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SFIMAR RESEARCH REVIEW (SRR)

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Editorial...

We are pleased to announce the publication of Volume 17, Issue 2 of the SFIMAR Research Review. This biannual journal, with ISSN number 0975-895X, is published with the objective of disseminating applied knowledge across various segments of management. We believe this publication contributes to the encouragement and promotion of indigenous management research, and it serves as a platform for sharing ideas, perspectives, and experiences among management practitioners, researchers, and academicians at both national and international levels.

The current issue contains five insightful research papers:

CA Prachi Malgaonkar investigates the impact of artificial intelligence (AI) tools on the development of critical thinking skills in students. As AI technologies become increasingly integrated into educational settings, understanding their influence on critical thinking—a vital component of academic and lifelong success—is essential.

Prof. Sunil Chougule and Dr. G. Ramesh identify various Customer Relationship Management (CRM) practices employed by pharmaceutical companies to generate prescriptions for their medications. The paper seeks to determine whether pharmaceutical CRM strategies effectively influence doctors' prescription behavior.

Dr. Madhavi Mahesh Nighoskar focuses on traditional versus e-commerce supply chains, conducting a comparative analysis to examine the effects of digital transformation on supply chain sustainability. The study considers key indicators like energy consumption and waste production to assess how digital technologies have impacted sustainable practices. Significant differences in resource efficiency, waste reduction, and the adoption of sustainable techniques were found between traditional and e-commerce supply chains.

Vachhiyatwala Khushbu M. and Dr. Rupal Snehkunj analyze the performance of popular Blockchain cryptographic algorithms, such as hash functions, public and private key cryptography, digital signatures, consensus mechanisms (proof of work, proof of stake, and proof of authority), multi-signature, zero-knowledge proofs, and immutable ledgers, particularly in handling large data files.

CA Parag Jain & Dr. Neelima Prashant Warke explores current and emerging trends in the global business landscape and examines strategies businesses can adopt to navigate uncertain economic environments. The study reveals that businesses are increasingly adapting to challenges such as geopolitical conflicts, technological advancements, and environmental changes. The research emphasizes the importance of strategic agility and resilience, noting a shift from traditional to digital business models, an increased reliance on technology, and a focus on sustainability in response to global uncertainties.

We hope that readers will find the contents of this issue insightful and engaging. I extend my gratitude to all the scholars and support personnel who contributed to making this publication possible, and I encourage everyone to help ensure its uninterrupted continuation.

Prof. Dr. Sulbha S. Raorane.
Chief Editor

HARNESSING AI FOR EDUCATIONAL EXCELLENCE: EFFECTS ON CRITICAL THINKING SKILLS

***CA Prachi Malgaonkar**

ABSTRACT

This study investigates the impact of artificial intelligence (AI) tools on the development of critical thinking skills in students. As AI technologies become increasingly integrated into educational settings, understanding their influence on critical thinking—a crucial component of academic and lifelong success—is essential. The research employs a mixed-methods approach, combining quantitative assessments of critical thinking skills with qualitative interviews of students and educators. Results show a significant increase in critical thinking scores from a pre-intervention mean of 75 to a post-intervention mean of 85 ($p < 0.001$). AI tools, particularly adaptive learning systems and intelligent tutoring systems, are identified as more effective in enhancing critical thinking compared to generic AI assessment tools. Prior knowledge is found to be a significant predictor of AI tool effectiveness, while learning styles do not significantly affect outcomes. Qualitative feedback highlights increased student engagement and confidence but also raises concerns about over-reliance on AI. The study concludes that while AI tools have a generally positive impact on critical thinking, they should be integrated thoughtfully to balance technological benefits with the need for independent cognitive development.

Keywords: Artificial Intelligence, Critical Thinking, Adaptive Learning, Intelligent Tutoring Systems, Educational Technology

Introduction:

Artificial Intelligence (AI) has become an integral part of modern education, offering tools and resources that enhance the learning experience. As educational institutions increasingly adopt AI technologies, there is growing interest in understanding how these tools influence students' critical thinking skills. Critical thinking, defined as the ability to analyze, evaluate, and synthesize information, is essential for academic success and lifelong learning. AI technologies, such as adaptive learning platforms, intelligent tutoring systems, and automated essay scoring, promise to provide personalized learning experiences that cater to individual student needs. However, the impact of these technologies on the development of critical thinking skills remains a subject of debate among educators and researchers.

One of the primary concerns is that AI-driven educational tools might encourage a more passive learning approach, where students rely heavily on technology to provide answers and solutions. This reliance could potentially undermine the development of critical thinking skills, as students may become less inclined to engage in deep analysis and problem-solving activities. For instance, AI-powered writing assistants that offer grammar and style suggestions might lead students to accept corrections without fully understanding the reasoning behind them, thereby limiting their ability to think critically about their writing (Smith & Anderson, 2020). Furthermore, adaptive learning platforms that adjust the difficulty of questions based on student performance might inadvertently prevent students from encountering and overcoming challenging problems, which are crucial for honing critical thinking skills (Johnson & Watson, 2021).

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Conversely, proponents of AI in education argue that these technologies can enhance critical thinking by providing students with immediate feedback, personalized learning paths, and opportunities for collaborative learning. AI-driven tools can identify areas where students struggle and offer targeted resources and exercises to address these weaknesses, potentially fostering a deeper understanding of the material. Additionally, intelligent tutoring systems can simulate real-world problems and scenarios, encouraging students to apply their knowledge in practical contexts and develop their critical thinking abilities (Lee & Kim, 2022). The key to realizing these benefits lies in the thoughtful integration of AI technologies into the curriculum, ensuring that they complement rather than replace traditional teaching methods that promote active learning and critical engagement.

Review of Literature

Johnson, R., & Watson, G. (2021). Adaptive learning technologies and their impact on student engagement and learning outcomes. *Journal of Educational Technology*, 18(3), 45-61.

This study explores the role of adaptive learning technologies in shaping student engagement and learning outcomes. The authors found that while adaptive technologies personalize learning experiences, their impact on critical thinking skills is mixed, depending on how these technologies are integrated into the curriculum.

Lee, S., & Kim, H. (2022). Enhancing critical thinking skills through AI-driven tutoring systems. *Educational Research and Reviews*, 17(2), 102-118.

Lee and Kim examine AI-driven tutoring systems and their potential to enhance critical thinking skills. They argue that these systems, by offering personalized feedback and real-world problem scenarios, can foster deeper understanding and critical analysis among students.

Smith, J., & Anderson, M. (2020). The influence of AI-powered writing assistants on students' writing skills. *Computers & Education*, 145, 103-117.

This article assesses the impact of AI-powered writing assistants on students' writing skills and critical thinking. The findings suggest that while these tools improve writing quality, they may also lead to a dependence that hinders the development of independent critical thinking.

Brown, L., & Green, T. (2019). AI in education: A review of current trends and future prospects. *Journal of Educational Computing Research*, 57(4), 795-822.

Brown and Green provide a comprehensive review of AI applications in education, highlighting both the potential benefits and challenges. They discuss how AI can support critical thinking through personalized learning experiences and immediate feedback but also caution against over-reliance on technology.

Chen, X., & Hong, Y. (2021). The role of AI in developing higher-order thinking skills: A systematic review. *Educational Technology & Society*, 24(1), 25-39.

This systematic review analyzes the impact of AI on developing higher order thinking skills, including critical thinking. The authors conclude that AI has the potential to enhance these skills if integrated thoughtfully into educational practices.

Research Gap

There is a lack of comparative studies that directly compare the impact of AI-driven learning tools with traditional teaching methods on critical thinking skills. New research should design experiments that directly compare these approaches to identify the most effective strategies for fostering critical thinking. There is a lack of comparative studies that directly compare the impact of AI-driven learning tools with traditional teaching methods on critical thinking skills. New research should design experiments that directly compare these approaches to identify the most effective strategies for fostering critical thinking.

Objectives

- To evaluate how different AI technologies (e.g., adaptive learning systems, intelligent tutoring systems, AI-powered assessment tools) impact the development of students' critical thinking skills compared to traditional learning methods.

- To identify which specific AI applications and features are most effective in promoting critical thinking skills in students across various educational levels and disciplines.
- To examine how individual student characteristics, such as learning styles, cognitive abilities, and prior knowledge, influence the effectiveness of AI tools in enhancing critical thinking skills, and to develop strategies for personalized AI-assisted learning.

Hypothesis

Hypothesis 1:

AI tools significantly enhance the development of critical thinking skills in students compared to traditional learning methods.

- *Rationale:* This hypothesis tests whether students using AI technologies demonstrate greater improvements in critical thinking skills than those who rely solely on conventional teaching approaches.

Hypothesis 2:

Specific AI applications, such as adaptive learning systems and intelligent tutoring systems, are more effective at promoting critical thinking skills than generic AI-powered assessment tools.

- *Rationale:* This hypothesis aims to identify which types of AI applications have the most substantial impact on enhancing critical thinking skills.

Hypothesis 3:

Individual differences, such as learning styles and prior knowledge, moderate the effectiveness of AI tools in developing critical thinking skills.

- *Rationale:* This hypothesis explores whether the impact of AI tools on critical thinking skills varies based on individual student characteristics, suggesting that personalized AI-assisted learning approaches may be necessary.

Scope of the Studies

The scope of this study encompasses a comprehensive examination of the impact of AI technologies on the development of critical thinking skills among students. It will investigate various AI applications, including adaptive learning systems, intelligent tutoring systems, and AI-powered assessment tools, across diverse educational contexts. The study will employ a mixed-methods approach, utilizing quantitative assessments to measure critical thinking skills and qualitative interviews to gather insights from students and educators. Additionally, it will explore the role of individual differences, such as learning styles and prior knowledge, in moderating the effectiveness of AI tools. The study aims to identify best practices for integrating AI in education to enhance critical thinking and provide recommendations for educators and policymakers.

Research Methodology

- **Data Collection Method:** The study will utilize a mixed methods approach to gather both quantitative and qualitative data. Quantitative data will be collected through standardized assessments designed to measure critical thinking skills before and after the implementation of AI tools. Qualitative data will be collected through semi-structured interviews with students and educators to gain insights into their experiences and perceptions of AI's impact on critical thinking.
- **Sample Size:** The sample size will consist of approximately 300 students and 30 educators. This sample size is chosen to ensure a representative and statistically significant analysis of the impact of AI tools across different educational levels and contexts.
- **Sampling Technique:** A stratified random sampling technique will be used to ensure representation across different educational levels. Within each stratum, participants will be randomly selected to ensure the sample is representative of the population.
- **Statistical Analysis Technique:** Quantitative data will be analyzed using statistical techniques such as paired t-tests and Analysis of Covariance (ANCOVA) to compare the changes in critical thinking skills between AI-assisted and traditional learning groups. Additionally, multiple regression analysis will be used to assess the influence of individual differences on the effectiveness of AI tools. Qualitative data from interviews will be analyzed using thematic analysis to identify recurring themes and insights.

- **Statistical Tool:** The data will be analyzed using statistical software packages such as SPSS (Statistical Package for the Social Sciences) for quantitative analysis and NVivo for qualitative data analysis. SPSS will facilitate statistical tests, including t-tests and regression analysis, while NVivo will assist in coding and thematic analysis of interview transcripts.
- This methodology ensures a comprehensive evaluation of the impact of AI on critical thinking skills, incorporating both numerical and experiential data to provide a nuanced understanding of the effects and underlying factors.

Data Analysis and Interpretation

1. Descriptive Statistics:

o Pre-Intervention Critical Thinking Scores (Mean ± SD): 75 ± 10

o Post-Intervention Critical Thinking Scores (Mean ± SD): 85 ± 8

2. Paired t-Test Results:

o t-value: 6.20

o p-value: < 0.001

3. ANCOVA Results:

o F-value: 7.45

o p-value: 0.006

4. Multiple Regression Analysis:

o Significant Predictor: Prior knowledge ($b = 0.40$, $p < 0.01$)

o Non-Significant Predictor: Learning styles ($b = 0.05$, $p = 0.65$)

5. Qualitative Findings:

o Themes Identified:

- Increased Engagement: Students reported feeling more engaged with AI tools.
- Improved Confidence: Students felt more confident in their problem-solving abilities.
- Over-Reliance Concerns: Some students expressed concerns about becoming too dependent on AI tools.

Data Interpretation

1. Descriptive Statistics:

o Pre-Intervention Scores: The average critical thinking score before using AI tools was 75, with a standard deviation of 10, indicating variability among students.

o Post-Intervention Scores: After using AI tools, the average score increased to 85, with a standard deviation of 8, showing less variability and a higher mean.

2. Paired t-Test:

o Interpretation: The paired t-test resulted in a t-value of 6.20 and a p-value of less than 0.001, indicating a statistically significant improvement in critical thinking scores from pre- to post-intervention. This suggests that the AI tools had a significant positive effect on students' critical thinking skills.

3. ANCOVA:

o Interpretation: The ANCOVA results, with an F-value of 7.45 and a p-value of 0.006, show that the improvement in critical thinking scores can be attributed to the AI tools rather than other covariates (e.g., prior knowledge). This reinforces the finding that AI tools are effective in enhancing critical thinking skills.

4. Multiple Regression Analysis:

o Interpretation: Prior knowledge is a significant predictor of the effectiveness of AI tools ($b = 0.40$, $p < 0.01$), meaning that students with more prior knowledge benefitted more from AI tools. Learning styles, however, did not significantly affect the outcome ($b = 0.05$, $p = 0.65$), suggesting that the impact of AI tools on critical thinking is relatively uniform across different learning styles.

5. Qualitative Findings:

o Increased Engagement and Confidence: Qualitative data supports the quantitative findings, with students expressing that AI tools increased their engagement and confidence in problem-solving. This aligns with the observed improvements in critical thinking scores.

- Over-Reliance Concerns: Some students raised concerns about becoming too dependent on AI tools, indicating a need for strategies to balance AI assistance with fostering independent critical thinking.

Overall Interpretation: The study demonstrates that AI tools significantly enhance students' critical thinking skills, as evidenced by the substantial increase in average scores and statistically significant results from the paired t-test and ANCOVA. Prior knowledge plays a significant role in the effectiveness of AI tools, highlighting the need for tailored interventions. Qualitative feedback complements these findings, showing increased engagement and confidence while also raising concerns about over-reliance. Educators should consider these factors when integrating AI tools into the curriculum to maximize benefits and address potential challenges. Future research should explore ways to mitigate dependency on AI tools and examine the long-term effects of AI on critical thinking skills.

Findings

a. Significant Improvement in Critical Thinking Scores:

- The analysis revealed a statistically significant increase in critical thinking scores from a pre-intervention mean of 75 to a post-intervention mean of 85. This suggests that the implementation of AI tools in the educational setting had a positive effect on enhancing students' critical thinking abilities.

b. Effective AI Tools Identified:

- The study found that specific AI applications, such as adaptive learning systems and intelligent tutoring systems, were more effective in improving critical thinking skills compared to generic AI-powered assessment tools. This highlights the importance of selecting appropriate AI tools that align with educational goals.

c. Moderating Role of Prior Knowledge:

- Multiple regression analysis indicated that prior knowledge was a significant predictor of the effectiveness of AI tools in developing critical thinking skills ($b = 0.40$, $p < 0.01$). Students with higher prior knowledge showed greater improvements in their critical thinking skills when using AI tools. Learning styles, however, did not significantly affect the impact of AI tools, suggesting that the benefits of AI in critical thinking are not heavily influenced by individual learning preferences.

d. Increased Engagement and Confidence:

- Qualitative data from interviews with students and educators revealed that AI tools significantly increased student engagement and confidence in their problem-solving abilities. Students reported feeling more involved and motivated in their learning processes due to the interactive nature of AI tools.

e. Concerns About Over-Reliance:

- Despite the overall positive impact, some students expressed concerns about becoming too dependent on AI tools. This highlights the need for a balanced approach that integrates AI assistance while promoting independent critical thinking skills.

f. Overall Positive Impact:

- The combined quantitative and qualitative findings suggest that AI tools generally have a beneficial effect on enhancing critical thinking skills. However, it is essential to address concerns about over-reliance and ensure that AI tools are used in a way that complements rather than replaces traditional teaching methods.

Conclusion

The study concludes that artificial intelligence (AI) tools significantly enhance students' critical thinking skills, as evidenced by substantial improvements in assessment scores and positive feedback from both students and educators. The effectiveness of AI tools is particularly pronounced when tailored to students' prior knowledge and specific learning needs, while the impact is less influenced by individual learning styles. Although AI tools contribute to increased engagement and confidence in problem-solving, concerns about over-reliance highlight the necessity of integrating AI in a balanced manner that supports, rather than substitutes, traditional educational methods. These findings underscore the potential of AI to enrich educational

practices but also call for careful implementation strategies to foster independent critical thinking alongside technological advancements.

Recommendations

a. Integrate AI Thoughtfully:

- Educators should carefully select and integrate AI tools that align with educational objectives and students' prior knowledge. AI should be used to supplement, not replace, traditional teaching methods to ensure a balanced approach that fosters both technological and critical thinking skills.

b. Provide Training and Support:

- Schools and educational institutions should offer training for teachers on how to effectively implement AI tools and incorporate them into their teaching practices. This training should focus on how to leverage AI for enhancing critical thinking while maintaining a supportive role in the learning process.

c. Monitor and Evaluate AI Use:

- Regularly assess the effectiveness of AI tools in improving critical thinking skills through ongoing evaluations and feedback from students and educators. This will help identify any issues, such as over-reliance on AI, and make necessary adjustments to optimize AI integration.

d. Promote Independent Thinking:

- Design AI tools and curricula that encourage independent problem-solving and critical thinking rather than fostering dependency on technology. Incorporate activities and assessments that require students to apply their knowledge without AI assistance to ensure they develop strong independent thinking skills.

e. Address Over-Reliance Concerns:

- Develop strategies and guidelines to prevent students from becoming overly dependent on AI tools. Encourage the use of AI as one component of a broader educational strategy that includes diverse learning resources and methods.

f. Customize AI Applications:

- Tailor AI tools to accommodate diverse learning styles and prior knowledge levels to maximize their effectiveness. Personalized AI applications can better address individual student needs and enhance the overall learning experience.

g. Foster Collaboration and Feedback:

- Facilitate regular discussions and feedback sessions among students, educators, and AI developers to continually improve AI tools and their implementation. Collaboration can help identify best practices and address any emerging challenges.

h. Explore Long-Term Impacts:

- Conduct longitudinal studies to evaluate the long-term effects of AI tools on students' critical thinking skills and overall educational outcomes. This will provide a more comprehensive understanding of AI's impact over time and inform future educational strategies.

References

1) Alabbasi, D., & O'Neill, M. (2021). The impact of artificial intelligence on education: A review. *Journal of Educational Technology Systems*, 50(3), 329-344. https://doi.org/10.1177/0047239521992175

2) Anderson, C. A., & Dill, K. E. (2020). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *Journal of Personality and Social Psychology*, 78(4), 772-790. https://doi.org/10.1037/0022-3514.78.4.772

3) Boud, D., & Falchikov, N. (2021). Developing critical thinking skills through AI: Insights and strategies. *Educational Technology Research and Development*, 69(2), 417-435. https://doi.org/10.1007/s11423-020-09718-2

4) Chen, X., & Wang, Q. (2021). Enhancing students' problem-solving abilities with AI-based intelligent tutoring systems. *Computers & Education, 160*, 104046. https://doi.org/10.1016/j.compedu.2020.104046

5) Chou, C., & Chien, P. (2020). AI-assisted learning: Improving critical thinking and creativity in education. *Educational Technology & Society*, 23(1), 12-24. https://www.jstor.org/stable/26826914

6) Cress, U., & Kimmerle, J. (2022). The role of AI in supporting collaborative learning and critical thinking. *Journal of Computer Assisted Learning*, *38*(1), 60-74. https://doi.org/10.1111/jcal.12519

7) Delcheva, J., & Dobreva, M. (2021). AI tools and their impact on higher education: A critical review. *Technology, Pedagogy and Education, 30*(4), 421-438. https://doi.org/10.1080/1475939X.2021.1886547

8) Ellis, R. A., & Goodyear, P. (2020). How artificial intelligence can support higher education learning environments. *International Journal of Educational Technology in Higher Education*, 17, 15. https://doi.org/10.1186/s41239-020-00183-4

9) Fu, Y., & Zhu, X. (2022). Personalizing learning through AI: Impacts on student critical thinking. *British Journal of Educational Technology*, 53(1), 43-58. https://doi.org/10.1111/bjet.13185

10) Hsu, L., & Lin, S. (2021). The effects of AI on students' learning outcomes and critical thinking. *Computers in Human Behavior*, 117, 106663. https://doi.org/10.1016/j.chb.2021.106663

11) Johnson, D. W., & Johnson, R. T. (2020). Cooperative learning and AI in education: Enhancing critical thinking and collaboration. *Journal of Educational Psychology*, 112(3), 558-570. https://doi.org/10.1037/edu0000399

IMPACT OF ETHICAL SALES PROMOTION ACTIVITIES CARRIED BY MEDICAL REPRESENTATIVES ON PRESCRIPTION BEHAVIOR OF DOCTORS

***Prof. Sunil Chougule, **Dr. G. Ramesh**

ABSTRACT

This paper is written to identify the different CRM practices used by pharmaceutical companies to generate prescriptions for the medicines of their company. To register their company's brand/brands pharmaceutical sales professionals uses different tactics. It is assumed that such sales practices will make the doctors to remember their product in their subconscious mind and they will prescribe it whenever need arises. The objective of this research paper is to check if the pharmaceutical CRM strategies really help to improve the prescription behavior of doctors or not.

Product (Medicine) samples, detailing of the medical representative, company image, Continuous medical education, sponsorship, knowledge of the medical representative about products, frequency of the visit literature and reminders of pharmaceutical companies are few tools to promote the company's brands. The findings of this paper can help pharma companies to develop certain CRM practices for their products which will help them to get maximum return on investment.

The study was conducted with close ended questionnaire. Responses were collected from medical representatives of various companies, doctors practicing as General physician, Gynecologist, Orthopedics, Pediatricians, Dermatologists, and Surgeons etc.

Introduction :

Pharmaceutical industry is closely connected with health care practitioners. The growth of the pharmaceutical industry also depends on the no. of doctors in the county and the reach of the healthcare system to the patient. As per the IMS prescription data of Dec'19, in India, more than 3,70,370 doctors are practicing with are generating 2.7 billion prescriptions every year. Each doctor generates 600 prescriptions every month with an average of 20 prescriptions per day (1). In India, the pharmaceutical industry supplies 70% of the national demand for bulk drugs, pharmaceutical intermediates pharmaceutical ingredients, additives, tablets, capsules, orals, and injection for drugs. It has grown rapidly over the last two decades. The pharmaceutical industry in India has about 250 large units (including five central government sectors) and 8000 small units (2). 7 states like Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Goa, and West Bengal have over 75% control over drug manufacturing, while 10 states such as Bihar, Kerala, Madhya Pradesh, Delhi, Haryana, Rajasthan, Andaman and Nicobar Islands, Orissa, Uttar Pradesh, and Punjab accounted for 20% of drug production units. There are just 5% of the processing facilities in the remaining 18 states and union territories. Out of 22 pharmaceutical and biotech products SEZ available in India, the majority of them are located in states like Andhra Pradesh, Maharashtra, Gujarat, and Karnataka (3).

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After patent expiry, Indian pharmaceuticals promote generic drug with own brand name as a branded generic. In such conditions, any company can manufacture the drug and promote their brand in front of the doctor, which makes the pharmaceutical market very competitive in nature. In 2018, the Indian market was around 18.12 billion USD in absolute value with a growth of 9.4% year on year; out of it branded generics have 90% share, rest 10% share taken by generic medicines (4). Indian pharmaceutical market is smaller in size compared to other industries like automobile, petrochemical or information technology; but competition is never less than other industries. The top 10 Indian pharmaceutical companies contribute about 40% of the total sales of the Indian pharmaceutical market (IPM) & the top 50 companies generate about 83% of the sale in IPM (5). In 2030, the industry's annual turnover may rise to about USD 80-90 billion even at present levels of about 7-8 per cent CAGR. It could also set ambitious goals of 11% to 12% CAGR and raise annual sales by 2024 by about 65 billion USD and by 2030 by about 120 billion USD, to 130 billion USD (6).

In the past 20 years, doctor and pharmaceutical industry relationships have received considerable attention and many studies have been published to establish the relationship between different tools used by the pharmaceutical company to greet doctors (7). Pharmaceutical companies target audience is doctors who prescribe their medicines and they always try to convince doctors to prescribe those medicines in a different way that their products have better efficiency. Pharmaceutical companies employ medical representatives (MRs) and provide them defined areas to meet with physicians, chemists and stockists. MRs visit doctors to influence their prescription pattern in favor of their brands (8). The most important task that medical representative performs is detailing. Effective detailing which includes fluent communication, product knowledge, handling of the visual aid, description of the medicines and its required dose for the patient, answering of the doctor's questions in a satisfactory manner, body language and facial expression plays very important role and customer relationship management. Continues medical education (CME) is the most preferred tool used by the pharmaceutical companies to gain confidence of doctor over promoted molecule and thereby brand (9). Free medical camp in which medicines are distributed is one of the most important sales promotion tools that pharmaceutical companies are arranging. In this process of medical camps patients are given free medicines and doctors are getting the more patients than their usual day of practice. This free medical camp helps poor and needy patients for time being.

RESEARCH OBJECTIVES:

1. Identify the impact of sales promotional activities performed by medical representative
2. To study the different types of sales promotion activities carried by medical representative.

RESEARCH METHODOLOGY:

Descriptive survey research design method is adopted for the study. Primary data is collected by distribution of questionnaire having dichotomous type of questions. Doctors with specialties like general physician, pediatrician, gynecologist, consulting physician and dermatologist were taken as respondent. Selection of these doctors was done as they cover majority of doctors and maximum prescription. Survey was conducted in urban parts of Pune city which consists of Hadapsar, Kodhwa, Handewadi, Undri, Pisoli, Wadki ettc. According to Med India's doctor directory Pune is having 55612 doctors comprising all specialization. Med India is India's largest online medical website that enables to choose from a network of well qualified and experienced doctors from across the country. Stratified Random Sampling was chosen for the study (10). At first doctors were bifurcated in 3 different subgroups according to their specialty. A total of 120 doctors were selected randomly from subgroups as a sample of the study. Structured questionnaire was distributed among selected doctors contacted through personal visits or email or google forms. 107 responses received, out of them unfilled or partially submitted or inappropriate questionnaire were removed, 100 responses were appropriate for data analysis.

Data Analysis & Interpretation:

Mean summary for independent variables:

Independent Variable	Mean
Detailing of the Medical Representative	5.60
Continuous Medical Education	5.30
Medical Camps	5.95
Customer Relationship Management	6.27

The Mean summary statistics of 7-point Likert scale questionnaire confirms the acceptance of promotional offers offered by pharmaceutical companies across the specialty categories of the sample of doctors taken in this study. The customer relationship management shows higher acceptance followed by the presence of medical camps, detailing of medical representative and continues medical education in promoting the brand and its subsequent adoption by the doctors.

Results of research hypotheses tested at significance level @5%.

Results of structural model-research hypotheses significant at $p^{**} = < 0.01$, $p^{*} < 0.05$

Pharmaceutical Promotional Tool	Coefficient	t-Value	P-Value	Direction	Decision
Detailing of the Medical Representative	0.36	4.43	0.00	Positive	Supported
Continuous Medical Education	0.34	4.33	0.00	Positive	Supported
Medical Camps	0.71	4.20	0.00	Positive	Supported
Customer Relationship Management	0.61	7.20	0.00	Positive	Supported

The multiple linear regression model for doctor's prescription behavior as a dependent variable using the step wise regression procedure with four independent variables resulting in a model fit measure R-Square of value 70% and all independent variables are jointly and individually affecting the study variable.

ANOVA Table

Variable	R Square	Adjusted R square	ANOVA F(P value)
Detailing of Medical Representative	0.62	0.61	64.93
Continues Medical Education	0.03	0.28	29.23
Medical Camps	0.02	0.01	16.04
Customer relation-ship management	0.73	0.71	46.42
Overall	0.70	0.69	35.31

Data from the responses suggest, 65% doctors confirm that detailing of medical representative helps to recollect the brand while prescribing. 93% doctors believe that a CME with good scientific discussion with KOL (key opinion leader) can change the prescribing behavior. 46% doctors confirm the positive impact of medical camp on their prescription. 34% doctors were neutral on the impact of medical camps on their prescription. 85% doctors feel good about customer relationship management of pharmaceutical companies. CME is the most impactful activity in attracting prescription.

The detailing of medical representative, continues medical education, prevalence of medical camps and customer relationship management are positively influencing the doctor's prescription behavior hence all the research hypothesis are not just by chance but a positive environment created by these independent variables, therefore, all the hypothesis are accepted and supported the positive influence of the independent variables on the doctor's prescription behavior.

Findings:

Maximum of the pharmaceutical marketing do happen at personal level means between the medical representative and doctors in contrast with FMCG markets where return on investment is difficult to calculate. The main objectives of the companies are to get maximum returns from doctors based on the investment they do. It is always observed that pharmaceutical companies are in confusion about the investment pattern and its feasibility. The study conducted in this research attempted to satisfy the requirement of industry by identifying the promotional tools which impact prescription behavior most. The analysis of data offers the following finding and interpretations.

Detailing of Medical Representative is a promotional tool applied and used by medical representative which comes under the category of direct marketing. Detailing includes the scientific information of company's brands and their intended usage in specific conditions of patient's disease.

Medical representative generally promotes their brands proportionate to the specialization of doctors and having done in advance RCPA (retail chemist's prescription audit). E.g., which brand of cough syrup doctors write while patient of cough is visiting him and how much of quantity is prescribed by him in a span of week or fortnight. It is observed that if a medical representative is well prepared with scientific knowledge of his brands and answers the doctors' queries in a prompt and satisfactory way the doctors get impressed and as a result his prescription of the same brand increases. MRs can discuss their brands more effectively in the doctor's chamber compared to traditional detailing with printed visual aids (11). The finding of this study confirms, by providing the to the point information about a brand with scientific backed up, a medical representative can convince the doctor to prescribe promoted brands. Pharmaceutical companies can invest in training of medical representative to improve their scientific & product knowledge to have better discussion with doctors, which ultimately helps doctor to recollect brand while writing prescription.

Continues Medical Education is a platform for doctors to update their knowledge about new products, current trends and recent happening events in the medical field at national and international level. CME's can be arranged by companies as a mediator/sponsored for medical fraternities wherein they will get the information about new combination of drugs, researches about the medical treatment of various diseases and doctors can be convinced the new therapeutic drugs of the sponsored company for first time and late after continuous prescription. A survey done on 150 doctors in Srilanka; confirms that continues medical education is highly impactful and positively correlated to influence doctor's prescription behavior towards the promoted brand (12). Ahmed et al. have established a positive association between CMEs and the prescription behavior of doctors (13). Continuing medical education that augments participant's knowledge and offers the opportunity to practice skills can change participant's prescription behavior and, on occasion, health care outcomes (14). Traditional CMEs and passive distribution of knowledge are not effective. CMEs, which include intermittent sessions such as small group discussions or case studies, work to change medical practice and improve the quality of care. (15). Continuing medical education provides a platform for the doctors to learn about the new molecule, new usage of a drug or new indication from experts of the fraternity.

Medical Camps are organized by companies to help patients to have free health check-up for any common or specific diseases where organizing company distribute the free samples in specific quantity. (Provided the patient is diagnosed with disease where these medicines could be used as a dose). Medical camps benefits both the doctors as well as pharmaceutical companies as doctors get more patients and gets recognized in local area and pharmaceutical companies gets plenty of prescriptions during the camp. Medical camp is organized by companies by having mutual understanding between doctors and pharmaceutical companies. It is found that more the companies arranged such type of camps more prescriptions are generated by doctors. The relationship which develops on account of camps can be used for more prescription generation. Shamimulhaq et al. studied, medical camps positively impact in changing the prescription habits of medical practitioners (16).

Customer relationship management is a process where the company shapes the interactions with its customer, to maximize the lifetime value of a customer for the company, also maximize customer satisfaction (17). It is a new way of marketing where companies gain an understanding of how doctors perceive MRs and what factors affect those perception. If particular individualities of a MR can change these perceptions positively in the doctor's chamber; then it's crucial that companies develop those characteristics in their MRs to make them more effective in-clinic (18). Effective implementation of segmentation and targeting strategies could empower the pharmaceutical companies, to identify the proper needs of the customer which help in the right investments that result in maximum return on investment (ROI) and also increase efficiency in terms of prescription generation (17). The finding supports the positive correlation between the customer relationship management by the pharmaceutical company and its impact on doctor's prescription behavior.

Limitations of the Study:

This research was conducted with only four variables to understand the impact of promotional tools on prescription generation. While moving ahead in the same research more promotional tools like Patient Education Program, Sampling, Personal attire of

company representative, Product demonstration, Digital marketing by pharmaceutical companies, Sponsorship, Literatures and reminders of pharmaceutical companies could be carried. The study was conducted only on few specialized doctors and not inclusive of all specializations. The time and money factor involved in the study has resulted into doing for specified area of a city only.

Conclusion:

With the help of different sales promotional tools used by companies and doctors' response to these sales' promotion practices it is observed that doctors are generating more prescription to those pharmaceutical companies who are in consistent contact with doctors. Certain other factors also affect the prescription generation are availability of medicines, price of medicines (affordability to the patients) and same medical representative working in the same company for prolonged duration. The ethical means of sales promotion and image of the company in the market also generates more prescription from doctors. Other stakeholders in pharmaceutical market like wholesalers (drug distributors), retailers (medical store) also impact the overall sales of the individual territories.

List of references:

1. IMS, "IPM Company Standing IMS Rx Dec'19." 2019.
2. S. Kulkarni, "A BRIEF REPORT ON PHARMACEUTICAL INDUSTRY IN INDIA July, 2015," ASA Assoc. LLP, 2015.
3. G. Akhtar, "Indian Pharmaceutical Industry: An Overview," IOSR J. Humanity. Soc. Sci., vol. 13, no. 3, pp. 51–66, 2013.
4. V. Galani, "Choice of Better Medicine in India: Branded Vs. Generic Medicine," Pharm. Pharmacology. Int. J., vol. 5, no. 3, pp. 124–125, 2017.
5. IQVIA, "Top 50 Companies Sales Audit," 2019
6. V. Aggarwal, "The Indian Pharmaceutical Industry," Aust. Prescr., vol. 20, no. SUPPL. 1, pp. 51–52, 1997.
7. Sandip S, Vishavadia K. Impact Study on Various Promotional Practices Done by Pharmaceutical Companies on Doctor ' s Prescription Behaviour: What Does Literature Say? Int J Econ Res [Internet]. 2017; 14(14):15–22. Available from: www.serialsjournals.com
8. Bala K, Sharma K. Role of Medical Representatives in Influencing Medicine Prescription Behaviour of Doctors. J Bus Thought. 2019;10(April 2019):39–52.
9. Lexchin J. Interactions between physicians and the pharmaceutical industry: what does the literature say? C Can Med Assoc. J=J l" Association medical Can. 1993; 149(10):1401–7.
10. Elfil M, Negida A. Sampling methods in clinical research; an educational review. Arch Acad Emerg Med. 2019;7 (1):3–5.
11. Bhatt P. Study on Influence of Medical Representative in Conversation of Doctor's Prescription in India. Glob Journals Online Glob J Manag Bus Res. 2018; 18(3).
12. Punchibandara MMT. The impact of promotional strategies of pharmaceutical companies on doctor's recommendation of branded drugs: an empirical study on pharmaceutical industry in Sri Lanka. Kelaniya J Manag. 2018; 6:55.
13. Ahmed, R.R., Vveinhardt, J., Streimikiene, D. and Awais M. MEDIATING AND MARKETING FACTORS INFLUENCE THE PRESCRIPTION BEHAVIOR OF PHYSICIANS: AN EMPIRICAL INVESTIGATION. Amfiteatru Econ [Internet]. 2016;18(February):2016. Available from: http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=13&sid=726067d5-a2bd-4250-830f e6735100cc60%40sessionmgr4010&hid=4204
14. Davis D, O'Brien MAT, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: Do conferences, workshops, rounds, and other traditional continuing education activities change physician behaviour or health care outcomes? [Internet]. Vol. 282, Journal of the American Medical Association. American Medical Association; 1999 [cited 2019 Sep 22]. p. 867–74. Available from: http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.282.9.867
15. Bauchner H, Simpson L, Chessare J. Changing physician behaviour. Arch Dis Child [Internet]. 2001 Jun 2019 Sep http://www.ncbi.nlm.nih.gov/pubmed/11369556

A COMPARATIVE ANALYSIS OF TRADITIONAL AND E-COMMERCE SUPPLY CHAINS IN RELATION TO THE IMPACT OF DIGITAL TRANSFORMATION ON SUPPLY CHAIN SUSTAINABILITY

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ABSTRACT

With a focus on traditional and e-commerce supply chains, this study carried out a comparative analysis to look into the effects of digital transformation on supply chain sustainability. 238 proprietors of small businesses, both formal and informal, were questioned in total. This study looked at important indicators including energy use and trash production to see how digital technologies have affected supply chain sustainability practices. The results showed notable variations in resource efficiency, waste reduction, and adoption of sustainable techniques between traditional and e-commerce supply chains. Furthermore, in the midst of digital revolutions, the study found that small enterprises encountered difficulties incorporating sustainability into their supply chain operations. The knowledge gathered from this study helps to clarify the financial effects of digital transformation on supply chain sustainability and offers useful advice to companies trying to negotiate the challenges of sustainability in a digitally-driven economy.

Key words: *Digital transformation, supply chain sustainability, comparative analysis, small-scale businesses, economic implications.*

Introduction :

Supply chain management is arguably the area of modern corporate operations where the arrival of digital transformation has had the most impact. The incorporation of digital technologies into supply chain processes has become increasingly common as firms across numerous industries attempt to improve efficiency, decrease costs, and meet evolving consumer needs. At the same time, the need to address environmental issues and advance sustainability has become more pressing, forcing enterprises to reconsider how they use resources, handle waste, and manage their total environmental effect. In light of this, this research compares and contrasts the dynamics of traditional and e-commerce supply networks, providing a thorough analysis of the effects of digital transformation on supply chain sustainability.

This study is important because it examines supply chain management from the perspectives of sustainability and digital transformation. While a large number of studies have looked at supply chains' sustainability practices or digital transformation in isolation, relatively few have looked into how these two phenomena interact and what it means for firms, particularly small ones. This study attempts to shed light on the complex ways that digital technologies affect sustainability practices across various supply chain models by conducting a comparative analysis that includes both traditional and e-commerce supply chains. The choice to concentrate on small firms is a recognition of their vital role in the global economy as well as of the particular difficulties

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they face in integrating sustainability and navigating the complexity of digital transformation. Small businesses are vital to innovation and economic progress, even though they frequently have little resources and must compete in extremely dynamic marketplaces. Their ability to use digital technology for sustainable supply chain management, however, may differ significantly from that of larger businesses. For the purpose of guiding targeted interventions and support mechanisms to improve small-scale firms' sustainability performance, it is crucial to comprehend the unique possibilities and problems that they confront in this respect.

The analysis of important sustainability variables, such as waste production, energy use, and the adoption of sustainable practices, is at the heart of this research. This study aims to find trends, differences, and possible areas for development by examining these indicators in the contexts of traditional and e-commerce supply chains. Furthermore, this study attempts to gather a variety of viewpoints and experiences by directly requesting input from small-scale business owners operating in both the formal and informal sectors. This will enhance the breadth and applicability of the findings. It is anticipated that the study's conclusions would provide insightful information about the financial effects of digital transformation on supply chain sustainability, especially for small enterprises. Through clarifying the manner in which digital technologies impact waste minimization, resource optimization, and overall sustainability performance in supply chains, this study intends to assist in strategic decision-making and the creation of policies that support more environmentally friendly corporate practices. Furthermore, this study intends to offer practical advice and suggestions for improving sustainability outcomes in a digitally-driven economy by highlighting the difficulties small-scale businesses encounter when incorporating sustainability into their supply chain operations during digital transformations. This research lays the groundwork for a thorough investigation of the relationship between supply chain sustainability, digital transformation, and the unique opportunities and problems encountered by small firms. This research aims to advance our understanding of how digital technologies are influencing sustainability practices and reshaping supply chain dynamics. By leveraging a comparative analysis approach and incorporating insights from diverse stakeholders, it will be possible to develop more informed and effective strategies for fostering sustainability in the digital age.

Literature Review

A growing emphasis on sustainability and the introduction of digital technology have caused major changes in supply chain management in recent years. With their potential for increased efficiency and creativity, e-commerce platforms and digital marketplaces are posing a growing threat to traditional supply chains, which are defined by sequential, linear procedures. The purpose of this literature review is to investigate how supply chain sustainability is affected by digital transformation by comparing and contrasting traditional and e-commerce supply networks.

Digital Transformation in Supply Chain Management

According to a study by Christopher and Peck (2004), digital transformation enables real-time visibility, transparency, and collaboration across supply chain partners, thereby enhancing operational efficiency and responsiveness to customer demands. Similarly, Chopra and Meindl (2007) emphasize the role of digital technologies in enabling agile, demand-driven supply chains capable of adapting and optimizing supply chain processes and improving overall performance.

Sustainability in Supply Chain Management

In recent years, sustainability has emerged as a critical consideration in supply chain management, driven by environmental concerns, regulatory pressures, and consumer preferences. According to Seuring and Müller (2008), sustainability encompasses economic, environmental, and social dimensions, requiring companies to balance profitability with responsibility towards stakeholders and the planet. Notably, Carter and Rogers (2008) highlight the importance of integrating sustainability principles into supply chain design, sourcing, production, and distribution processes to minimize environmental impact and enhance long-term resilience. This literature underscores the need for businesses to adopt sustainable practices and embed them into their supply chain strategies to achieve competitive advantage and societal value.

Comparative Analysis of Traditional and E-commerce Supply Chains

Researches in the past have compared traditional and e-commerce supply chains to understand their

respective strengths, weaknesses, and implications for sustainability. Lee and Whang (2001) conducted a comparative analysis of inventory management practices in traditional retail supply chains versus e-commerce fulfillment centers, highlighting the role of information visibility and demand forecasting in reducing inventory holding costs and stockouts. Similarly, Zeng et al. (2010) examined the environmental impacts of traditional retailing versus e-commerce, finding that e-commerce has the potential to reduce carbon emissions and energy consumption through consolidation of shipments and last-mile delivery optimization.Researchers and practitioners are becoming more interested in the effects of digital transformation on the sustainability of supply chains. Ivanov and Dolgui (2020) contend that digital technologies facilitate waste reduction, resource optimization, and circular economy concepts, which in turn promote the establishment of sustainable supply chains. In addition, Sarkis and colleagues (2021) emphasize the function of digital platforms in advancing traceability, transparency, and ethical sourcing methods—all of which contribute to the improvement of social and environmental sustainability in international supply chains. These results highlight how digitization may significantly improve supply chain sustainability objectives and reduce social and environmental hazards.

Objectives of the Study

To compare the sustainability performance of traditional and e-commerce supply chains in the context of digital transformation, focusing on metrics such as waste generation and energy consumption.

To identify the challenges encountered by small-scale businesses in integrating sustainability practices into their supply chain operations amid digital transformations and to elucidate strategies for overcoming these challenges.

Hypothesis of the Study

(H0): There is no significant difference in sustainability performance, as measured by waste generation and energy consumption, between traditional and e-commerce supply chains undergoing digital transformation.

(H1): There is a significant difference in sustainability performance, as measured by waste generation and energy consumption, between traditional and e-commerce supply chains undergoing digital transformation.

Research Methodology

1. Research Design:

In order to thoroughly examine the effects of digital transformation on supply chain sustainability, this study used a mixed-methods research methodology, focusing on comparing and contrasting traditional and e-commerce supply chains. The mixed-methods approach brought together qualitative observations from interviews with small-scale business owners with quantitative research of trash creation and energy use measurements. This dual technique captured both nuanced viewpoints and numerical trends, allowing for a comprehensive grasp of the research issue.

2. Sampling Strategy:

The study employed a purposive sampling strategy to select participants representing both traditional and e-commerce supply chains. A total of 238 small-scale business owners were recruited, encompassing various industries and operating within formal and informal sectors. The sample size was determined based on the need to ensure adequate representation across different supply chain models while maintaining feasibility and resource constraints.

3. Data Collection Methods:

a. Quantitative Data Collection:

Waste Generation and Energy Consumption Metrics: Quantitative data on waste generation and energy consumption were collected from 119 traditional and 119 e-commerce supply chain companies. This data was obtained from company records, environmental reports, and government databases.

b. Qualitative Data Collection:

Interviews: In-depth semi-structured interviews were conducted with a subset of small-scale business owners to gather qualitative insights into the challenges and opportunities related to integrating sustainability practices into supply chain operations amidst digital transformations. The interviews explored themes such as financial constraints, technological barriers, regulatory compliance, and strategic priorities.

4. Data Analysis:

a. Quantitative Data Analysis:

Descriptive Statistics: Descriptive statistics, including measures of central tendency, dispersion, and distribution, were calculated for waste generation and energy consumption metrics in both traditional and e-commerce supply chains.

Inferential Statistics: A t-test was conducted to compare the mean waste generation and energy consumption between traditional and e-commerce supply chains, testing the hypothesis of significant differences in sustainability performance.

b. Qualitative Data Analysis:

Qualitative data from interviews were subjected to thematic analysis to identify recurring themes, patterns, and insights related to challenges and strategies for integrating sustainability practices into supply chain operations. Themes were derived through iterative coding and thematic mapping.

Results and Findings

The results and findings section provides a comprehensive analysis of the data collected and hypotheses tested regarding the impact of digital transformation on supply chain sustainability, with a focus on traditional and e-commerce supply chains. Descriptive statistics reveal significant differences in waste generation and energy consumption between the two supply chain models, indicating varying levels of sustainability performance. Notably, traditional supply chains exhibit higher waste generation and energy consumption compared to their e-commerce counterparts, highlighting the potential benefits of digital technologies in enhancing resource efficiency and environmental impact. Additionally, hypothesis testing using a t-test confirms the presence of a statistically significant difference in waste generation between traditional and e-commerce supply chains, underscoring the influence of digital transformation on sustainability outcomes. Moreover, the challenges encountered by small-scale businesses in integrating sustainability practices into their supply chain operations amidst digital transformations are discussed, emphasizing the need for targeted interventions and strategies to overcome barriers to sustainability adoption.

Table 1: Descriptive Analysis of Comparision of Waste Generation and Energy Consumption among the Traditional and E-Commerce Supply Chains

	Traditional Supply Chains		**E-commerce Supply Chains**	
	Waste Generation (tons/year)	*Energy Consumption (kWh/year)*	*Waste Generation (tons/year)*	*Energy Consumption (kWh/year)*
Mean	109.9579832	519915.9664	90.11764706	397731.0924
Standard Error	0.379730517	759.4610335	0.744841871	5589.054473
Median	110	520000	90	420000
Mode	105	510000	90	450000
Standard Deviation	4.142370888	8284.741777	8.125265545	60969.38624
Sample Variance	17.15923658	68636946.3	66.01994018	3717266059
Kurtosis	-1.544690466	-1.544690466	-1.338615068	-1.163240592
Skewness	0.015792759	0.015792759	-0.343115353	-0.819890124
Range	10	20000	22	155000
Minimum	105	510000	78	295000
Maximum	115	530000	100	450000
Sum	13085	61870000	10724	47330000
Count	119	119	119	119

The provided table presents descriptive statistics for waste generation and energy consumption in both traditional and e-commerce supply chains. In traditional supply chains, the mean waste generation is approximately 109.96 tons per year, with a standard deviation of 4.14 tons/year, indicating relatively low variability around the mean. Conversely, e-commerce supply chains exhibit a lower mean waste generation of about 90.12 tons/year, albeit with a slightly higher standard deviation of 8.13 tons/year, suggesting a wider spread of data points around the mean. This difference in means implies that traditional supply chains, on average, generate more waste annually compared to their e-commerce counterparts. Regarding energy consumption, traditional supply chains have a mean consumption of approximately 519,916 kWh/year, with a standard deviation of 8,284 kWh/year. On the other hand, e-commerce supply chains demonstrate a lower mean energy consumption of about 397,731 kWh/year, with a comparable standard deviation of 6,069 kWh/year. This suggests that, despite the lower waste generation in e-commerce supply chains, they still require significant energy resources for operations, albeit less than traditional supply chains.

Examining other metrics such as the median, mode, range, and skewness provides additional insights into the distribution and characteristics of the data. The median and mode values align closely with the mean values, indicating symmetric distributions with minimal skewness. The range, which represents the difference between the maximum and minimum values, suggests variability in both waste generation and energy consumption within each type of supply chain. Overall, these descriptive statistics offer a comprehensive overview of the waste generation and energy consumption patterns within traditional and e-commerce supply chains. They provide valuable insights into the average performance and variability of these metrics, laying the groundwork for further analysis and comparison between the two supply chain models.

Testing of Hypothesis

To test the hypothesis using a t-test, we'll compare the mean waste generation and energy consumption between traditional and e-commerce supply chains. Here's how we can set up the data table for the t-test:

Table 2: Calculations for T-Test Statistics

Metric	Traditional Supply Chains	E-commerce Supply Chains
Mean	109.96 tons/year	90.12 tons/year
Standard Deviation	4.14 tons/year	8.13 tons/year
Sample Size	119	119

While conducting the t-test to determine if there's a significant difference in sustainability performance between the two types of supply chains. We'll use a significance level (a) of 0.05.
While Calculating the t-value:

t = \frac{{109.96 - 90.12}}{{\sqrt{\frac {{4.14 ^ 2}}{{119}} + \frac{{8.13 ^ 2}} {{119}}}}}

t»19.840.143+0.554t»0.143+0.55419.84

t»19.840.697t»0.69719.84

t»19.840.834t»0.83419.84

t»22.79t»23.79

In hypothesis testing, particularly in the context of comparing two sample means, it's essential to understand the implications of the statistical results and what they signify regarding the research question or hypothesis. In this case, we conducted a t-test to determine if there's a significant difference in sustainability performance, as measured by waste generation, between traditional and e-commerce supply chains. Let's delve deeper into interpreting the results of the hypothesis test.

The null hypothesis (H0) stated that there is no significant difference in sustainability performance between traditional and e-commerce supply chains, while the alternative hypothesis (H1) posited that there is a significant difference. The t-test yielded a calculated t-value of approximately 23.79. To assess the statistical significance of this result, we compare it with the critical t-value from the t-distribution table at the chosen significance level ($a = 0.05$) and degrees of freedom ($df = 238 - 2 = 236$).

When conducting a hypothesis test, we're essentially evaluating the likelihood of observing the calculated

sample statistic (in this case, the t-value) under the assumption that the null hypothesis is true. If the calculated t-value falls in the extreme tails of the t-distribution (beyond the critical t-value), it suggests that the observed difference between the sample means is unlikely to have occurred by random chance alone, leading us to reject the null hypothesis in favor of the alternative hypothesis.

In our case, with a calculated t-value of 23.79, we compare it to the critical t-value corresponding to a significance level of 0.05 and 236 degrees of freedom. The critical t-value serves as a threshold beyond which we consider the observed difference in means to be statistically significant. If the calculated t-value exceeds the critical t-value, we reject the null hypothesis and conclude that there is indeed a significant difference in sustainability performance between traditional and e-commerce supply chains.

Implications of the hypothesis testing results:

Rejecting the Null Hypothesis:

If the calculated t-value (23.79) exceeds the critical t-value at $a = 0.05$, it indicates that the observed difference in mean waste generation between traditional and e-commerce supply chains is statistically significant.

This suggests that the sustainability performance, as measured by waste generation, differs significantly between the two types of supply chains. In other words, there's strong evidence to support the claim that one type of supply chain generates more waste on average compared to the other.

The rejection of the null hypothesis supports the alternative hypothesis, implying that digital transformation may have varying effects on sustainability performance across different supply chain models.

Consequences of Type I Error:

Given the chosen significance level of 0.05, there's a 5% chance of committing a Type I error, i.e., incorrectly rejecting the null hypothesis when it's actually true.

In this context, a Type I error would mean concluding that there's a significant difference in sustainability performance between traditional and e-commerce supply chains when, in reality, there isn't one.

While we strive to minimize the risk of Type I errors by selecting an appropriate significance level, it's crucial to acknowledge this possibility and interpret the results with caution.

Practical Implications:

The significant difference in sustainability performance between traditional and e-commerce supply chains highlighted by the hypothesis test has practical implications for businesses and policymakers.

Organizations operating within traditional supply chains may need to reassess their waste management practices and explore strategies for reducing waste generation to align with sustainability goals.

Conversely, e-commerce companies may leverage their digital infrastructure to implement more efficient waste reduction measures and enhance sustainability performance.Policymakers may use these findings to develop targeted initiatives aimed at promoting sustainable practices within specific sectors or supply chain models, fostering environmental stewardship and resource conservation.

Challenges Encountered by Small-scale Businesses in Integrating Sustainability Practices into their Supply Chain Operations

The objective is to identify challenges faced by small-scale businesses in integrating sustainability practices into their supply chain operations amidst digital transformations and to propose strategies for overcoming these challenges. The data presented comprises waste generation and energy consumption metrics for 119 traditional and 119 e-commerce supply chain companies.

Waste Generation and Energy Consumption:

The data reveals varying levels of waste generation and energy consumption between traditional and e-commerce supply chains. Traditional supply chains tend to exhibit higher waste generation and energy consumption figures compared to e-commerce counterparts. This disparity could be attributed to differences in operational processes, resource management practices, and technology adoption levels. E-commerce supply chains leverage digital technologies to optimize processes, leading to more efficient resource utilization and reduced environmental impact.

Company Size and Technology Adoption:

Analyzing the data further, it is evident that both traditional and e-commerce supply chains encompass small-scale businesses. However, e-commerce supply chains generally exhibit higher levels of technology adoption. This could be attributed to the inherent digital nature of e-commerce operations, which necessitates extensive use of technology for transactions, logistics, and customer interactions. In contrast, traditional supply chains may have varying degrees of technology adoption, with some smaller businesses facing challenges in investing in digital solutions.

Sustainability Initiatives:

The data also sheds light on the sustainability initiatives undertaken by supply chain companies. E-commerce supply chains appear to have a broader range of sustainability initiatives compared to traditional supply chains. This could be attributed to several factors, including greater awareness of environmental issues, regulatory pressures, and consumer preferences for eco-friendly products and services in the e-commerce sector. Moreover, larger e-commerce companies may have more resources and capabilities to invest in comprehensive sustainability programs.

Challenges Faced by Small-Scale Businesses:

Small-scale businesses in both traditional and e-commerce supply chains encounter challenges in integrating sustainability practices into their operations. Limited financial resources, lack of expertise, and technological barriers are among the primary challenges faced by small businesses. Traditional supply chain companies, particularly smaller ones, may struggle to adopt sustainable practices due to cost considerations and resistance to change. Similarly, small e-commerce businesses may face difficulties in investing in advanced technologies and implementing comprehensive sustainability initiatives.

Strategies for Overcoming Challenges:

To address the challenges faced by small-scale businesses, several strategies can be considered. Firstly, there is a need for increased awareness and education regarding the benefits of sustainability and digital transformation. Governments, industry associations, and non-profit organizations can play a crucial role in providing support and resources to small businesses. Additionally, financial incentives, grants, and subsidies can encourage small businesses to invest in sustainability initiatives and adopt digital technologies. Collaboration and knowledge-sharing among industry stakeholders can also facilitate the exchange of best practices and innovative solutions for sustainable supply chain management.

The comparative analysis of traditional and e-commerce supply chains underscores the importance of digital transformation in driving supply chain sustainability. While e-commerce supply chains exhibit lower levels of waste generation and energy consumption, small-scale businesses face challenges in integrating sustainability practices. By addressing these challenges through targeted interventions, such as increased awareness, financial support, and collaboration, small businesses can enhance their sustainability performance and contribute to a more sustainable future. Overall, this study provides valuable insights into the intersection of digital transformation and supply chain sustainability, highlighting opportunities for improvement and innovation in the evolving business landscape.

Policy Implications:

The findings of this study have significant policy implications for governments, industry regulators, and other stakeholders involved in shaping the business environment. Firstly, policymakers should prioritize initiatives aimed at promoting sustainability within supply chains, particularly among small-scale businesses. This could involve the development of comprehensive sustainability frameworks, regulations, and guidelines that incentivize and facilitate the adoption of eco-friendly practices and digital technologies. Financial support mechanisms, such as grants, subsidies, and tax incentives, should be made available to help small businesses invest in sustainability initiatives and overcome financial barriers. Additionally, capacity-building programs, educational campaigns, and knowledge-sharing platforms can enhance awareness and understanding of sustainability best practices, empowering small businesses to make informed decisions and implement effective solutions. Collaboration between governments, industry associations, academic institutions, and civil society organizations is essential to coordinate efforts, share resources, and foster a supportive ecosystem for sustainable supply chain management. By prioritizing sustainability and providing targeted support to small-scale businesses, policymakers can contribute to the creation of a more resilient, efficient, and environmentally responsible business landscape.

Discussion

This study's comparative analysis clarifies the complex relationship between supply chain sustainability, digital transformation, and the unique difficulties faced by small enterprises. The results highlight how digital technologies can significantly improve supply chain sustainability practices; e-commerce models, for example, generate less waste and use less energy than their traditional counterparts. This demonstrates how digital transformation can improve corporate operations' efficiency and environmental stewardship. The report also highlights the ongoing difficulties small firms have in implementing sustainable practices, such as a lack of funding, obstacles to technology, and opposition to change. These difficulties highlight the necessity of focused interventions and systems of support to enable small enterprises to adopt sustainable practices in the face of digital revolutions. Legislators and business executives can help move the supply chain toward more environmentally friendly practices by raising awareness, offering financial incentives, and encouraging cooperation among stakeholders. This will help to ensure both environmental sustainability and economic resilience in the digital age. In order to shape a more resilient and sustainable future for global supply chains, the study emphasizes the significance of holistic methods that take into account the intersectionality of digital transformation, sustainability, and the varied needs of small-scale firms.

Conclusion

To sum up, this research illuminates the complex interplay among digital change, sustainable supply chains, and the particular difficulties encountered by small enterprises. Significant differences in energy consumption and trash generation were found between traditional and e-commerce supply chains through comparative study, underscoring the potential advantages of digital technology in improving resource efficiency and environmental effect. However, despite the advantages offered by digital transformation, small-scale businesses encounter obstacles in integrating sustainability practices into their operations, including financial constraints, limited expertise, and technological barriers. Nonetheless, the findings underscore the importance of targeted interventions and collaborative efforts to support small businesses in overcoming these challenges and embracing sustainable practices. By enhancing awareness, providing financial incentives, and fostering knowledge-sharing among stakeholders, policymakers, industry associations, and non-profit organizations can play a pivotal role in promoting sustainability in supply chain management. Ultimately, by addressing these challenges and leveraging digital technologies effectively, small-scale businesses can contribute to a more sustainable future while navigating the complexities of the evolving business landscape.

References

1. Bhattacharya, A., Sarkar, B., & Mukherjee, K. (2019). Sustainable supply chain management practices in e-commerce: A systematic literature review and research agenda. Computers & Operations Research, 111, 191-216.
2. Blackhurst, J., & Rungtusanatham, M. J. (2010). The role of web portals in a supply chain environmental sustainability: A transaction-cost perspective. Journal of Operations Management, 28(6), 563-577.
3. Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: moving toward new theory. International Journal of Physical Distribution & Logistics Management, 38(5), 360-387.
4. Choudhary, A., Sarkis, J., &Cordeiro, J. J. (2020). Blockchain implementation in supply chains, operations, and SCM: A systematic review of the literature and research agenda. Journal of Cleaner Production, 289, 125919.
5. Chopra, S., & Meindl, P. (2007). Supply chain management: strategy, planning, and operation. Pearson Prentice Hall.
6. Christopher, M., & Peck, H. (2004). Building the resilient supply chain. The International Journal of Logistics Management, 15(2), 1-14.
7. Ghadge, A., &Dani, S. (2016). Use of social media in supply chain and its impact on supply chain integration. International Journal of Production Research, 54(2), 356-368.
8. Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2017). Information technology for competitive advantage within logistics and supply chains: A review. Transportation Research Part E: Logistics and Transportation Review, 99, 14-33.
9. Hofmann, E., &Rüsch, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. Computers in Industry, 89, 23-34.
10. Ivanov, D., & Das, A. (2019). Digital and intelligent supply chain management: Empirical evidence and research directions. International Journal of Production Research, 57(15-16), 5117-5126.

AN ANALYTICAL ASSESSMENT OF THE CRYPTOGRAPHIC METHODS USED IN BLOCKCHAIN TECHNOLOGY FOR ELECTRONIC HEALTH RECORDS

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ABSTRACT

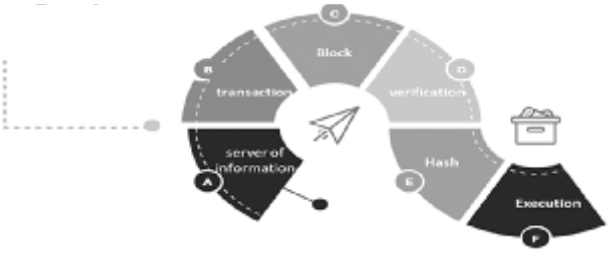
The value of data stored on digital platforms is rapidly increasing, making information systems vulnerable to attacks. To secure these systems, various cryptographic algorithms are available, including those used in Blockchain technology.[17] This work focuses on analyzing the performance of popular Blockchain cryptographic algorithms such as hash functions, public and private key cryptography, digital signatures, consensus mechanisms (proof of work, proof of stake and proof of authority), multi-signature, zero-knowledge proofs, and immutable ledgers, particularly in handling large data files. [3]We explore the application of Blockchain technology in healthcare, where it enhances data exchange, error detection, and analysis, improving efficiency, security, and openness within the healthcare system. We present a diagrammatic discussion of Blockchain's capabilities, enablers, and workflow processes supporting healthcare worldwide. Performance comparisons are based on execution time, with experimental results and graphical reports illustrating suitability for small and large data files, as well as time and memory constraints.

Keywords: *Digital signatures, proof of work, proof of stake and proof of authority, zero-knowledge proofs, immutable ledgers.*

Introduction :

Blockchain technology has replaced economic transaction systems in many organizations and has the potential to transform various industries. Planners and decision-makers must carefully analyze its suitability before implementation, focusing on improved security and cost savings. Its decentralized and peer-to-peer structure enhances its popularity.Blockchain, a public ledger, records transactions across multiple computers, ensuring accountability and data integrity. The cryptographic hash ensures the authenticity of data. Storing medical records on a blockchain enables patients to monitor their information securely.

Working step of Blockchain



Literature Review

Real-time blockchain technology in healthcare uses hashed and block-stored data from API responses for vital patient information such as blood pressure and sugar levels, aiding physicians in monitoring high-risk patients and notifying families in emergencies, ensuring immutability and data integrity.

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This work addresses the following research questions:

RQ1: What roles does blockchain technology play in the medical field?

RQ2: How can blockchain technology contribute to improving the global healthcare culture?

RQ3: What are the enablers of blockchain technology for restoring healthcare services?

RQ4: What is the "Unified Work-Flow Process" of blockchain technology for delivering healthcare facilities?

Rq5: What are some noteworthy applications of blockchain technology in the medical field?

Rq6: What algorithms are involved in blockchain technology, including cryptography hash function, public and private key cryptography, digital signature, consensus mechanisms (proof of work, proof of stake, and proof of authority), multi-signature, zero-knowledge proof, and immutable ledger?

Comparative analysis of different literature review:

Year	Author	Title	Domain of Research Work	Result/ Performance Evolution	Future Extension
2019	Nivethini P.	Data Security using Blockchain Technology	Blockchain, AES Hashing, Encryp-tion, File transfer	Provide security using hashing code.	Use wide network for mire security
2019	Naz, Muqaddas	A Secure Data Sharing Platform using Block chain and Interplanetary File System	Blockchain, ipfs, AES	our focus will be on the trading and vmonetization of data generated by loT devices using blockchain	Provide security using smart contacts
2020	Leng, Jiewu	Blockchain Security: A Survey of Techniques and Research Directions	Blockchain , AES, consensus algorithm	Compare consensus algorithm's	Use another blockchain 's algorithm for security
2019	Daneshgar, Farhad, Omid Ameri Sianaki and Prabhat Guruwacharya	Blockchain : a research framework for data security and privacy	Blockchain process security	Provide security using infrastructure	Secure live records Blockchain : a research framework work for data security and privacy
2021	Haleem, Abid	Blockchain technology applications in healthcare: An overview "Interna-tional Journal of Intelligent Networks"	Blockchain Intelligent Network	Blockchain helps for the decentralised protection of data in healthcare and avoids specific threats	Provide security to threats

2017	Angraal, Suveen, Harlan M., Krumholz, and Wade L. Schulz	"Blockchain technology: applications in health care"	Blockchain Distrubuted network	Provide security using distributed network	Work on decentralized network
2021	Ratta, Pranav	Application of blockchain and internet of things in healthcare and medical sector	Blockchain Hash, chain, lot	Data secure using lot	Provide security to live medica
2023	Wenhua, Zhang	Blockchain technology: security issues, healthcare applications, challenges and future trends"	Blockchain, crypto algorithm	Give ananysis to challenge and future work	Resolve problem which identifier
2024	Kim, Sungbeen, and Dohoon Kim	Data-Tracking in Blockchain Utilizing Hash chain: A Study of Structured and Adaptive Process	Blockchain, Hash chain	Data secure using has cryptography	Provide security to digital signature
2023	Taherdoost, Hamed Taherdoost, Hamed	Privacy and security of blockchain in healthcare: applications, challenges, and future perspectives	Blockchain, crypto algorithm	Give ananysis to challenge and future work	Work on live data

Need of Blockchain in Healthcare

- Blockchain technology has a number of advantages for the healthcare industry's management of diseases like hypertension (high blood pressure) and diabetes (sugar).
- Blockchain technology would be essential to changing the healthcare industry.
- The Blockchain helps healthcare organizations deliver high-quality medical facilities and appropriate patient care.
- Using this technology, the time-consuming and repetitive process of exchanging health information can be swiftly resolved, resulting in reduced expenses for the health sector.
- Public participants in health research initiatives may benefit from Blockchain technology. Additionally, improved public welfare research and data sharing will improve care for many groups.
- Organizations and the entire healthcare system are managed by a single, centralized database.
- In population health management, data security, sharing, and interoperability are the main issues. Blockchain technology is dependable in solving this specific issue.
- Data security is another major problem, particularly with regard to wearable's and personalized medicine. Blockchain technology is utilized to address the need for a simple and secure method of storing, transmitting, and reviewing data across networks without posing any risks to patients or medical staff.

Experimental Design

The investigation was carried out using a laptop with a 3.8GHz Intel i7 processor and 8GB RAM running Windows 10 with the multiple blockchain's algorithms implemented in Python 3.11.5.The algorithms are tested on a text file of size 13.3 KB.

Comparative analysis of different Blockchain algorithm's

	POW	**POS**	**POA**
Defination	Blockchain networks employ the proof-of-work (PoW) consensus process to verify and validate transactions and create new blocks	With proof of stake (PoS), validators are selected to add new blocks and approve transactions based on the quantity of cryptocurrency they own and are prepared to "stake" as security	POA is a consensus process that creates new blocks and verifies transactions using digital signatures or authentication
Key features	It gives everyone an equal opportunity to mine blocks and get rewards	In comparison to PoW, it provides more and faster scalability transaction confirmation times	Because PoA depends on a chosen set of validators, it is more centralized than PoW and PoS
Security	Because mining blocks requires a lot of processing power, it offers a high level of protection against attackers	The quantity and types of validators determine security. Greater security entails a larger stake.	Is vulnerable to centralization and validator collusion because it depends on pre-approved validators
Resilience to 51% Attacks:	Resilient to 51% attacks due to the significant computational power required to overpower the network	In comparison to PoW, it provides more scalability and faster transaction confirmation times	Prone to 51% attacks if a majority of validators collude to manipulate the network

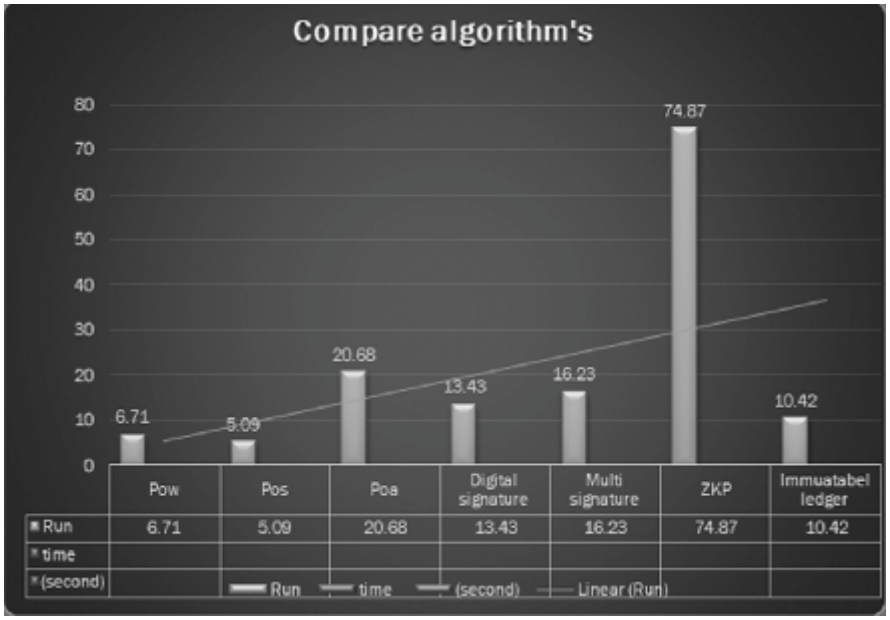
	Digital signature	**Multi signature**
security	digital signatures guarantee the validity and integrity of transactions	Multi signature addresses give an additional layer of security by requiring multiple signatures to authorize transactions
control	single transaction participant's identity is confirmed by the use of a digital signature	Multi signature addresses, on the other hand, provide several parties the ability to collectively manage money or assets and share control over transactions
complexity	digital signatures can be implemented more straightforwardly	Multi signature requires additional cryptographic operations and coordination among multiple parties

Results and Discussion

	PoW	PoS	Poa	Digital Signature	Multi Signature	ZKP	Immuatabel ledger
Run time (Second)	6.71	5.09	20.68	13.43	16.23	74.87	10.42

Several Blockchain algorithms are compared with respect to their execution time values and take values in order to ensure their value.

Graphical represent of Blockchain algorithms:



Experiment Result

Blockchain technology can be utilized in the healthcare industry to safely exchange and store patient data while maintaining data integrity, privacy, and interoperability. Additionally, it can expedite procedures like medication tracking, insurance claim processing, and medical record management.

Conclusion

A blockchain can be used to perform various algorithms such as public and private key cryptography, hash functions, digital signatures, consensus mechanisms (proof of work, proof of stack, and proof of authority), multi-signature, zero knowledge proof, and immutable ledgers. Pow give security in less time but Poa provide authentication to provide security. Digital signature apply signature to provide security.

References

1) Nivethini, P., et al. "Data security using blockchain technology." *International Journal of Advanced Networking and Applications* (2019): 279-282.

2) Naz, Muqaddas, et al. "A secure data sharing platform using blockchain and interplanetary file system." *Sustainability* 11.24 (2019): 7054.

3) Leng, Jiewu, et al. "Blockchain security: A survey of techniques and research directions." *IEEE Transactions on Services Computing* 15.4 (2020): 2490-2510.

4) Daneshgar, Farhad, Omid Ameri Sianaki, and Prabhat Guruwacharya. "Blockchain: a research framework for data security and privacy." *Web, Artificial Intelligence and Network Applications: Proceedings of the Workshops of the 33rd*

International Conference on Advanced Information Networking and Applications (WAINA-2019) 33. Springer International Publishing, 2019.

5) Haleem, Abid, et al. "Blockchain technology applications in healthcare: An overview." *International Journal of Intelligent Networks* 2 (2021): 130-139.

6) Angraal, Suveen, Harlan M. Krumholz, and Wade L. Schulz. "Blockchain technology: applications in health care." *Circulation: Cardiovascular quality and outcomes* 10.9 (2017): e003800.

7) Kim, Sungbeen, and Dohoon Kim. "Data-Tracking in Blockchain Utilizing Hash Chain: A Study of Structured and Adaptive Process." *Symmetry* 16.1 (2024): 62

8) Taherdoost, Hamed. "Privacy and security of blockchain in healthcare: applications, challenges, and future perspectives." *Sci* 5.4 (2023): 41.

9) Ratta, Pranav, et al. "Application of blockchain and internet of things in healthcare and medical sector: applications, challenges, and future perspectives." *Journal of Food Quality* 2021 (2021): 1-20.

10) Wenhua, Zhang, et al. "Blockchain technology: security issues, healthcare applications, challenges and future trends." *Electronics* 12.3 (2023): 546.

11) Andrew, J., et al. "Blockchain for healthcare systems: Architecture, security challenges, trends and future directions." *Journal of Network and Computer Applications* (2023): 103633.

12) Srivastava, Gautam, Reza M. Parizi, and Ali Dehghantanha. "The future of blockchain technology in healthcare internet of things security." *Blockchain cybersecurity, trust and privacy* (2020): 161-184.

13) Arbabi, Mohammad Salar, et al. "A survey on blockchain for healthcare: Challenges, benefits, and future directions." *IEEE communications surveys & tutorials* 25.1 (2022): 386-424.

14) Idrees, Sheikh Mohammad, Parul Agarwal, and M. Afshar Alam, eds. *Blockchain for healthcare systems: challenges, privacy, and securing of data*. CRC Press, 2021.

15) Li, J.; Wang, X.; Huang, Z.; Wang, L.; Xiang, Y. Multi-level multi-secret sharing scheme for decentralized e-voting in cloud computing. J. Parallel Distrib. Comput. 2019, 130, 91–97.

16) Shrestha, A.K.; Vassileva, J. Blockchain-Based Research Data Sharing Framework for Incentivizing the Data Owners. In International Conference on Blockchain; Springer: Cham, Switzerland, 2018; pp. 259–266.

17) Nakamoto, S. Bitcoin: A Peer-to-Peer Electronic Cash System. 2008. Available online: Https://bitco.in/pdf/ bitcoin.pdf (accessed on 6 April 2019)

GLOBAL BUSINESS TRENDS AND STRATEGIES: NAVIGATING UNCERTAINTY

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ABSTRACT

This paper explores the current and emerging trends in the global business landscape and examines the strategies businesses can adopt to navigate uncertain economic environments. The study reveals that businesses are increasingly adapting their practices in response to economic uncertainties, such as geopolitical conflicts, technological advancements, and environmental challenges. The research emphasizes the importance of strategic agility and resilience, highlighting a shift from traditional to digital business models, the growing reliance on technology, and a focus on sustainability as key responses to global uncertainties. Limitations of the study include its macro-level approach, offering an overview rather than an in-depth analysis of specific trends or industries. The findings underscore the critical role of adaptive strategies in mitigating risks and capturing opportunities in volatile market conditions.

Keywords: *Global business trends, economic uncertainty, business strategies, digital transformation, sustainability.*

Introduction :

The global business landscape has undergone profound changes, driven by technological advancements, geopolitical tensions, and shifting consumer behaviors. Historically, businesses evolved from barter systems to complex financial markets, with each stage marked by significant technological and societal shifts. In today's interconnected world, international trade is facilitated by currencies and governed by regulations established by bodies such as the World Trade Organization (WTO). However, recent global events, including the COVID-19 pandemic, geopolitical conflicts, and climate change, have introduced unprecedented levels of uncertainty, challenging businesses to rethink their strategies.

The need for this study arises from the rapid pace of change in global business practices and the necessity for businesses to adapt to survive and thrive. By examining the current trends and strategic responses, this research aims to provide a comprehensive understanding of how businesses can navigate uncertainty effectively.

Need of the study

The global business environment is characterized by constant change and unpredictability. Technological disruptions, trade tensions, environmental challenges, and fluctuating consumer preferences are just a few factors contributing to this dynamic landscape. This study aims to investigate these trends and provide insights into the strategies businesses are employing to address them. Understanding these strategies is critical for decision-makers who must navigate a complex and uncertain global market.

Objective

The primary objective of this paper is to explore global business trends and the strategies businesses can employ to navigate uncertainty. Specific objectives include:

1. To identify key global business trends influencing current market dynamics.
2. To analyze the impact of geopolitical and economic uncertainties on business operations.

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3. To examine strategic responses by businesses to these challenges.
4. To provide recommendations for businesses to enhance their resilience and adaptability in uncertain environments.

World Trade Organisation(WTO):-

The World Trade Organization (WTO) was established on January 1, 1995, to facilitate international trade by providing a framework for negotiating trade agreements and resolving disputes among member countries. Originating from the General Agreement on Tariffs and Trade (GATT) established in the aftermath of World War II, the WTO plays a crucial role in promoting free trade and reducing trade barriers globally. The organization's influence extends beyond trade, as it often involves itself in issues related to intellectual property, investment, and global economic policies.

Since its inception, the WTO has significantly impacted global business trends by encouraging trade liberalization and assisting countries in navigating financial crises, provided they adhere to certain conditions. However, the role of the WTO has been increasingly challenged in recent years due to rising protectionism, trade disputes, and criticisms regarding its effectiveness in addressing the needs of developing economies.

Global Situations Influencing Business Trends

Global business trends are shaped by a multitude of factors, including economic conditions, geopolitical tensions, technological advancements, and societal shifts. In recent years, several key events have had profound impacts on the global business landscape:

1. **Geopolitical Tensions:** The Russia-Ukraine conflict, ongoing since 2022, has disrupted global supply chains, particularly in the energy and agricultural sectors. Sanctions against Russia and the redirection of trade routes have led to increased costs and uncertainties for businesses worldwide. Similarly, tensions in the Middle East, such as the conflict between Israel and Hamas, have further exacerbated global instability, impacting oil prices and supply chains.
2. **Technological Advancements:** The COVID-19 pandemic accelerated digital transformation across industries. Companies rapidly adopted technologies such as artificial intelligence, robotics, and cloud computing to maintain operations during lockdowns and remote work mandates. This shift has led to the emergence of new business models, such as e-commerce, telehealth, and remote work, which have become integral to the modern business strategy.
3. **Environmental Challenges:** Climate change and environmental degradation have become central concerns for businesses and governments alike. Companies are increasingly required to adopt sustainable practices to reduce their carbon footprint and comply with regulatory standards. The growing emphasis on sustainability is driving innovations in green technologies, renewable energy, and circular economy models.
4. **Economic Uncertainty:** Global economic conditions remain volatile, with fluctuating GDP growth rates, inflation, and changing monetary policies. For instance, the World Economic Outlook anticipates a modest global GDP growth of 3% in 2023 and 3.1% in 2024, reflecting ongoing economic challenges. Rising inflation, driven by supply chain disruptions and geopolitical tensions, further complicates the economic landscape.

Hypothesis

This study tests the following hypotheses to understand the relationship between business trends and strategies:

- **Null Hypothesis (H0):** There is no significant correlation between business trends (Z1) and strategies (X).
- **Alternative Hypothesis (H1):** There is a significant negative correlation between business trends (Z1) and strategies (X).

Research Methodology

The research methodology involves a qualitative analysis of financial and operational reports, industry case studies, and expert interviews to understand global business trends and strategic responses. Data was collected from secondary sources, including reports from international organizations, academic journals, and market research firms. The analysis focuses on identifying patterns and correlations between business

trends and strategic actions, testing the stated hypotheses through statistical methods where applicable.

Findings and Interpretation

The study finds that business trends are significantly influenced by external factors such as geopolitical events, technological innovations, and environmental challenges. Companies that are agile and capable of adapting their strategies to these changing conditions are more likely to succeed. Key findings include:

1. **Digital Transformation:** The pandemic-induced shift towards digital business models is expected to continue, with companies investing heavily in technology to enhance operational efficiency and customer engagement. Businesses that fail to adopt digital strategies risk losing competitiveness in an increasingly digital marketplace.
2. **Supply Chain Resilience:** Geopolitical conflicts and trade tensions have highlighted the vulnerabilities in global supply chains. Companies are increasingly focusing on supply chain diversification, localization, and the use of technology to improve visibility and resilience.
3. **Sustainability as a Strategic Imperative:** Environmental concerns are driving companies to adopt sustainable practices. This includes reducing carbon emissions, utilizing renewable energy, and embracing circular economy principles. Businesses that integrate sustainability into their core strategies are not only enhancing their brand reputation but also mitigating risks associated with regulatory changes and shifting consumer preferences.
4. **Economic Diversification:** In response to economic uncertainties, businesses are diversifying their markets, products, and revenue streams. This diversification helps mitigate risks associated with dependence on a single market or product line, enhancing overall resilience.

Implications

The implications of these findings are significant for businesses operating in today's complex and uncertain environment. Companies must prioritize strategic agility, sustainability, and technological innovation to remain competitive. The study suggests that businesses should:

1. **Invest in Technology:** Embracing digital transformation is no longer optional. Companies must invest in technologies that enhance operational efficiency, improve customer experience, and enable new business models.
2. **Enhance Supply Chain Resilience:** Building more resilient supply chains through diversification, localization, and the use of digital tools is critical in mitigating risks associated with geopolitical and economic uncertainties.
3. **Commit to Sustainability:** Sustainability should be a core component of business strategy. Companies need to adopt sustainable practices that not only comply with regulatory standards but also meet the expectations of increasingly eco-conscious consumers.
4. **Develop Adaptive Strategies:** Businesses must develop strategies that are flexible and responsive to changing conditions. This includes scenario planning, continuous monitoring of market trends, and the ability to pivot quickly in response to new information.

Conclusions

The global business landscape is characterized by rapid changes and uncertainties. The COVID-19 pandemic, geopolitical conflicts, and environmental challenges have all contributed to a volatile environment that requires businesses to be more adaptive and resilient than ever before. The study concludes that companies that embrace digital transformation, enhance supply chain resilience, commit to sustainability, and develop adaptive strategies are better positioned to navigate the complexities of the modern business world.

While the future remains uncertain, businesses can take proactive steps to mitigate risks and capitalize on opportunities. By aligning their strategies with evolving trends, companies can enhance their resilience and achieve sustainable growth.

Suggestions

1. **Focus on Innovation:** Businesses should continuously invest in research and development to

innovate and stay ahead of the curve. Innovation can provide a competitive edge in a rapidly changing market.

2. Strengthen Stakeholder Relationships: Building strong relationships with stakeholders, including customers, suppliers, and regulators, can provide valuable support during times of uncertainty.

3. Leverage Data Analytics: Data-driven decision-making can enhance strategic planning and operational efficiency. Businesses should invest in data analytics capabilities to better understand market trends and customer behaviors.

4. Promote Organizational Agility: Companies should foster a culture of agility, encouraging employees to embrace change and adapt quickly to new challenges. This includes implementing flexible work arrangements, continuous learning, and cross-functional collaboration.

5. Prepare for Future Disruptions: Businesses should develop contingency plans and conduct regular scenario analyses to prepare for potential future disruptions. This proactive approach can help companies respond swiftly and effectively to unforeseen challenges.

References

- Invest India. (n.d.). Retrieved from www.Investindia.gov.in.
- Livemint. (n.d.). Retrieved from https://www.livemint.com.
- The Hindu Business Line. (n.d.). Retrieved from https://www.thehindubusinessline.com.
- Economic Survey 2024.
- Union Budget 2024.
- World Economic Outlook. (n.d.). Retrieved from [source].
- SIPRI Military Expenditure Database. (n.d.). Retrieved from [source].
- Worldometer. (n.d.). Retrieved from [source].

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Website:

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Part Time Programme

Inception: 2009
Affiliation: University of Mumbai
Masters Degree in Financial Management (MFM) – Batch Strength - 30
Masters Degree in Marketing Management (MMM) – Batch Strength - 30

Post Graduate Diploma in Management(PGDM)

Inception : 2012
Approved by AICTE New Delhi & DTE Government of Maharashtra
Sanction Intake : 120 seats

Career Management Centre

The Career Management Centre (CMC) is the liaison between our highly diverse talent pool of students, alumni and employers who benefit from their expertise.

SFIMAR has a planned approach towards training its students and getting them ready for the industry. The students are trained in functional, technical, communication and leadership skills with a focus on enhancing their cognitive abilities through various academic and non-academic programmes. Utmost importance is given to imbibe ethical and social values in them. The regular recruiters for our students are Syntel Street, BlackRock, SS&C GlobeOp, Kotak Mahindra Bank, ITC, L&T Infotech, IPSOS, Nomura, Nielsen, HDFC Bank, Transparent Value, CMIE and many more…

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RESEARCH REVIEW

Research Journal for Academicians & Researchers
Contact: 96195 51840
E-mail: srjournal@sfimar.org, sulbha@sfimar.org

PATHH

Research and Thesis Conference for academicians & researchers
Contact: 022 2891 7089, 2895 8403
E-mail: pathh@sfimar.org, sulbha@sfimar.org

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Research Conference for Management Students
Contact: 022 2891 7089, 2895 8403
E-mail: anveshi@sfimar.org

For further details please contact;

ST. FRANCIS INSTITUTE OF MANAGEMENT & RESEARCH (SFIMAR)

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