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EDITORIAL
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On behalf of the Global Academic Forum on Technology, Innovation, and Management (GAFTIM), we are delighted to present the first issue of the third volume of the International Journal of Computations, Information, and Manufacturing (IJCIM). This issue brings together an array of scholarly articles that explore the intersection of technology, information, and manufacturing, offering valuable insights into various aspects of contemporary research. In this issue, we have gathered thought-provoking articles that delve into key areas of interest and relevance in today's dynamic world. The featured articles cover a wide range of topics, encompassing emerging trends and challenges across multiple disciplines.

One of the primary concerns in healthcare is the effective utilization of big data analytics and machine learning. In this issue, you will find an in-depth analysis of the role of big data analytics and machine learning in healthcare, highlighting the potential for improved decision-making and patient outcomes. The advent of metaverse technology has revolutionized student engagement and academic performance. Our journal explores the impact of metaverse technology on education, shedding light on its implications for immersive learning experiences and enhanced student outcomes. Furthermore, the issue also addresses the significance of demand forecasting and big data in optimizing supply chain performance. It investigates the interplay between these factors, offering valuable insights into supply chain management and operational efficiency. In an increasingly digital world, risk management and information security in online operations are of paramount importance. This issue delves into the challenges and strategies associated with safeguarding online operations, emphasizing the significance of comprehensive risk management practices. Additionally, we examine the Technology Acceptance Model (TAM) and the attitude of consumers towards online shopping. By exploring consumers' perceptions and acceptance of online shopping platforms, these studies shed light on the factors influencing consumer behavior and preferences in the digital marketplace. Last but not least, the issue features an exploration of heart disease prediction accuracy using a hybrid machine learning approach. The article investigates the potential for utilizing machine learning techniques to enhance the accuracy of heart disease prediction, offering valuable insights into preventive healthcare strategies.

We express our heartfelt gratitude to the authors for their outstanding contributions to this issue. We also extend our appreciation to the esteemed reviewers for their meticulous evaluation and invaluable feedback, ensuring the quality and rigor of the published articles.

We hope that this volume of IJCIM will serve as a platform for knowledge dissemination, promoting interdisciplinary research and fostering advancements in the fields of technology, information, and manufacturing.

Editor-in-Chief
Prof. Haitham M. Alzoubi

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Big Data Analytics in Healthcare: Exploring the Role of Machine Learning in Predicting Patient Outcomes and Improving Healthcare Delivery

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A B S T R A C T

Healthcare professionals decide wisely about personalized medicine, treatment plans, and resource allocation by utilizing big data analytics and machine learning. To guarantee that algorithmic recommendations are impartial and fair, however, ethical issues relating to prejudice and data privacy must be taken into account. Big data analytics and machine learning have a great potential to disrupt healthcare, and as these technologies continue to evolve, new opportunities to reform healthcare and enhance patient outcomes may arise. In order to investigate the patient's outcomes with empirical evidence, this research was conducted using an online survey to incorporate healthcare professionals, patient's reviews, and clinical staff. The data were analyzed using SmartPLS 4.0 to predict the structural model. The findings revealed a direct impact as positive influence of using machine learning on healthcare performance and patient outcomes through big data analytics. Moreover, it is evident that this can lead to personalized treatment plans, early interventions, and improved patient outcomes. Additionally, big data analytics can help healthcare providers optimize resource allocation, improve operational efficiency, and reduce costs. The impact of big data analytics on patient outcome and healthcare performance is expected to continue to grow, making it an important area for investment and research

1. INTRODUCTION

Big data analytics has become increasingly important in healthcare as the amount of data generated by patients, healthcare providers, and medical devices has exploded in recent years. Healthcare organizations are using big data analytics to gain insights into patient health, improve clinical outcomes, and reduce costs. With the help of advanced analytics tools, healthcare providers can analyze large volumes of data to identify patterns, trends, and correlations that can help them make more informed decisions about patient care. This has the potential to transform healthcare by enabling more personalized treatment plans, predicting health risks, and improving the overall quality of care (Kambatla *et al.*, 2014). However, there are also significant challenges associated with big data analytics in healthcare, including data privacy and security concerns (Saeed, 2023), as well as the need to develop effective algorithms and models to make sense of the vast amounts of data generated by the healthcare industry.

However, machine learning —which is a typology of artificial intelligence (AI)— has become a powerful tool for predicting patient outcomes in healthcare (Ngiam and Khor, 2019). With the ability to analyze large volumes of patient data, machine learning algorithms can spot patterns and

connections that human analysts might not notice right away (Zhang *et al.*, 2021). Machine learning models can forecast the possibility that a patient will experience certain diseases or outcomes by examining patient data such as medical history, test findings, vital signs, and other variables (Javaid, et al. 2022). Healthcare professionals can utilize this data to create individualized treatment plans, make better decisions about patient care, and enhance clinical outcomes. It has already proven successful to apply machine learning to predict outcomes for a variety of medical illnesses, including diabetes, heart disease, and cancer, among others.

Moreover, machine learning is increasingly being used in healthcare to predict patient outcomes and improve healthcare performance. By analyzing vast amounts of patient data, machine learning models can spot patterns and connections that human analysts might not immediately notice. This research can be used by healthcare providers to develop personalized treatment plans, improve clinical decision-making, and ultimately improve patient outcomes. Machine learning can also be used to improve healthcare performance by optimizing operational processes, reducing costs, and increasing efficiency. For example, machine learning models can be used to predict patient demand for healthcare services, identify areas of inefficiency in healthcare delivery, and optimize resource allocation. However, this research implies the use of machine learning in healthcare using a hypothesized model, including the need to ensure the accuracy and reliability of models, protect patient privacy and security (Aslam *et al.*, 2022), and integrate machine learning into clinical workflows. As healthcare continues to generate vast amounts of data, the potential of machine learning to improve patient outcomes and healthcare performance is likely to continue to grow.

2. LITERATURE REVIEW

2.1. Machine Learning Influence on Patient Outcomes and Healthcare Performance

In-hospital mortality rates for patients with heart failure were predicted using machine learning algorithms, according to a study that was published in the Journal of Medical Systems. According to (Schroeder and Lodemann, 2021), machine learning models had an area under the receiver operating characteristic curve (AUC-ROC) of 0.83 and could predict death rates with high accuracy. The authors came to the conclusion that machine learning could enhance clinical judgement and eventually enhance patient outcomes (Alshurideh *et al.*, 2020). According to a study published in the Journal of the American Medical Association (JAMA), machine learning algorithms were used to forecast acute kidney damage (AKI) in individuals who were hospitalized. The study discovered that a machine learning model was more accurate in predicting AKI than conventional clinical models. The authors suggested that machine learning could be used to improve AKI diagnosis and ultimately improve patient outcomes (Gluck and Gostin, 2023). (Iqbal *et al.*, 2022) highlights the potential benefits of time-based enhancements in scheduling algorithms, which can be relevant for optimizing the execution of machine learning algorithms in healthcare analytics.

A systematic review published in the Journal of Medical Internet Research examined the use of machine learning in predicting patient outcomes in cancer care (Wolinetz and Tabak, 2023). The review found that machine learning models were able to predict cancer diagnosis, prognosis, and treatment response with high accuracy. The authors concluded that machine learning has the potential to improve cancer care by enabling more personalized treatment plans and improving patient outcomes. Similarly, various studies suggest that machine learning has the potential to improve patient outcomes and performance in healthcare by enabling more accurate diagnosis, more personalized treatment plans, and more informed clinical decision-making (Zhang *et al.*, 2021). Based on the above discussion following hypothesis have developed:

H1a: Machine Learning influence Patient Outcomes

H1b: Machine Learning influence Healthcare Performance

2.2. Big Data Analytics influence Patient Outcomes and Healthcare Performance

Big Data Analytics has emerged as a game-changer in the healthcare industry, providing new opportunities to improve patient outcomes and healthcare performance. Finding patterns and

trends in massive datasets is one of the main advantages of big data analytics in the healthcare industry. Healthcare professionals can learn important information about patient behavior, disease trends, and treatment outcomes by studying patient data (Elgendy and Elragal, 2014). In turn, this empowers them to decide on patient treatment with greater knowledge, ultimately resulting in better patient outcomes. The effect of big data analytics in lowering hospital readmissions was examined by (Hussein *et al.*, 2018). Predictive analytics were proven to significantly reduce readmissions when used in conjunction with patient coaching and education. This shows that Big Data Analytics can be used to pinpoint patients who are in danger of readmission, enabling medical professionals to take action and stop readmissions in their tracks before they happen.

(Dubey, Gunasekaran and Childe, 2019) examined the use of Big Data Analytics to improve patient outcomes in the treatment of diabetes they also found that by analyzing patient data, healthcare providers were able to identify patients who were not responding well to treatment and make adjustments to their treatment plans. As a result, patients showed significant improvements in their glycemic control. In addition to improving patient outcomes, Big Data Analytics can also have a positive impact on healthcare performance (Niñerola, Hernández-Lara and Sánchez-Rebull, 2021). The study found that big data analytics could be used to identify areas of inefficiency and waste in healthcare delivery, leading to cost savings and improved performance. The study also found that big data analytics could be used to improve patient satisfaction by identifying areas where patient experience could be enhanced. Based on the above discussion following hypothesis have been developed:

H2a: Big Data Analytics influence Patient Outcomes

H2b: Big Data Analytics Healthcare Performance

2.3. Machine Learning Impact on Healthcare Performance through Big Data Analytics

(Zhang *et al.*, 2020) examined the use of machine learning to predict healthcare utilization and costs. Machine learning models outperformed traditional statistical models in predicting healthcare utilization and costs, indicating that machine learning can be an effective tool for healthcare cost management. A prior study published in the Journal of Biomedical Informatics investigated the application of machine learning to foretell heart failure patients' readmissions. It discovered that machine learning models were more accurate than conventional statistical models at predicting readmissions, indicating that machine learning can improve patient outcomes by identifying high-risk patients and allowing for early intervention.

According to, machine learning had a positive impact on healthcare performance, including improved patient outcomes, reduced healthcare costs, and enhanced healthcare quality. (Schroeder and Lodemann, 2021) highlighted the importance of data quality and governance in implementing machine learning models in healthcare. A research published in the Journal of Healthcare Informatics Research investigated the use of machine learning to predict healthcare-associated infections (SRAIDI, 2022). In addition, machine learning models were able to predict healthcare-associated infections with greater accuracy than traditional statistical models, indicating that machine learning can improve patient safety by identifying high-risk patients and enabling early intervention. Based on the above discussion following hypothesis have been developed:

H3a: Big Data Analytics mediate the impact of Machine Learning on Patient Outcomes

H3b: Big Data Analytics mediate the impact of Machine Learning on Healthcare Performance

2.4. Patient outcome influence on healthcare performance

One study published in the Journal of Hospital Medicine examined the impact of healthcare performance on patient outcomes in a hospital setting (Gordon *et al.*, 2020). The study found that hospitals with higher performance scores had lower rates of complications, mortality, and readmissions (Gordon *et al.*, 2020). The study also found that patients treated in higher-performing hospitals were more likely to have a positive experience and be satisfied with their care. (Aljameel *et al.*, 2021) investigated the relationship between healthcare performance and patient outcomes in a primary care setting. Moreover,

patients who received care from higher-performing primary care practices had lower rates of hospitalization and emergency department visits. Various authors also found that patients in higher-performing practices were more likely to receive preventive care and have better chronic disease management (Szijártó Ádám Somfai Ellák, 2023).

The effect of healthcare performance on patient outcomes across a variety of contexts was the subject of a systematic review that was published in the Journal of Patient Safety. According to the analysis, better patient outcomes, such as lower mortality rates, fewer problems, and higher patient satisfaction, were linked to healthcare systems that performed better. The review also emphasized the significance of cooperation, leadership, and culture in fostering healthcare performance and enhancing patient outcomes.

2.5. Problem Statement

The healthcare industry generates a massive amount of data from various sources, such as electronic health records, medical imaging, and wearables. This data contains valuable insights that can help healthcare providers make more informed decisions, improve patient outcomes, and reduce costs. However, the complexity and scale of this data make it challenging to analyze using traditional methods. Therefore, the healthcare

industry is turning to big data analytics to unlock the potential of this data.

However, one promising approach to big data analytics in healthcare is machine learning, which can analyze large datasets and identify patterns that may not be apparent to humans. Despite the potential benefits of machine learning in healthcare, there is a significant literature gap regarding its practical contribution to healthcare delivery. Many healthcare providers are still using traditional methods to analyze patient data, and there is a lack of understanding of how machine learning can be integrated into clinical practice. Therefore, this research aims to explore the role of machine learning in predicting patient outcomes and improving healthcare delivery. The study will investigate the potential of machine learning to revolutionize healthcare delivery and fill the literature gap by demonstrating its practical contribution to healthcare.

2.6. Research Model

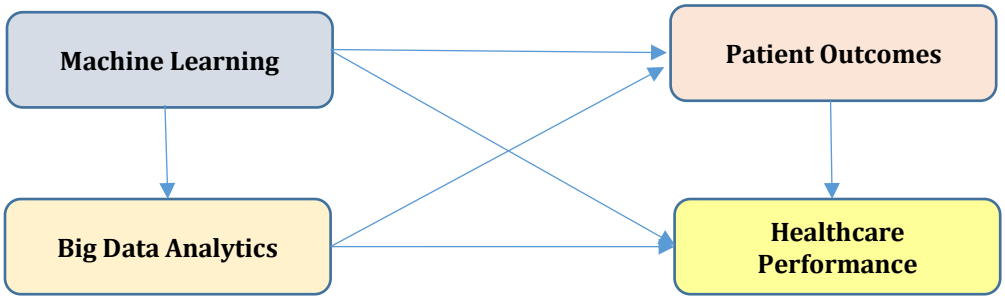

Figure 1: Conceptual Research Model

2.7. Research Hypotheses

H1a: Machine Learning Positively Influence Patient Outcomes

H1b: Machine Learning Positively Influence Healthcare Performance

H2a: Big Data Analytics positively influence Patient Outcomes

H2b: Big Data Analytics positively influence Healthcare Performance

H3a: Big Data Analytics mediate the impact of Machine Learning on Patient Outcomes

H3b: Big Data Analytics mediate the impact of Machine Learning on Healthcare Performance

H4: Patient Outcomes Positively Influence Healthcare Performance

3. METHODOLOGY

Primarily, using suggestions from the healthcare sector and professionals, an online survey tool was developed. By completing a pilot study, contributions from the expert opinion of healthcare professionals and practitioners were incorporated into the survey questionnaire. The survey's content was divided into four categories, the first of which focuses on the fundamental facts about the target industry and the demographics of the respondents. The information pertinent to the degree of big data analytics employed in healthcare is the topic of the next section. The measurement of machine learning in healthcare was the focus of the third portion, while advances in patient outcomes delivery were covered in the fourth section. Furthermore, Public and private hospitals were targeted from Dubai city, UAE. Respondents were accessed through emails to fill the questionnaire.

Based on the strategy suggested for PLS-SEM by (Kock, 2015), the appropriateness of the sample size is assessed. The study also contained 142 samples, which satisfied the requirements for the minimal sample size. The results were included to an excel file for additional statistical software analyses. The PLS-SEM method, as recommended by (Hair, Black and Babin, 2010), is used in this research to analyze the data. PLS models that used higher-order constructs also showed. The research uses the PLS-SEM approach despite the short sample size. The hypothesized model is investigated using the Smart PLS 4.

4. DATA ANALYSIS

4.1. Measurement Model

The same technique of assessment criteria can be regularly used as for any PLS-SEM analysis to assess higher-order construct models. Using a three-step process, (Hair *et al.*, 2012) described a measuring model.

Step 1: Evaluate internal consistency and reliability using the Cronbach Alpha (CA) and Composite Reliability (CR) metrics.

Step 2: Validation by convergence: "Validation through convergence is the degree to which the construct converges in order to explain the variance of its items." This was examined using the Average Variance Extracted (AVE) measurement.

Step 3: Discriminant validity, which is the degree to which a construct is empirically different from other constructs in the structural model, is the fourth step. This was evaluated using the Fornell-Larcker criterion and the (HTMT), whose value should be less than 0.85. Indicator loadings, composite reliability, and actual values are described in Table 2. The Fornell-Larcker criterion value and the HTMT results are shown in table 2.

Table 1: Convergent Validity

Variables	CR (rho a)	CR (rho c)	AVE	Cronbach's Alpha
Big Data Analytics	0.851	0.885	0.606	0.838
Machine learning	0.728	0.796	0.642	0.839
Patients Outcome	0.753	0.819	0.589	0.729
Healthcare Performance	0.773	0.834	0.612	0.726

This study model's dependability is evaluated through Cronbach's alpha. Cronbach's alpha values of >0.7 are regarded as satisfactory, per Hair et al. (2014). As seen in Table 1, all Cronbach's alpha values are higher than 0.7. The composite reliability (CR) and average variance extract (AVE), as well as the item reliability of each variable (factor loadings), are used to evaluate the convergent validity of the current study model (Hair et al., 2016). The CR and AVE values (for each construct) should, in the opinion of experts, be greater than 0.7 and 0.5, respectively. According to Table 2, all CR and AVE values meet the standards for acceptance. As per Hair et al. (2014), all items' factor loadings are also more than 0.5 at the person level. Next,

Table 2: Discriminant Validity HTMT, Fornell-Larcker Criterion

HTMT					
	Construct	BDA	ML	PO	HP
BDA	Big Data Analytics				
ML	Machine learning	0.661			
PO	Patients Outcome	0.734	0.753		
HP	Healthcare Performance	0.528	0.762	0.773	
Fornell-Lacker Criterion					
		BDA	ML	PO	HP
BDA	Big Data Analytics	**0.779**			
ML	Machine learning	0.543	**0.725**		
PO	Patients Outcome	0.592	0.710	**0.717**	
HP	Healthcare Performance	0.589	0.600	0.455	**0.709**

4.2. Structural Measurement Model

According to (Hair *et al.*, 2012), collinearity was investigated, Higher-order latent variables in this study include bid data analytics, machine learning, patients outcomes and healthcare performance. A reflecting model was used to design each construct. Coefficient of determination (R2) values and path coefficient values are crucial for reporting the structural model. Big Data Analytics, Machine Learning, Patients Outcome, Healthcare Performance all have R2 values of 0.306, 0.351, and 0.585, respectively, which indicate moderate coefficient outcomes when analyzing the research's R2 values. The resampling technique known as "bootstrapping" involves drawing a sizable number of subsamples from the original data (with replacement) and estimating models for each subsample. Table 3 shows the findings of path coefficient and t values using bootstrapping with 5000 subsamples, significance level of 5%, and confidence level of 95% as input settings for PLS-SEM program.

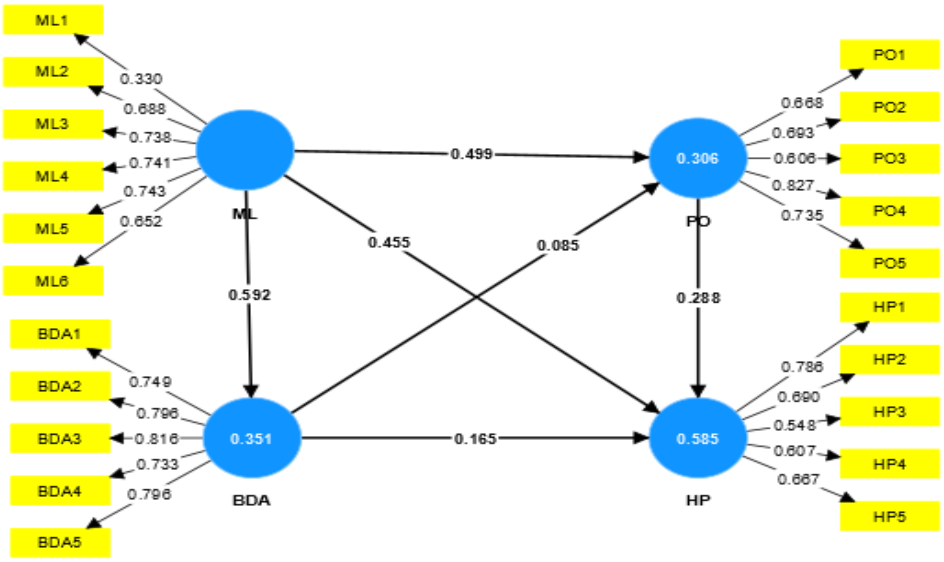

Figure 2: Structured Equation Model

Table 3: Hypothesis Testing

Indirect Effect ML>PO with BDA & ML >HP with BDA								
					Percentile bootstrap 95% confidence interval			
Hypothesis Paths		β	R^2	t-value	Lower 2.5%	Upper 95%	p-value	Decision
H1a	ML→PO	0.61	0.30	2.24			0.000	Supported
H1b	ML→HP	0.30	0.58	3.64			0.000	Supported
H2a	BDA→PO	0.48		6.39			0.000	Supported
H2b	BDA→HP	0.46		5.15			0.000	Supported
H3a	ML→BDA→PO	0.56	0.35	3.33	.122	.541	0.003	Partial Mediation
H3b	ML→BDA→HP	0.55		5.81	.205	.760	0.000	Partial Mediation
H4	PO→HP	0.59		7.02			0.001	Supported

Table 3 presents the p-values and beta coefficients before elaborating on this area. Because data-driven accounts for 30% of the variation in Patient outcomes (B= 0.61, p 0.000), H1a is well supported. Because machine learning accounts for 58% of the variation in healthcare performance, H1b is strongly supported (B= 0.30, p 0.000). Big Data Analytics explains 35% of variation in patient outcome (B= 0.48, p 0.000), providing strong evidence for H2a. Big Data Analytics has significant impact on healthcare performance (B= 0.46, p 0.000), hence H2b is supported. H3a and H3b depicted as partial mediation by explaining the significant indirect impact ML on PO with mediating effect of BDA (B=0.56, p 0.003) and ML has significant indirect impact on healthcare performance by mediating effect of BDA (B=0.55, p 0.000) proving the partial mediation. The findings revealed that the mediation effect was statistically significant, indicating that hypothesis H3a and H3b were supported. H4 explaining the relationship between patients' outcomes and healthcare performance as significant (B=0.59, p 0.001) supporting H4 of the model.

5. DISCUSSION OF RESULTS

Initially the findings revealed that the hypotheses (H1a, H1b, H2a, H2b, H3a, H3b and H4) that were established to understand the relationship and influence between big data analytics and healthcare performance are highly significant and support the findings of previous studies. It appears that BDA and ML practices, which focus on patient's outcomes and healthcare delivery performance, are considered extremely significant positions compared to other traditional ways. The value of R2 and path coefficient for lean technical practices are also approved. As a result, with the vast amount of healthcare data being generated every day, it has become increasingly important to find ways to process and analyze this data in a way that can improve patient outcomes, reduce costs, and increase overall efficiency. This is where big data analytics and machine learning come in, offering the potential to extract insights from large and complex datasets that would be difficult or impossible to uncover using traditional methods. Additionally, our research findings approve the hypothetical approach describing the significance level of big data analytics implementation to improve healthcare delivery and patient outcome, for example, one area where big data analytics and machine learning have shown great promise is in the field of personalized medicine.

Furthermore, by analyzing large datasets of patient information, including genetic, clinical, and lifestyle data, machine learning algorithms can identify patterns and correlations that can help healthcare providers make more informed decisions about diagnosis, treatment, and prevention strategies. For instance, healthcare professionals can utilise machine learning algorithms to identify individuals who are at high risk for specific diseases, enabling early intervention and possibly preventing the condition from ever developing. Moreover, the research findings emphasized to incorporate machine learning and big data analytics as a contemporary need for desired outcomes in healthcare sector. Similarly, personalized medicine, big data analytics and machine learning can also be used to improve the overall performance of healthcare systems. For example, by analyzing large datasets of patient outcomes and treatment protocols, machine learning algorithms can identify areas where current practices may be inefficient or ineffective, and suggest new approaches that could improve outcomes and reduce costs. This can help healthcare providers make more informed decisions about resource allocation, staffing, and treatment strategies, ultimately leading to better patient outcomes and more efficient use of resources.

6. CONCLUSION

The impact of utilizing big data analytics and machine learning to enhance healthcare performance and improve patient outcomes cannot be overstated. These technologies have opened up a world of possibilities, allowing healthcare providers to extract valuable insights from massive datasets that were previously untapped. By leveraging these insights, healthcare professionals can make more informed decisions regarding personalized medicine, treatment protocols, and resource allocation, ultimately leading to better patient outcomes and a more efficient healthcare system. The ability to analyze vast amounts of healthcare data empowers healthcare providers to identify patterns, correlations, and risk factors that were previously difficult to detect. This knowledge enables early intervention, disease prevention, and personalized treatment plans tailored to individual patients. Moreover, machine learning algorithms continuously learn and adapt, improving over time and staying up-to-date with the latest medical research and practices.

6.1. Practical Implications and Future Recommendations

As the field of healthcare continues to evolve, big data analytics and machine learning are becoming increasingly important in improving patient outcomes in research. Here are some future recommendations for using these technologies: Firstly, use big data analytics to identify patient patterns by analyzing large amounts of patient data, healthcare providers can identify patterns in patient behavior, treatment outcomes, and disease progression. This information can be used to develop personalized treatment plans for each patient, which can lead to improved outcomes.

Additionally, machine learning algorithms can be trained on large datasets to predict outcomes for different patient groups. For instance, a machine learning system may be trained to identify people who are most likely to contract a specific disease, enabling medical professionals to take early action and stop the disease's progression.

Secondly, prediction models that can assist healthcare professionals in making better judgements regarding patient care can be created using machine learning algorithms. For example, a predictive model could be used to identify which patients are most likely to develop a particular complication after surgery, allowing healthcare providers to take steps to prevent the complication from occurring. Lastly, big data analytics and machine learning have enormous potential to improve patient outcomes in research. By analyzing large amounts of patient data, healthcare providers can identify patterns, develop predictive models, and design more targeted clinical trials that are more likely to succeed. With continued investment in these technologies, we can expect to see significant improvements in patient outcomes in the years to come.

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Impact of Metaverse Technology on Student Engagement and Academic Performance: The Mediating Role of Learning Motivation

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A B S T R A C T

Metaverse technology, encompassing virtual reality (VR) and augmented reality (AR), offers immersive and interactive learning environments that can enhance student engagement. The personalized and adaptive nature of metaverse experiences has the potential to spark students' intrinsic motivation and promote active involvement in their learning. In order to evaluate the impact of metaverse technology on academic performance and level of engagement this research was aimed to assess the academic performance with mediating effect of learning motivation. We conducted an empirical research through an online survey that initially utilized to measure the collected data. Data collected from 33 educational institution located in Dubai UAE. A total of 251 respondent's data were utilized and assessed through structured equation modelling. SmartPLS 4 was used to check the model convergent validity, discriminant validity and hypothesis testing. The findings revealed student involvement can be positively impacted by the employment of metaverse technology, which in turn improves academic performance. However, it's critical to take into account potential access restrictions and the necessity for a well-rounded educational strategy that combines metaverse experiences with other teaching strategies. Future studies should focus on the precise mechanisms by which metaverse technology influences learning motivation, engagement, and performance, as this will give researchers important information for developing efficient metaverse-based educational interventions.

1. INTRODUCTION

The idea of the metaverse has received a lot of attention recently as a disruptive technology with the potential to change many facets of our life. A virtual reality environment known as the metaverse allows users to interact with other users and a computer-generated world in real time. The potential impact of the metaverse on education and student engagement is becoming more clear, despite the fact that it has historically been predominantly connected with entertainment and gaming. Student involvement is a critical element that directly influences learning results and motivation in the education sector (Hedrick et al., 2022). Traditional teaching approaches frequently fail to engage and inspire pupils, which results in disengagement and poor academic achievement. But the development of metaverse technology offers a fresh and fascinating chance to fundamentally alter student engagement and learning motivation.

The immersive aspect of the metaverse offers students a dynamic and interactive learning environment that can pique their interest and encourage engagement. Students can examine

tough ideas and situations that are otherwise challenging to picture or access using virtual simulations. For instance, astronomy students can virtually travel through the solar system to observe celestial occurrences and better comprehend astronomical principles (Nelson Laird and Kuh, 2005). Additionally, the metaverse enables cross-border, cross-cultural collaboration in learning by bringing students from various backgrounds together. Students can work together on projects, participate in online debates, and gain knowledge from professionals and instructors all across the world. This connectivity fosters information exchange and improves social interaction, making learning more interesting and rewarding. (Saeed, 2023)'s insights into digital workplaces can contribute to understanding the potential impact of metaverse technology on student engagement and academic performance.

Moreover, it is impossible to overestimate the importance of studies on how metaverse technology affects student engagement and learning motivation in the educational setting. For educators, policymakers, and researchers to make well-informed judgements about the integration of the metaverse into educational practices, they must have a clear understanding of how the metaverse might improve student engagement and motivation (Sawang et al., 2017). We can pinpoint the particular metaverse mechanisms and tactics that increase motivation and engagement through thorough research. This information can then be applied to design engaging learning environments, effective pedagogical strategies, and customized interventions that maximize the potential advantages of metaverse technology. Additionally, research on this subject can influence the creation of standards, guidelines, and best practices for the use of the metaverse in education as well as the discussion of educational technology as a whole. By pursuing research in this area, we can unleash the metaverse transformational power and open the door to a day when education is more fascinating inclusive, and effective.

1.1. Problem Statement

A projecting topic of research in the discipline of education is the effect of metaverse technology on academic performance, with learning motivation. Although immersive and interactive learning experiences are provided by metaverse technology, it is important to comprehend how these experiences affect students' motivation, engagement, and subsequent academic success. To understand the precise mechanisms by which metaverse technology influences student engagement and learning motivation, as well as how these variables mediates the relationship between metaverse technology and academic performance, an empirical research is required. In order to fill the research gap this research will empirically collect the evidence from education sector to gauge the importance of metaverse technology to assess the academic performance. Understanding these dynamics will help educators and researchers make the best use of metaverse technology to improve students' academic results by shedding light on the factors assist in boosting academic performance.

2. THEORETICAL FRAMEWORK

2.1. Metaverse Technology

The concept of the metaverse, a virtual reality environment where users can communicate with other participants and a computer-generated world, has received a lot of interest lately. Metaverse technology has developed as a promising field with significant ramifications for numerous industries, including entertainment, gaming, social media, and commerce, as the technological landscape changes (RAHMAN et al., 2023). In order to build a persistent, shareable, and immersive digital realm, metaverse technology combines virtual reality (VR), augmented reality (AR), blockchain, artificial intelligence (AI), and other cutting-edge technologies. Users have access to a variety of activities through it, including gaming, socializing, attending virtual events, conducting business, and exploring virtual worlds.

2.2. Learning Motivation

Learning and academic success depend heavily on motivation. It is crucial for educators and researchers to comprehend what motivates people to engage in learning activities and persevere in the face of difficulties. The process of learning and academic success depend heavily on motivation. It motivates people to participate in educational activities, put forth effort, and persevere in the face of difficulties. For educators, researchers, and learners themselves, it is essential to comprehend

the idea of learning motivation (Lin et al., 2017). The term "learning motivation" refers to the internal and environmental elements that affect people's desire, zeal, and openness to learning (Ainley, 2006). It includes all of the different cognitive, affective, and behavioral processes that influence people's interest in and effort put forth in educational endeavors. Understanding the nature of learning motivation, its theoretical underpinnings, and the variables that influence it can help us improve motivation and maximize learning experiences.

2.3. Student Engagement

A complex concept that has received a lot of attention in educational research and practice is student involvement. It speaks to the extent of students' involvement, interest, and active participation in their educational activities and learning process. As stated by (Pangsapa et al., 2023), Academic success, wellbeing, and educational outcomes are all influenced by student engagement, which is a crucial component of the learning process. Teachers can create stimulating learning environments that encourage students' active involvement, emotional investment, and cognitive development by understanding the aspects of student engagement, using suitable measurement methodologies, and putting effective ideas into practice.

2.4. Academic Performance

Academic performance, which represents the academic accomplishments and results of students in diverse learning environments, is a vital component of education. It is essential for educators, decision-makers, and researchers to comprehend the elements that affect student success. Moreover, it is stated by (Lee and Kwon, 2022), academic performance is a subtle and complicated concept that is influenced by several social, familial, academic, and individual aspects. It is crucial to comprehend these factors and how they affect academic achievement if one is to improve educational outcomes. Teaching quality, motivation, parental participation, and school climate are just a few of the variables that educators and policymakers should take into account when designing interventions and supportive environments that encourage improved academic performance.

3. LITERATURE REVIEW

3.1. Metaverse Technology Influence Student Engagement

Metaverse technology, with its immersive and interactive virtual reality environments, holds significant potential to transform student engagement in educational settings. This literature review aims to explore the influence of metaverse technology on student engagement, examining its impact on various dimensions of engagement, the underlying mechanisms, and potential implications for educational practice. According to (Hedrick et al., 2022), students can explore virtual settings, interact with items, and take part in simulations or virtual experiments because of metaverse technology. These immersive learning opportunities can improve students' critical thinking, problem-solving, and cognitive engagement. A study explored (Alawadhi et al., 2022), learning experiences that are personalized and adaptable are possible as a result of metaverse technology. (Saeed et al., 2019) and (de Carvalho et al., 2022)shed light on the practices and challenges of nomadic knowledge sharing, offering insights that can inform the understanding of how metaverse technology may impact student engagement and academic performance through enhanced knowledge sharing practices.

By addressing their particular requirements and learning preferences, students can receive customized feedback, individualized training, and adaptable content in virtual environments, which promotes engagement. According to (Yang et al., 2022), through the use of metaverse technology, students can communicate with professors and their peers virtually. Students' emotional investment and sense of belonging are increased by this social involvement, which encourages collaboration, teamwork, and knowledge sharing. In addition, students' attention and interest can be captured by the novelty and excitement of metaverse technology, increasing engagement. The metaverse interactive and aesthetically pleasing features can arouse interest and generate a positive emotional reaction, which can result in long-lasting engagement. Based on various prior studies we have developed a hypothesis as follow:

H1: Metaverse Technology significantly influence

Student Engagement.

3.2. Metaverse Technology Influence Learning Motivation

Learning experiences that are immersive and interactive now have new possibilities due to the development of metaverse technology. According to (Salloum et al., 2023), using metaverse technology, students can actively participate in realistic simulations, problem-solving situations, and virtual experiments, fostering chances for experiential learning. Students' curiosity, excitement, and enjoyment can be sparked by these immersive experiences, improving their intrinsic motivation to study. Learning through the use of metaverse technology gives students more control and freedom. Students can choose their own learning routes, explore virtual settings at their own speed, and carry out self-directed activities. This independence may encourage pride in one's work and intrinsic motivation. As highlighted by (Lee and Hwang, 2022), learning settings that support autonomy can be facilitated by metaverse technology. It adheres to the tenets of self-determination theory by providing options, enabling self-paced learning, and encouraging learners' voice and agency. Environments that enable autonomy increase intrinsic drive, engagement, and enjoyment. Through virtual worlds, avatars, and communication capabilities, metaverse technology facilitates social engagement and collaboration between students. The sense of relatedness, social belonging, and cooperative learning that might result from these social interactions can have a good effect on the motivation to learn. Based on prior studies we have developed a hypothesis as follow:

H2: Metaverse Technology significantly influence Motivation Learning.

3.3. Metaverse Technology Influence Student Engagement through Learning Motivation

The integration of metaverse technology in educational settings has opened up new possibilities for transforming student engagement. As directed in one study by (Sawang et al., 2017), students are actively engaged in virtual settings thanks to the immersive and engaging learning experiences provided by metaverse technology. Students can participate more cognitively and experientially by taking part in simulations, virtual experiments, and problem-solving activities. According to (OXFORD and SHEARIN, 1994), experiences of learning can be personalized and self-directed with the help of metaverse technology. Students are able to move around virtual spaces, pick their own learning routes, and partake in activities that suit their interests and preferences. This independence and personalization help students to become more engaged.

As discussed by (Seashore Louis, 2020), the use of metaverse technology can increase students' intrinsic motivation by delivering engaging and valuable learning. The immersive quality of the metaverse combined with interactive challenges and simulations encourages interest, enjoyment, and curiosity, all of which have a good impact on student engagement. According to (Hepplestone et al., 2011), the metaverse's autonomy and personalization are consistent with self-determination theory. Metaverse technology increases students' intrinsic motivation and engagement by giving them options, control over their education, and chances to show their knowledge. As stated by (Nelson Laird and Kuh, 2005), metaverse technology has the potential to significantly influence student engagement, with learning motivation playing a crucial mediating role. By understanding how metaverse technology enhances intrinsic motivation, self-determination, and competence, educators can design effective instructional strategies and virtual learning environments that optimize student engagement. Continued research is needed to further explore the dynamics of this relationship and identify best practices for leveraging metaverse technology to enhance both motivation and engagement in educational settings. Based on the prior studies we have developed a hypothesis as follow:

H3: Metaverse Technology significantly influence Student Engagement with mediating role of Learning motivation.

3.4. Learning Motivation Influence Student Engagement

Learning motivation is a key aspect in determining students' degree of engagement, which is essential for academic achievement. (Heiberger and Harper, 2008) suggested a strong positive relationship between learning motivation and student

engagement. Students who are intrinsically motivated, driven by their internal interest and enjoyment of learning, tend to exhibit higher levels of engagement. Furthermore, external factors such as teacher support, classroom climate, and the presence of challenging tasks can also influence students' motivation and subsequent engagement.

According to (Nelson Laird and Kuh, 2005), student involvement is a multifaceted concept that includes students' active participation, zeal, and interest in their education. On the other side, motivation refers to the internal and external forces that propel people to start and maintain particular behaviors, including learning. It is critical for educators and researchers who want to improve student learning outcomes to comprehend the connection between learning motivation and student engagement. (Sawang et al., 2017) also highlighted the role of instructional practices in fostering learning motivation and student engagement. Providing students with meaningful and relevant learning experiences, offering choice and autonomy, setting clear expectations, and providing timely feedback are some instructional strategies that can enhance motivation and engagement. Based on the prior studies we have developed a hypothesis as follow:

H4: Learning Motivation significantly influence Student Engagement

3.5. Student Engagement Influence Academic Performance

As highlighted by (Collings and Mellahi, 2009), the level of participation, dedication, and investment that students have in their educational experiences is referred to as student engagement. On the other hand, academic performance includes academic accomplishment, learning results, and overall educational success. For educators and researchers looking to improve instructional strategies and student outcomes, an understanding of how student involvement affects performance is essential. Various studies have confirmed that it is commonly acknowledged that predicting and supporting positive student outcomes depends on student participation. It is linked to greater academic success, higher retention rates, and better overall educational experiences (Abaidoo, 2018). The results in different studies evaluation consistently show a favorable correlation between student engagement and academic achievement. Grades, test results, and general learning outcomes all show that engaged students are more likely to exhibit better levels of academic accomplishment.

Additionally, they are more likely to keep at their studies, turn in assignments on time, and engage in class activities. According to (Das and Padmavathy, 2021), academic performance has been found to be influenced by a number of aspects of student engagement, including behavioral, emotional, and cognitive engagement. Moreover, students' participation and interest in academic activities, such as attending courses and finishing homework, is referred to as behavioral engagement. While cognitive engagement indicates students' active thinking, critical analysis, and in-depth topic knowledge, emotional engagement is related to students' affective responses and positive attitudes towards learning. Based on the prior studies we have developed a hypothesis as follow:

H5: Student Engagement significantly influence Academic Performance.

3.6. Research Model

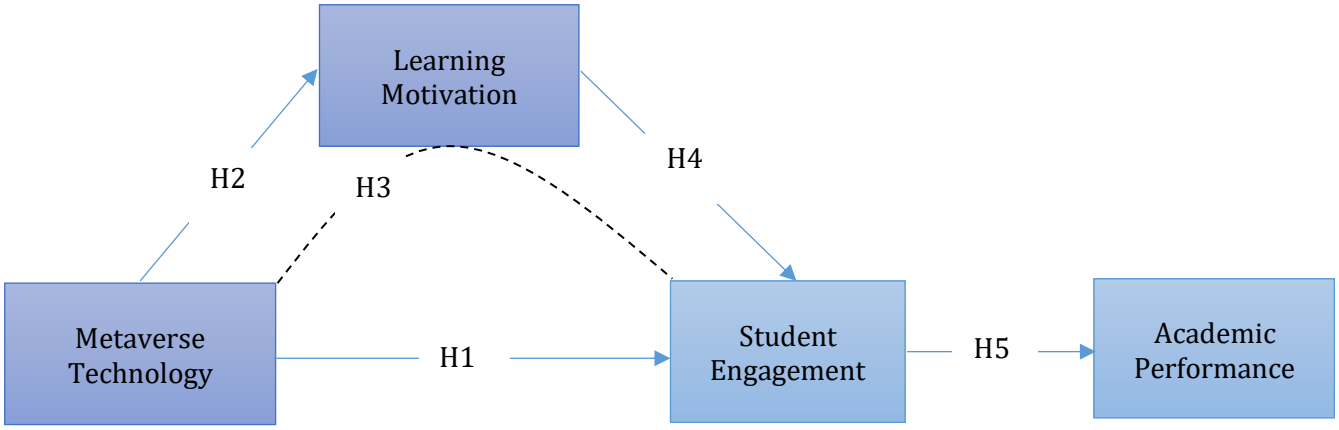

Figure 1: Conceptual Research Model

3.7. Hypothesis Development

H1: Metaverse Technology significantly influence Student Engagement

H2: Metaverse Technology significantly influence Learning Motivation

H3: Metaverse Technology significantly influence Student Engagement with mediating role of Learning Motivation

H4: Learning Motivation significantly influence Student Engagement

H5: Student Engagement significantly influence Academic Performance

4. METHODOLOGY

Considering this quantitative research approach is popular and acknowledged in the study of metaverse technology and the evaluation of the intricate relationships between variables and constructs, a survey methodology was used to evaluate the conceptual model to measure the metaverse technology and its impact on student engagement and performance through learning motivation in the educational sector UAE. Top 33 educational institutes located in Dubai UAE were made up the target population sample for this research. As a sort of social interaction where students shared their personal experience of using metaverse technology and its outcomes to their learning level as well as the teaching and staff also approached to administer the learning outcomes and lesson delivery to the students using web based, technology based classes.

The survey questionnaire consisted of four construct containing 22 items developed by authors. The items were used to measure each construct separately. All items of the four construct was anchored on the five-point scale from 5=strongly agree to 1=strongly disagree. There were 251 participants in total for the final data analysis, of which 50.9% of the male participants (N=128) and 49% of the female participants (N=123).

5. DATA ANALYSIS

The data was investigated by examining its reliability, composite reliability, and average variance extract under the measurement model. The relationships between constructs were examined on the basis of SEM through collected data. The present study used SMART-PLS for data analysis through measurement model and structural equation modelling techniques.

Table 1: Convergent Validity, Discriminant Validity (CA, CR, AVE)

Variables	Cronbach's Alpha	CR	AVE	MT	LM	SE	AP
Metaverse Technology	0.883	0.832	0.517	-			
Learning Motivation	0.854	0.838	0.590	0.54	-		
Student Engagement	0.890	0.892	0.665	0.72	0.70	-	
Academic Performance	0.871	0.844	0.776	0.63	0.51	0.69	-

MT=Metaverse Technology, LM=Learning motivation, SE=Student Engagement, AP=Academic Performance, CA=Cronbach's Alpha, CR=Composite Reliability, AVE=Average Variance Extracted.

In order to be accepted statistically and reliably for the data collection tool (Hair et al., 2010), values for Cronbach alpha, composite reliability, and average extracted (AVE) must all remain higher than 0.7, whereas values for AVE must remain higher than 0.5. The findings in the above table 1 shows all the values meet the benchmark value evidencing an accepted and reliable model. We also took discriminant validity into account in addition to internal reliability and convergent validity. By assessing the level of correlation between model constructs, discriminant validity illustrates how distinct the constructs are from those of other structures. The average correlations between the heterotrait-heteromethod and the average HTMT are used to determine HTMT using the

bootstrapping routine. To confirm discriminant validity between conceptions, the HTMT value should be less than 0.90 or 0.85. No construct had a value higher than 0.90, as shown in Table 1, showing adequate discriminant validity.

5.1. Structural Equation Model

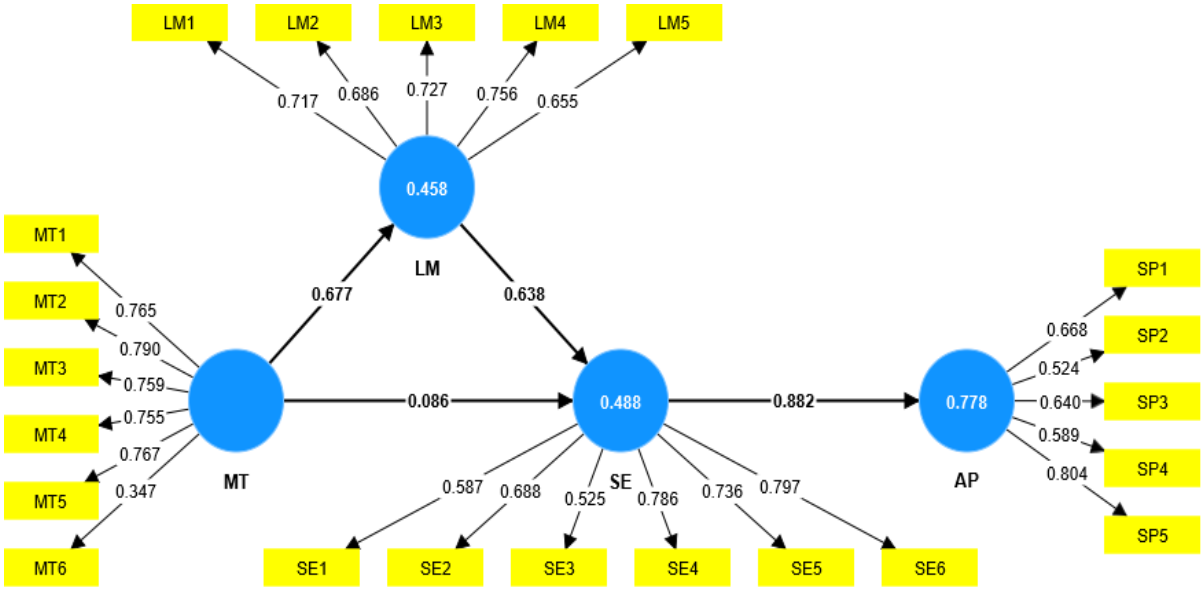

Figure 2: Measurement Model Assessment

5.2. Hypothesis Testing

The evaluation of the direction, power, and significance level of the path coefficients (betas) were the elements employed to examine the research hypotheses in this research. The minimum individual R^2 level should be higher than the least standard value of 0.10 (10%), according to (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, 2017). The R^2 criteria measures how strongly an independent variable affects a dependent variable; the three values of 0.19, 0.33, and 0.67, respectively, represent low, moderate, and high R^2 levels. Furthermore, bootstrap use to assess the significance of the connections, t-statistics were used. According to Fig. 2, all routes are statistically significant (Garson, 2012) if the T-statistic is more than 1.96 at the 95% confidence level. T-statistics above 1.65, 99% above 2.57, and 99.90% above 3.29 are acceptable at the 90% confidence level.

Table 2: Hypothesis Testing

Hypothesis	Paths	β	R^2	t-value	p-value	CI 2.5%	CI 95%	Supported
H1	MT→SE	0.086	0.488	4.12	0.000	0.383	0.611	Yes
H2	MT→LM	0.677	0.458	11.51	0.000	0.385	0.623	Yes
H3	MT→LM→SE	0.671		4.93	0.009	0.241	0.754	Partial Mediation
H4	LM→SE	0.638		3.28	0.002	0.310	0.692	Yes
H5	SE→AP	0.882	0.778	8.70	0.000	0.217	0.843	Yes

MT=Metaverse Technology, LM=Learning motivation, SE=Student Engagement, AP=Academic Performance
Significance level at P>0.05

6. DISCUSSION

This research was done in order to fill gaps in prior

research. First, we looked into how metaverse technology impacts academic performance with mediating role of learning motivation. Regarding metaverse technology, the findings demonstrated that metaverse technology have a significant impact on student engagement (B= 0.086, t = 4.12, p 0.000). H1 is supporting in our statistical analysis. The metaverse technology has significant impact on learning motivation with findings (B=0.677, t=11.51, p 0.000) supporting the H2 of the model. The indirect effect of metaverse technology has significant impact on student engagement with mediating effect of learning motivation depicted as significant (B=0.671, t=4.93, p 0.009) supporting H3 with partial mediation. The influence of learning management has significant impact on student engagement with (B=0.638, t=3.28, p 0.002) supporting the H4 of the model. Lastly, the student engagement has proven as significant with academic performance (B=0.882, t=8.70, p 0.000) supporting the H5 of the model.

The empirical findings of our research are consistent with the prior studies (Pangsapa et al., 2023). Similarly, the ability of metaverse technology to offer students incredibly immersive and engaging learning experiences is one possible advantage. The metaverse use of virtual reality (VR) and augmented reality (AR) can increase student engagement by building believable and fun simulations that let them explore and engage with difficult ideas in a practical way. These engaging activities have the power to pique students' curiosity and intrinsic drive, which will subsequently boost engagement and improve performance. Additionally, metaverse technology can open up possibilities for individualized and flexible learning experiences. The findings revealed that students are able to interact with learning materials that are specifically suited to their requirements and preferences through the customization of virtual worlds and interactive content. This customization can increase students' autonomy and sense of control, two elements that are known to have a beneficial impact on motivation and engagement. Students may be more inclined to put forth effort and maintain focus as a result, which will likely result in better results.

Consequently, the potential for revolutionizing educational experiences lies in the impact of metaverse technology on academic performance and student engagement, as mediated by learning motivation. Although the immersive and interactive features of metaverse technology might increase motivation and engagement, it is important to carefully address access disparities, the harmony of virtual and real-world learning experiences, and the particular methods of mediation. By carefully considering these elements, educators and researchers can use metaverse technology to build engaging and productive learning environments that boost academic performance.

7. CONCLUSION

In conclusion, the impact of metaverse technology on student engagement, academic performance, and learning motivation in the education sector is substantial. Empirical findings of this research caught a significant relationship among variables. However, the immersive and interactive nature of the metaverse provides students with dynamic learning experiences, fostering curiosity and active participation. Whereas, collaborative features enable global connections, promoting social interaction and knowledge sharing. Moreover, personalized learning capabilities cater to individual needs, enhancing motivation and driving student success. The gamification elements inherent in the metaverse create intrinsic motivation, turning learning into an enjoyable experience. By conducting research and understanding the specific mechanisms underlying the metaverse impact, educators and policymakers can harness its potential to revolutionize education. By embracing metaverse technology, we can create a future where students are deeply engaged, motivated to learn, and equipped with the skills necessary for success in the digital age.

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Impact of Big Data on Supply Chain Performance through Demand Forecasting

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A B S T R A C T

By enabling more precise demand forecasting, the use of big data has changed the field of supply chain management. Companies may more accurately predict customer demand by gathering and analyzing enormous amounts of data from many sources, including customer behaviors and market trends, and then adjusting their production and inventory levels accordingly. By ensuring that goods and services are accessible when and where they are required, this improves customer happiness in addition to the efficiency and cost-effectiveness of the supply chain. The data collected from both primary and secondary sources to achieve the research objectives. The data collected from hospitality industry and evaluated through SmartPLS software to investigate the hypothesized model. An online survey through a questionnaire was the data collection tools used for attaining data. A survey analysis was conducted on the individuals employed to the supply chain departments. In addition, the findings revealed a positive significant of big data on supply chain performance through demand forecasting. Overall, the impact of big data on supply chain performance through demand forecasting is significant and continues to drive innovation and improvement in the hospitality sector.

1. INTRODUCTION

Big data in terms of supply chain management can be defined as the analytics that is used in quantitative methods to enhance the decision making abilities of the management across different activities of the company. Big data helps the overall supply chain management to expand its operational dataset. This helps in internal analysis out of the traditional aspect. Hence, the SCM (Supply chain management) of the organizations get benefits to do forecasting (Frederico et al., 2021). In addition to this, Big data in supply chain management also helps apply statistical methods to existing and new data sources. New insights are induced, which becomes effective in the decision making abilities of supply chain management. Hence, based on the strategic choices, the front-line operations are improved, i.e. identifying significant operating models for a proper supply chain. The main aim of the research is to understand the impact or role of big data over supply chain management, through demand forecasting (Kaisler et al., 2013).

Furthermore, big data is said to be one of the most effective factors in the supply chain industry in the present business world. Big data can also be said as the combination of processing systems, tools and several algorithms to interpret the insights of organizational data and information. It is taken as a key step in the modern organization as it may help the management of the company to minimize

the costs and improve the efficiency. Therefore, based on the big data analytics and statistical aspect, the decision making abilities of the company can be improved (Bahrami and Shokouhyar, 2021). (Khalid et al., 2023) give insightful information on the use of machine learning for fileless malware detection, which can help in understanding the possible effects of big data analytics on supply chain performance through improved cybersecurity measures. (Ali et al., 2020) and (Latif et al., 2020) offers insights that can contribute to understanding the potential impact of big data analytics on supply chain performance through improved demand forecasting

In addition to this, in terms of SCM (Supply Chain Management), the landscapes are being difficult with respect to time. Organizations use the ERP system and several storage systems in their data storage management. Moreover, the traditional systems in supply chain management are being inaccurate and inadequate. This is one of the major reasons companies are adopting big data to improve the performance of supply chain management. Hence, in the present business world, big data in supply chain management helps in creating unstructured and structured formats using the real-time data. Also, big data enables the collaboration of 3Vs (Velocity, volume and Variety) and supply chain analytics for end-to-end integration and supplier networks (Feizabadi, 2022). Forecasting helps this combination and in understanding the insights of supply streamlining. This ultimately helps the management of an organization to make decisions that would be eBay for operational aspects, i.e. stock inventory, budget planning, cargo booking, budget expansion etc. In other words, forecasting is an effective technique to predict and take data for future value based on unique trends.

2. LITERATURE REVIEW

2.1 Big data

Big data is a key component for the organization that can be utilized in a wide range of aspects. Big data is used for planning, development and sourcing, execution, delivery and return. All these separated steps act as major influencing factors of supply chain performance. Moreover, these factors are also related to forecasting. In the case of planning, big data helps to integrate the data and information across the total network of the supply chain. This may also include statistical data to have a forecasted demand with more accuracy, including inventory levels, sales numbers etc. In terms of development and sourcing, big data helps in reducing the potential costs of the company. Therefore, the overall revenue or profit rate gets improvised. According to (Shamout, 2019), big data in supply chain analytics helps to evaluate the compliance and performance of contractors based on real time aspects. Big data also helps in reconfiguring the available resources such as tools, space, people, materials etc. hence, the predictions of scheduled maintenance or estimation cost can be adjusted or minimized by the organization. In terms of the delivery stage, big data is effective in inducing accuracy, speed and efficiency. With the help of external data, the real-time delivery is superimposed. It is said that big data also helps in getting a good return on supply chain performance (Bag et al., 2020). Lastly, big data analytics can be useful in minimizing the overall operational cost to provide a seamless return by the combination of sales system and inventory, outbound and inbound flows. Three dimensions are incorporated to measure the big data efficiency are as follow:

2.1.1. Technological Innovation

Several sectors, corporations, and economies around the world have grown and developed as a result of technological innovation. The elements that spur innovation are a significant topic of study in the literature on technological advancement. Many elements, including technological ability, market demand, intellectual property protection, and availability of money and resources, have been noted as having an impact on innovation by several academics (Azubuike, 2013). For instance, businesses with great technological capabilities and a creative culture are more likely to create novel products and services.

2.1.2. Internet of Things (IoT)

The term "Internet of Things" (IoT) describes a network of interconnected systems, objects, and gadgets that have sensors and software built into them so they can communicate and collect data. IoT literature is extensive and varied, covering a wide

range of subjects including IoT applications and advantages, risks and issues related to IoT, and IoT design and standards. The uses and advantages of IoT are a major topic of study in the IoT literature. The potential advantages of IoT across a variety of sectors, including industry, healthcare, transportation, and agriculture, have been emphasized in numerous studies. By delivering real-time data and insights, for instance, IoT can increase operational efficiency by facilitating improved decision-making and resource optimization (Hussein et al., 2018).

2.1.3. Blockchain Based Data

Much study has recently been conducted on blockchain-based data. The literature on blockchain-based data includes a wide range of issues, such as the characteristics of blockchain technology, its uses in various fields, and the difficulties and advantages of its uptake. The characteristics of blockchain technology are a significant field of study in the body of literature on blockchain-based data. Many studies have emphasized how decentralized and secure blockchain technology is, making it the best choice for managing and storing sensitive data (Rawat, 2022). Data integrity can be guaranteed using blockchain technology, which uses cryptographic methods to construct an immutable and tamper-proof ledger (Francisco and Swanson, 2018).

2.2 Supply Chain Performance

Supply chain performance is the outcome of operational excellence. This completely depends on balanced scorecards, strategy development, supply chain management, investment etc. This is usually dependent on the quantifying process of effectiveness and efficiency. Effectiveness is related to the requirements of the customers, whereas organizational efficiency is the utilization of economic resources by the company to get a predetermined customer satisfaction level. If the supply chain performance is effective and beneficial for the company, it will enrich the supply chain management and the overall business operation of the company (Alzoubi, 2018). However, a lack of performance measurement in the supply chain system can be a severe obstacle for an organization. There are a few significant importance of supply chain performance as follows:

- *Drive actions of the organizations:* Supply chain performance can be the reason for driving two major actions. Firstly, it helps in getting high visibility in the workplace. The employees would strive to get high level performance. Secondly, it helps to improve the decision making abilities of the company. Hence, the management of the companies can adopt correct action plans for the company.
- *Decision-making abilities:* Supply chain performance measurement can help the company to evaluate the proper set of decision criteria and the alternatives. The measurement system's structure drives the actions and decisions at the tactical, strategic and operational levels. Therefore, an accurate supply chain performance measurement helps the management to target and optimize the performance throughout multiple objectives.
- *Closed-loop control:* It is said that feedback should be an integral part of the business process. Effective supply chain performance would have the necessary feedback to reveal progress, facilitate inter-understandings, and identify potential opportunities and communications among the employees. This helps to try and adopt new and innovative strategies as well.

2.3 Forecasting

Forecasting is the process of predicting the pricing or supply and demand of a particular product in an industry. Statistical data and information related to forecasting can help an organization to understand the market condition and demand. Based on the statistical forecast, an organization can increase or decrease its production. It can be related to cost performance, inventory and capacity process, financial performance etc. Also, the forecast also helps in supply chain management to understand the areas of lacking to meet the expectations and demands of the customers (Feizabadi, 2022). Therefore, the customer's relationship gets improvised.

2.4 Research Model

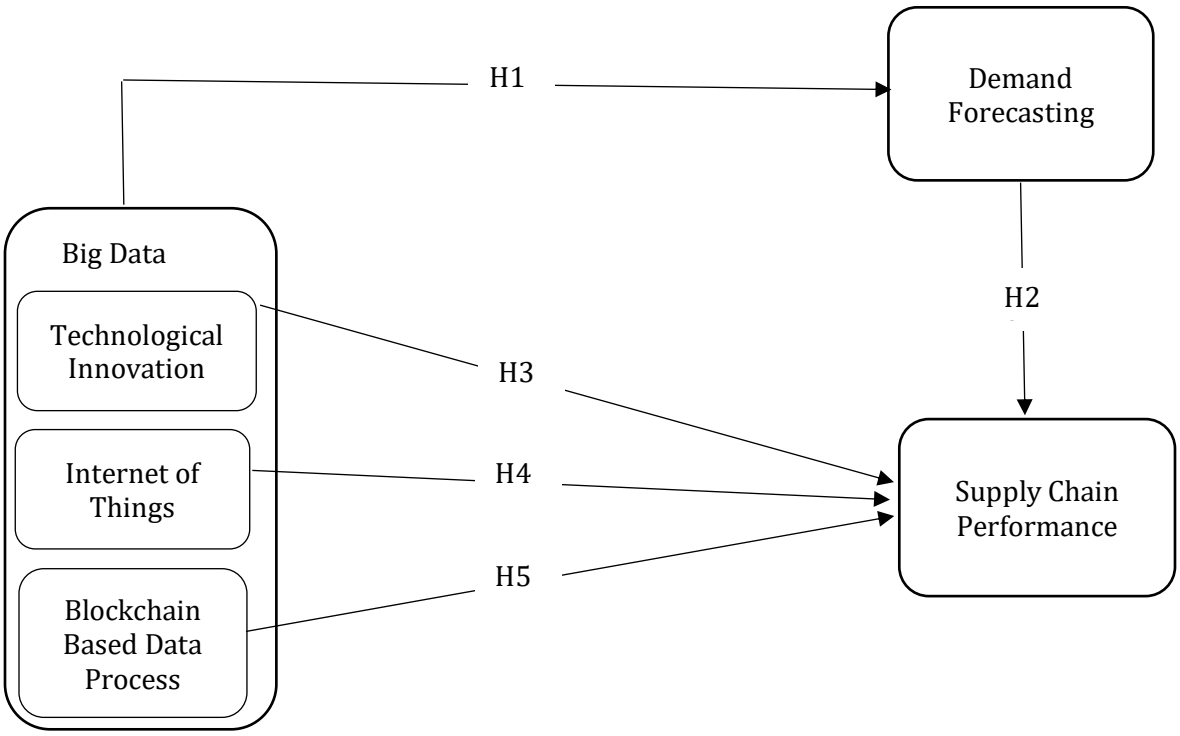

Figure 1: Research Model

2.5. Research Hypotheses

H1: Big Data positively influence the Demand Forecasting

H2: Demand Forecasting positively influence the Supply Chain Performance

H3: Technological Innovation positively influence Supply Chain Performance

H4: Internet of Things Positively Influence Supply Chain Performance

H5: Blockchain Data positively influence Supply Chain Performance

2.6 Methods and Materials

In order to conduct the research, a quantitative approach was used. Through an online survey with the employees working to the hospitality industry in the context of the primary data collection. We have developed a various survey questions for the study and distributed them to survey respondents using a survey-monkey link. Additionally, we have carried out the research while adhering to all ethical standards. The research has been explained and interpreted using a descriptive research design. The researcher was able to obtain significant and necessary information through the use of a descriptive strategy. For this purpose, a convenient random sampling considered to identify the number of participants for the survey. The survey was conducted with 160 participants in the hospitality industry based in UAE. For the

purpose of statistical analysis, SmartPLS software was used to examine the research hypothesis. Model validity and reliability was also checked before testing the model hypothesis.

3. EMPIRICAL ANALYSIS

3.1. Convergent Validity and Discriminant Validity

The measurement's internal consistency dependability was initially assessed using Cronbach's alpha and composite reliability (CR). The CR threshold and Cronbach's alpha are both 0.70. All of the constructs have CR values and Cronbach's alpha coefficients above 0.70, as indicated in Table 1, demonstrating good internal consistency dependability. Also, when assessing convergent validity, factor loadings and extracted average variance were taken into consideration (AVE). All factor loadings are higher than the suggested value of 0.70, and AVE values are higher than the recommended value of 0.50, according to Table 1, which supports the convergent validity (Hair et al., 2018). Also, the discriminant validity was evaluated using the heterotrait-monotrait ratio of correlations (HTMT). In the model validity process, no construct's HTMT score should be more than the recommended value of 0.85. According to Table 1, the HTMT ratio satisfied the recommended criteria, demonstrating the discriminant validity.

Table 1: Composite Reliability, AVE, HTMT

Variables	Cronbach's Alpha	AVE	CR(rho c)	BD	TI	IoT	BCD	DF	SCP
Big Data	0.873	0.898	0.922	-					
Technical Innovation	0.842	0.761	0.905	0.564	-				
Internet of Things	0.739	0.793	0.923	0.619	0.459	-			
Blockchain Based Data	0.895	0.588	0.935	0.655	0.681	0.554	-		
Demand Forecasting	0.888	0.751	0.885	0.722	0.634	0.611	0.639	-	
Supply Chain Performance	0.936	0.724	0.948	0.598	0.797	0.723	0.765	0.583	-

BD=Big Data, TI=Technological Innovation, IoT=Internet of Things, DF=Demand Forecasting, SCP=Supply Chain Performance, CR=Composite Reliability, AVE=Average Variance Extracted, CA=Cronbach's Alpha

3.2. Structured Equation Modeling

The PLS method was used to generate the path coefficients, however the PLS boot-strapping approach with a resampling of 5000 was used to regulate the implication of the path coefficients at significance level (0.05). The chi-square value (R2 value) was first assessed in order to confirm the explanatory power of exogenous factors on endogenous variables. As a result, the model was able to account for 93% of the variance in supply chain performance, which exhibits a high variance rate, and 72% of the variance in Big Data. The R2 values showing the exploratory power are shown in Figure 2.

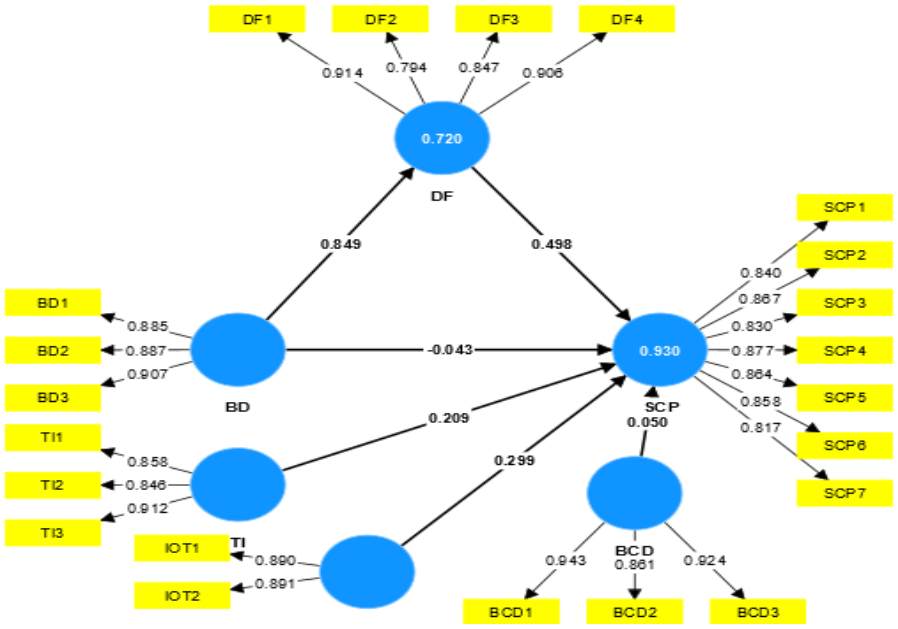

Figure 2: Structured Model Measurement

Additionally, the hypothesis testing findings exhibited, big data positively influence the demand forecasting (Big Data->Demand Forecasting = 0.450, t = 3.30, p 0.000) supporting the H1. The relationship of demand forecasting is positively associated with supply chain performance (DF->SCP = 0.849, t = 15.1, p 0.003), supporting H2. This is demonstrated in Table 2. Moreover, H3, H4 and H5 associated with big data dimensions indicating the relationship with supply chain performance as (TI->SCP= 0.347, t=2.17, p=0.000), (IoT->SCP= 0.502, t=2.88, p=0.000), and (BCD->SCP= 0.370, t=3.05, p=0.000) indicating the significant relationship supporting H3, H4, and H5 respectively.

Table 2: Hypothesis Testing using Bootstrapping Method

Hypothesis	Paths	Beta	R^2	t-value	p-value	Decision
H1	Big Data Industry → Demand Forecasting	0.450	0.720	3.30	0.000	Supported
H2	Demand Forecasting → Supply Chain Performance	0.849	0.930	15.1	0.003	Supported
H3	Technological Innovation → Supply Chain Performance	0.347		2.17	0.000	Supported
H4	Internet of Things → Supply Chain Performance	0.502		2.88	0.000	Supported
H4	Blockchain Based Data → Supply Chain Performance	0.370		3.05	0.000	Supported

*Note: Level of significance at p<0.05***, critical value <1.69.*

4. DISCUSSION

4.1. Implementation of Big Data to improve Supply Chain Performance

The research findings covered a variety of topics that can enhance the effectiveness of the supply chain. But big data's impact on supply chain effectiveness has drawn a lot of attention lately. Big data, which includes information on consumers, sales, and social media interactions, refers to the vast amount of structured and unstructured data that businesses and organizations produce. Big data analytics may help firms make informed decisions and streamline their operations, which will increase production and efficiency.

In addition, findings suggested the ability of big data to improve visibility and transparency throughout the entire supply chain is one of the key advantages it has for supply chain management. Organizations can better understand their

operations and spot potential development areas by examining data from a variety of sources. Data analysis, for instance, can help detect supply chain bottlenecks, such as delays in production or shipment, enabling firms to take remedial action to enhance performance.

H1: Big Data positively influence the Demand Forecasting

The findings of the research exposed demand forecasting using big data analytics can help businesses make wise decisions and streamline their operations for better performance and more efficiency. The capacity of big data to improve accuracy and dependability in demand forecasting is one of its primary advantages. Conventional forecasting techniques rely on past data and patterns, which could not accurately reflect the state of the market or consumer trends. Contrarily, big data analytics enables businesses to examine real-time data from numerous sources, such as social media, site analytics, and online reviews, in order to better understand consumer behavior and preferences. This makes it possible for companies to create demand estimates that are more precise, improving resource allocation, production planning, and inventory management.

H2: Demand Forecasting positively influence the Supply Chain Performance

It has evidenced through the study analysis that demand forecasting, which entails projecting future consumer demand for goods or services, is a crucial component of supply chain management. Organizations may improve the performance of their supply chains by optimizing their inventory management, production planning, and resource allocation. It has examined the effect of demand forecasting on supply chain efficiency in this important discussion. Improved inventory management is one of the most important effects of demand forecasting on supply chain efficiency. Organizations may maintain ideal inventory levels by using accurate demand forecasting, which helps them avoid overstocking and unnecessarily tying up money while yet having enough inventory to meet customer demand. This aids businesses in preventing stockouts and lowers the danger of having too much inventory, improving productivity and profitability.

H3: Technological Innovation positively influence Supply Chain Performance

The findings contributed to carry the concept that clarifies one of the most significant impacts of technological innovation on supply chain performance is the improvement in efficiency. Automation and robotics have made it possible to streamline processes and reduce the time and labor required to complete tasks. This has resulted in faster production cycles, reduced lead times, and improved delivery times, which can improve customer satisfaction and reduce costs for businesses. Another key impact of technological innovation is the increased visibility and traceability of products throughout the supply chain. IoT sensors and tracking technologies allow businesses to monitor the location, condition, and status of products in real-time, which can help prevent delays, reduce waste, and improve inventory management.

H4: Internet of Things Positively Influence Supply Chain Performance

According to the empirical findings and the prior studies, it is noticed that the Internet of Things (IoT) has had a significant impact on supply chain performance in recent years (Rejeb et al., 2020). IoT refers to the connection of physical devices and sensors to the internet, enabling them to communicate and share data with each other. This technology has the potential to revolutionize supply chain management by improving efficiency, reducing costs, and enhancing visibility and control. In addition, IoT can also improve supply chain efficiency by automating processes and reducing manual intervention. For example, IoT-enabled machines and robots can monitor and control production processes, reducing errors and improving quality. IoT can also enable predictive maintenance, where machines can alert operators when maintenance is required, reducing downtime and improving overall efficiency.

H5: Blockchain Data positively influence Supply Chain Performance

According to the final hypothesis being investigated, the immutable and transparent record of every transaction that takes place along

the supply chain could revolutionize supply chain management. The performance of supply chain management can be enhanced by using this technology in a number of ways, including by boosting productivity, cutting expenses, and enhancing transparency. The results also revealed that one further significant advantage of blockchain technology is its capacity to lower supply chain costs. Blockchain technology can assist to lessen the need for middlemen in the supply chain by offering a safe and open ledger of all transactions.

5. CONCLUSION

It is evident that Big Data and Forecasting have a significant impact on improving the overall performance of the Supply chain. It has been pointed out that with the implementation of Big Data in the supply chain, the decision-making ability of the organization can be improved. Big data can help in the various aspects of the SCM, such as planning, delivery, manufacturing, development and return of the products. With the help of the data acquired from Big data, the organization can forecast the market value and demand. This would help the organization in earning much higher revenues and help in reducing the wastage of the products.

In addition, big data analytics has the potential to greatly impact supply chain performance in the hospitality industry through demand forecasting. The ability to collect and analyze vast amounts of data from various sources allows for more accurate and timely predictions of customer demand, enabling hotels and other businesses in the industry to optimize their inventory levels and supply chain operations. This can result in reduced costs, increased efficiency, and improved customer satisfaction. Yet before leveraging customer data for demand forecasting, organizations must carefully evaluate the moral and privacy ramifications. It will be intriguing to see how supply chain management techniques in the hotel sector change as big data analytics continues to advance.

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Impact of Information Security on Online Operations: The Mediating Role of Risk Management

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A B S T R A C T

Online operations are becoming a crucial component of the healthcare ecosystem in the modern world. But, as technology has become more widely used, so too has the risk of cyberattacks grown. Implementing information security measures is therefore crucial if we are to preserve sensitive patient data and maintain online operations. By recognizing, evaluating, and controlling possible dangers, risk management is essential in reducing these risks. In order to understand how information security affects online operations in the healthcare sector, this study will look at the mediating role of risk management. A hypothetical model was assessed using SmartPLS 4.0 containing 132 respondent's data from 56 healthcare providers (hospitals) in Dubai UAE. The empirical results can offer insightful information about the significance of information security and risk management in guaranteeing the security and safety of sensitive patient data in the context of online healthcare.

1. INTRODUCTION

Information security is now of utmost importance to enterprises, especially those in the healthcare industry. Healthcare organizations must take the necessary precautions to maintain the security, integrity, and availability of their information in light of the growing volume of sensitive patient information being stored and exchanged electronically. Healthcare businesses are exposed to a variety of risks, not just information security issues. They must also control risks related to patient security, legal compliance, economic security, and other things. In order to maintain the continuity and sustainability of healthcare services, good risk management is essential. This review of risk management in healthcare with a focus on information security will cover the significance of risk management, fundamental ideas and principles, and best practices for managing risks. (Naeem et al., 2019) introduced a scalable mutation testing approach that utilizes predictive analysis of a deep learning model, offering insights that can contribute to understanding the potential impact of information security measures on online operations through improved risk management

Online operations and information security are essential components of the healthcare sector. The need to keep patient data private has become critical as healthcare professionals depend more and more on technology to store and exchange patient data. Sensitive patient information must be protected by healthcare institutions from cyber threats such data breaches, ransomware attacks, and phishing schemes. With the rise of

telemedicine and remote patient monitoring in recent years, online operations in healthcare have also grown in significance. Although these technologies have helped healthcare practitioners increase patient outcomes and access to care, they also present a special set of security problems. (Saeed, 2023a) and (Saeed, 2023b) explains the role of security and privacy in e-commerce and digital workspaces. Moreover, healthcare firms must have strong information security processes and systems in place to guard against cyber threats given the sensitive nature of patient information. Implementing safe software and hardware, educating workers about cybersecurity best practices, and regularly auditing and evaluating their security posture are all part of this. In this situation, healthcare companies must adopt an all-encompassing strategy for information security and online operations, incorporating security into every facet of their work and placing a constant emphasis on the protection of patient data. By doing this, they can contribute to ensuring that patients receive high-quality, secure care in a reliable setting.

2. LITERATURE REVIEW

2.1. Information Security and Risk Management

Due to the prevalence and sophistication of cyber threats, information security is becoming more and more crucial to risk management. There are several things to take into account to make sure that information security measures are successful in limiting risk, according to several studies. According to (Federico Del Giorgio, 2022), using risk management frameworks is a crucial component of information security. These frameworks offer a methodical method for detecting, evaluating, and reducing risks and can be customized for particular businesses or groups. For addressing cybersecurity risk in critical infrastructure sectors, for instance, the National Institute of Standards and Technology (NIST) Cybersecurity Framework offers a collection of recommendations and best practices. In addition, the function of employees in information security is another important factor. Organizations must give enough training and resources to ensure that employees understand the risks and how to reduce them. Employee conduct and knowledge are crucial in averting cyber assaults. Organizations must also have policies and procedures in place to deal with security issues, guarantee that they are reported right away, and make sure they are dealt with. External factors, like laws and industry norms, can also have an impact on how successful information security procedures are.

H1: There is significant relationship between Information Security and Risk Management.

2.2. Information Security and Online Operations

A prior study demonstrated many ways in which information security benefited online operations (Von Solms and Van Niekerk, 2013). First of all, it decreased the possibility of data breaches and raised client confidence, which increased sales and revenue. By minimizing the time and effort required to address security events, it improved the efficiency and efficacy of online operations. Lastly, it assisted companies in adhering to legal and regulatory obligations, helping them avoid exorbitant fines and legal actions. The authors discovered that a few other factors affected how information security affected online operations (Bandyopadhyay et al., 2010). For instance, it was discovered that the influence of information security on online operations depends on the size of the organization, the type of business, and the level of security investment. Information security was shown to have a greater impact on bigger companies and those in the financial industry than on smaller companies and those in other industries. Overall, the research indicates that the success of online activities depends heavily on information security. To increase the effectiveness and efficiency of their online operations as well as customer trust and confidence, businesses must invest in information security. The report offers insightful advice for businesses looking to enhance their online operations through information security spending.

H2: There is significant relationship between Information Security and Online Operations.

2.3. Risk Management and Online Operations

As highlighted by (Chu et al., 2020), the use of risk assessment tools and frameworks is a crucial factor in risk management for online operations. These tools can assist businesses in risk identification and

prioritization, risk assessment of likelihood and possible impact, and risk mitigation strategy development. For instance, the ISO 27001 standard, which can be used for online operations, offers a framework for addressing information security threats. The requirement for a thorough security strategy is a crucial component of risk management for online operations. This entails putting in place suitable security measures including firewalls, antivirus software, and encryption as well as conducting regular security tests and assessments. In order to ensure a prompt and efficient reaction in the event of a security breach, companies should also have an incident response strategy in place. The literature also underlines how crucial employee education and awareness are to reducing risk in online business operations. Organizations must give enough training and resources to ensure that employees understand the dangers and how to manage them. Employees play a crucial role in preventing cyber assaults and securing sensitive information.

H3: There is significant relationship between Risk Management and Online Operations.

2.4. Information Security impact on Online Operations with mediating role of Risk Management

For businesses that operate online, information security is a crucial. While concerning the security of online transactions have been raised due to the rise in security lapses and cyberattacks, which can result in monetary loss, reputational harm, and legal consequences. According to (Min, 2019), risk management is essential for organizations to minimize the impact of security breaches and cyber-attacks on their online operations. This framework also considers the impact of information security on online operations and how risk management can mediate this impact. In one study, investigate how risk management acts as a mediator in how information security affects online operations in Chinese e-commerce enterprises. The study discovered that risk management mediates the positive impact of information security on online operations. The study also discovered that risk management benefits online business. Another study by (Sindhuja, 2014) looks at how online buying behavior is impacted by information security, including the roles of risk perception and risk management. The study discovered that risk management efficiently supports the information security, which has a considerable positive impact on online purchasing behavior. The study also discovered that risk perception had a detrimental effect on consumers' online shopping behavior.

(Bottle and Aylin, 2008) study explores how risk management functions as a mediating factor in the UAE when examining the influence of information security on the adoption of online banking. The study discovered that risk management mediates the influence of information security, which has a considerable beneficial impact on the adoption of online banking. The study also discovered that the adoption of internet banking is positively impacted by risk management (Fan et al., 2015). In a study (Rachid et al., 2017), the mediating effects of risk perception and risk management are examined in relation to the influence of information security on online buying behavior in China. The study discovered that risk management mediates the influence of information security, which has a considerable impact on online shopping behavior. However, there are few components have been discussed in order to assess the risk and manage within the information security concerns, for instance, “risk identification”, “risk analysis’, and “risk mitigation”. The use of risk assessment frameworks, such as the ISO/IEC 27005 standard, which offers a systematic approach to identifying and analyzing risks in information security, is one well-known method of risk identification. Identifying assets and their values, identifying threats and vulnerabilities, evaluating the likelihood and effect of risks, and choosing appropriate controls to manage risks are all stages that are often included in these frameworks (Brandon-Jones et al., 2014).

The use of threat modelling techniques, which entail identifying potential threats and attack vectors to a system or application, is another method of risk identification. These methods usually entail building a thorough model of the system or application, spotting potential threats and vulnerabilities, and figuring out how likely and damaging these threats are to be. However, information security relies heavily on the process of risk analysis, which examines potential threats and weaknesses to information assets and evaluates their likelihood and potential effects.

Using quantitative risk analysis approaches, such as the annualized loss expectancy (ALE) method, is one method of doing risk analysis. Based on the likelihood that the breach will occur and the potential consequence of the breach, this method estimates the cost of a prospective security breach over a one-year period. Moreover, risk mitigation is a critical process in information security that involves implementing controls and strategies to reduce the likelihood and potential impact of risks to information assets. Using technical controls like firewalls, intrusion detection and prevention systems, and encryption is one method of risk reduction. These safeguards are intended to stop illegal access to information assets, identify and address potential security holes, and guard against unauthorized disclosure or alteration of sensitive data. The prior studies evidences proven there is no mediation of risk management in the relationship between information security and online operations in healthcare sector. Based on the above literature following hypothesis was developed:

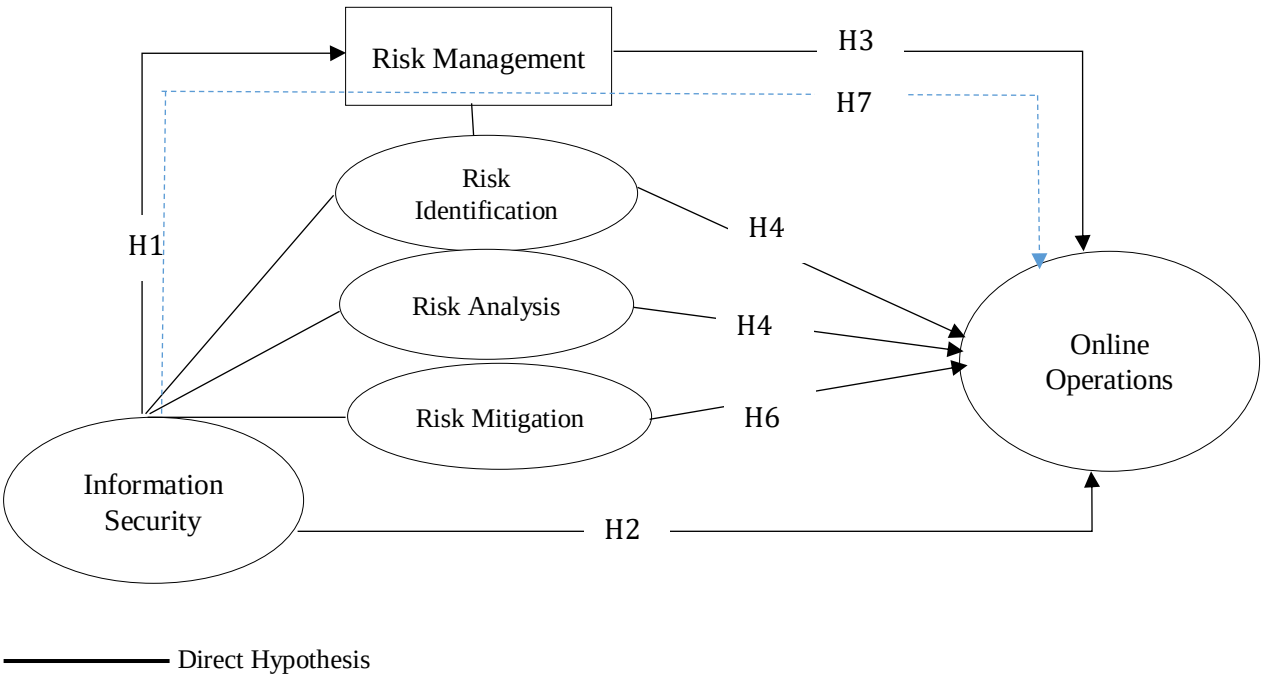
H4: There is significant relationship between risk identification and online operations using information security.

H5: There is significant relationship between risk analysis and online operations using information security.

H6: There is significant relationship between risk mitigation and online operations using information security.

H7: There is significant relationship between information security and online operations with mediating role of risk management.

2.5. Research Model



Mediating Hypothesis

Figure 1: Research Model

3. METHODOLOGY

The research was conducted to examine the impact of information security on online operations with mediating role of risk management. These variables were assessed using a quantitative technique to collect empirical evidences from healthcare sector located in UAE. however, the healthcare sector has increased to adopt the information security because of using technological techniques in the business models. So the managerial employees were targeted to respond our survey questionnaire in order to collect primary data of the research. 56 public and private hospitals were approached to get the responses. 132 respondent's data were utilized to assess the research model.

The survey instrument was a five point likert scale questionnaire developed by authors. The questionnaire contained 23 items specified to each variable (dimension) respectively. The respondent's data were assessed using SmartPLS 4.0 software to validate the model. The model assessment inclusive of discriminant and convergent validity, PLS-SEM approach was applied to check path coefficients and significance level of the hypothesis. Empirical analysis section contains overall statistical analysis demonstrated below.

4. DATA ANALYSIS

4.1. Assessment of the Measurement Model

Reliability (item and internal consistency) and validity tests are included in the measuring model to validate the variables utilized in this investigation (convergent and discriminant). The validity and reliability of the construct are demonstrated in Table 1. The results (see Table 1) show that the structures' internal reliability was further validated using CA and CR values, and the outcome had to be greater than 0.60 to be considered acceptable. The results show that all factors' CA and CR values exceeded the recommended value of 0.60, indicating that the study met the requirements for internal consistency and reliability.

Table 1: Composite Reliability, Cronbach's Alpha, AVE, HTMT

Variables	IS	RM	OO	RI	RA	RMT	CA	CR	AVE
Information Security	-						0.871	0.899	0.636
Risk Management	0.564	-					0.844	0.829	0.613
Online Operations	0.619	0.459	-				0.917	0.844	0.722
Risk Identification	0.655	0.681	0.554	-			0.814	0.907	0.654
Risk Analysis	0.722	0.634	0.611	0.639	-		0.732	0.898	0.578
Risk Mitigation	0.598	0.797	0.723	0.765	0.583	-	0.865	0.836	0.620

IS=Information Security, RM=Risk Management, OO=Online Operations, RI=Risk Identification, RA=Risk Analysis, RMT=Risk Mitigation, AVE=Average Variance Extracted, CA=Cronbach's Alpha

The convergent validity of the research variables was also examined using the AVE value, and the results revealed that the AVE values ranged from 0.501 to 0.640, which is higher than the recommended value of 0.50. It is plausible to conclude that the research variables satisfy convergent validity as a result. The validity (discriminant) of the research variables was also evaluated using the heterotrait-monotrait correlation ratio (HTMT). The results showed that, no problems with discriminant validity are shown by the HTMT values for all components being less than 0.85. The results display that the variables under study have strong discriminant validity.

Table 1 demonstrate overall results.

4.2. Structured Equation Modeling and Hypothesis Testing

The structural model is evaluated after the establishment of the measurement model, and the hypothesis is then tested. The study employed PLS-SEM and employed a boot-strapping resampling procedure with 5000 subsamples. In Figure 2 and Table 2, the outcomes of the hypothesis testing are displayed.

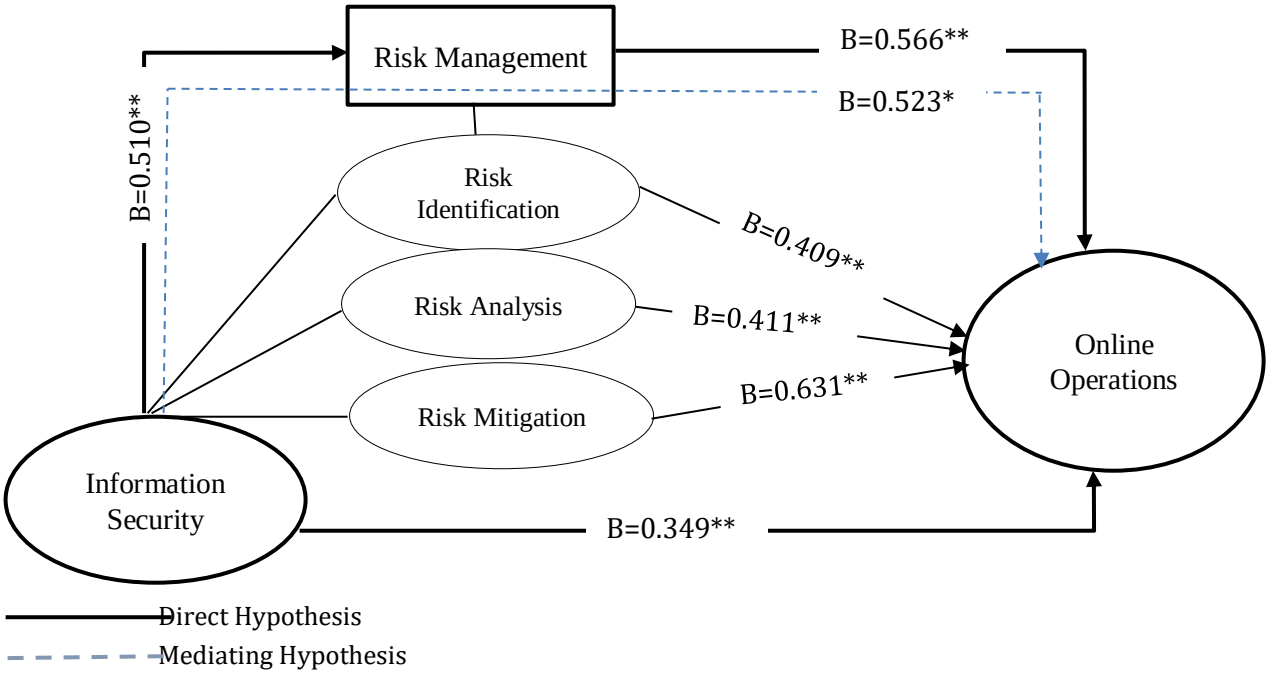


Figure 2: Structured Model Measurement

Additionally, the hypothesis testing findings exhibited, big data positively influence the demand forecasting (IS → RM β= 0.51, t = 4.31, p 0.000) supporting the H1. The results indicating a significant impact of information security on online operations as (IS → OO β= 0.34, t = 3.66, p 0.000), supporting H2 of the model. The H3 demonstrate the relationship between risk management and online operations a significant relationship by (β=0.56, t=2.99, p=0.000) supporting H3 of the model. In addition, the components of risk management were assessed with online operations that depicted significant relationship as (IS → RI → OO, β= 0.40, t=7.10, p=0.000), supporting H4. The impact of risk analysis showed as (IS → RA → OO, β= 0.41, t=5.51, p=0.000), and (IS → RMT → OO β= 0.63, t=9.11, p=0.003) shows the H6 is also accepted. Finally, the H7 representing the main mediating hypothesis revealed as partially mediated between the relationship of information security and online operations with path coefficients of (IS → RM → OO, β=0.52, t=6.34, p=0.000) indicating a support to H7 of the research model. Table2 and figure 2 demonstrate the hypothesis results.

Table 2: Hypothesis Testing using PLS-SEM

Paths	Beta	t-value	p-value	Decision
H1: Information Security → Risk Management	0.510	4.31	0.000	Supported
H2: Information Security → Online Operations	0.349	3.66	0.000	Supported
H3: Risk Management → Online Operations	0.566	2.99	0.000	Supported

H4: Information Security → Risk Identification → Online Operations	0.409	7.10	0.000	Supported
H5: Information Security → Risk Analysis → Online Operations	0.411	5.51	0.000	Supported
H6: Information Security → Risk Mitigation → Online Operations	0.631	9.11	0.002	Supported
H7: Information Security → Risk Management → Online Operations	0.523	6.34	0.000	Partial Mediation

*Note: Level of significance at p<0.05**, Critical Value„t <1.69.*

5. DISCUSSION

Our research analysis proven to be said the significant impact of information security on online operations through risk analysis, identification and mitigation. However, due to the potentially serious and wide-ranging consequences of security breaches, information security is of the utmost importance for online activities. Without sufficient security measures, businesses run the danger of disclosing critical information, losing client confidence, and tarnishing their name. In order to reduce possible risks and the effects of security breaches on online operations, good risk management is crucial. One essential factor to take into account is how risk management influences how information security affects online operations. The process of discovering, evaluating, and reducing possible threats to information assets is known as risk management. Organizations can better safeguard their digital assets and lessen the impact of security breaches on their online operations by using the right risk management practices.

The empirical findings demonstrated the significance level of risk management on online operations. Similarly, implementing efficient security controls is one method risk management can mitigate the impact of information security on online operations. To prevent unauthorized access to their systems and safeguard sensitive data, for instance, businesses can put in place access controls, encryption, and intrusion detection systems. They may lessen the potential harm to their online operations and lower the likelihood and effect of security breaches by doing this. Furthermore, a culture of security can be established throughout the firm due to proper risk management. This include raising awareness of potential hazards, putting policies and procedures in place to lessen risks, and giving staff members security training. The findings suggest it's crucial to remember that risk management cannot totally avoid the possibility of security breaches having an adverse effect on online operations. Because cyber risks are dynamic in nature, enterprises must maintain vigilance and flexibility in their risk management procedures. To detect new threats and make sure that risk management solutions continue to work over time, regular risk assessments, vulnerability scans, and penetration testing are critical.

6. CONCLUSION

In conclusion, there has been noted a significant impact of information security on online operations with mediation of risk management. However, data security is an essential component of internet business in the healthcare industry. Effective risk management is a key mediator in reducing these risks because security breaches can have serious effects on patient data and online operations. Sensitive patient data must be protected from illegal access, modification, or disclosure, so healthcare companies must put in place effective risk management plans that involve technical and administrative controls. Additionally, they must make sure that all employees are compliant with all applicable legal and regulatory obligations, as well as aware of any risks and how to minimize them. Moreover, the ability to manage risk effectively is essential for preserving the confidence of patients and other stakeholders. Healthcare businesses with strong risk management practices are more likely to be regarded as responsible stewards of patient information, increasing their standing and encouraging client loyalty.

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Technology Acceptance Model and Attitude of Consumers towards Online Shopping with Special Reference to UAE

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A R T I C L E I N F O

Keywords:

Online shopping, e-commerce, consumer behaviour, consumer intention, consumer buying attitude, e-transactions awareness, TAM model.

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A B S T R A C T

The research focuses on the potential for customers of different goods and services to adopt an Internet-based buying attitude that is more intensive than the current scenario inside the UAE. The access of Internet, the volume of Internet usage, and consumer knowledge of e-commerce are used to assess customers' e-readiness. Taken into account in the research a total of 264 e-transactions permitted clients from the cities were included in the study. Three different analyses and multiple regression analysis have been employed to determine out that the original desire of the residents of Dubai and Sharjah. Our examination used a descriptive methodology and survey technique to address relevant results and their implications for probable B2C e-shopping adoption in the nation's shopping activities.

1. INTRODUCTION

Although becoming a significant leisure as well as financial hub inside the globe, the United Arab Emirates (UAE) has yet to completely achieve its goal in B2C e-shopping practises. Several branded merchants in several service and product areas keep operating in a traditional manner while embracing World Wide Web based selling activities, indicating inadequacies in this respect (Chong et al., 2010). The expansion of the virtual market place with affordable high-quality Internet access for both residents and businesses, as well as the decreasing cost of computers with an increase in potential users, indicate underutilised opportunities and, thus, the possibility of B2C e-Commerce adoption in the UAE. Given the existence of low-cost, increased Web access in the region, this position contrasts sharply also with actuality of measure of benefit as well as facilities in other regions of the world, notably in Europe, the United States, and many other Asian nations. Nevertheless, in aspects of web ticketing for air travel, online auctioning, and online purchases for customer commodities, there are some effective B2C e-Commerce strategies functioning inside the UAE. Furthermore, the current Internet penetration rate in the region demonstrates the possibility of virtual market threshold levels that have been untapped thus far (Kim et al., 2015)..

Depending mostly on research in this area, the current scenario is considered as a proposal for a remedy, such as inadequate aspects of e among buyers, rather than corporate preparedness to implement B2C style e-shopping. The establishment of a plan map for B2C e-Commerce

adoption in the region will be aided by quantifying this proposition in terms of assessing customer propensity to purchase online (Wei et al., 2009). Successful B2C e-Commerce adoption in the area has the potential to change the UAE's online buying environment, which is typified by large malls packed with people. Benefits such as improved quality of life, cost savings, including service effectiveness have been highlighted as justifications for e-shopping adoption. Furthermore, these analyses have identified a number of businesses which might help improve e-shopping adoption in distinct demographic situations (Özkan et al., 2010). Consumer attitudes regarding World Wide Web based online shopping, on the other hand, are seen as the most important factor in determining the success of B2C e-commerce in a given area. As a result, the significant research issue envisioned in this analysis is to identify buyers' tendency to buy electronically in regard to e-shopping which might serve as a foundation for creating an initial feature stance for B2C e-shopping adoption strategies inside the territory (Brusch & Rappel, 2020). Inside the scope of this research, E-Readiness is a metric designed to construct a categorization scheme for innovation adoption prospects from both the personal and commercial perspectives. Evaluating customers' e-Readiness will aid in determining their propensity to make online purchases for a variety of items as well as offerings that just aren't currently accessible online inside the UAE. Simultaneously, the worldwide economy for diverse goods and administrations available via shopping, including traditional and innovative, is growing steadily. Concerns such as growing online shopping centre, falling overhead expenses, ease of buying, and time savings due to logistical issues such as traffic and transit costs are all driving to this expansion. Nevertheless, businesses providing goods and services in the UAE are clearly not capitalising on the potential market with B2C e-Commerce apps in their everyday activities, necessitating this research into the capabilities as well as views of e-shopping adoption from the standpoint of purchasers as per Long, Q. (2016).

2. LITERATURE REVIEW

2.1. Research Motivations

In the United Arab Emirates, the underutilization of e-commerce applications in retailing operations of items and services is evaluated from two entrepreneurial perspectives: consumer preference and product availability in the direction of B2C e-shopping platforms as well as their capacity. It should be included into the fully prepared online food businesses, cloth business etc (Kalinic & Marinkovic 2016). Understanding customer preferences for the, on the other hand, is a difficult task. World wide web based retail activities are seen to be a promising topic of research the current production's challenge as well as, as a result, and its goals where the study's hypotheses have been presented in this manner:.

a. To recommend a way for implementing Business to consumer (B2C) online shopping in the selling of diverse products and services.
b. Buyers of different goods as well as facilities were asked to rate their e-shopping awareness.
c. To determine customer approval of ordering items as well as digital goods.

To achieve these goals, the accompanying null hypothesis (H0) were evaluated, but also presented in this study such as:

a. Buyers' e-shopping knowledge is unaffected by their social economic factors.
b. Shoppers' knowledge of online shopping is unaffected by the amount of time they spend on the online portal.

Buyers' propensity to purchase items as well as digital goods is influenced by overall understanding of online shopping system.

2.2. Related work

Consumer innovativeness and online buying information reliance have a direct and beneficial effect on future online shopping intention, according to data analysis, proving the core TAM theories. The introduction of easier-to-use interfaces in online buying can enhance information reliance, but only if perceived utility stays high. The ease of use view of the shopping medium, referred to as "shopping channel" throughout this research, is favourably influenced by consumer innovation. A wide range of stakeholders are affected by the growing use of the internet as a retail channel. Retailers are expected

to sell online, logistics companies are compelled to rearrange their supply chains, and local governments are attempting to maintain local retail competitive while also managing the growth in freight transportation. In this context, a growing corpus of research is looking into the socio-economic characteristics of online shoppers as well as the regional variance in B2C demand. However, as one might anticipate from such a young development, there is little agreement (Song, J. & Zahedi, F. 2001). (Ali et al., 2020) present an aspect-based requirement mining technique that can contribute to understanding the factors influencing the technology acceptance and attitudes of consumers towards online shopping. (Khalid et al., 2023) offer valuable insights into machine learning-based fileless malware detection, which can contribute to understanding the technological measures relevant to ensuring consumer trust and security in the context of online shopping in the UAE.

The global use of the Internet has exploded in recent decades, needing a greater knowledge of how e-commerce is adopted across cultures (Saeed, 2023). In light of this, this study adds to the current literature on technology uptake and acceptability in the following ways. To better understand e-commerce adoption across cultures, the authors first create an expanded technology acceptance model that integrates trust and perceived behavioural control and test it in contexts outside of the United States. Despite some notable contrasts between the two cultures, the predictive power of the technological acceptance model is strong and remains true for both Pakistan and Canada, contrary to the authors' expectations. Second, while the impact of perceived ease of use and perceived usefulness on consumers' intends to purchase online was confirmed in both cultures, the findings show the complicated linkages between perceived ease of use, perceived usefulness, and intention to adopt in each nation. The authors give advice to technology managers and e-retailers on how to navigate the adoption of new technology and e-commerce in different cultural situations. As the most rapidly developing online shopping sector, online grocery shopping plays a significant part in the present online market (Hidayat-ur-Rehman et al., 2016). Despite this, customers in various European nations adopt this purchasing style in different ways. The Technology Acceptance Model (TAM) may be utilised to better analyse customer behaviour toward frequent online buying in order to explain such a difference. This study goes beyond TAM and applies it to online grocery buying, assuming that users perceive online grocery shopping as a system interaction, i.e. a web page interface. The purpose of this study is to describe customer behaviour in the online grocery buying arena. Structural equation modelling was used to identify characteristics that influence online grocery purchasing and, more importantly, to discover positive correlations between them (Ciasullo et al., 2017).

The goal of this article is to look at the elements that influence young people's adoption of internet shopping in Macedonia. In the Republic of Macedonia, online shopping is becoming increasingly popular, particularly among the youth. Youth have long been acknowledged as a very representative sample of today's online population. This is especially true for our country's internet buyers. The suggested study paradigm is TAM based, enhanced with relevant characteristics that are crucial for online shopping– trust, website usability and customer service. They are very important criteria for the Republic of Macedonia, given the size of the market, inadequate delivery methods, and incapacity to utilise online payment, as well as other major aspects that might impact customers' ultimate decision to purchase online. Regression analysis is used to examine the significance of the features included in our expanded TAM model. All researched elements are confirmed to be important based on the findings (Ghose et al.2011). Further research on the moderating impacts of demographic characteristics might lead to a better understanding of customers' attitudes toward shopping online. Computer anxiety and web annoyance have also been identified as variables influencing online consumer behaviour. For customers all across the world, the COVID-19 epidemic has created a new reality. To cope, users of digital technologies have been forced to embrace and apply specialised technologies almost immediately. They're doing it in a socially isolated environment, all while being afraid of contracting the sickness. The goal of this research is to investigate how unexpected events disturb established theoretical models and what this

means for the post-COVID-19 future. As a result, the paper examines the unified theory of acceptance and use of technology (UTAUT) model in the context of the COVID-19 pandemic and social isolation, and it identifies herd behaviour as a possible new mechanism influencing behavioural intention under these unusual decision-making conditions (Alnsour et al., 2019).

This study explores the effect and impact of choice overload and Internet shopping anxiety on online shopping patronage in the context of fashion products by examining the extent to which consumers seeking variety while shopping online would experience an overload of the innumerable choices offered to them and whether the availability of a large assortment of choices will have a significant effect on the patronage of e-stores providing choice in their products. The study also aimed to look at the anxiety that customer's feel when buying online, as well as the impact that anxiety has on customers' willingness to shop at online retailers. Globally, e-shopping is on the rise, and the COVID-19 epidemic has further accelerated this trend. The use of internet shopping in Lisbon prior to the pandemic breakout is examined in this research. By concentrating on a single city, variables such as internet connection and delivery services may be controlled, boosting the remaining aspects of the online transaction. The findings reveal that internet purchasing is spatially dependent in an interurban context as a reflection of different socioeconomic groups' residential location choices. Furthermore, as internet access and delivery services become more widely available, residential location preferences may come to explain e-commerce adoption in both urban and non-urban settings (Al-Zoubi, 2016).The e-shopping geography of Lisbon reveals that age and prosperity are factors in explaining e-shopping adoption, with a clear contrast between core and peripheral districts, some of which contain large social housing developments. As a result, if stores relocate online, certain consumers' purchasing options may become limited as a result of their socioeconomic position and resulting residential choices. Nonetheless, smart agreements between businesses and the government may be formed to boost shopping options. Physical establishments should be encouraged to open in places where people are less likely to purchase online. The public sector may further support e-shopping adoption by fostering digital literacy, which is especially important given that Portugal's population is ageing, as it does in most European nations.

The goal of this study is to determine the characteristics that attract individuals in the United Arab Emirates (UAE), especially in Dubai, to use e-government. The UAE is regarded as one of the Arab world's major providers of this service. In 2001, Dubai, one of the UAE's emirates, publicly inaugurated this service. This research provides a paradigm including the following exogenous factors: internet connection quality, computer self-efficacy, security problems, and website features, based on the technology acceptance model (TAM). To assess the strength of the hypothesised associations, the data was analysed using structural equation modelling (SEM). The findings bolster the extended TAM model's ability to predict people' attitudes about e-government. They also show how external variables, such as perceived ease of use and perceived usefulness, have a major impact on individuals' attitudes. The conclusions of this study's findings are explored, and recommendations for further research are made. The quick advancement in the creation and availability of the internet is keeping up with the growth of e-commerce operations. However, just because internet technology is available and widely used does not mean that consumers choose to purchase online. The purpose of this study is to look at the elements that influence customers' decisions to engage in online buying in the UAE, and to see if the dominance of mall culture has an impact on consumer adoption of online shopping. Consumer views and intentions regarding internet buying were assessed using the Technology Acceptance Model. The data was gathered using the convenience sample approach and internet questionnaires. Based on the examination of sample data, it is clear that online shopping is still not particularly popular in the UAE, with inhabitants preferring to purchase in malls. The study's findings are relevant to e-commerce retail companies operating in countries where mall culture has a significant impact on the retail landscape, as they will aid them in devising a plan to suit both online and in-store customers' buying preferences. The influence of the COVID-19 epidemic on the study's aims and conclusions is also taken into account.

In recent study, academics have added additional dimensions to standard IS adoption models to capture users' relational, social, and emotional views. These ideas have prompted inquiries into their origins as well as the nature of the user-artefact connection. Users see and respond to information technology (IT) objects as social partners, and they build perceptions about their social features, according to this article. As a result, users' views of how close these features are to their own have an impact on their evaluations of these objects. Our paper uses social psychology and human-computer interaction research to develop hypotheses about the effects of perceived personality similarity (PPS) and perceived decision process similarity (PDPS) on a variety of beliefs in the context of online shopping and using an automated shopping assistant (enjoyment, social presence, trust, ease of use, and usefulness). The findings suggest that PDPS is a precursor to these beliefs, whereas PPS's effects are mostly mediated by PDPS. Furthermore, the findings show that the impacts of perceived similarity outweigh the effects of individual judgments of the user's and assistant's personalities and decision-making processes in general. The ramifications of these findings for IS design are significant. They emphasise the necessity of creating objects that may be tailored to the preferences of consumers. They also emphasise the necessity of evaluating perceptions of similarity rather than focusing exclusively on views of the IT artefact's attributes, which is a popular strategy in IS adoption study.

Computer and internet advancements have altered how people interact, work, and play in the contemporary world, as well as how we do business. Businesses have migrated into the virtual realm provided by the internet to sell products and services online, not just because computers and computer networks have become completely integrated into most actual corporate activities. The first e-commerce websites appeared in the 1980s, and with the introduction of the internet in the early 1990s, online retail transactions have constantly increased in complexity and number throughout the world. As a result, it is unfortunate that the Kingdom of Saudi Arabia (KSA) is trailing behind in terms of e-commerce development. The country is already a major oil producer and has achieved considerable advances in both computer hardware and software in the Middle East's ICT industry. However, the fact that such a wealthy nation has such a low adoption of retail e-commerce (online shopping) is cause for worry, and an investigation into the causes for the poor adoption of retail e-commerce (online shopping) was necessary (Akhter, F. 2008). The primary gaps in the research are due to a concentration on the B2B e-commerce model, as well as technological and environmental factors, while disregarding human psychology and capabilities. Another It was also discovered that there was a gap in categorising existing users into distinct user categories. The investigation this dissertation attempted to fill in the gaps by investigating the existing state of ecommerce (online shopping) in Saudi Arabia and determining the necessary conditions for its acceptance a statistical model to capture the link between ecommerce adoption and important parameters from a B2C perspective, identifying different types of ecommerce adopters, and exploring the influence of age, gender, and expertise on the adoption of ecommerce in Saudi Arabia. The qualitative findings emphasised the importance of the model's components, as well as the age, gender, and knowledge difficulties that are unique to the Saudi Arabian cultural setting. In addition, qualitative data collection and analysis revealed information on the attitudes and feelings of ecommerce users in Saudi Arabia. Age, gender, ICT expertise, payment, delivery system, product availability, trust, and past experience were all shown to be variables in Saudi Arabia's e-commerce adoption (Celik, 2016).

The goal of this study was to see how different factors influenced the Online Shopping Experience (OSE) of customers in the United Arab Emirates who used Amazon and Noon e-commerce platforms (UAE). The authors identified seven characteristics that potentially influence OSE through a study of literature and subsequent analysis, including customer service, customer happiness, reliability, self-congruity, attractiveness, product diversity, and affordability (value for money). Using an integrated research framework, the influence of these on the customer's purchasing experience was investigated in this study. The expected influence of sub-factors of these dimensions on the purchasing experience in the context of both Amazon and Noon consumers was investigated further (Saxena, R. P. 2019). The study's findings

imply that by concentrating on customer service, customer delight, reliability, product diversity, and self-congruity, e-commerce platforms in the UAE may enhance their consumer experience. It is also hinted that the e-commerce business in the UAE can gain a competitive advantage by focusing on the theoretical components of OSE and their implementation in appropriate circumstances (Al Harizi, 2019).,

3. METHODOLOGY

The comprehensive plan for carrying out the investigation activity is created based on the nature of the problem detected and the study's following objectives. As a result, this study uses a descriptive research design using a questionnaire as the major information gathering tool. The survey method, in this context, is defined as the organisation of circumstances for data collection and analysis in a way that tries to combine relevance to the study objective with procedural efficiency (Abdallah, S., & Jaleel, B. 2018). In terms of important current research designs on e-commerce studies, an empirical study of customer attitudes regarding World Wide Web based online purchase in UAE used a descriptive survey research framework backed through the regression model. Likewise, while researching the e-readiness of SMEs in Australia, researchers used a descriptive research approach with a planned interview schedule. .,

3.1. Questionnaire framework and sampling

The questionnaires used in the study has twenty six variables, including one by open-ended asking materials and three via a two - point rating (Y/N) style. The rest of twenty one factors got assessed using a five – rating scale, as recommended by. Those factors got divided into three variables such as:

a. Eight factors make up the demographic statistics.
b. Internet usage measurement technique with four factors.
c. E-shopping awareness evaluation technique with ten factors divided into three aspects: fundamental comprehension, goods considerations, as well as online transaction issues.

With 83 participants, a pilot survey was undertaken to get a preliminary assessment of the research instrument's dependability of customers who use the online services. Prior to operation in two important ways, the instruments were compared to the actual anticipated sample size. Information is retrieved during the pilot testing; sampling regions the data was evaluated, as well as the results proved the validity of all of the key aspects.

Table 1 Reliabilities and measurement and measured with Likert scale with the five point of the scale

Reliabilities and Measurement Items				
Assemble	Dimensions	Particular	Cronbach Alpha	Compound Reliabilities
Online Shopping consciousness	Fundamental appreciative	Online shopping appears to be a viable option.	0.75	0.76
		I have understood how to shop on the internet.		
		I've don't ever given to online shopping a serious consideration.		
		I have got some information about the online shopping.		
	Goods Knowledge	I am not prefers to shop by e-shopping system	0.84	0.84
		Taking the product from store is the better then to by product from Online shopping system		

	Digital payment during purchase	As per my thought the credit or the debit card is not mandatory during the online shopping	0.77	0.78
		I am afraid about my credit card during the online shopping.		
		I am preferred to take product from online shopping but don't want to pay by credit card.		

Cronbach alphas (C-alpha) and Compound reliabilities metrics were used to assess the multi-item scale's reliability in each dimension. Overall dependability ratings were higher than the suggested minimal of 0.60. All metrics of reliability are over 0.70 for all three aspects of e-Commerce awareness, such as fundamental knowledge, product concerns, and online payment worries, as shown in table 1, which summarises all measuring items, C- alphas, composite reliability, and scales for all the products.

In the Emirates of Dubai and Sharjah, a survey of customers of various products and services was undertaken between families with Web access at residence. The surveys were delivered and then gathered with the participants' completed replies. Every one of the people polled was classified as customers of various products and services, and they were identified based on their ability to surf the Web and have a basic understanding of Pcs. Because one of the important indicators for selection of participants is the presence of an Internet connection at home, all of the respondents who took part in the survey had a decent working understanding of Pcs. The social articulation of the homes is another important element in sample selection. This has been proposed by several experts as the primary variable accounting for transformation and modernisation the measure of engagement of the home by said greater community via the popular communication, trips to distribution points as well as towns, including support of the organisation of the outside society is referred to as sociological integration. Inside the UAE, residents in cities such as Sharjah as well as Dubai are required to have a high amount of social communication. In addition, the respondents were educated about the nature and purpose of the study in order to assure their sincere cooperation and reduce survey mistakes. As a result, the sample approach used for this research may be classified as probability sampling method. The information for this research was gathered during September and December 2021. The poll has a sample size of 264 people, including 100 participants in Dubai as well as 164 in Sharjah. In terms of the random sample for such customer research it was suggested that rather than depending on a rigorous mathematical formula, the choice on a sample size might be based on experience and good judgement.

4. TESTING RESEARCH MODEL & RESULTS DISCUSSION

As shown in Figure 1, consumers' online shopping awareness (OSA) is a function of socioeconomic characteristics and their levels of Internet usage intensity. Age, Sexual identity, Degree, Earnings, as well as Occupation are the primary socioeconomic characteristics of the customers studied in this study. In terms of determining the intensity levels of Internet usage, it was claimed that the frequency of access and the period of every contact may be used to determine a person's degree of online activity. As a result, Internet browsing intensity (I) is assessed in terms of Online surfing experience (OSE), Online surfing frequency (OSF), and online surfing time a week (OST). The mathematical formula 1 is used to represent this mathematically.

$$I = OSE + OSF + OST \quad (1)$$

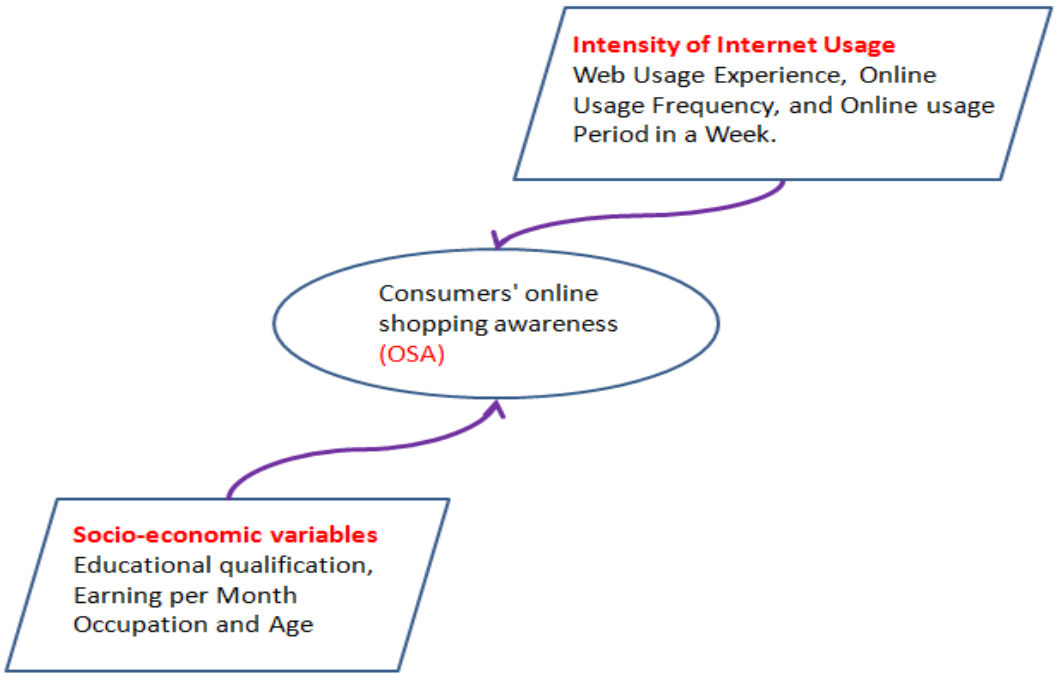

Figure 1 Consumer e-shopping awareness research model there are two alternative regression models available.

Figure 1 exoalin about the consumer e-shopping awareness research model where the investigation framework developed for researching customers' e-Commerce awareness, two separate regression models are explored, one consisting of socioeconomic characteristics and the other comprising of data on consumer online shopping awareness (OSA). Figure 1 depicts a study model in which the dependent variable for OSA is thought to be impacted by two pairs of individual variables. The following are the equations 2 and 3 for each of these regression models.

$$OSA = €0 + €1\phi1 + €2\phi2 + €3\phi3 + €4\phi4 + \sum \quad (2)$$

Where,

OSA : Consumer online shopping awareness,
Φ 1 : Qualifications,
Φ 2 : Earning per month,
Φ 3 : Occupation
Φ 4 : Age
€1, €2, €3, €4: Regression predicted value which is autonomous usual verities through zero mean plus equivalent difference.
€0 : Continuous
∑ : Standards Error

As well as,

$$OSA = €0 + €1£1 + €2£2 + €3£3 + €4£4 + \sum \quad (3)$$

Where,

OSA : Consumer online shopping awareness,

£ 1 : Online surfing experience (OSE) per year as well as per month,
£ 2 : Online surfing frequency (OSF) per day,
£ 3 : online surfing time a week (OST),
€1, €2, €3, : Regression predicted value which is autonomous usual verities through zero mean plus equivalent difference.
€0 : Continuous
∑ : Standards Error

It should be observed that the following two equations such as 2&3 are treated as two distinct regression models, and no attempt is made to combine all of the independent variables into a single regression model because the measurement items were found using various theoretical models.

As shown in Figure 2, the readiness of consumers to adopt Internet shopping is a function of their e-shopping awareness. The survey looked at three important aspects of customer e-shopping awareness: fundamental knowledge, item issues, as well as internet banking anxieties.

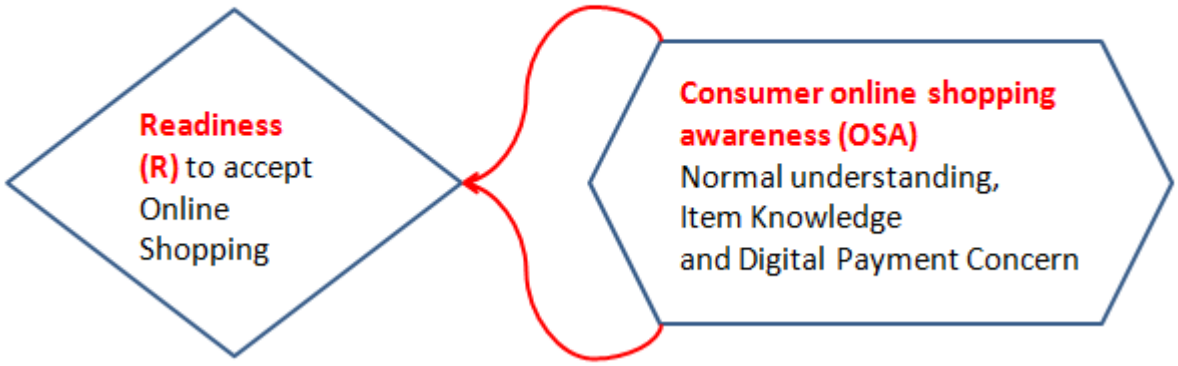

Figure 2 Investigation frameworks for consumer readiness for accepting the online shopping system.

Inside the conceptual framework constituted for teach the customer Readiness (R) to adopt Internet-based shopping, the third regression model consisting of variables from different dimensions of online shopping awareness such as basic understanding, product concerns, and online payment concerns is considered, and this model is stated in equation 4 as regards.

$$R = €0 + € 1\psi 1 + € 2\psi 2 + € 3\psi 3 + \sum \quad (4)$$

Where,
R : Customer Readiness for acceptance the online shopping,
Ψ 1 : Normal understanding for online shopping concern,
Ψ 2 : Knowledge about the item characterisation using online shopping system,
Ψ 3 : Knowledge about the digital payment system for online shopping system
€1, €2, €3, : Regression predicted value which is autonomous usual verities through zero mean plus equivalent difference.
€0 : Continuous
∑ : Standards Error

The regression models presented in formulas two and three are used to test the hypotheses one, two and three in the research, and the results are described as a consequence.

Buyers' knowledge of online shopping is not thought to be influenced by demographic criteria such as academic achievement, total salary, age, or employment type. In the multiple regression analysis done to test the hypothesis – 1, these socio-economic factors are evaluated in the regression model presented in equation-2 and regarded as a collection of critical socio-economic factors. Table -2 shows the outcomes of this research

At the 5% level, the F value of 9.397 is deemed to be significant. As a result, at a 5% level of significance, hypothesis 1 (Null Hypothesis) is rejected. Furthermore, the modified Value of R - square of 0.104 implies that these groupings of critical socio - economic status for consumers represent 10.4 % of the online shopping awareness of customers.

Table 2 The results of the regression analysis for the hypothesis-testing 1 procedure

		Un std. Coefficient	Std. Err.	Std. Coefficient	t	R- squire adjusted	F
		B		Beta			
Model 1	Continuous	1.542	0.540	_	2.167*	0.104	9.497*
	Qualifications	-1.013E-02	0.159	0.000	-0.005		
	Earning in a month	0.217	0.102	0.150	2.567*		
	Age	-0.165	0.103	-0.104	-1.463		
	Job details	0.626	0.107	0.318	5.361*		

Table 2 clearly shows significant independent factors such as monthly income and consumer occupational status are significant at the 5% level, having t values of 2.567 as well as 5.36I, respectively. As a consequence, the findings of the regression model two factors in influencing customer online shopping awareness amongst set of critical socio-demographic variables, although, the influence of the independent variable educational status is not shown to be significant at the 5% level.

The frequency with which customers use the Internet is measured in terms of Internet usage intervals, weekly Internet usage time, and Internet usage experience. The impacts of such affecting factors been shown to have a considerable impact on UAE buyers' e-shopping awareness. Inside the regression analysis used to test hypothesis – 2, these factors are taken into account in the regression model supplied in equation-3 and handled as a group of main influencing variables.

Table 3 Consumer e-Commerce Awareness and Internet Usage Intensity

		Un std. Coefficient	Std. Err.	Std. Coefficient	t	R- squire adjusted	F
Model 2		B		Beta			

	Continuous	28.897	1.342	_	18.169*	0.516	78.157*
	Consumer web access per day	1.040	0.236	0.298	4.190*		
	Consumer web access in a week in every hr.	1.067	0.119	0.400	7.027*		
	Consumer web access as per the Yr. and month	0.157	0.316	0.021	0.389		

Table 3 shows that the F score of 78.157 is substantial at the 5% range in this analysis. As a result, just at 5% significant level, hypothesis 2 is denied. Furthermore, the modified Value of R - square of 0.516 suggests that these sets of impacting variables for consumers contribute 57 percent of the online shopping awareness of customers. The findings with this analysis back up what was previously published. Table 3 indicates that the independent variables Web browsing time per week and Internet usage interval in days have 't' scores of 7.027 as well as 4.190 which are meaningful now at 5% range. It can be deduced from these 't' values that customers' e-commerce understanding is highly dependent on the factors Web browsing time and usage frequency.

Table 4 Rregression Analysis Results of hypotheses Testing

Model 3		Un std. Coefficient B	Std. Err.	Std. Coefficient Beta	t	R- squire adjusted	F
	Continuous	-2.678	0.597	_	- 4.012	0.36	24.011
	Normal understanding about online shopping	0.037	0.0 13	0.198	2.090*		
	Knowledge about item for online shopping	0.104	0.049	0.162	1.798*		
	Digital payment and its security system in online shopping	0.114	0.029	0.301	-3.294*		

Table 5 Statistics on customer readiness to purchase online product via the Internet and their trust in the electronic payment mechanism

	Consumers' desire can acquire things over the World wide web is divided into three categories.			Customer trustworthiness for digital payments is classified.		
	Common desire	Good desire	Very good desire	Common reliability	Better reliability	Best reliability
Customer strength	101	41	122	69	94	101
%	38.2%	15.4%	46.4%	26.1%	35.6%	38.3%

Total figure	264 = 100%	264= 100%

as seen in table 4, the calculated score of 24.011 is determined to be significant at the 5% level, indicating that the test for hypothesis-3 was successful. As a result, at a 5% level of significance, hypothesis 3 is rejected, corroborating the previous result. Furthermore, the calculated Value of R - square of 0.36 implies that three primary variables of online shopping consciousness included in the research account for 41% of the customers' readiness to purchase things via the Web. Table 4 further shows the 't' scores of 2.090,1.789, and -3.294, which relate to three elements of online shopping consciousness like fundamental knowledge, goods worries, as well as online shopping transaction considerations, are substantial so at 5% standard. The negative t value for transaction worry, on the other hand, indicates that people are more afraid of online transactions and are less likely to purchase electronically. Like a result, customers' first propensity to purchase products over the web has a high amount of reliance on all three dimensions of e-Commerce knowledge. In a similar vein, it was noted that increased customer interaction is a crucial aspect which can help to the development of B2C online shopping businesses.

As a consequence, the findings of this regression analysis support earlier studies about the potential for B2C kind online shopping deployment in selling various items and services that are not already available electronically in the research region. Furthermore, the findings in table-5 reveal that 60 percent of customers in the research region had an excellent or very good readiness to purchase electronically.

5. CONCLUSION & RECOMMENDATIONS

The main conclusion of this research is that there is a mismatch in the industry among customers' inclination to purchase electronically and the existence of certain services. Throughout this aspect, it has been discovered that 60% of online customer have an excellent or very good readiness to purchase things over the World Wide Web. Despite of common belief, the majority of prominent retailing businesses in the UAE do not provide B2C online shopping platforms. With the ever-expanding virtual market place, this is seen as a massive underutilization of the infrastructure for e-commerce opportunities, despite the ever-increasing demand for such items & services. The findings of this study can also be supported mostly by information supplied.

Customer online shopping awareness is influenced by a collection of socio-economic parameters such as educational status, monthly salary, work status, as well as age. Customer online shopping awareness levels, in contrast, are highly dependent on their monthly earnings and employment position. In this regard, it is discovered about 25% of customers get a monthly household income of AED ten thousand or more. In terms of consumer occupations, 10% of them especially in different businesses, while 35% work for corporations or public sectors. The volume of Web surfing has a major impact on customer e-shopping consciousness. People with a high degree of e-commerce knowledge have a high level of reliance on the Internet usage interval in days and length in hours each week. In this regard, it has been discovered that 35% of customers have utilised World Wide Web based e-shopping platforms to buy as well as selling goods or services.

The organisational efficiency for shopping firms operating in the UAE is as follows, based on the foregoing findings from this study. There are also some few regulatory recommendations included.

- Inside the industry, the scenario for B2C online shopping operations for some potential items and services is not well-improved. It is a terrific potential which is currently underused inside the industry. Several established although tiny merchants, on the other hand, are revolutionizing the industry by providing home delivery services for the items that are booked. As a result, current merchants

in the wider context, notably sellers of groceries and food goods in the market, should step up to provide this service to their clients more efficiently than they do now.

- The majority of free deliveries provided by select established but tiny merchants are dependent on a telephone-based scheduling system and personal ordering in the store. This sort of new measure is not thought to be as straightforward in relation to the products that are shown for purchasing and thereafter delivered. This challenge may be solved by implementing a web-based selling approach. As a result, well-known branded shops should set up B2C e-shopping platforms for import and export in the UAE. In this context, the current study's findings about customers' readiness to utilise similar technologies are an extra benefit in the early phases of such enterprises.

- Customer apprehensions about the dependability of present digital payment mechanisms are a major source of anxiety across Internet users that need to be addressed. In this context, the role of banking firms, particularly those that provide credit card and debit card services, is seen as increasingly important since they are seen as being in a key position to improve client trust in different e-payment methods. Such lenders should also step committed to advancing devise a plan which can permit transactions with digital mode in greater volumes than the current scenario in the UAE.

- In a nation such as the UAE, in which the prospects are endless, the system also plays an even more part of the design than it does now to encourage the rise of e-shopping.
  Further particular, the government and various administrations should promote e-shopping awareness among potential SMEs, SMBs, and even Web users, since the infrastructural electronically in the UAE remains underused in terms of commercial and macroeconomic factors.

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Improving Heart Disease Prediction Accuracy Using a Hybrid Machine Learning Approach: A Comparative study of SVM and KNN Algorithms

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A B S T R A C T

The largest cause of mortality worldwide is heart disease, and early identification is critical in limiting disease development. Early approaches for detecting cardiovascular illnesses assisted in determining the progressions that should have happened in high-risk persons, reducing their risks. The major goal is to save lives by recognising anomalies in cardiac circumstances, which will be performed by identifying and analysing raw data produced from cardiac information. Machine learning can provide an efficient method for making decisions and creating accurate forecasts. Machine learning techniques are being used extensively in the medical business. A unique machine learning technique is provided in the proposed study to predict cardiac disease. The planned study made advantage of open source heart disease dataset from kaggle. Hybrid algorithms for machine learning prediction are the logical mixture of many previous methodologies designed to improve efficiency and produce improved outcomes. The presented work introduces a hybrid method that employs the notion of categorization for prediction analysis. We used real patient data to build a hybrid technique to predicting cardiac disease. KNN and SVM classification techniques were utilized in this paper. Jupyter Notebook is used to implement this hybrid method. A hybrid technique outperforms other algorithms in the prediction analysis of heart disease.

1. INTRODUCTION

The practise of collecting useable information and patterns from a range of raw datasets is usually referred to as data mining. It comprises analyzing massive amounts of data and discovering trends or patterns using one or more techniques. It is useful in a variety of contexts, including analysis, research, and healthcare. Because data mining is a method of investigation and Numerous excellent early prediction systems for healthcare have evolved from medical datasets, which can detect trends in large volumes of data (J. H. Joloudari, et al., 2019). Improving the level of healthcare in the medical sector is best described by the guiding variables that have an influence on it, among which is healthcare data, which may be viewed as the system's foundation for improvement for each patient. The application of data mining techniques to extract knowledge from medical records or datasets will help in the discovery of sickness occurrence, evolution, recognition, and significant facts to establish the sources of diagnostic procedures based on the components existing inside healthcare. An investigation for the information cycle for the classification of illnesses

might potentially involve data mining techniques. Therefore, it will reveal hidden relationships and detect patterns in the data, leading to better and enhanced diagnostic recognition. This paper gives us insight into the subject of heart disease prognosis. The heart, which weighs around 3 pounds, is a vital body organ. The ribcage shields it, as it is located on the left side of the chest. All the body's organs are supplied with blood by the heart through a system of blood arteries. The blood helps the body stay healthy by supplying it with the minerals and oxygen it needs. Heart illness or heart dysfunction can cause serious health issues like heart attacks, strokes, and even death. To guarantee appropriate treatment and care, it is crucial to identify any heart disease symptoms at an early stage. The aim of this study is to design a system that aids in determining whether a patient has cardiac disease by suggesting a hybrid approach utilizing data mining techniques. For this, predictions are made using a predictive analysis model and a variety of algorithms. This model's procedure is divided into four steps. Pre-process the raw data at this step. At the second stage, transform the data that has been processed into a useable form for model. Model training in the third stage. Fourth step uses a learning model to create predictions and then reviews them as necessary.

2. LITERATURE REVIEW

(Jabbar, et al., 2016) conducted research on heart disease by utilising the random forest method and Cleveland dataset. In order to carry out the investigation, the author uses the Chi Square attribute selection of features as well as the GA-based selection of features model. Despite the fact that the evaluation was confined to existing machine learning models, the experimental findings reveal that the suggested model with GA feature selection beat the present models. (Al-Milli, and Nabeel, 2013) explores the use of a back propagation neural network in predicting cardiac disease. The author used a deep learning model known for its accuracy in disease prediction and implemented it using a deep learning. The Cleveland dataset was used in the study, and a simulation was done in Matlab. While the research has yielded promising results, there is room for improvement by employing deep learning models and applying the findings to real-world applications. (Hashi, E.K. and Zaman, M.S.U, 2020) A cognitive method is used in this article to predict heart disease. The study assesses five machine learning techniques for prediction based on their accuracy. The logistic model tree is used to increase prediction accuracy by utilising an ADA boost and bagging model. The experimental results show that the random forest model predicted cardiac disease with great accuracy. (Soni, Jyoti, et al., 2011) The author of this article investigates the prediction of cardiac disease using methods based on data mining. Decision tree algorithm, KNN method,Bayesian classification, neural network classifications, and techniques are all evaluated in the study. Furthermore, the author looks into the usage of genetic algorithms for feature selection in identifying critical traits for heart disease. The decision tree model achieves good accuracy in the experiments. (Alkeshuosh, Azhar Hussein, et al, 2017) this publication describes a method for detecting cardiac disease that employs the Particle Swarm Optimization method. The author created explicit rules based on the Particle swarm optimization algorithm and tested them to find a more precise rule for detecting heart disease. Following the evaluation of the rules, the author employed the C 5.0 algorithm for disease classification based on binary classification. The author verified great accuracy was achieved using Particle sworm optimization and a Decision Tree algorithm. (UCI Official site) offers a study on the prediction of heart disease using data mining techniques. The research looks at techniques like the KNN algorithm, decision tree algorithms, neural network classifications, and Bayesian classification techniques. Furthermore, the author investigates the use of genetic algorithms for feature selection of critical heart disease features. The study tests different strategies and assesses their performance, concluding that the decision tree model achieves excellent accuracy. (P. M. Barnaghi, et al., 2012) In this article a author uses random forest and decision tree first for prediction and to measure their accuracy. After that he uses a mixed hybrid approach consisting decision tree and random forest for the prediction of heart disease and measure the accuracy and compare from the previous. And it gives an excellent performance as compared to other models. (Khalid et al., 2023)provide insights into machine learning-based techniques that can contribute to enhancing

the accuracy of heart disease prediction, while (Aslam et al., 2022) emphasize the importance of data security and privacy compliance in the context of improving healthcare analytics. (Saeed et al., 2019) explore the practices and challenges of nomadic knowledge sharing, providing insights that can inform the development of collaborative approaches in improving heart disease prediction accuracy using hybrid machine learning algorithms.

3. ALGORITHMS USED

3.1. KNN

A supervised learning algorithm called the K-Nearest Neighbor (KNN) classifier divides a given dataset into various clusters based on the user's citations (P. M. Barnaghi, et al., 2012). This algorithm is flexible and can be applied to classification and regression issues. KNN's fundamental premise is that items that are similar often cluster together, and the algorithm finds these clusters by measuring the separation between different data points. Since KNN holds the data and performs operations on it during the classification phase rather than learning directly from the training dataset, it is sometimes referred to as a lazy learner algorithm. A new data point's classification is determined by the majority vote of its closest neighbours. Modifying the value of k can have an impact on the accuracy of algorithm.

3.2. Support Vector Machine

SVM is a specialised supervised machine learning classifier that may be utilised in statistical learning (Alkeshuosh, Azhar Hussein, et al., 2017) for linear and non-linear dataset categorization. It works by utilising a non-linear mapping function to change the original dataset into a more understandable representation. SVM seeks for a linear hyperplane in this newly transformed space that can partition the data points into different classes. The hyperplane is an ideal decision-making boundary, and SVM creates them with support vectors. The hyperplane can split data into multiple classes by utilizing an appropriate function for nonlinear function. Despite being a precise classification approach, SVM is computationally expensive since it involves addressing quadratic issues using mathematical functions that require sophisticated calculations that can take time (Soni, Jyoti, et al., 2011)

3.3 Hybrid Approach

A hybrid is typically defined as a combination of two or more elements with traits that are either similar or dissimilar. Different elements have various characteristics, however once they're joined, the final element may have both characteristics. A hybrid approach combines two or more algorithms, each init hold thier set of benefits. Integration of algorithms produce new results that may be more accurate and precise than utilising the techniques alone. The hybrid model is created by merging the KNN and SVM methods. Svm probabilities are used in the hybrid model. The knn probabilities are combined with the train data and sent into the svm algorithm. Likewise, SVM probabilities are determined and supplied into the test data. Lastly, values are forecast. Machine learning is applied to a preprocessed dataset, and the predicted cardiovascular disease for the provided test dataset.

5. METHODOLOGY

The suggested work is written in Python and implemented in Jupyter Notebook. All of the methodology's implementation phases are used here. The dataset used to train the system is obtained from the UCI machine learning library (UCI Official site).

5.1. Data Description.

This study utilized a heart disease Dataset obtained from the UCI machine learning repository to construct a model. The Dataset included various attributes such as sex, age, resting blood pressure, chest pain, fasting blood sugar, cholesterol, maximum heart rate achieved, resting electrocardiogram, ST depression induced by exercise, exercise-induced angina, number of major vessels, slope of peak exercise ST, pred attribute, and thalassemia.

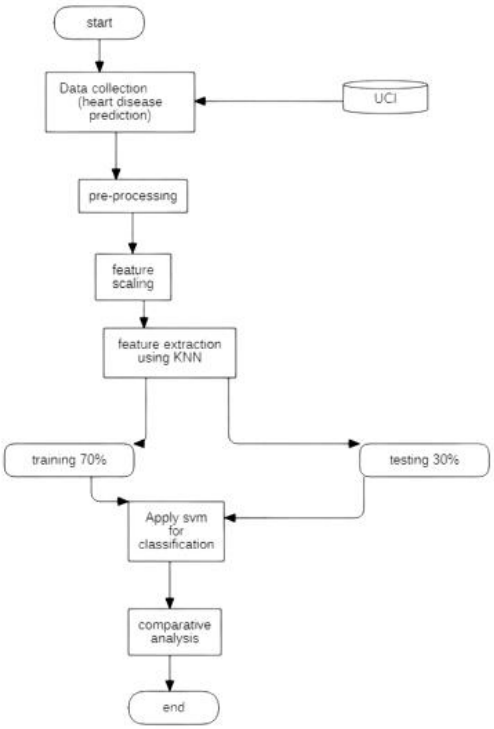

Figure 1

5.2. Working

Proposed workflow utilized two machine learning algorithms and a hybrid model to achieve accurate predictions of heart disease. The advantages of this approach include implementing an optimized model through the use of the hybrid model. The methodology involved collecting the dataset from uci.edu, performing data visualization, and splitting the dataset into test and train data. We are applying the KNN and SVM models for training and analysis. The model is trained using 70% of the dataset as training input, and the remaining 30% is used as testing data for heart disease prediction. The KNN, SVM, and Hybrid of both are used to predict heart disease. The predicted values are then plotted and compared for accuracy.

5.3. Camparative analysis

In this scientific work, the proposed strategy was compared against current approaches to establish their usefulness. The findings demonstrated that the suggested method is more precise, efficient, and appropriate for predictive analysis. The assessment is carried out using confusion matrix parameters, that are typically used to evaluate a model's performance on a dataset containing known actual values. A confusion matrix is a table that summarises the outcomes of a classification issue prediction, offering four values: True Positive (TP), False Negative (FN), True Negative (TN), and False Positive (FP). Several factors are obtained from the confusion matrix to compare the strategies. The study computed three factors for each technique: accuracy, precision, and recall.

Accuracy: This parameter calculates the proportion of values obtained that agree with the true values.

Acuracy Formula = TP + TN/TP + FP + TN + FN

Precision: This parameter computes the proportion of results that are relevant.

Precision Formula = TP /TP + FP

Recall: This parameter computes the proportion of total relevant values categorised properly by the algorithm.

Recall Formula = TP/ TP + FN

6. DISCUSSION ON THE RESULTS

Python was used to implement our suggested study, together with relevant libraries such as sklearn, pandas, and matplotlib. This study's dataset was taken from uci.edu and consisted of heart disease cases. To predict cardiac disease, algorithms based on machine learning such as KNN and SVM were used. A hybrid model integrating KNN and SVM was also created to increase the uniqueness of this study. According to the findings of this study shown in table 1, the hybrid model were successful in diagnosing cardiac disease. KNN had an accuracy of roughly 75%, SVM had an accuracy of 76% , and the hybrid model had an accuracy of 81% .

Table 1. Experimental results

Algorithm	Accuracy	Precision	Recall	F1
SVM	76	80	80	80
KNN	75	80	78	79
Hybrid	81	80	89	84

Table 1 shows the performance metrics achieved by the proposed hybrid technique and based algorithms following their implementation, include recall, precision, accuracy, and f1-score.

Table 2. Accuracy results

Algorithm	Accuracy
SVM	76
KNN	75
Hybrid	81

Table 2 compares the proposed hybrid model to existing algorithms on the basis of the accuracy performance indicator. The proposed hybrid technique outperforms all existing algorithms in terms of accuracy. The suggested hybrid approach's parameter values outperform the results of other algorithms, as indicated by the graph shown in

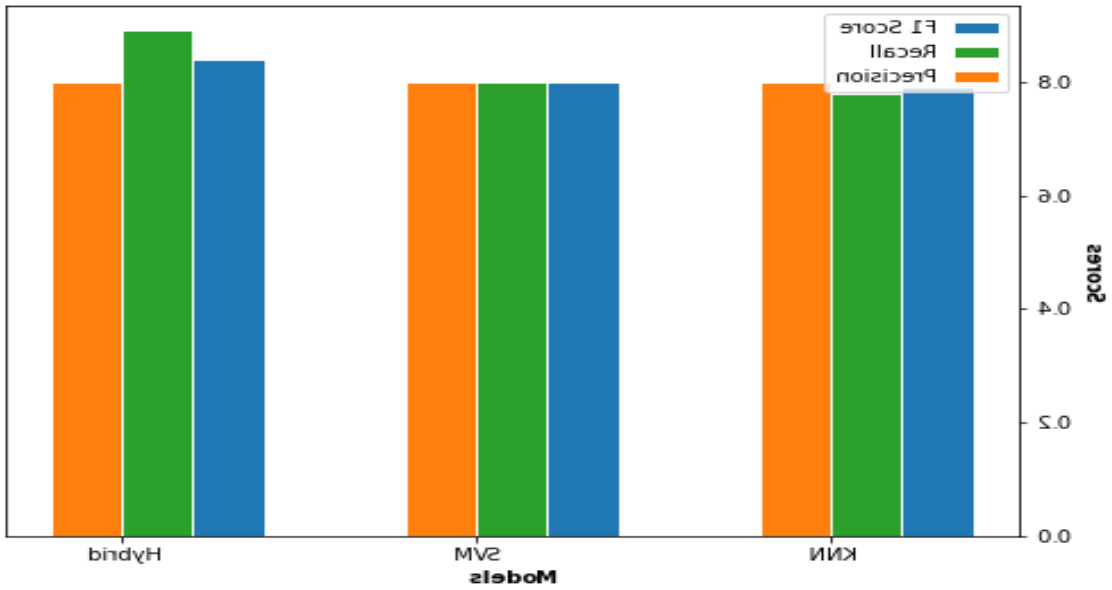

Figure 2

Figure 2. This performance analysis reveals that the suggested approach outperforms existing algorithms in predicting liver disorders.

7. CONCLUSION

The method of information mining includes analyzing crude information to reveal critical designs that can advise future applications. This strategy utilizes different classification strategies to anticipate heart disorders. Our research approach utilizes knn to extricate properties from a endless dataset and applies svm classification to create a model for predictive analysis. Compared to built up calculations such as KNN and SVM, our proposed approach yields prevalent comes about. Our investigation shows that the cross breed approach accomplishes a 81% exactness rate in anticipating heart disease prediction, outperforming the execution of other calculations on the same dataset.

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