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Role of Digital Infrastructure, Block Chain And Computational Approaches Towards Sustainable Business Performance

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***Abstract*— The aim of the research is to investigate the influence of Digital Infrastructure, Automation and Blockchain Technology, and Computational Approaches on Sustainable Business Performance. The study was examined through structured questionnaire using a five-point Likert scale and was given to employees across sectors such as retail, healthcare, manufacturing, logistics, energy, and information technology. Various statistical techniques like ANOVA, Chi-square, Correlation, and Regression analyses are used to have depth insights of the research. The findings reveal that there is a strong relationship among technological enablers and sustainable business performance. The study concludes that technological integration is crucial for improving efficiency, innovation, and long-term business sustainability. Future research should focus on expanding the model with additional variables and longitudinal analysis to deepen the understanding of sustainable business excellence.**

Keywords— digital infrastructure, automation and block chain, computational approaches towards sustainable business performance.

I. INTRODUCTION

Business always relies on sustainable performance. Sustainable business performance is a significant measure which determines the success and growth of the business. Organizations in corporate sector should understand the changing aspects of performance. This helps to invite external stakeholders like investors, shareholders, clients and other new opportunities also arises [1]. Robust performance is expected in today competitive markets. Organizations also face lot of challenges, where sustainability becomes very difficult and survival becomes a question mark. It is important that organizations need to have updated evaluation systems that helps to measure the business performance [2]. Organizations have started to show interests to adapt to modern trends like maintenance of digital infrastructure, automating of business, implementation of artificial intelligence and leveraging of the results of technologies. Studies highlight that implementation of technological advancements like big data have transformed the business and has provided sustainability in the revenue of the business. As the above research areas are in development stage, the motivation of the research is look into the role and contribution of digital infrastructure, automation and block chain technology and computational approaches towards sustainable business performance which is the major research of the study.

II. REVIEW OF LITERATURE

A. Digital Infrastructure

In recent years studies belonging to digitalization and sustainability have gained attention. The two variables are rarely studied. The review of literature states that digital technology applications and innovations contribute towards business models on environmental performance. In order to know about digital ecosystem, the data of 1083 companies between 2014 and 2019 were gathered and analyzed. The study found that proficient methods for architects to engage in the digital ecosystem and concluded that enhanced environmental performance has resulted in greater efficient convergence. Private architects' embrace of digital service enhances financial performance, while the integration of digital infrastructure allows public architects to assume a more significant role. This is evident from the finding that companies exhibiting “high” environmental performance can enhance their financial results much more effectively through digital service than the variables. the companies try to leverage the advancement of digital infrastructure without exception. Though the idea of digitalization and sustainability has gained attention in recent studies, additional efforts are needed to connect these two ideas and clarify their relationship. A large amount of literature has examined the effects of digital technology applications and innovations in business models on environmental performance, yet it has largely overlooked the reverse influence of environmental performance on digitalization. So it is important, business can take digital services in their business, since it helps to build sustainability.

Another research study highlights on the ideas of digital infrastructure, service-oriented architecture, and microservices. the study highlights the advantages and difficulties of developing a sustainable infrastructure rooted in a service-oriented framework. It further discusses that microservice architecture and cloud services, can offer entities possessing enhanced agility and flexibility necessary for fostering sustainability in a market on digitization [3]. It is very clear that digital infrastructure helps to provide sustainable business performance.

B. Automation and Block chain technology

The research in emerging technologies like Artificial Intelligence, Blockchain, and Big Data are providing transformation and sustainability to the business and organizational performance. The research done through

structured interview methods highlight that information, adaptability i.e. motivating employees to get trained in technology through control methos have provided good results. Technological integration has made attainment of strategic objectives evolve along with digital transformation. This research helps to provide framework on technology related advancement and proper ethical AI application in business [4].

The research on hyper automation discusses on providing transformation to the business performance by employing sophisticated automation methods that helps in solving complex business operations. Block chain powered networks provides enhanced automated capabilities that helps to provide secure real time data. The research done in Chinese electronics industry provides better results through block chain technology automation in China. This automation can influence business outcomes and provides sustainable supply chain value. The conventional business practices in manufacturing industry have not led to advancements. By implementation of green environmental practices and meeting environmental SDGs, Blockchain related technology practices have yielded considerable results. environmentally related information due to its real-time, shareable, and completely transparent data have brought significant changes in the industry. This eco-friendly transformation guarantees business adherence to environmental SDGs and facilitates real-time compliance sharing with various stakeholders via blockchain technology, thereby confirming a beneficial mediating effect of green supply chain management practices. The suggested strategic framework suggested through the research have discovered new antecedents of blockchain technology, that has sufficiently guided for transforming the conventional supply chain management framework into a green supply chain management framework and have provided sustainable business performance as the outcome [5].

Every business wants to improve their performance through their information, products and services. They need to bring sustainable performance in the business through successful implementation of block chain practices. This provides enhanced supply chain transparency, knowledge management and effective outcomes. The manufacturing industry in China industry uses have researched and highlight that knowledge management and technology implementation in business have provided endured sustainability.

Research on block chain technology highlights that it has helped to improve organizational performance, on a survey taken among Chinese manufacturing firms. The supply chain is one of the most important and prominent sectors that provides sustainable business results. When the Industry focuses on employing technology to all sectors it provides preference in employing block chain technology. The findings indicate that blockchain technology positively contributes to the circular economy through features like visibility, transparency, relationship management, and smart contracting. Moreover, eco-friendly practices were shown to have a beneficial connection with both environmental and economic avenues impacting the firms' performance, while environmental performance was similarly linked positively to the firm's economic well-being [10]. Another predictor of the sustainable business performance is automation and block chain technology adoption.

C. Computational Approaches

This study extended Altman's original Z-score model which is computational approach to better predict the financial health of UK companies between 2000 and 2013, particularly around the recent financial crisis. Using discriminant analysis and performance ratios, the researchers found that cash flow is a statistically significant addition to the original Z-score variables. The paper developed a new model, the J-UK model, which combines the original Z-score variables with the cash flow ratio. The model helps to predicting the health of UK companies before, during, and after the financial crisis. This helps to provide improved predictive power for getting sustainable business performance [7].

This research investigates the effectiveness of the Classification and Regression Tree (CART) data mining method for Business Failure Prediction (BFP), a critical task for various stakeholders. The computational method named CART offers advantages like simplicity, easy implementation, and accuracy, its application in BFP research has been limited. The study had tried to explore the performance of the business and helps to predict the failure. Other approaches like Top Data Mining Methods: Support Vector Machine (SVM) and k-Nearest Neighbour (KNN) which is used to assess the business performance [8].

The paper has used fuzzy logic approach to determine the noise efficiently. The authors have utilized two important model ideas Chance-constrained programming and Fuzzy membership. Both helps to ascertain uncertainty and helps deal with vague or imprecise information in data. The software finals helps to optimize the work as per the study [9].

This study presents a unique approach that utilizes machine learning (ML), particularly the k-means clustering technique, to evaluate operational excellence (OE) maturity stages in businesses located in emerging markets. The research seeks to recognize and categorize phases of OE maturity to facilitate sustainable development efforts. 106 companies' data belonging to different sectors were gathered. K mean algorithm was utilized in order to get a fresh viewpoint on sustainable business development and management in developing markets. The k-means clustering grouped companies into five maturity levels, from "Basic" to "Champion." This categorization offers a structure for comprehending the progression of OE practices and their impact on sustainable development [10].

In today's business world, corporate are looking out for different kinds of sustainability. Corporate sustainability is one among them. Development, implementation and applicability of big data analytics and block chain technology help to increase corporate sustainable performance. Leveraging on technologies helps to provide new technology based sustainable outcomes like data-driven competitive sustainability, data driven culture and organization information management. The research suggests to capitalize on technologies for sustainable corporate outcome [6].

D. Sustainable Business Performance

The energy sector has consistently been notable for its significant contribution to economic growth as well as its substantial environmental effects. Three significant developments have recently impacted the energy sector in

various countries: the transition to clean energy, the liberalization of markets, and the rise of digitization. These advancements facilitated innovative business models within a coevolving regulatory environment. Although earlier studies indicated that support policies significantly contributed to the development of sustainable new business models, there has been limited focus on how reliant these models are on specific regulations, and consequently, to what degree they may be vulnerable to becoming outdated when regulations shift. The research has discussed on innovative solutions and by more reforms will be able to provide sustainable business outcomes [10].

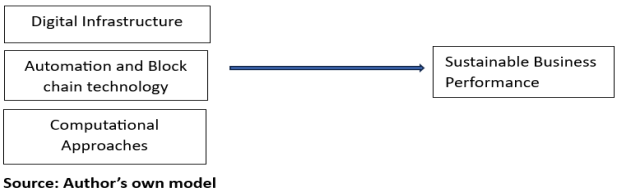
The energy sector is the place most of the research happens. This sector provides sustainable financial outcomes for the companies' commercial activity business. The research looks out for the role of sustainability in business. The ESG index and other indicators were considered for the study. Sustainability policies influence the sustainable business performance and financial performance of the business [11].

In health sector the implementation of United Nation SDG plays a vital role. These goals have considerable impact on the outcomes of the business [12]. Factors like balanced score cards and performance monitoring systems helps in bringing sustainable outcomes. The research proves the same.[13]
Health care organizations help to provide outcomes which are sustainable in nature if artificial intelligence are properly implemented. The research conducted among health care employees, indicate that AI have helps to implement innovative solutions and sustainability initiatives and solutions in the health care sector as per the study [14].
The research carried in IT sector in Istanbul that human resource practices and quality management practices are responsible for providing social sustainable outcomes to the business. It increases the firm performance and overall performance management of the organizations. This has helped to provide better quality, commercialization, creativity and innovation to the business [15].

III. RESEARCH GAPS AND CONCEPTUAL FRAMEWORK

The research gaps are derived based on the past studies titled review of literature. Review of literature highlights that lesser articles are found in the area of leverage of technology for sustainable business outcome. Lesser literature reviews are witnessed on the topics of automation, block chain, digital infrastructure and computer-based approaches as all the mentioned variables are latest developments Fig 1.

a. Conceptual Framework



Source: Author's own model

Figure 1 showing the conceptual framework of research

Research Questions

How the organizational profile of the respondents impact the sustainable business performance?
How do respondents perceive various factors measured through the Likert scale related to sustainable business performance?
Is there a significant association between the age of respondents and their perception of sustainable business performance?
Do Digital Infrastructure, Automation and Block chain technology and Computational Approaches have positive influence towards the outcome Sustainable Business Performance?

Objectives of the study

To understand the organizational profile of the respondents of the study.
To analyze the Likert scale responses of the respondents of the study.
To examine the association between age and sustainable business performance of the study.
To investigate the association among Digital Infrastructure, Automation and Block chain technology and Computational Approaches on Sustainable Business Performance.
To analyse the linear relationship among Digital Infrastructure, Automation and Block chain technology and Computational Approaches on Sustainable Business Performance.

Hypothesis of the study

H1: There is significant difference in sustainable business performance based on the organizational profile of the respondents.
H2: There is a significant difference in the Likert-scale responses of the respondents across the studied constructs.
H3: There is a significant association between work experience and sustainable business performance.
H4: There is a significant association between Computational Approaches with Sustainable Business Performance.
H5: Digital Infrastructure, Automation and Blockchain Technology, and Computational Approaches significantly predict Sustainable Business Performance.

IV. RESEARCH METHODOLOGY

Research Methodology

The research methodology comprises of research process like 1. Formation of questionnaire for the study after identification of suitable research gaps . 2. Collection of data from the respective responses 3. Analyzing and interpretation of the data 4. Discussion of the data

Formation of questionnaire: The 5 point Likert scale questionnaire comprises of strongly agree to disagree was formulated. The questionnaire was formulated in the form of Likert scale. The Likert responses are 5 as Strongly Agree, 4 as Agree response 3=Neutral response, 2= Disagree Response and 1=Strongly Disagree response. The questionnaire was circulated in google forms to different employees of retail, health, manufacturing, technology, logistics and energy companies. 300 responses were collected.

Data collection: Interested employees who are willing to respond to the questionnaire alone were considered for the

study. Convenience sampling was adopted for the study Tables 1-9.

V. DATA ANALYSIS

Table 1 showing the Reliability

Cronbach's alpha statistics	
No of items	Cronbach's alpha
4 variables	0.651

From the above table it is inferred that the reliability of the questionnaire is 0.651, which is the above the required measure of 0.5.

Demographic profile

Table 2 showing gender of the respondents

Male	38	12.66667
Female	262	87.33333

From the above table it is inferred that 87 percent are female respondents of the study.

Table 3 showing age of the respondents

Age	No of respondents	%
21-30yrs	67	22.33333
31-40yrs	137	45.66667
41-50yrs	86	28.66667

From the above table it is inferred that 45 percent of the respondents belong to the age group of 31-40 years.

Table 4 showing Work Experience of the respondents

Work Experience	No of Respondents	%
21-25 Yrs	35	11.66667
26-30yrs	39	13
31-35yrs	233	77.66667

From the above table 4 it can be stated that 77.6 percent of the respondents have a long work experience in the range of 31-35 years.

H1: There is significant difference in sustainable business performance based on the organizational profile of the respondents.

Table 5 showing Analysis Of Variance

Source	DF	Sum of squares	Mean squares	F	Pr > F
Between subjects	297	2917.47	9.823	2.869	**<0.0001**
Within subjects	596	11340	19.027		
Between measures	2	9306.02	4653	1358.9	**<0.0001**

From the above table the analysis of variance of the data highlights there is a significant mean difference of the respondents and it is proved to be significant. The hypothesis is proved.

H2: There is a significant difference in the Likert-scale responses of the respondents across the studied constructs.

Table 6 showing Likert-scale responses

Variable name	Strongly Agree (%)	Agree (%)	Neutral (%)
Digital Infrastructure	30	22	49
Automation And Block Chain Technology	26	21	53
Computational Approaches	42	92	44
Sustainable Business Performance	53	41	6

From the above table it is inferred that for digital infrastructure, automation, computational approaches contribute towards the sustainable business performance. 42 and 92 percent of the respondents have strongly agreed, and agree that computational approached practiced in business contributes towards sustainability.

H3: There is a significant association between work experience and sustainable business performance.

Table 7 showing the chi-square test

Variance	10.458
Chi-square (Observed value)	3116.401
DF	298
p-value (Two-tailed)	**<0.0001**
alpha	0.05

From the above table it is inferred that work experience significantly contributes towards the sustainable business performance. The observed chi-square value is 3116.401 with a significant p value of <0.0001.

H4: There is a significant association between Computational Approaches with Sustainable Business Performance.

Table 8 showing Correlation Analysis

Digital Infrastructure	**1**	0.825	
Computational approaches	**1**	0.679	
Sustainable Business Performance	0.679	0.825	**1**
Significance	0.001		

It is inferred from the above table that computational approaches and digital infrastructure adopted in business helps to provide sustainable business outcomes.

H5: Digital Infrastructure, Automation and Blockchain Technology, and Computational Approaches significantly predict Sustainable Business Performance.

Table 9 showing Regression analysis

Multiple R	0.990
R Square	0.981
Significance	0.004

The above shows that the variables Digital Infrastructure, Automation and Blockchain Technology, and Computational Approaches is able to explain the model by 98 percent. The

predictor variables significantly predict the sustainable business performance.

VI. Discussion

The research instrument has shown a value of 0.651 which is above the threshold mentioned [16]. This is acceptable value in order to carry forward the exploratory research study. The respondents for the study are from different sectors like retail, manufacturing, energy, health care, manufacturing, logistics and Information technology companies. Female participants have shown more interest towards responding the instrument of the research study. Employees who have work experience of 30 to 40 years who have exposure to various functionalities and business practices have participated in the study. The research questions have been proved. The male and female respondents have shown significant difference in their opinion on sustainable business performance. They highlight that sustainability depends on size, structure, and operational practices which has impact on the sustainable outcomes of the business. recognize the roles of digital infrastructure and automation with blockchain technology in driving sustainable practices. This reflects a strong consensus among respondents that digital transformation and computational strategies are key enablers of sustainability in modern organizations. The research further provides insights and demonstrates employees with longer work experience tend to greater understanding and contribution toward sustainability initiatives, possibly due to accumulated knowledge, leadership, and familiarity with organizational goals. it is inferred that computational approaches and digital infrastructure significantly enhance sustainable business outcomes, promoting efficiency, data-driven decision-making, and innovation. predictors collectively have a significant and positive influence on sustainable business performance. The technological enablers i.e., Digital Infrastructure, Automation and Blockchain Technology, and Computational Approaches have strongly contributed to the sustainable business performance. All the research questions and hypothesis are proved via various statistical analysis. The novelty of the study organizations in all sector are ready to invest in digital infrastructure, utilize block chain technology for safer handling of transactions and utilize computational approaches like advanced mathematical, statistical and analytical approaches for better decision making, optimization of resources and better outcomes towards sustainable business performance.

VII. CONCLUSION

The present study has shown that technological enablers strongly contribute to the sustainability of the business. Leveraging technology and time related factors helps to provide the needed outcomes for the business. As technology are implemented in to business, corporates also expect positive results. More longitudinal research studies can be conducted with different variables in order to have a better understanding on the business excellence. The study concludes that technological integration is no longer optional but a strategic necessity for organizations aiming to enhance competitiveness, resilience, and sustainable growth. By leveraging these technologies, businesses can optimize resource utilization, reduce operational inefficiencies, and foster innovation while aligning with environmental and social sustainability objectives.

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