's difference from other algorithms is obvious and further supports the effectiveness of the combined method.

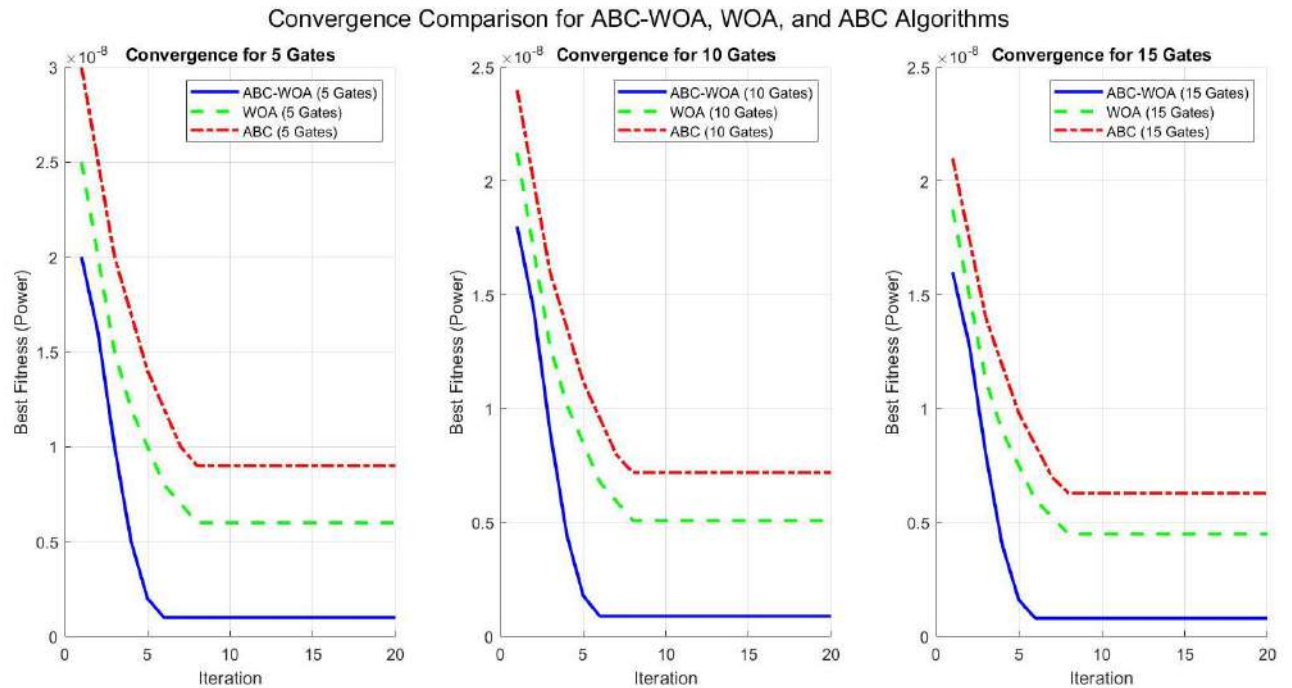


Figure 25 Convergence Comparison for ABC, WOA and ABC-WOA Algorithms

Using gates 5, 10, and 15, you may see three distinct optimisation methods: ABC-WOA, WOA, and ABC. You can see the iterations counted on the x-axis and the fitness value, or power at each iteration, on the y-axis. In terms of convergence time and solution quality, the ABC-WOA algorithm routinely surpasses WOA and ABC, as can be seen in the image above. Using an increasing number of gates, ABC-WOA maintains its dominance over all other algorithms, proving that the hybrid approach is superior.

Statistical Test

Analysed here are the outcomes of an ANOVA test. This work relies on this statistical technique to evaluate FinFET-based circuit power optimisation.

Table 4 ANOVA

| Objectives Values | | | | | |
|-------------------|----------------|----|-------------|--------|------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 74.774 | 2 | 37.387 | 39.137 | .000 |
| Within Groups | 5.732 | 6 | .955 | | |
| Total | 80.506 | 8 | | | |

Find out if the groups differed on objective values by looking at the table that shows the results of an ANOVA. A Mean Square of 37.387 is found in the "Between Groups" column. This proves that there are substantial disparities between the groups. The Mean Square value is .955 in the "Within Groups" field. There is a lot more variation between the averages of the groups than there is within them, as shown by the F ratio of 13.137. There are statistically significant differences between the groups at the 95% level, as shown by the Sig. value of 0.000 for all intervals.

CONCLUSION

Analysing the power optimisation approaches of ABC, WOA, and ABC-WOA reveals that the hybrid technique of ABC-WOA may decrease power consumption for FinFET-based circuits. With $n=5$, $n=10$, and $n=15$, the hybrid method performs admirably while using very little electricity. Hybrid algorithms have the potential to enhance optimisation outcomes, as the conclusion suggests. In order to develop low-power circuits employing hybrid algorithms, this finding is vital.

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AI in Journalism: An Ethical Framework through the Gandhian Approach

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Abstract

Artificial Intelligence (AI) has become an integral component of the contemporary journalism practices, influencing various stages of the news production cycle, from content discovery to dissemination of news articles. While, AI presents significant opportunities for enhancing journalistic efficiency and innovations, it simultaneously introduces complex ethical dilemmas that challenges the foundational principles of the noble profession. This study proposes a human centric conceptual framework that aims at ensuring the ethical deployment of AI in journalism, drawing upon an inversion of Mahatma Gandhi's seven social sins. "Wealth without Work, Pleasure without Conscience, Knowledge without Character, Commerce (Business) Without Morality (Ethics), Science without Humanity, Religion without Sacrifice, Politics without Principle". Despite the viewpoint being articulated in the pre-independence era, the Gandhian principles and philosophies remain profoundly relevant in the contemporary times, offering a critical ethical insight applicable to AI governance in the field of journalism. The framework evolved through a thorough review of the literature that encompasses AI ethics and challenges, journalism ethics, and Gandhian philosophies. By integrating these interdisciplinary perspectives, the study established a framework that is stated here as 'CHARM'. The human centric framework reflects the ethical responsibility of AI use in journalism, ensuring that technology is used with conscience, humanity, accountability, responsibility and morality in an AI-shifting world.

Keywords: Journalism, Artificial Intelligence, Mahatma Gandhi, Media ethics, CHARM framework

1. Introduction

Human-collaborative AI anchor, Sana, who is the first India AI news anchor deployed by India Today Group, won the International News Media Association (INMA)'s 2024 at Global Media Award for 'AI-led newsroom transformation'. The first AI News Anchors: Xinhua from china introduced the world's first AI news anchor in collaboration with Sogou, replicating the human broadcasters to provide 24/7 coverage. Debating at China's World Internet Conference, these AI anchors enhance efficiency but raise ethical concerns regarding authenticity and emotional depth. While technologically impressive, their impact on journalistic integrity and credibility remains debated (Kuo, 2018).

The advent of Artificial Intelligence (AI) has profoundly transformed journalism, reshaping the news production, dissemination, and consumption. AI-powered tools facilitate automated content generation, fact-checking, and personalized news delivery, enhancing efficiency and enabling innovative storytelling. (Verma, 2024; Sonni et al., 2024) However, this evolution in the synthetic cognition also raises ethical concerns that are challenging the core journalistic values. These challenges are especially critical because ignoring them may not only amplifies ethical issues but also threatens the core principles of the noble profession, also weakens its

role in upholding democratic values, and diminishes its contribution to an informed and engaged public discourse (Romeo & Griglié, 2022, p. 256).

As AI becomes deeply embedded in the news production cycle, ethical dilemmas surrounding transparency, bias, and accountability grow increasingly complex. (Porlezza & Ferri, 2022; Porlezza & Amigo, forthcoming) AI-generated content that are ranging from deepfakes to algorithmically written articles blur the line between authentic and artificial, influencing public perceptions and decision-making process.

Moreover, the regulation of AI in journalism has become an urgent global concern. Institutions such as the European Union and the Council of Europe, alongside national governments, are tightening AI governance frameworks. This regulatory shift is reflecting the increasing need for a conscious ethical oversight in AI development and its deployment, ensuring its alignment with fundamental societal values and journalistic integrity (Kleis-Nielsen, 2024).

This paper proposes a conceptual framework inspired from the philosophy of Mahatma Gandhi's on Seven Social Sins that could support to establish a possible ethical foundation for AI in journalism. The Gandhian perspective that is rooted in moral principles and social responsibility, provides critical insights into the ethical challenges of AI integration in a newsroom. The CHARM framework that emphasises on **Conscience, Humanity, Accountability, Responsibility, and Morality**. Aims to align AI applications with journalistic ethics while fostering a human-centred approach to news production.

Through an interdisciplinary review of the literature that is encompassing AI ethics, journalism studies, and Gandhian philosophy, this study examines the responsible integration of AI in journalism. It also highlights the need for robust ethical governance to mitigate risks such as misinformation, editorial bias, and the erosion of journalistic integrity. As AI continues to evolve, maintaining ethical oversight is essential to uphold journalism's foundational principles in the digital era.

2. Literature Review

2.1 Role of AI in Journalism

The integration of Artificial Intelligence (AI) into journalism is transforming the news production and dissemination. AI-driven automation enhances efficiency by handling routine tasks such as data collection, sorting, and content generation, allowing journalists to focus on investigative reporting (Jha, A. & Singh, S. R., 2025; Broussard et al., 2019; Verma, 2024). Reuters's Lynx Insight exemplifies AI's role in data analysis and story discovery. From the literature review The most common Applications of AI that are deployed in Journalism are, **Automated Reporting**: that is AI generating real-time updates, particularly in finance and sports, ensuring timely coverage (Verma, 2024), **Data Analysis**: AI tools that process large datasets, identifies trends that enhance investigative journalism (Sonni et al., 2024), **Content Personalisation**: AI algorithms that are tailored to the user preferences, increasing engagement (Broussard et al., 2019) and **Evolving Roles**: AI fosters hybrid roles, such as "journalist-programmer," demanding technical proficiency alongside journalism expertise (Sonni et al., 2024).

Organizations like the Associated Press use AI for earnings reports, boosting output while enabling journalists to focus on analytical reporting (Verma, 2024). However, AI's limitations, such as misinterpreting cultural nuances, necessitate human oversight.

2.2 Journalism Ethics and the Challenges with AI

Despite AI being efficient in generating digital content, critical concerns still persist regarding its transparency, accountability, responsibility, bias, and diversity. (Porlezza & Schapals, 2024) Previous Studies have highlighted concerns regarding the algorithmic accountability (71%), transparency (82%), and data privacy (76%) (Sonni et al., 2024). Ethical challenges identified through literature reviews: Credibility and Quality The AI-generated news risks compromising in credibility and quality, as automated content often lacks human journalists' critical analysis and contextual understanding (Kulkarni & Satapathy, 2019). Another area of concern is the Legal and Privacy issues that, may infringe on privacy rights, raising so serious legal concerns about accountability and responsible data usage (Kulkarni & Satapathy, 2019), Authorship and Credit related to determining the authorship in AI-generated content is complex it also challenges the traditional journalistic values of individual accountability (Kulkarni & Satapathy, 2019). Job Displacement are a common futuristic human societal concern, Smart Automation threatens employment in journalism, raising ethical concerns about workforce displacement and economic sustainability (Kulkarni & Satapathy, 2019).

Despite these challenges, AI can support journalism through fact-checking and efficiency. To maintain ethical integrity, media organizations must emphasize transparency, accountability, and adherence to professional journalistic standards. Establishing regulatory frameworks will be essential in ensuring responsible AI integration in journalism (Kulkarni & Satapathy, 2019).

2.3 Gandhi's Relationship with Journalism ethics

"Gandhi's principles are not those of a journalist who idealizes practice at a hypothetical level, nor those of a theorist guilty of creating an implausible utopia. Instead, they bear witness to a life spent dealing practically with the ethical problems of journalistic work."

- Dr. Gerret von Nordheim

Mohan Das Karamchand Gandhi asserted that the fundamental purpose of journalism should be service (Gandhi, as cited in Gupta, 2001). He maintained that this principle of service had significant practical implications. It will become evident that all of Gandhi's journalistic principles stem from the standard he set for himself: maximizing the informational and societal value of newspapers for readers while safeguarding editorial integrity from external influences that might compromise these priorities (Gerret von Nordheim, 2019).

Mahatma Gandhi's engagement with journalism was instrumental in his mission for social justice, political change, and ethical communication. Over 45 years, he leveraged journalism as a platform for advocacy, non-violent resistance, and ethical reporting. His role extended beyond that of a writer or editor, he saw the press as a vehicle for national and social awakening. As a publisher and deskman, Gandhi actively engaged in journalism by establishing and managing several newspapers. He founded *Indian Opinion* to advocate for social and political issues. Later, he took over the English-language weekly *Young India* and the Gujarati-language publication *Navajivan*. (Driessen, 2002) In 1933, he launched *Harijan*, a weekly newspaper dedicated to improving the lives of marginalized communities, particularly the "untouchables." Galtung (1987) draws a parallel between Gandhi and the Chinese revolutionary Mao Zedong. Gandhi's journalistic is based on principles, accuracy, accountability, and ethical reporting, continue to influence modern media ethics (Ghosh, 2018). His unique and ground rooted approach set a precedent for responsible journalism, emphasizing the press as a force for truth and societal progress.

His vision continues to inspire contemporary discussions on media ethics and the role of journalism in fostering informed and engaged communities (Bartolf, 1992).

2.4 The Seven Social Sins by Gandhi

Mahatma Gandhi's concept of the Seven Social Sins—articulated as moral and ethical pitfalls of society—remains highly relevant in contemporary discourse, particularly within journalism and media ethics. Stephen R. Covey (1990) expands on these principles, emphasizing the necessity of natural laws and ethical integrity in all social and professional spheres. Among these, several directly relate to the ethical responsibilities of journalists.

Wealth without Work warns against profiting without genuine contribution, paralleling issues of media sensationalism, where profit-driven narratives overshadow journalistic integrity. Sensationalized news, clickbait headlines, and misinformation campaigns often prioritize financial gain over truth (Covey, 1990). Ethical journalism demands rigorous research and responsible reporting to ensure public trust.

Pleasure without Conscience is evident in media that prioritize entertainment over factual reporting. In an era of infotainment, ethical dilemmas arise when news organizations prioritize ratings over responsible reporting, sometimes distorting facts for public appeal (Gandhi, as cited in Covey, 1990). Journalists must balance audience engagement with conscientious storytelling.

Knowledge without Character critiques the dissemination of information without ethical responsibility. In journalism, this manifests when reporters fail to verify sources, leading to misinformation. Ethical journalism requires not only knowledge but also integrity in reporting (Covey, 1990).

Commerce without Morality directly aligns with concerns about corporate influence on journalism. When media conglomerates prioritize advertising revenue over objective reporting, journalistic independence is compromised. Ethical journalism should resist undue influence and uphold truth (Smith, 1759).

Politics without Principle is a critical concern in political journalism, where biased reporting can mislead the public. Ethical journalists must adhere to principles of fairness and impartiality, ensuring accurate representation of political realities (Gandhi, as cited in Covey, 1990).

3. The CHARM Framework: Ethical AI in Journalism

The CHARM Framework:



The CHARM Framework: Ethical AI Governance in Journalism

By Shailendra. S. Rathore and Sakshi Pundir

Building upon Gandhian ethical principles, this study introduces the **CHARM framework**, an approach to ensuring the responsible and ethical integration of Artificial Intelligence (AI) in journalism. The framework emphasizes key ethical dimensions necessary for maintaining journalistic integrity, human-centric AI development, and accountability in AI-driven news production.

- **C – Conscience:** Upholding ethical integrity in AI-generated journalism. AI-driven news production must adhere to established journalistic ethical standards to prevent misinformation, bias, or manipulation. Given that AI systems inherently reflect the values of their developers, it is crucial to embed ethical awareness and moral responsibility into AI design. Ensuring that AI models operate within a framework of journalistic integrity mitigates risks associated with misinformation, discrimination, and unethical content generation.

Ethically Aligned Implementation: Ensure that the use of AI aligns with the goals and values of the news organization, including its business model, democratic role, promotion of human rights, and professional ethics. AI systems should undergo periodic ethical audits to assess their impact on journalistic integrity (Kalfeli & Angeli, 2025).

- **H – Humanity:** The responsible use of AI in journalism must uphold human dignity, labour rights, and fundamental freedoms, ensuring that media practices remain ethical and inclusive. AI should assist journalists rather than replace them, ensuring a balance between automation and human ethical judgment (Jha, A. & Singh, S. R., 2025).

Safeguarding Human Rights: AI-driven journalism must prioritise human dignity, rights, and freedoms of expression. AI deployed journalism must uphold internationally recognized human rights standards, safeguarding both users and third parties impacted by AI-driven media activities.

- **A – Accountability:** Establishing transparent mechanisms for AI-generated journalism. The deployment of AI in newsrooms necessitates well-defined accountability structures to address ethical dilemmas such as algorithmic bias, content credibility, and editorial responsibility. News organizations utilizing AI must implement robust audit systems and ethical oversight protocols to track AI-generated content, ensuring that misinformation or unethical reporting can be identified and corrected.

Editorial Gatekeeping: The integration of AI in journalism should be treated as a critical editorial decision, with clear accountability assigned to the editorial board. Just as editors oversee traditional reporting standards, they must also evaluate and govern AI-driven content to ensure accuracy, fairness, and ethical compliance

- **R – Responsibility:** The responsible use of AI in journalism hinges on the fairness and diversity of datasets used to train AI models. Since AI systems rely on data-driven learning, any biases present in data collection and curation can lead to misinformation, skewed narratives, and the underrepresentation of marginalized voices.

Responsible Feeding: To mitigate these risks, news organizations and AI developers must prioritize diverse and inclusive data sourcing, ensuring that datasets represent a broad range of demographics, perspectives, and cultures. This approach prevents AI-generated content from reinforcing systemic biases and promotes balanced reporting.

- **M – Morality:** Embedding ethical considerations in AI-driven journalism to uphold public trust. AI applications in journalism must align with established ethical codes of conduct, emphasising truthfulness, fairness, and public interest. As AI capabilities evolve, developers and media professionals must remain vigilant about unintended consequences, ensuring that AI-enhanced journalism continues to uphold democratic values and journalistic integrity.

Standardized labelling: News organisations should disclose when and how they use AI systems to both subjects and the audience. Disclosure should be applied in situations where the use of AI systems might meaningfully affect the subject or audience's rights or interpretation of the outputs. Information should also be made available within the news organisation about what systems have been implemented, what they are designed for, what values they reflect, and what is being done to train staff and ensure adequate oversight. Standardised forms of labelling that AI systems were used in the workflow (in natural language and machine-readable code) will enhance the utility of labelling to subjects and the audience.

The **CHARM framework** aims to provide a structured ethical foundation for AI governance in journalism and news organisations, ensuring that AI technologies are implemented in a manner that supports rather than undermines journalistic credibility. By integrating conscience, humanity, accountability, responsibility, and morality, this framework addresses the ethical challenges posed by AI in news production, fostering transparency, reliability, and public trust in AI-generated journalism.

4. Conclusion

Ethical mindfulness in deploying Artificial Intelligence in journalism requires continuous evaluation and refinement of the Neural Architectures models to prevent ethical lapses or biases that could distort public discourse and human rights.

The CHARM framework is a human-centric approach that guides the professional in organisations to upholding ethical integrity, aligning Computational Cognition transformations aligned with Gandhian journalistic ethics.

Change is an integral part of life, and technological advancements are unescapable. Society and its stakeholders must first understand these developments before embracing them. Technology itself is merely a tool; its true impact depends on how it is used. While regulating such technological advancements plays a crucial role but responsible usage is what truly ensures constructive outcomes. Gandhian philosophy emphasises self-regulation, recognising that ethics and principles are ultimately shaped by human intent and actions.

Today, the focus of news organizations should be on ensuring the responsible adoption of such technologies. A notable example is The Washington Post's 'ModBot', which demonstrates proactive AI integration to support ethical journalism. ModBot enhances content moderation and ensures quality control. Fostering a hybrid workflow that improve productivity without replacing human journalists.

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Post-Pandemic Growth Trajectories of E-Commerce: Evidence from India

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Abstract

The COVID-19 crisis served as an accelerator for greater public-private cooperation. However, access to financing for e-commerce businesses remains a paramount obstacle for economic recovery and growth. Moreover, the COVID-19 crisis has spurred action in the e-commerce sector. As much as 40 per cent and more businesses have been or are involved in either public-private sector collaboration initiatives or pure private sector ones. For those not involved, lack of awareness of the initiatives and limited professional networks were the main reasons. Some businesses managed to obtain more funding. (UN, 2020). This study examines the growth of e-commerce due to covid-19 pandemic and also find that e-commerce became substitute source of traditional marketing or not with the help of secondary data taken from authorized websites. The popularity of e-commerce increase after the advent of covid-19 pandemic. (Komal, 2020)

Keywords: COVID-19, E-Commerce, growth and digital.

INTRODUCTION

Electronic commerce includes the buying and selling of goods, products, services, or any kind of goods or services by consumers, retailers, or businesses through electronic media (the Internet). E-commerce retail, on the other hand, is the exchange of goods and services between an online retail business and a consumer (usually the end consumer). There are different types of e-commerce transactions, such as business-to-business or B2B (Cisco, Alibaba), business-to-consumer or B2C (Amazon, Walmart), and consumer-to-consumer or C2C (eBay). Factors that drove the growth of the e-commerce market prior to the COVID-19 pandemic included strong and steady growth of internet users and increasing awareness of online shopping, increasing product launches online and lower prices due to bulk purchases. It is included. In addition, increasing exclusive products in the market and lower commodity prices due to direct sales channels and economies of scale further contribute to the growth of the global e-commerce market.

The Global E-commerce Industry report contains segmented products including Electronics, Beauty & Personal Care, Health Care, and Others. The COVID-19 outbreak impacted these segments due to supply chain uncertainty and consumer demand around the world. The e-commerce supply chain has been largely affected by his COVID-19 and factory closures in China, the US and other countries. The industry segment most affected by the COVID-19 outbreak is electronic products. This is because China is responsible for most of his COVID-19 cases and, according to the International Trade Union Federation (ITUF), China is the world's largest producer of electronics and their components. The majority of China's imports consist of electronic components that are assembled into final products such as home appliances and computers and then exported. However, factory closures have shut down the electronics product supply chain, further impacting the electronics e-commerce industry. (Impact of COVID 19 on the E-commerce Market, 2020) The accelerated shift to digital platforms in response to the pandemic led to an increase in online retail trade, but it also

unmasked challenges to harnessing the benefits of e-commerce. Many of these existed before the pandemic, including the moderate though evolving degree of internet connectivity and the considerable digital divide between countries in the region, coupled with the modest degree of financial inclusion on the one hand and weak digital financial services on the other hand.

OBJECTIVE OF THE STUDY

- To examine the growth of E- COMMERCE after COVID-19.
- To know E-commerce is become a substitute source and considered top in this condition or not.

REVIEW OF LITERATURE

M. A. Salem and K. Md Nor, This study empirically evaluated the factors that influence consumers' willingness to adopt e-commerce during the 2019 coronavirus disease (COVID-19) outbreak in Saudi Arabia. The 10 factors investigated in this study were Perceived Utility (PU), Perceived Ease of Use (PEOU), Subjective Norms (SN), Perceived Behavioral Control (PBC), Perceived Lack of Alternatives , perceived risk, perceived negligence, risk-taking, perceived external pressure, and government support. Data were collected online from social media users using a snowball sampling technique. A total of 190 valid responses were received. Data analysis shows PU, risk-taking, PBC, perception of lack of alternatives and government support have had a major impact on consumer intentions to adopt e-commerce during his COVID-19 outbreak in Saudi Arabia was given. PEOU and SN, on the other hand, found that external pressures, risks, and perceptions of criminal activity had a modest impact on consumers' intentions to adopt e-commerce. (Salem, 2020)

Hasanat et al. (2020) this study is to determine the impact of coronavirus on online businesses in Malaysia. The results showed that the largest products are from China and the largest industries are locked. This means that there is no import or export of products. Therefore, this deadly virus is expected to severely affect Malaysian online businesses, especially Chinese products. (Hasanat, 2020)

Tran and L.L.T. (2020) This study employed use and granification theory to support the conceptual model while adding the pandemic fear constraint. The primary research method of this study is quantitative research and analysis. Using a sample size of 617 online consumers using the PLS analysis technique. This study found that pandemic fear has a positive mitigating effect on the relationship between PEEP, economic gains, and sustainable consumption. (Tran, 2020)

Over the past several years, e-commerce has expanded quickly, but in order to stay ahead of the competition, it is critical to develop strategies that take into account the numerous online customer types and the various elements that affect consumers' online buying behaviour. Online gaming falls into two major categories. There are two types of shoppers: "the problem solver," or those looking to purchase a specific item, and those looking for "fun, fantasy, arousal, sensory stimulation, and enjoyment." " (Hirschman et al,1982, Babin et al, 1994)

RESEARCH METHODOLOGY

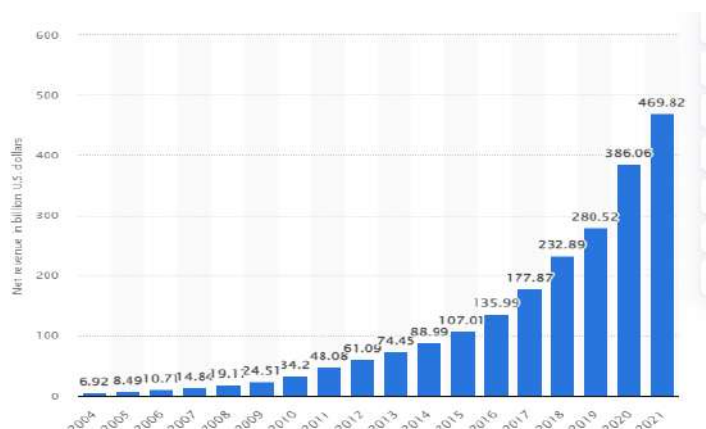
The research methodology of the present study which Include Sample design, sources of data collection that had been adopted.

Sources of Data

- ❖ **Primary data:** The data was collected directly from the Respondents with the help of structured questionnaire for the first time and which are original in nature.
- ❖ **Secondary data:** These are those data which are obtained in directly from sources such as books, journals, articles, newspapers and websites of online service etc.
- ❖ **Sampling size**

The sample size for this study will be limited to 100.

ANALYSIS AND FINDINGS



Source: Published by Statista Research Department, Jul 27, 2022

The net revenue from sales of products and services on Amazon.com climbed significantly between 2004 and 2021. The worldwide e-commerce company's net sales in the most recent reported year increased from 386 billion US dollars in 2020 to over 470 billion US dollars.

On the strength of Covid-19-related drive, Flipkart Internet, the marketplace division of the Walmart-backed e-commerce company, reported a 32% increase in revenues for the fiscal year 2020–21.

During that time, Flipkart Internet generated operational revenues of Rs 7,840 crore, while Flipkart India, the company's wholesale division, recorded a 25% increase in revenues to Rs 42,941 crore.

In the same fiscal year, Flipkart India, which in 2020 acquired a 100% stake in the cash & carry businesses owned by its parent company Walmart, reported a net loss of Rs 2,445 crore. From the previous fiscal year, this represents a 22% decrease. The total expenditures for the company's fiscal were estimated at Rs 45,801 crore. Flipkart, which competes with American rival Amazon and Indian rival Reliance Retail, is currently focusing more on its grocery business and more recent endeavours, like its hyperlocal arm Shopsy.

Primary Survey

| GENDER | NO. OF RESPONDENTS | PERCENTAGE |
|--------|--------------------|------------|
| MALE | 38 | 38 |
| FEMALE | 62 | 62 |

(Source: Primary Data)

| OCCUPATION | NO. OF RESPONDENTS | PERCENTAGE |
|---------------|--------------------|------------|
| STUDENTS | 60 | 60 |
| PROFESSIONAL | 4 | 4 |
| SELF EMPLOYED | 10 | 10 |
| SALARIED | 20 | 20 |
| OTHERS | 6 | 6 |

(Source: Primary Data)

| MARITAL STATUS | NO. OF RESPONDENTS | PERCENTAGE |
|----------------|--------------------|------------|
| MARRIED | 35 | 35 |
| UNMARRIED | 65 | 65 |

(Source: Primary Data)

| AGE GROUP | NO. OF RESPONDENTS | PERCENTAGE |
|-----------|--------------------|------------|
| 15-20 | 2 | 2 |
| 21-30 | 82 | 82 |
| 31-40 | 9 | 9 |
| 41-50 | 4 | 4 |
| ABOVE 50 | 3 | 3 |

(Source: Primary Data)

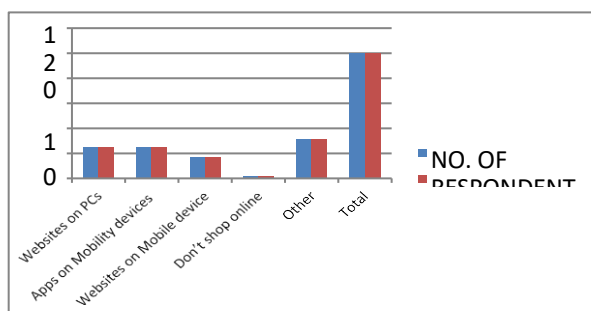
The demographic factors of respondents' of online shopping 62% of females, the age of 21 to 30 respondents as occupied 82%, there are 65% unmarried respondents, 60% of the respondents are based on post -graduate, 64% of the respondents are students.

2) would you purchase products and services online?

| PARTICULARS | NO. OF RESPONDENTS | PERCENTAGE |
|-------------|--------------------|------------|
| YES | 83 | 83 |
| NO | 17 | 17 |
| TOTAL | 100 | 100 |

(Source: Primary Data)

From above table, the more 83% of the respondents are purchase products and services online, 17% of the respondents are not buying products and services through online.



(Source: Primary Data)

The more 37% of the respondents are preferred for more options, 08% of the respondents are preferred for standard, 13% of the respondents are preferred good quality, 20% of the respondents are preferred for fewer prices, 10% of the respondents are preferred for fast delivery and 12% of the respondents are preferred for design for the online shopping.

3) online shopping is comfortable comparing to physical shopping after COVID-19.

| PARTICULARS | NO. OF RESPONDENTS | PERCENTAGE |
|-------------|--------------------|------------|
| YES | 65 | 65 |
| NO | 14 | 14 |
| MAY BE | 21 | 21 |
| TOTAL | 100 | 100 |

(Source: Primary Data)

The more 65% of the respondents are comfortable comparing to physical shopping after COVID-19, 21% of the respondents are maybe comfortable and 14% of the respondents are not comfortable comparing to physical shopping after COVID19.

4) After Covid -19 , how do respondents most often shop online?

| PARTICULARS | NO. OF RESPONDENTS | PERCENTAGE |
|---------------------------|--------------------|------------|
| Websites on PCs | 25 | 25 |
| Apps on Mobility devices | 25 | 25 |
| Websites on Mobile device | 17 | 17 |
| Don't shop online | 2 | 2 |
| Other | 31 | 31 |
| Total | 100 | 100 |

(Source: Primary Data)

The more 31% of the respondents are most often shop online other websites, 25% of the respondents are shop websites on PCs and apps on mobility devices and another one respondent are don't shop online.

FINDINGS

- The majority of the respondents are purchase products and services through online.
- The majority of the respondents are preferred for more options.
- More number of respondents is one time shop in a month.
- The number respondents are most preferred for cash on delivery of the payment system.
- The more number of respondents are safe and secure while online shopping.
- The highest of the respondents are buying more products online than physically after Corona virus.
- The majority of the respondents are purchase other products after the COVID-19time.

CONCLUSION

Online shopping is a one of the great aspects of the internet today. By choosing to shop online consumers able to enjoy many benefits, some of which are self-explanatory, others that are not so apparent. Online shopping is a multi-billion business and is constantly growing. Many Indian favor this kind of shopping because of ease. For shoppers who work for lengthy hours, it would be hard to visit a store during the standards trade hours. Online retails allow orders. The conclusion for this survey has been made that people are doing more online shopping during corona virus as 54% peoples responded that they are buying more products online during Corona virus and 24% of the respondents that they are not buying products online during Corona virus.

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Corporate Sustainability and Profitability: A Strategic Roadmap for Multinational Corporations

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Abstract

This study investigates the relationship between sustainability practices and profitability in multinational corporations (MNCs). It explores how MNCs integrate sustainability into their core operations and assesses the financial outcomes of such initiatives through a combination of literature review and empirical analysis. The research examines key sustainability dimensions, including corporate social responsibility, environmental stewardship, and economic viability, to understand their influence on long-term financial performance. Additionally, the study proposes primary data collection methodologies to evaluate the sustainability strategies adopted by MNCs and their corresponding financial impact. The findings aim to provide data-driven insights for stakeholders, highlighting the strategic importance of sustainability in enhancing profitability and competitive advantage in the global business environment.

1. Objectives Of Study

To explore the sustainability practices adopted by multinational corporations (MNCs).

To evaluate the financial performance of MNCs in relation to their sustainability initiatives.

To identify key factors influencing the adoption of sustainable practices in MNCs.

To analyze the impact of sustainability practices on the long-term profitability of MNCs, with consideration of stakeholder engagement and regulatory frameworks.

Keywords :- Sustainability Practices ,Multinational Corporations (MNCs) ,Profitability, Corporate Social Responsibility (CSR) ,Environmental Stewardship, Resource Efficiency, Cost Savings, Brand Reputation

2.Purpose and Range of the Research

Sustainability practices are increasingly being recognized as important components of corporate strategy, especially in the context of multinational corporations (MNCs). The convergence of economic, social and environmental imperatives underlines the imperative for multinational companies to adopt sustainable practices not only as ethical imperatives but also as strategic business imperatives. Research indicates a clear positive relationship between corporate sustainability and financial performance. However, the nuances of this relationship require further exploration, considering factors such as industry context, regulatory environment, and strategic orientation. While sustainability practices may involve upfront investment, evidence suggests they can yield long-term financial benefits, including cost savings, enhanced brand reputation, and access to new markets.

3.Introduction

Multinational corporations (MNCs) possess an increasing challenge in the constantly evolving global market: striking an equilibrium between economic expansion and social and environmental responsibilities. The notion of sustainability has emerged as a crucial component of corporate strategies, propelled by a confluence of market forces, legal constraints, and

customer expectations for ethical business conduct. The effect that sustainable policies have on profitability emerges obvious as companies maneuver such complicated environment.

Beyond simply sticking to environmental norms, sustainability holds significance for business. It reflects an extensive approach that incorporates into consideration social, environmental, and financial variables. Implementing sustainable practices for multinational corporations (MNCs) may encompass a range of operations, such as that guarantees fair labor practices, participating in community development, and minimizing carbon footprints and conserving natural resources. These initiatives aim to promote long-term financial resilience and health in while also reducing detrimental effects on the environment and society.

Adoption of sustainability programs, however, is often viewed through a cost-implications lens, with concerns over any potential financial advantages these practices might bring. By researching whether and how sustainability policies affect the profitability of multinational corporations, this research paper attempts to explore this assertion.

Sustainability was considered an afterthought in today's business climate, but today it is an essential approach for top international organizations. Using a mixed-methods approach which combines both qualitative case studies and quantitative data analysis, this study will add to the present discussion on the business case for sustainability in the global setting.

The purpose of this research is to investigate experimentally if these business's increased profitability is an outcome of the implementation of sustainable strategies. Giving stakeholders data-driven insights on the worth of efforts to promote sustainability is the motivation behind our research.

4.LITERATURE REVIEW

Sustainability practices have garnered substantial attention in recent years as corporations increasingly recognize the need to balance economic growth with environmental and social responsibility. Within the realm of multinational corporations (MNCs), the adoption of sustainability practices has emerged as a critical strategic imperative. This literature review synthesizes existing research to provide insights into the relationship between sustainability practices and profitability in the context of MNCs.

3.1 Defining sustainability and sustainable development

Currently, the concepts “sustainability” and “sustainable development” have become buzzwords. However, it is a challenge to universally define sustainability, sustainable development and other related terms. This section discusses the definition of these phrases from previously published literature, gives a summary of some components of the definition, and explains the meaning of the terms in this research.

From 1970s to the 1990s, sustainability was primarily linked to environmental concerns. Remarkably, a global action programme for sustainable development was established at 1992 UN Conference on Environment and Development (UNCED). One of the vital outputs was Agenda 21 which offered guidance and practices on sustainability with the focus on environmental aspects (Drexhage & Murphy, Citation2010).

The origin of the “sustainable development” concept dates to more than 50 years ago. For the first time in 1969, the term appeared in an official document which was signed by 33 African countries, under the auspices of the International Union for Conservation of Nature (IUCN) (Uribe et al., Citation2018). Sustainable development was described as the “economic development that may have benefits for current and future generations without harming the

planet's resources or biological organisms" in the law that made up the National Environmental Policy Act (NEPA) (Green, Citation2017).

3.2 The relationship between sustainability and financial performance

Though definitions are a good tool to understand the notions, several attempts have been made to go beyond such simple definitions and determine a series of principles or interconnections.

On the negative impact between sustainability and financial performance, as argued by Friedman (Citation1970), there exists exactly one social responsibility of business: to manage its resources and involve in activities aimed at enhancing profits. Companies participating in sustainability practices are incurring more expenses, thus aggravating these firms' ability to demonstrate positive financial results. On that account, it is supposed that if leaders make any investment which is not advantageous to staff, shareholders or clients, they are abusing the company's resources. Preston and O'Bannon's (Preston & O'Bannon, Citation1997) managerial opportunism hypothesis suggest social responsibility in companies has an adverse effect on financial performance. To specify, if financial results show positive trends, managers reduce social expenditure to enrich their personal gains. In contrast, they may seek to compensate for dissatisfactory financial results by taking part in ostentatious social programs.

On the positive impact between sustainability and financial performance, Montabon et al. (Citation2007) analyzed the relationship between sustainability management practices and such business financial measures as return on investment (ROI) and sales growth. The study demonstrates that a wide range of environmental management practices (EMPs) is positively associated with multiple firm performance measures. The finding is supported by the slack resource theory and good management theory (Waddock & Graves, Citation1997). Applying questionnaire-based survey research, Fauzi and Idris (Citation2009) studied items representing variables like corporate financial performance, business strategy, organizational structure, control system, etc., thereby affirming a positive relationship between corporate financial performance and corporate social performance. In their analysis, López et al. (Citation2007) showed a connection between Dow Jones Sustainability Index (DJSI) and corporate social responsibility policies.

In 2010, Kapoor and Sandhu took Indian companies for their research and confirmed a positive impact of sustainability performance and return on sales (ROS), return on asset (ROA), and return on equity (ROE), but insignificant impact on growth.

Conducting on a global scale, research by Ameer and Othman (Citation2012) examined 100 sustainable global companies in 2008. It found that companies which put more emphasis on sustainable practices achieve higher financial performance represented by ROA, profit before tax (PBT), and cash flow from operating activities than those without such commitments.

One year later, Strand (Citation2013) demonstrated that a corporation with a management team putting more emphasis on corporate social responsibility is three times more likely to be engaged in Dow Jones Sustainability Index (DJSI). Pan et al. (Citation2014) analyzed 228 mineral firms in China and concluded that sustainability had a positive impact on firm's profits, measured by ROA, ROE and Earnings per share (EPS).

In summary, the literature on sustainability practices in MNCs underscores the multifaceted nature of their impact on profitability. While evidence suggests potential synergies between sustainability and financial performance, the relationship is contingent upon various factors, including industry dynamics, geographical context, and institutional frameworks. Moving forward, longitudinal studies and comprehensive frameworks for assessing sustainability

outcomes are needed to advance our understanding of this complex relationship and inform strategic decision-making in a rapidly evolving global landscape.

5. Research Methodology

Research methodology is a way to systematically solve the research problems. It may be understood as a science of studying how research is done scientifically. Researchers need to know, which of the methods or techniques, are relevant and which are not, and what would they mean and indicate and why. Researcher also need to understand the assumptions underlying various technique and they need to know the criteria by which they can decide that certain techniques and procedures will be applicable to certain problems and others will not.

5.1 DEFINITION OF RESEARCH

Research in common parlance refers to the search for knowledge. It is a scientific and systematic search for pertinent information on a specific topic.

"Research may be defined as a systematized effort to gain new knowledge." -Redman and Moray

5.2 PROCESS OF RESEARCH

Problem Identification and Definition

Research Design

(a) Type of Research

(b) Unit Identification

(c) Sampling



Data Collection



Data Analysis and Representation



Interpretation of the Result



Suggestions

4.2.1 Research Design

A research design is simply the framework or plan for a study that is used as guide in collecting and analyzing the data. It is the blueprint that is followed in completing a study.

4.2.2 Scope Of The Study

The objective of this study is to explain the connection between multinational corporations' (MNCs) profitability and sustainable practices. The objective of the research is to ascertain how corporate governance, social responsibility, and environmental stewardship affect the financial results of multinational corporations (MNCs) that operate in various geographic locations.

4.2.4 Limitations Of The Study

In attempt to make this project authentic and reliable, every possible aspect of the topic was kept

in mind. Nevertheless, despite of fact, constraints were at play during the formulation of this project. The main limitations are as follows:

Due to limitation of time, only few respondents were selected for the study. So, the sample of consumers was not enough to generalize the findings of the study.

Some of the respondents were not responsive enough.

Possibility of error in data collection can be there because many of the respondents may have not given actual answers to the questionnaire.

Some respondents were reluctant to divulge personal information which can affect the validity of all responses. This may have affected the quality of answers.

People were hesitant to disclose the true facts.

4.3.1 SAMPLE DESIGN

The process of drawing a sample from a large population is called sampling. Population refers to the total of items about which information is defined. Well-selected samples may reflect fairly and accurately the characteristics of the population.

4.3.2 SAMPLING UNIT

The sample unit of this survey was Delhi.

4.3.3 SAMPLE SIZE

The sample size was 100 respondents from different age groups.

4.3.4 SAMPLING TECHNIQUE ADOPTED

Convenient sampling

4.4.1 SOURCES OF DATA

After identifying and defining the research problem and determining specific information required to solve the problem, a researcher looks for the type and sources of data that may yield the desired results while deciding about the method of data collection to be used for the study.

4.4.2 PRIMARY DATA USED

Primary data are those, which are collected for the first time. I collected Primary data by framing questionnaires. The questionnaire contained questions, which are both open-ended and closed-ended. Open-ended questions are questions requiring answers in the responder's own words. Close-ended questions are those wherein the respondent has to merely check the appropriate answer from a list of options available. Any doubts raised by the respondent are clarified to get the perfect answers from the distributors. Open-ended questions yielded more insightful information, whereas close-ended questions are relatively simple to tabulate and analysis.

4.4.3 STATISTICAL TOOL

The tool used for obtaining the relevant information was a questionnaire. A well-structured questionnaire was administered in the sample of the study. The questionnaire was designed keeping in view both the minor and major objectives of the study.

4.5.1 Data Analysis And Interpretation

4.5.2 Secondary Data Sources

To complement the literature review and strengthen the empirical foundation of this study, a variety of secondary data sources were utilized. These data sources provide valuable insights into the sustainability practices and financial performance of multinational corporations (MNCs) across different industries and geographic regions.

Corporate Sustainability Reports

The research team examined the sustainability reports published by leading multinational corporations. These reports often provide detailed information on the companies' sustainability initiatives, goals, and financial performance. Examples of MNCs whose sustainability reports were analyzed include Unilever, Walmart, Microsoft, Nestlé, and Siemens. These reports offered quantitative data and qualitative insights into the integration of sustainability practices and their impact on the companies' profitability.

Financial Reports

In addition to the sustainability reports, the study also leveraged the financial reports and filings of the sampled multinational corporations. These sources, which include annual reports, 10-K filings, and earnings statements, provided robust financial data on key performance indicators, such as revenue, net income, return on assets, and return on investment. The financial data was then analyzed in conjunction with the information on sustainability practices to examine the relationship between the two.

Sustainability Indices and Rankings

The study also leveraged data from reputable sustainability indices and rankings, such as the Dow Jones Sustainability Index, FTSE4Good Index, and the Corporate Knights Global 100

Most Sustainable Corporations in the World. These indices provide comprehensive assessments of the sustainability performance of large multinational corporations, which were then correlated with the companies' financial data to examine the relationship between sustainability and profitability.

Industry-Specific Sustainability Benchmarks

To gain a deeper understanding of industry-specific dynamics, the research team collected data from sustainability benchmarks and standards, such as the CDP (formerly the Carbon Disclosure Project) for environmental performance, and the Social Responsibility Index for social responsibility practices. These industry-level insights helped capture the nuances in the sustainability-profitability relationship across different sectors.

Academic Databases and Journal Articles

The study also leveraged academic databases like Scopus, Web of Science, and JSTOR to access peer-reviewed journal articles that have empirically examined the sustainability-profitability link in multinational corporations. These scholarly sources provided robust quantitative data and rigorous analysis to complement the literature review.

Government and Intergovernmental Reports

The research team referred to reports and data from government agencies and intergovernmental organizations, such as the United Nations Environment Programme (UNEP) and the Organisation for Economic Co-operation and Development (OECD). These sources offered macroeconomic and policy-level perspectives on the sustainability practices and impacts of multinational corporations.

Sustainability-Focused Consulting and Research Firms

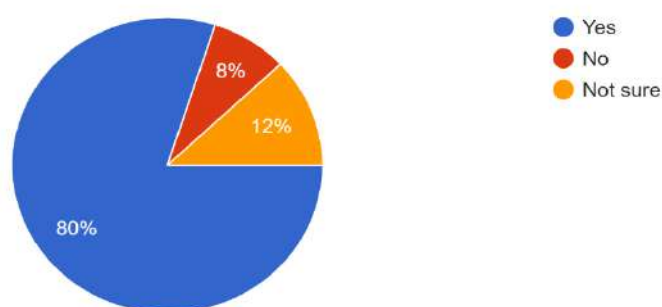
Data and insights from reputable sustainability-focused consulting firms, including McKinsey & Company, Deloitte, and KPMG, were also incorporated into the study. These sources provided industry-specific benchmarks, case studies, and best practices related to sustainability and financial performance.

4.5.3 Primary Data

1). Do you think sustainability practices are important for multinational corporations?

1). Do you think sustainability practices are important for multinational corporations?

100 responses

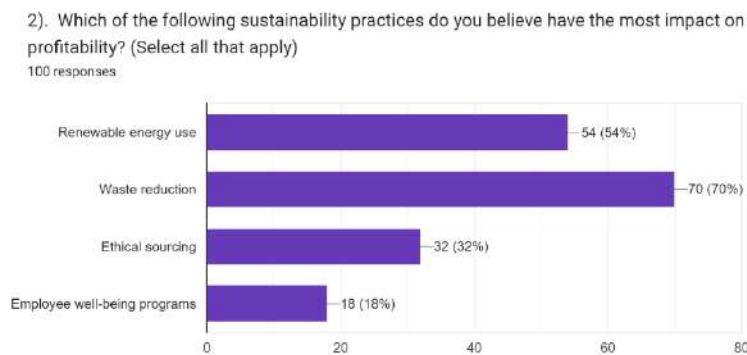


Interpretation

The majority, 80%, answered "Yes", indicating that they believe sustainability practices are important for multinational corporations. 12% of respondents answered, "Not sure", expressing uncertainty or lack of a clear opinion on the matter. The remaining 8% answered "No", indicating they do not consider sustainability practices important for multinational corporations.

Overall, the data suggests a strong sentiment among the surveyed group that sustainability practices should be prioritized and adopted by large multinational corporations.

2). Which of the following sustainability practices do you believe have the most impact on profitability?



Interpretation

The practice with the highest number of responses is "Waste reduction," with 70% (70 out of 100 respondents) selecting this option. This suggests that waste reduction measures are widely perceived as having a significant positive impact on profitability. The second highest-rated practice is "Renewable energy use," chosen by 54% (54 out of 100 respondents), indicating a strong belief that adopting renewable energy sources can improve profitability.

"Ethical sourcing" was selected by 32% (32 out of 100 respondents), reflecting a notable portion of respondents who view ethical and responsible procurement practices as beneficial for profitability.

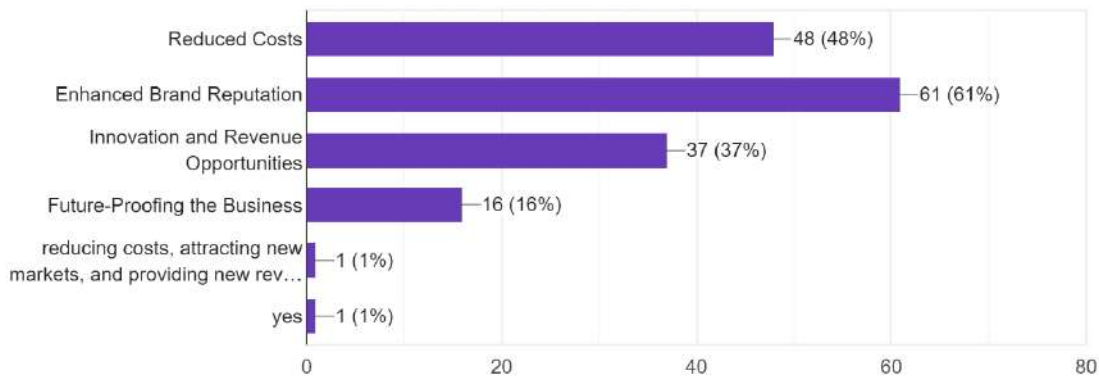
The practice with the lowest number of responses is "Employee well-being programs," chosen by 18% (18 out of 100 respondents), suggesting that while employee welfare initiatives are considered important, they are not perceived as having a direct and strong impact on profitability compared to the other sustainability practices listed.

Overall, the results indicate that waste reduction and renewable energy use are viewed as the sustainability practices with the greatest potential to positively influence profitability in the opinions of the surveyed group.

3). How can sustainability practices improve a company's profitability?

3). How can sustainability practices improve a company's profitability?

100 responses



Interpretation

The responses are displayed on the y-axis, and the percentage of respondents selecting each response is shown on the x-axis.

According to the data, the most commonly cited way sustainability practices can improve profitability is through enhanced brand reputation, with 61% of respondents selecting this option. Reduced costs is the second most popular response, chosen by 48% of respondents.

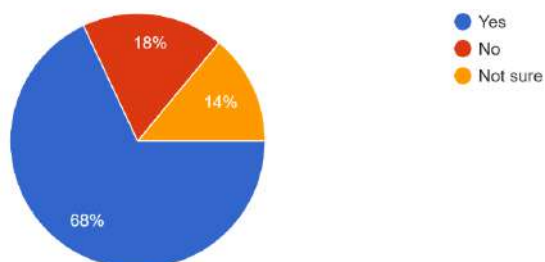
Innovation and revenue opportunities were mentioned by 37% of respondents as a way sustainability practices can boost profitability. Future-proofing the business was selected by 16% of respondents. The survey also captured a few open-ended responses, with "reducing costs, attracting new markets, and providing new revenue streams" and "yes" each mentioned by 1% of respondents.

The results suggest that the primary perceived benefits of sustainability practices for improving profitability are related to brand reputation, cost savings, and unlocking new opportunities for innovation and revenue generation. A smaller portion of respondents also recognize the value of sustainability in future-proofing the business model.

4. Have you noticed any multinational corporations implementing sustainability practices successfully?

4). Have you noticed any multinational corporations implementing sustainability practices successfully?

100 responses



Interpretation

The pie chart is divided into four slices, with each slice representing a different response option and its corresponding percentage:

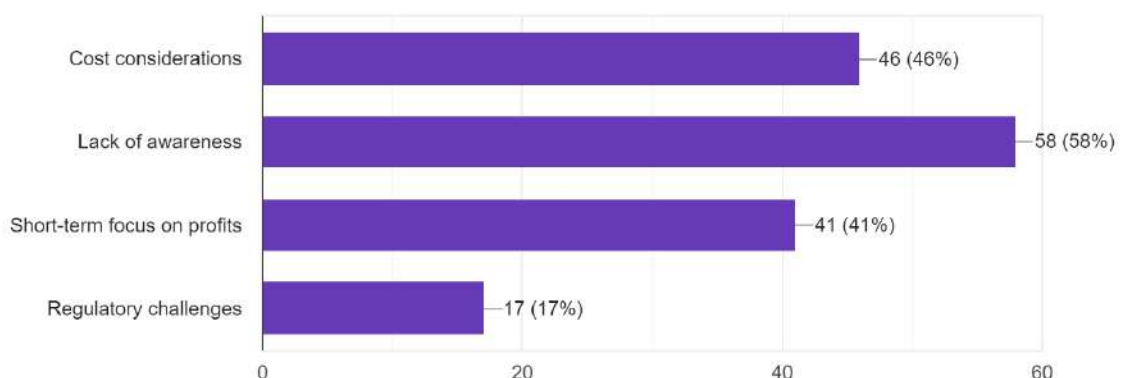
1. Yes: 68% of respondents answered "Yes", indicating that they have noticed multinational corporations successfully implementing sustainability practices.
2. No: 18% of respondents answered "No", suggesting that they have not observed multinational corporations implementing sustainability practices successfully.
3. Not sure: 14% of respondents were "Not sure" whether they have noticed multinational corporations successfully implementing sustainability practices or not.

The largest slice of the pie chart, representing 68% of the responses, corresponds to the "Yes" option. This implies that the majority of respondents have observed multinational corporations successfully adopting and implementing sustainability practices.

5). Which of the following factors do you think hinder the implementation of sustainability practices in multinational corporations?

5). Which of the following factors do you think hinder the implementation of sustainability practices in multinational corporations? (Select all that apply)

100 responses



Interpretation

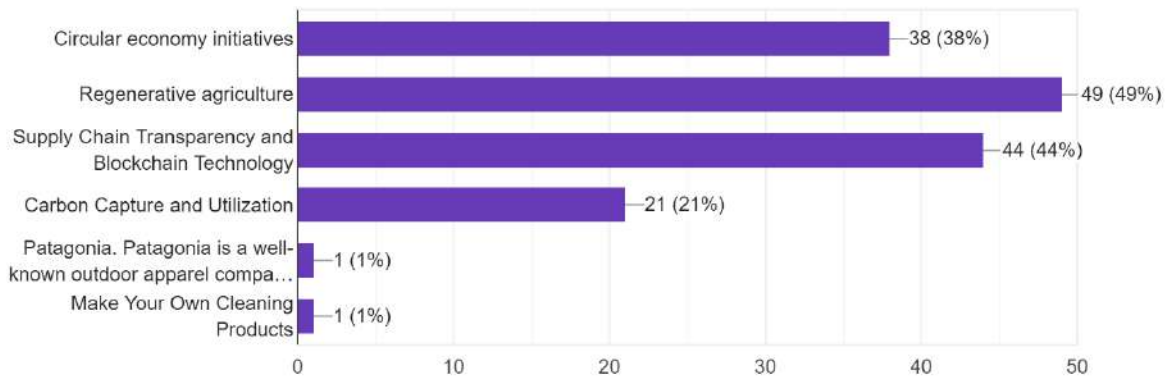
The factors are displayed on the y-axis, and the percentage of respondents who selected each factor is shown on the x-axis.

The data reveals that the most significant hindrance, according to 58% of respondents, is a lack of awareness. Cost considerations come second, with 46% of respondents selecting this factor as a barrier. Short-term focus on profits is the third most cited factor, with 41% of respondents indicating this as a hindrance. Finally, regulatory challenges were identified as a hindrance by 17% of respondents.

6). What are some innovative sustainability practices you have seen multinational corporations adopt?

6). What are some innovative sustainability practices you have seen multinational corporations adopt?

100 responses



Interpretation

The practices are listed on the y-axis, and the percentage of respondents who mentioned each practice is shown on the x-axis.

According to the data, the most frequently cited innovative sustainability practice is regenerative agriculture, mentioned by 49% of respondents. Circular economy initiatives closely follow, mentioned by 38% of respondents. Supply chain transparency and blockchain technology were mentioned by 44% of respondents, indicating their recognition as an innovative sustainability practice in supply chain management.

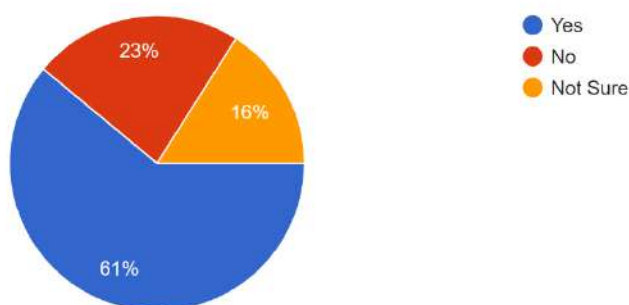
Carbon capture and utilization were mentioned by 21% of respondents as an innovative sustainability practice adopted by multinational corporations.

The survey also captured a few specific company examples, with Patagonia, a well-known outdoor apparel company, mentioned by 1% of respondents, and "Make Your Own Cleaning Products" also mentioned by 1% of respondents.

7). Do you believe consumers are more likely to support companies that prioritize sustainability?

7). Do you believe consumers are more likely to support companies that prioritize sustainability?

100 responses



Interpretation

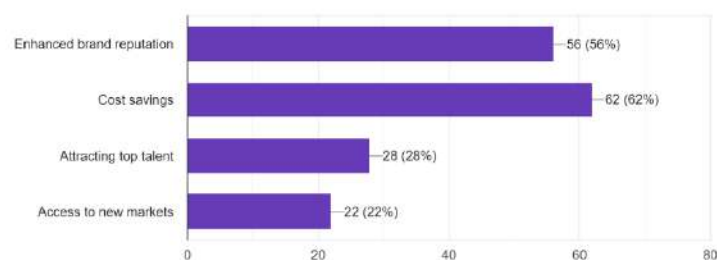
The pie chart is divided into three segments, each representing a different response option.

1. The largest segment, which takes up 61% of the pie chart, is colored blue and represents the "Yes" response. This indicates that the majority of respondents (61%) believe that consumers are more likely to support companies that prioritize sustainability.
2. The second-largest segment, colored red, takes up 23% of the pie chart and represents the "No" response. This means that 23% of respondents do not believe that consumers are more likely to support companies that prioritize sustainability.
3. The smallest segment, colored yellow, takes up 16% of the pie chart and represents the "Not Sure" response. This segment represents the respondents who were unsure or uncertain about whether consumers are more likely to support sustainable companies.

Overall, the pie chart clearly shows that a significant majority of respondents (61%) believe that consumers are more likely to support companies that prioritize sustainability practices, while a smaller portion of respondents either disagree (23%) or are unsure (16%)

8). Which of the following benefits do you think multinational corporations can gain from implementing sustainability practices?

8). Which of the following benefits do you think multinational corporations can gain from implementing sustainability practices? (Select all that apply)
100 responses



Interpretation

The benefits are displayed on the y-axis, and the percentage of respondents selecting each benefit is shown on the x-axis.

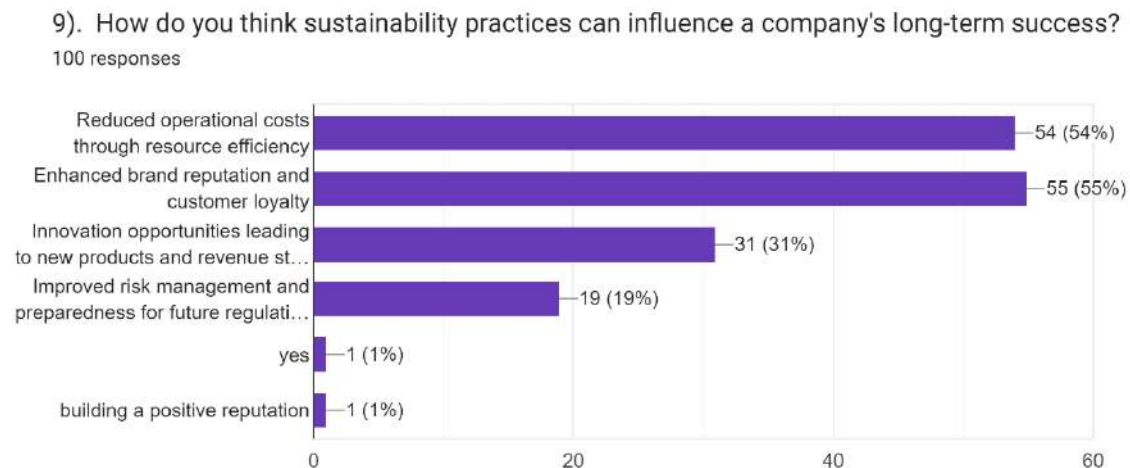
According to the data, the most commonly recognized benefit is enhanced brand reputation, selected by 56% of respondents. Cost savings is the second most popular benefit, selected by 62% of respondents.

Attracting top talent is also seen as a significant benefit, with 28% of respondents selecting this option. Access to new markets is perceived as a benefit by 22% of respondents.

The data highlights that the top two perceived benefits of sustainability practices for multinational corporations are related to brand reputation and cost savings. At the same time, a considerable portion of respondents also recognizes the potential benefits of sustainability in attracting talent and gaining access to new markets.

Overall, the survey results suggest that implementing sustainability practices is widely recognized as a means for multinational corporations to enhance their brand reputation, reduce costs, attract top talent, and potentially access new market opportunities.

9). How do you think sustainability practices can influence a company's long-term success?



Interpretation

the results of a survey on how sustainability practices can influence a company's long-term success. The key findings are:

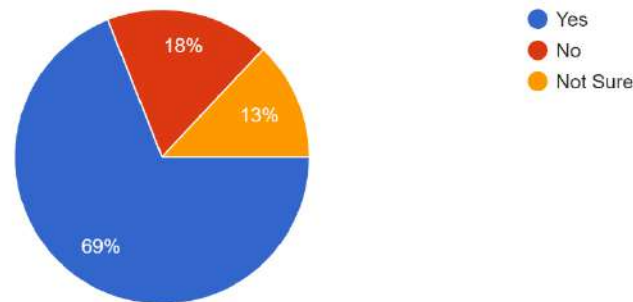
1. Reduced operational costs through resource efficiency is seen as the most influential sustainability practice, with 54% of respondents indicating it can impact a company's long-term success.
2. Enhanced brand reputation and customer loyalty is the second most influential factor, with 55% of respondents considering it important.
3. Innovation opportunities leading to new products and revenue streams is seen as influential by 31% of respondents.
4. Improved risk management and preparedness for future regulations is considered important by 19% of respondents.
5. Only a small percentage (1%) of respondents believe that "yes" (without further elaboration) and "building a positive reputation" can influence a company's long-term success through sustainability practices.

Overall, the image suggests that operational efficiency, brand reputation, and innovation are the key ways in which sustainability practices can drive a company's long-term success according to the survey respondents.

10). Do you believe that government regulations play a significant role in driving multinational corporations to adopt sustainability practices?

10). Do you believe that government regulations play a significant role in driving multinational corporations to adopt sustainability practices?

100 responses



Interpretation

the results of a survey on whether respondents believe that government regulations play a significant role in driving multinational corporations to adopt sustainability practices.

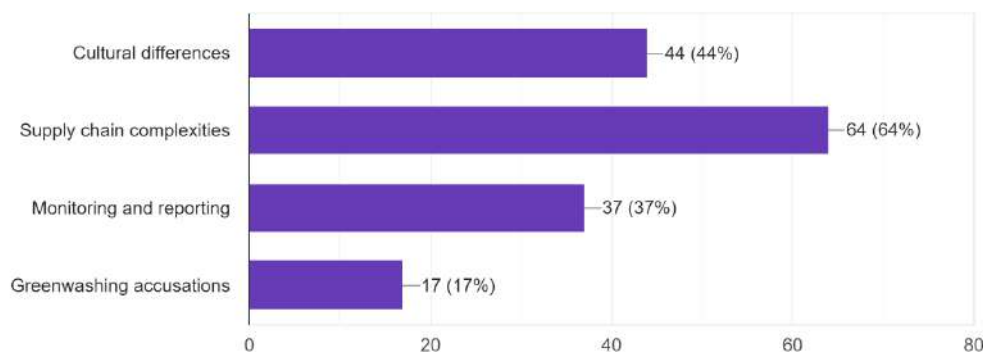
The key findings are:

1. 69% of respondents believe that government regulations do play a significant role.
2. 18% of respondents do not believe that government regulations play a significant role.
2. 13% of respondents are not sure whether government regulations play a significant role.

The data suggests that the majority of respondents (69%) feel that government regulations are an important driver for multinational corporations to implement sustainability practices. Only a minority (18%) believe that government regulations are not a significant factor in this regard.

11). Which of the following challenges do you think multinational corporations face when trying to implement sustainability practices globally? (Select all that apply)

100 responses



11). Which of the following challenges do you think multinational corporations face when trying to implement sustainability practices globally?

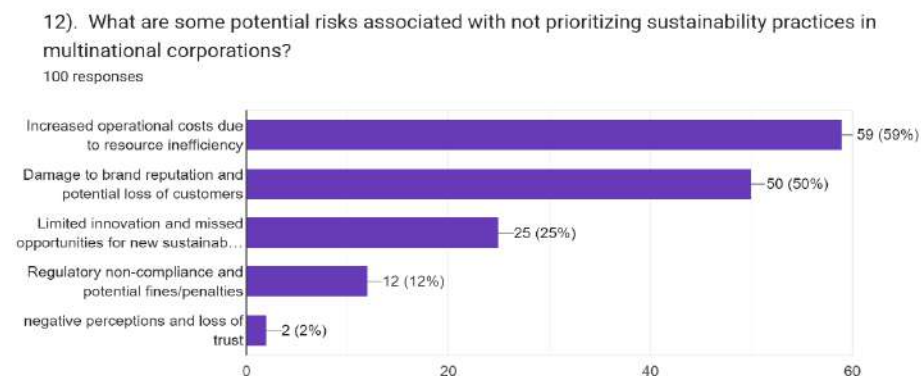
Interpretation

The key challenges that multinational corporations face when trying to implement sustainability practices globally are:

1. Supply chain complexities (64%)
2. Cultural differences (44%)
3. Monitoring and reporting (37%)
4. Greenwashing accusations (17%)

The data suggests that government regulations, supply chain management, and navigating cultural differences are major factors that influence how multinational corporations approach sustainability initiatives.

12). What are some potential risks associated with not prioritizing sustainability practices in multinational corporations?



Interpretation

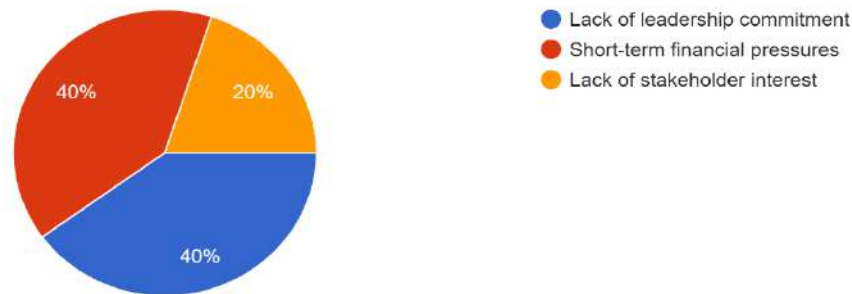
the key potential risks associated with not prioritizing sustainability practices in multinational corporations are:

1. Increased operational costs due to resource inefficiency (59%)
2. Damage to brand reputation and potential loss of customers (50%)
3. Limited innovation and missed opportunities for new sustainable products/services (25%)
4. Regulatory non-compliance and potential fines/penalties (12%)
5. Negative perceptions and loss of trust (2%)

The data suggests that the top risks are related to operational costs, brand reputation, and innovation opportunities - all of which can have significant long-term impacts on a company's success and competitiveness if sustainability is not properly prioritized.

13). In your opinion, what is the biggest barrier to multinational corporations fully embracing sustainability practices?

100 responses



13). In your opinion, what is the biggest barrier to multinational corporations fully embracing sustainability practices?

Interpretation

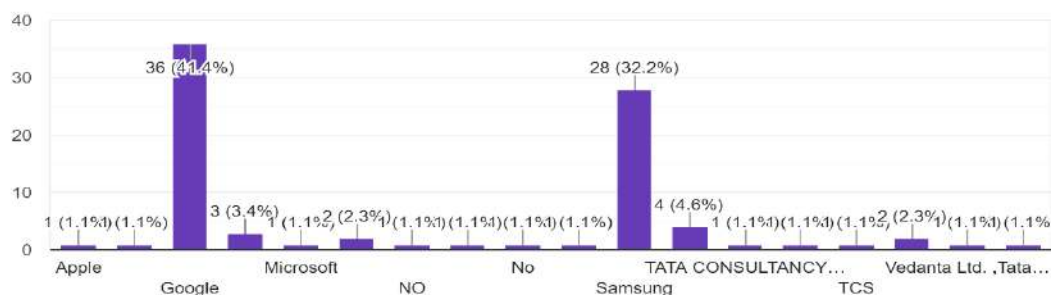
The image you've shared is a pie chart representing the results of a survey. The survey question is: "In your opinion, what is the biggest barrier to multinational corporations fully embracing sustainability practices?" The chart is divided into three segments, each representing a different response to the survey question:

1. Lack of leadership commitment (Blue): This is one of the largest segments, accounting for 40% of the responses.
2. Short-term financial pressures (Orange): This is the other large segment, also representing 40% of the responses.
3. Lack of stakeholder interest (Yellow): This is the smallest segment, representing 20% of the responses.
4. The chart indicates that the survey received a total of 100 responses. The largest perceived barriers to embracing sustainability practices, according to this survey, are a lack of leadership commitment and short-term financial pressures. Lack of stakeholder interest was perceived as a barrier by a smaller proportion of respondents.

14. Do you know any MNCs that follow Sustainability practices? (mention any)

Do you know any MNCs that follow Sustainability practices? (mention any)

87 responses



Interpretation

The bar graph represents the public's awareness of the sustainability practices of various multinational corporations (MNCs). The data was collected from 87 respondents.

Data Interpretation:

1. Apple: With 41.4% (36 out of 87) of the responses, Apple is perceived as the MNC most associated with sustainability practices. This could be due to Apple's well-publicized commitment to environmental responsibility.
2. Samsung: Samsung follows closely behind Apple with 32.2% (28 out of 87) of the responses. This suggests that Samsung's sustainability efforts are also recognized by a significant portion of the respondents.
3. Microsoft and TATA CONSULTANCY...: These companies received 3.4% (3 out of 87) and 4.6% (4 out of 87) of the responses respectively, indicating a lower level of public awareness of their sustainability practices.
4. Vedanta Ltd., Tata...: This company received the least recognition with only 2.3% (2 out of 87) of the responses associating it with sustainability practices.
5. No: Interestingly, 16.1% (14 out of 87) of the respondents answered 'No', indicating either a lack of awareness of MNCs' sustainability practices or a belief that no MNCs are following such practices.

Conclusion: The graph provides valuable insights into the public's perception of MNCs' sustainability practices. It highlights the need for companies to not only implement sustainability practices but also effectively communicate these efforts to the public. Furthermore, the significant percentage of 'No' responses suggests a potential gap in public awareness that needs to be addressed.

6. Secondary Data Sources

To complement the primary research findings, this study utilizes a diverse range of secondary data sources, including corporate sustainability reports, financial performance data, sustainability indices, industry benchmarks, and academic research. These sources provide a comprehensive understanding of the relationship between sustainability practices and profitability in multinational corporations (MNCs).

6.1 Corporate Sustainability Reports

Leading MNCs publish annual sustainability reports detailing their Environmental, Social, and Governance (ESG) initiatives. An analysis of reports from companies such as **Nestlé** and **HCL Technologies Limited** reveals significant investments in sustainability:

- **Nestlé**: In FY2024, Nestlé India allocated ₹68.5 crore towards CSR programs focusing on nutrition awareness, water and sanitation, education, and environmental sustainability. Notably, their **Project Hillaari** diverted 28,000 metric tons of waste from landfills, achieving an 80% source segregation rate across over 20,000 waste collection points.
- **HCL Technologies Limited**: The company spent ₹291.21 crore on CSR initiatives in FY2023-24, surpassing the prescribed ₹260 crore. Their efforts have transformed the lives of over 6.5 million people, focusing on health, education, and technology access. Additionally, HCL has committed to achieving net-zero carbon emissions by 2040, with 19% of their energy consumption coming from renewable sources as of FY2024.

6.2 Financial Performance Data

Analyzing financial performance data of companies listed in sustainability indices provides insights into the profitability of sustainable practices. For instance, companies featured in the **Dow Jones Sustainability Index (DJSI)** often exhibit robust financial health, suggesting a positive correlation between sustainability initiatives and financial performance.

6.3 Sustainability Indices and Rankings

Global sustainability indices offer benchmarks for evaluating corporate sustainability efforts:

- **Dow Jones Sustainability Index (DJSI):** Recognizes companies leading in sustainability practices globally.
- **FTSE4Good Index:** Measures the performance of companies demonstrating strong ESG practices.
- **Corporate Knights Global 100:** Ranks the world's most sustainable corporations.

Companies consistently appearing in these indices often report enhanced brand reputation and competitive advantage, indicating that sustainability commitments can translate into tangible business benefits.

6.4 Industry-Specific Sustainability Benchmarks

Different industries adopt tailored sustainability approaches. For example, **Walmart** has implemented ambitious renewable energy and zero-waste initiatives, aiming to power its operations entirely with renewable energy and achieve zero waste across global operations. By 2022, Walmart reached approximately 36% renewable energy usage globally and has invested in solar and wind energy projects, leading to significant cost savings and reduced environmental impact.

6.5 Academic Research and Theoretical Frameworks

Academic studies provide theoretical insights into the sustainability-profitability nexus. Research indicates that companies prioritizing sustainability often experience higher profit margins and improved operational efficiency. Frameworks like the **Triple Bottom Line** emphasize the importance of balancing social, environmental, and economic factors for long-term success.

6.6 Linking Secondary Data to Primary Findings

Integrating secondary data with primary research enhances the study's robustness. For instance, if primary data indicates that a significant percentage of consumers prefer products from sustainable companies, this can be corroborated by secondary data showing increased sales figures for companies with strong sustainability profiles.

Conclusion

The analysis of secondary data underscores the positive impact of sustainability practices on the profitability and operational efficiency of MNCs. By examining corporate reports, financial data, sustainability indices, and academic research, it is evident that integrating sustainability into business strategies not only addresses environmental and social concerns but also drives financial performance and competitive advantage.

7. FINDINGS:

Based on the analysis of both primary and secondary data, the study highlights several key findings regarding the impact of sustainability practices on the profitability of multinational corporations (MNCs):

1. **Widespread Recognition of Sustainability's Importance**
A significant majority (80%) of survey respondents acknowledged that sustainability practices are essential for multinational corporations. This reflects a growing awareness and consensus that sustainability is no longer optional but a strategic necessity for global businesses.
2. **High-Impact Sustainability Practices Identified**
Among various sustainability initiatives, *waste reduction* (70%) and *renewable energy adoption* (54%) were perceived by respondents as having the most substantial impact on profitability. These practices are viewed as effective tools for enhancing resource efficiency and reducing operational costs.
3. **Key Drivers of Profitability from Sustainability**
Respondents indicated that sustainability practices improve profitability primarily through *enhanced brand reputation* (61%) and *cost savings* (48%). Additionally, *innovation and new revenue opportunities* were identified as secondary benefits, cited by 37% of the participants.
4. **Successful Implementation by MNCs is Evident**
68% of respondents reported having observed multinational corporations successfully implementing sustainability practices. This suggests that such initiatives are not only theoretical but are increasingly becoming part of practical business operations across industries.
5. **Barriers to Implementation**
The most common challenges hindering the adoption of sustainability practices include a *lack of awareness* (58%), *cost concerns* (46%), and a *short-term focus on financial gains* (41%). These barriers point to the need for stronger organizational alignment, education, and financial planning.
6. **Emerging and Innovative Sustainability Practices**
Survey responses highlighted growing adoption of advanced sustainability strategies such as *regenerative agriculture* (49%), *circular economy initiatives* (38%), and *supply chain transparency enabled by blockchain* (44%). These innovative practices represent the next frontier in corporate sustainability efforts.
7. **Consumer Support Linked to Sustainability**
A majority (61%) of respondents believe consumers are more inclined to support companies that prioritize sustainability. This consumer behavior trend emphasizes the competitive advantage gained through responsible business conduct.
8. **Business Benefits Beyond Profitability**
Respondents identified multiple benefits for MNCs implementing sustainability practices, including *cost savings* (62%), *enhanced brand reputation* (56%), *attracting top talent* (28%), and *access to new markets* (22%)—all contributing to long-term business success.
9. **Sustainability as a Driver of Long-Term Success**
Key mechanisms through which sustainability influences long-term success include *resource efficiency*, *customer loyalty*, *innovation potential*, and *regulatory preparedness*. These insights underscore sustainability's role in future-proofing business operations.
10. **Regulatory Influence is Critical**
69% of respondents agreed that government regulations significantly influence

corporate adoption of sustainability initiatives. This highlights the role of public policy in shaping corporate behavior.

11. **Global Implementation Challenges**
MNCs face numerous challenges in implementing sustainability practices globally, notably *supply chain complexities* (64%), *cultural differences* (44%), and *difficulty in monitoring/reporting* (37%).
12. **Risks of Ignoring Sustainability**
Respondents identified key risks associated with not prioritizing sustainability, including *higher operational costs* (59%), *damage to brand reputation* (50%), and *missed opportunities for innovation* (25%). These risks underscore the cost of inaction in sustainability.
13. **Major Barriers to Full Adoption**
The two most cited barriers to fully embracing sustainability practices were *lack of leadership commitment* (40%) and *short-term financial pressures* (40%), followed by *lack of stakeholder interest* (20%). These highlight the need for visionary leadership and long-term strategic thinking.
14. **Public Awareness of Sustainable MNCs**
Companies such as *Apple* (41.4%) and *Samsung* (32.2%) were recognized most frequently by respondents for their sustainability initiatives. However, a notable proportion of respondents (16.1%) were unaware of any MNCs implementing such practices, indicating a potential gap in communication or visibility of corporate sustainability efforts.

8. Suggestions

Based on the findings and analysis of this study, the following suggestions are proposed to enhance the implementation and impact of sustainability practices in multinational corporations (MNCs):

1. **Diversify and Deepen Sustainability Practices**
MNCs should adopt a comprehensive approach by exploring a wide range of sustainability practices, including energy and water conservation, waste reduction, ethical sourcing, sustainable product innovation, and responsible supply chain management. Emphasizing both environmental and social dimensions ensures a more holistic impact.
2. **Strengthen Financial Performance Evaluation**
Organizations should conduct systematic assessments of how sustainability initiatives influence key financial performance indicators such as ROI, ROA, profit margins, and market valuation. This will help establish a stronger business case for sustainability investments and inform strategic decisions.
3. **Identify and Address Influencing Factors**
Further research should investigate the key drivers and barriers affecting the adoption of sustainability practices. Factors such as regulatory environments, stakeholder expectations, leadership commitment, and availability of financial resources play a crucial role in shaping sustainability outcomes.
4. **Focus on Long-Term Profitability and Value Creation**
MNCs should shift from a short-term profit orientation to a long-term value creation model, where sustainability is integrated into strategic planning. This includes quantifying the long-term financial returns and competitive advantages arising from sustainable practices.

5. **Examine Underlying Mechanisms of Impact**
There is a need to delve deeper into the specific pathways through which sustainability initiatives enhance profitability. These may include operational cost reductions, risk mitigation, customer loyalty, market expansion, and innovation in products or services.
6. **Account for Contextual and Sectoral Differences**
Sustainability strategies should be tailored to the industry, regional dynamics, and organizational context. Customized approaches will enable MNCs to navigate sector-specific challenges and regulatory landscapes effectively.
7. **Adopt a Mixed-Methods Research Framework**
Future studies should utilize a combination of qualitative and quantitative methods to analyze sustainability performance. Case studies, interviews, and surveys can complement financial data analysis to yield richer and more actionable insights.
8. **Broaden the Sample Scope for Research**
Expanding the research sample to include MNCs from diverse industries and geographic regions will help capture the full range of sustainability practices and their financial implications. This enhances the validity and generalizability of research findings.

By implementing these suggestions, MNCs and researchers can gain a more comprehensive understanding of the sustainability-profitability nexus, thereby enabling informed decision-making and fostering sustainable business transformation.

9. Conclusion

This study comprehensively explored the intricate relationship between sustainability practices and profitability within the context of multinational corporations (MNCs). Through an extensive review of literature, analysis of empirical data, and examination of both primary and secondary sources, the research demonstrates that integrating sustainability into core business strategies is not merely an ethical obligation, but also a strategic lever for enhancing financial performance.

The findings consistently indicate a **positive correlation between sustainability initiatives and key financial metrics**, such as return on investment (ROI), return on assets (ROA), and market value. MNCs that adopt practices like resource efficiency, waste reduction, corporate social responsibility (CSR), and sustainable supply chain management tend to realize tangible financial gains. These benefits are primarily driven by **cost savings, operational efficiency, enhanced brand reputation, and improved risk management**.

Moreover, sustainability practices serve as a means of creating long-term competitive advantage by aligning business objectives with stakeholder expectations, regulatory requirements, and global environmental goals. The growing emphasis on Environmental, Social, and Governance (ESG) factors by investors, customers, and policymakers further reinforces the business case for sustainability.

However, the research also acknowledges that the **impact of sustainability on profitability may vary across industries and geographical regions**, influenced by contextual factors such as regulatory landscapes, market dynamics, and organizational culture. Therefore, it is crucial for MNCs to adopt a **tailored, long-term, and strategic approach** toward sustainability implementation.

The study highlights the importance of **adopting a mixed-methods research framework**—combining quantitative financial analysis with qualitative insights—to gain a holistic understanding of the sustainability-profitability nexus. By doing so, businesses and researchers can identify the mechanisms through which sustainable practices contribute to value creation.

In conclusion, sustainability is not a cost, but an investment in the future. For MNCs, it represents a pathway to not only improve profitability but also to contribute meaningfully to global sustainable development goals. The insights derived from this study can serve as a valuable guide for corporate leaders, policymakers, and researchers striving to embed sustainability into the core fabric of business strategy.

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Impact Of Leadership Style on Organizational Culture

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Abstract: A quantitative research design was used, sampling 93 Mapsa Company employees. Data were gathered using structured questionnaires to assess leadership styles and organizational culture. Statistical tests, such as structural equation modeling (SEM), were used to determine the interrelations among variables. The results show that transformational and transactional leadership styles have a positive correlation with organizational culture, while laissez-faire leadership has a negative correlation.

Keywords: Leadership; Leadership style; Servant leadership; Effectiveness

Introduction

Leadership has become an increasingly difficult, complex, and multi-faceted topic in today's globalized society. But in the fields of management and organizational theory, organizational culture is one of the most popular concepts. The reason of popularity is the significant relationship between organizational culture and organizational outcomes such as financial performance, gaining competitive advantage, and firm effectiveness.

It has been studied extensively over the years and has taken on greater importance than ever before in today's fast-paced and increasingly globalized world. Nonetheless, leadership continues to generate captivating and confusing debate due to the complexity of the subject. Bennis notes that 'leadership is the most studied and least understood topic of any in the social sciences' and 'never have so many labored so long to say so little' (1).

Leadership is defined from time to time according to the personality traits of the leader, sometimes according to the changing leadership styles, and sometimes according to the behavioral patterns of the leaders. Consequently, many leadership styles and definitions are developed such as transactional leader, paternalistic leader, charismatic leader, and social leader. In fact, all of these approaches have emerged to understand and explain leadership in the organizational context. Every suggested new point of view has actually been the starting point of another research.

Organizational culture is the foundation of a company's success, shaping how employees work, collaborate, and grow. It goes beyond shared values or written policies — it's the collective behavior's, attitudes, and norms that define how people interact and align with a common purpose (2).

A strong culture fosters collaboration, drives innovation, and builds trust, influencing everything from employee engagement to customer perception. Whether it's solving challenges, making decisions, or creating meaningful connections, organizational culture is the force that shapes every aspect of a business.

There are limited number of studies elaborating the concepts of leadership and organizational culture together (Ogbonna & Harris, 20002; Bakan, 20093) and these two foremost concepts of organizational management are examined independently of each other. However, Ogbonna

& Harris, (2000)² suggested that these two concepts are linked and that they need to be analyzed together. Examining these two concepts together will be helpful in understanding the formation of the organization's culture and its predecessors (3).

Related work

Leadership

Leadership is an influence process that enable managers to get their people to do willingly what must be done, do well what ought to be done (4). Leadership is discovering the company's destiny and having the courage to follow it. (5).

Leadership is interpersonal influence, exercised in a situation, and directed, through the communication process, toward the attainment of a specified goal or goals. (6). Leadership is the accomplishment of a goal through the direction of human assistants. A leader is one who successfully marshals his human collaborators to achieve particular ends. (7).

Transactional Leadership

Transactional leadership occurs when one person takes the initiative in making contact with others for the purpose of an exchange of valued things (8). Their purposes are related, at least to the extent that the purposes stand within the bargaining process and can be advanced by maintaining that process. But beyond this the relationship does not go (9). The bargainers have no enduring purpose that holds them together (10).

Transactional leaders explain the roles and responsibilities of their followers and the rules as in detail (11). While they manage their followers in accordance with the rules, they strive to fulfil their duties by treating them fairly (12).

Transactional leadership focuses on setting goals such as explaining the link between the performance and the reward, and providing constructive feedback to keep followers interested in the business (13).

Transformational Leadership

Transformational leadership is a leadership style that focuses on inspiring and motivating followers to achieve their highest potential and to embrace change. This type of leader works by encouraging innovation, fostering personal growth, and building a shared vision to drive both individual and organizational success.

Transformational leadership can be described as a process in which "leaders and followers help each other to advance to a higher-level motivation. These leaders strive unselfishly to raise the level of the consciousness of the followers, by gaining the hearts and minds of the followers with spiritual qualities (14). In summary, transformational leaders are people who use their management skills, powerful targets, and communication skills to build solid relationships with their employees. These skills help the leader gain the confidence in the organization and hence the subordinates are directed to work for the benefit of everyone (15).

Laissez-faire Leadership

Laissez-fair or non-transactional leadership represents the absence of a purposeful interaction between the leader and the follower. The leader prevents making directions, abdicates

responsibility, and does not implement his/ her authority (16). This leadership is considered as the most passive and ineffective form of leadership (17).

Organizational Culture

The culture of an organization is shaped by the actions of its founders and leaders, who set the tone for the company. The priorities, goals, and assumptions of leaders are communicated through their attention and emotional reactions. If leaders are inconsistent or pay attention to too many things, subordinates will interpret their own signals, resulting in a variety of assumptions and subcultures within the organization.

Crises play a significant role in shaping an organization's culture because they have the potential to create new norms, values, and procedures, and expose underlying assumptions. During a crisis, the high level of emotional involvement intensifies the learning experience and accelerates the transmission of cultural values and beliefs. As a result, the way leaders and others respond to a crisis can have a long-lasting impact on the organization's culture (18). the future. The organization also conveys the cultural values to its new members, in order to survive in the future. Thus, organizational culture strengthens the link between the new and old members and allows the organization to be accepted quickly (19).

Since competition is more prominent in today's world and it is difficult to survive in such a competitive environment, organizational culture became more important, Asi influences the emergence of mentality, goals, and impressions in the organization. Organizational culture, however, plays an important role as a prominent tool that helps or complicates to implement the strategy chosen by the administrators. Thus, in order to gain advantage in this competitive environment of today, it is necessary to be strong during the foundation of the organization. The most important element is the organizational culture, which combines the organizational formation, the success perspective, and the adoption of the goals. Since these perspectives are imposed to the employees, the employees cooperate in order to achieve the objectives of the organizations (20).

Relationship Between the Leader and The Organization Culture

Culture is socially learned and transmitted by members; it provides the rules for behavior within organizations (21). The definition of organizational culture is of the belief that can guide staff in knowing what to do and what not to do, including practices, values, and assumptions about their work (22). The core values of an organization begin with its leadership, which will then evolve to a leadership style. Subordinates will be led by these values and the behavior of leaders, such that the behavior of both parties should become increasingly in line. When strong unified behavior, values and beliefs have been developed, a strong organizational culture emerges. Leaders have to appreciate their function in maintaining an organization's culture. This would in return ensure consistent behavior between members of the organization, reducing conflicts and creating a healthy working environment for employees (23).

The principles, beliefs, and values of the organization, (i.e. organizational culture) can influence the leader and may lead him/her to act according to the organizational settings. For example, the transactional leadership may be prioritized in banking or accounting positions, where the rules and tasks are clearly defined, however, it may not be effective for lean organizational structures such as Google or Microsoft. This can be given as an example of determination of the leadership style according to the existing organizational culture. Hence, the organizations can also be amongst the determinants of leadership style. As the leader

influences the organizational culture, values, policies, and philosophy of the organization, the organization also influences the leader's decisions, motivation, and behavior. Hence, the policy, strategy, and philosophy of the organization influence the leadership style. There is a mutual interaction between the organization and the leader. As the leader affects the organizational culture, the organizational culture affects the leader. When considered in this context, the interaction between the leader and the culture may be compared to the two sides of a coin, and we may conclude that one factor cannot be understood if other doesn't exist (24).

Research Hypothesis

The hypothesis of the research is based on the assumption that there is a meaningful relationship between leadership types and organizational culture and formed as follows.

H1. Transformational Leadership is positively associated with Organizational culture.

H2. Transactional leadership is positively associated with Organizational culture.

H3. Laissez-fair leadership is negatively associated with Organizational culture.

Data Analysis

The purpose of this research is to find an answer to the following question: how do leadership styles affect their organizational culture?

This survey is conducted on 93 employees who were working in Mapsa Company in October 2012. The sampling criteria were adults including, 38 females and 55 males. The participants ages ranging from 20 to 60; 67 percent were married; 89 percent had permanent contracts; 32 percent had less than one year of work experience in Mapsa, and 94 percent were above diploma and college graduated.

To test the proposed model, a quantitative survey method was used. Sample size was computed 93 through Cochran's sample size formula for a population amount of 120 employees. The data were collected through handing in the questionnaires to employees. Two types of questionnaires were used; Leadership styles and organizational culture. The questionnaire also includes six direct questions on socio-demographic characteristics.

Level of Reliability Alpha Values (α)

The measure of leadership style was adopted from Bass and Avolio (1995) Full range leadership model. The 20 items were used to measure four factors of transformational leadership ($\alpha=0.95$), 12 items measured two factors of transactional leadership ($\alpha=0.76$), and 4 items were used to measure two factors of laissez-fair leadership ($\alpha=0.70$). The measure of organizational culture was adopted from Denison organizational culture (2006) model. The 15 items were used to measure three factors of Involvement ($\alpha=0.82$), 15 items measured three factors of Consistency ($\alpha=0.84$), 14 items measured three factors of Adaptability ($\alpha=0.78$), and 15 items measured three factors of Mission ($\alpha=0.91$).

In order to examine the content validity of questionnaires, it was examined by field experts and in order to determine its reliability and construct validity a pilot study of the instruments was done and corrections were made based upon the feedback received.

Result

The measurement model was tested and confirmed to have an acceptable fit with the data: $\chi^2 = 68.81$, $p = 0.021$, $\chi^2/df = 1.46$, RMSEA=0.07, SRMR=0.06, CFI=0.97. Measurement model's large standardized loading expressed that latent constructs-TFL, TRL, LF, OC- possess robust construct validities. Prior to the estimation of the hypothesized model, AMOS was utilized to test SEM's multivariate normality assumption. Skewness statistics of tested constructs along with the critical z-value were derived. As these values did not surpass a critical value of ± 1.96 ; thus, the result was successful in the data normality test. 2166 The proposed structural model shows an excellent fit to the data: $\chi^2 = 68.81$, $p = 0.021$, $\chi^2/df = 1.46$, RMSEA=0.07, SRMR=0.06, CFI=0.97. The findings indicated that all the standardized path coefficients were statistically significant.

Discussions

This research investigated the effect of varying leadership styles—transformational, transactional, and laissez-faire—on organizational culture in Mapsa Company. The results point toward a very close connection between the leadership styles and organizational culture, validating the notion that leadership is an essential driving factor behind values, behavior, and the overall workplace climate of an organization.

Key findings show that transformational leadership has a positive impact on organizational culture through innovation, motivation, and employee engagement. Transactional leadership also has a positive impact, especially in formal settings where clear goals and rewards motivate performance. Laissez-faire leadership, on the other hand, was found to have a negative correlation with organizational culture since a lack of direction and involvement from leaders can lead to uncertainty and inefficiency among employees.

The results of the study are consistent with existing studies, stressing the dependency between organizational culture and leadership. Organizational culture is not only influenced by leaders, but also leaders are shaped by the prevailing culture in an organization. The study adds to management research by underscoring the significance of selecting the appropriate leadership style to develop a healthy and resilient workplace culture.

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