BIG DATA ANALYTICS FOR SMES' PERFORMANCE SUSTAINABILITY IN POST-COVID-19 KENYA

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Abstract

Small and medium-sized businesses (SMEs) play a critical role in a nation's economy, contributing significantly to its wealth and fostering innovation. Globally, they account for up to half of all jobs and 90% of all businesses. However, SMEs often grapple with limited access to credit from suppliers, compounded by liquidity challenges, decreased sales, and defaults, as supply chains struggle to secure credit. Factors like advance payments, penalties for delayed credit payments, and recurring expenses further exacerbate the vulnerability of Smashing the context of Kenya's post-COVID-19 landscape. This study aimed to explore the potential of Big Data Analytics and Data Science in sustaining SMEs' performance. Drawing from theories such as Complex Adaptive System and Strategic Choice Theory, a descriptive survey design was employed, on a target population of 287 managers of SMEs in each sub County, in Nairobi. Employing a stratified sampling method, a total of 260 respondents were interviewed. Data was analyzed using descriptive statistics, including frequencies, percentages, mean, and standard deviation, while inferential statistics like multiple regression and Pearson correlation were used to examine relationships between variables. The study revealed that Business Intelligence, with a mean score of 3.9 (std. dv = 0.851), and Machine Learning, with a mean of 3.7 (std. dv = 0.928), both had a positive impact on SMEs' sustainability, with an overall average mean of 3.8 (std. dv = 0.8895). Similarly, Data Analytics, comprising Predictive Analytics (mean = 3.73, std. dv = 0.850) and Prescriptive Analytics (mean = 3.85, std. dv = 0.684), positively influenced SMEs' performance, with an average mean of 3.79 (std. dv = 0.767). These findings underscore the potential of Data Science drivers like Business Intelligence and Machine Learning in helping SMEs tackle unforeseen challenges in competitiveness. The study further highlights the importance of implementing a robust legal framework to safeguard data in the context of Data Analytics, particularly in predictive and prescriptive analysis, as a means to enhancing SMEs' performance, survival, and growth in the post-COVID-19 era.

Keywords: *Big Data Analytics, Data Analytics, Business Intelligence, Machine Learning, Predictive Analytics*

1.0 Introduction

Small and medium-sized businesses (SMEs) contribute to approximately half of all jobs and 90% of businesses worldwide but were significantly affected globally due to COVID 19 pandemic because of their small size and limited resources (Kumar *et al.,* 2021). They continue to face limited credit availability from creditors, who also face liquidity problems, lower sales, and higher rates subjecting the sector to severe financial constants. The sector continues to face severe financial constraints as a result of supply chains not receiving credit from suppliers. A decrease in household income of approximately 36% was experienced by 95% of the entrepreneurs. Household income continues to be impacted by lower sales and family members losing jobs or seeing their wages reduced.

According to KBA MSMEs Survey Report, (2021) 35% of them missed or delayed loan repayments. Thus more small and medium-sized enterprises (SMEs) required financing to continue operating yet business owners struggle to obtain the necessary liquidity to revive and flourish. The study indicated that the majority of merchants accepted digital payments before the pandemic. However, a significant increase in the use of digital financial services resulted from exclusion of transactions exceeding 1,000 Ksh. (10 USD). Thus between February and October 2020, the Central Bank of Kenya reported that the monthly volume of P2P transactions increased by 87 percent. The volume of transactions below Ksh. 1,000 (USD10) increased by 114 percent during this time, and 2.8 million more customers began using mobile money, resulting in significant growth in digital business transactions. A slight improvement of 8% was observed among SMEs that use partnerships or an e-commerce model to mitigate the negative effects of COVID-19. More SMEs in rural areas—89 percent compared to 62 percent in urban areas have yet to adopt any digital channel to grow their businesses and adapt to the shifting business environment (KBA MSMEs Survey Report, 2021).

Majority of SMEs are microfinance institution customers who have drained their reserve funds and offered resources to relieve the extreme monetary effect of the pandemic but still ran the risk of having their credit limits reduced as their savings decrease, making them more vulnerable and less able to handle unexpected events in the future. In order to keep their businesses afloat, SMEs have been learning how to diversify their sources of income (KBA MSMEs Survey Report, 2021). Thus, have been employing a variety of

strategies to stay afloat. These strategies include seeking credit and using loan proceeds to infuse funds into their businesses while also prioritizing business continuity and seeking external support to recover. Vitari, and Raguseo (2020) stated that Data Analytics will help SMEs to survive in today's dynamic business environment based on Predictive Analytics and Prescriptive Data Analytics to enable them make more data-driven decisions based on historical and present data and to predict future business dynamics and respond as appropriate.

Statement of the problem

In the wake of the COVID-19 pandemic, Kenya's small and medium-sized enterprises (SMEs) faced formidable obstacles in their quest for sustained performance and long-term viability. The pandemic has brought havoc on traditional business models and consumer behavior, necessitating a rapid adaptation of SMEs to the ever-changing business landscape. However, a significant impediment lies in the fact that many SMEs in Kenya lack the essential tools and strategies required to harness the potential of big data analytics effectively. This deficiency hampers their ability to make data-driven decisions that could bolster their performance and ensure sustainability in a post-pandemic world (Chumba *et.al.*, 2020).

Small and Medium Enterprises (SMEs) face a critical challenge in that their ability to navigate unforeseen situations is hindered by limited innovative technological capacities and underdeveloped research and development capabilities (Nath and Agrawal, 2020). These challenges become particularly pronounced during and post the COVID-19 pandemic. Survivability for SMEs therefore hinges on their capacity to address these problems by fortifying technological capabilities, especially in customer relations management (CRM). Additionally, there is a pressing need for SMEs to establish a flexible work system, allowing employees to work seamlessly from any location at any time. Failure to address these technological shortcomings poses a significant obstacle to SMEs' adaptability and sustainability in the face of ongoing and unforeseen challenges.

These challenges are compounded by various factors, including financial constraints, limited access to advanced technology, and lack of awareness and expertise in the realm of big data analytics. Additionally, SMEs in Kenya are operating in an intensely competitive environment, where adaptability and responsiveness to shifting market

dynamics are critical for survival. Without the capacity to leverage big data analytics, SMEs may struggle to identify emerging trends, understand customer preferences, and optimize their operational processes, potentially leaving them disadvantaged

Objective of the study

To establish the extent to which Big Data Analytics influence sustainability and performance improvement of small and medium-sized enterprises (SMEs) in Kenya after COVID-19 pandemic.

Research Question

The research was guided by the following research question:

To what extent does applications of Big Data Analytics influence the sustainability and performance improvement of small and medium-sized enterprises (SMEs) in Kenya the Post-COVID-19 pandemic?

Empirical Review

Maroufkhani et al. (2020) provides compelling insights into the transformative potential of BDA on SME sustainability and performance. The study effectively highlights how leveraging extensive and diverse datasets empowers SMEs to gain valuable insights into customer behaviors, identify market trends, and optimize operational efficiency. The emphasis on data-driven decision-making and strategic resource allocation underscores BDA's role as a catalyst for overall business improvement. The recognition of real-time analysis as a tool for proactive problem-solving and uncovering growth opportunities is commendable. Given the challenges posed by the post-COVID-19 era, the study rightly emphasizes BDA's contribution to equipping SMEs with the resilience and agility required to navigate dynamic market conditions. However, a critical examination of the study should consider the specifics of the proposed adoption model, potential limitations, and the generalizability of findings across different SME contexts to ensure the robustness and applicability of the proposed insights. Additionally, a deeper exploration of the challenges and ethical considerations associated with BDA adoption in SMEs would contribute to a more comprehensive understanding of its implications.

According to Nasrollahi *et al.*, (2021) study investigates the impact of big data adoption (BDA) on the performance of small and medium enterprises

(SMEs), presenting a comprehensive model. The research unveils BDA's multifaceted influence on SMEs, positively affecting both operational (efficiency, productivity) and economic (profitability, revenue) performance. Notably, no direct association was found between BDA and social performance. The study highlighted the mediating role of operational performance, where improvements in efficiency due to BDA contributed to enhanced economic performance. The model is conceptualized as a pyramid, with BDA components forming the base and arrows indicating causal relationships between layers. The findings emphasize BDA's potential for SMEs to streamline operations, make data-driven decisions, and gain a competitive edge. While acknowledging limitations, such as a small sample size and focus on Iranian SMEs.

Utilization of big data for informed decision-making across various sectors, as highlighted by Jin *et al*., (2020), presents a significant contemporary challenge. While the literature consistently emphasizes the substantial value and competitive advantages organizations can derive from accurate information, there is a potential downside to this increasing dependence on big data. Businesses are actively seeking to leverage big data, aiming to enhance decision-making processes and introduce new technologies for innovative data utilization and knowledge discovery (Storey and Song, 2021). However, the problem lies in the potential overreliance on big data, with organizations possibly neglecting the importance of human judgment and qualitative insights. Relying solely on data-driven decisions may overlook contextual nuances and intangible factors crucial for comprehensive decision-making. Additionally, the challenge extends to ethical considerations, including issues related to data privacy, security, and potential biases within the datasets. The rush to adopt big data solutions without addressing these concerns could lead to unintended consequences and undermine the intended benefits of enhanced decision-making and business value. Therefore, a critical examination of the ethical and human-centric aspects of big data utilization is imperative to ensure responsible and effective implementation across businesses of all sizes.

Sangpetch and Ueasangkomsate's (2023) studied the intricate interplay of big data analytics (BDA), circular economy (CE), and sustainable performance for small and medium-sized enterprises (SMEs). The research uncovers BDA's role as a potent enabler of CE practices within SMEs, utilizing data analysis on material flows, resource consumption, and product lifecycles to inform strategies for

product redesign, waste reduction, and closed-loop systems. The study underscores how embracing CE principles directly enhances SMEs' sustainable performance, reducing environmental impact, improving resource efficiency, and enhancing brand reputation.

The existing literature on Big Data Analytics (BDA) for SMEs' Performance Sustainability in the post-COVID-19 era underscores its transformative potential, emphasizing operational efficiency, market prediction, and long-term sustainability. However, a critical analysis reveals a notable gap in empirical research, particularly in understanding the specific challenges and opportunities faced by small and medium-sized enterprises (SMEs) in the aftermath of the pandemic. The literature lacks comprehensive insights into the practical implementation barriers, adoption challenges, and contextual factors influencing the successful integration of BDA tools within the distinctive operational structures of SMEs navigating the post-COVID-19 business landscape. Additionally, while broad benefits are acknowledged, there is a need for more focused exploration of sector-specific applications and varying impacts across different industries within the SME ecosystem. Closing these gaps would provide valuable insights for SMEs, policymakers, and researchers seeking to foster resilience and sustainability in the evolving post-pandemic business environment

Theoretical Framework

It highlights literature that corresponds with the study's general and specific objectives, fundamental theories correlated to the research and research gaps.

Complex Adaptive System theory provides a perspective for comprehending complex and dynamic systems characterized by numerous interconnected elements, whose behavior can often be unpredictable, as exemplified in various contexts, including businesses. It asserts that these systems are in a continual state of adaptation to their surroundings and are far from static entities. In the context of the study on Data Analytics for SMEs' Performance Sustainability in Post-COVID-19 Kenya, CAS theory gains relevance by recognizing that SMEs function within intricate and swiftly shifting environments. According to Tammisalo (2020), applying CAS theory to SMEs, one gains insights into how data analytics can be harnessed to navigate uncertainties, respond effectively to evolving market dynamics, and uphold sustained performance. This perspective underscores the study's focus on fostering adaptability, agility, and flexibility

in SMEs' adoption of data analytics to bolster their sustainability amid the post-pandemic challenges

The Strategic Choice Theory (SCT), pioneered by Richard Cyert and James G. March postulates that organizational decisions are shaped by a limited pool of information and are heavily influenced by the goals, values, and perceptions of key decision-makers within the organization. SCT underscores the concept of bounded rationality, highlighting that organizations make choices based on cognitive limitations and available information. Hazen, et.al (2020) in their study stated that SCT holds relevance as it sheds light on the decision-making processes of SMEs, particularly concerning adoption of data analytics. It suggests that SME leaders' cognitive processes and perceptions regarding the advantages and risks associated with data analytics will play a pivotal role in determining its adoption. SCT thus informs the study by accentuating the significance of leadership and organizational decision-making in the context of data analytics adoption and its potential influence on SME performance sustainability

Conceptual Framework

This study investigates to what extent do applications of Big Data Analytics, with a focus on Post-COVID-19 circumstances, influence sustainability and performance improvement of small and medium-sized enterprises (SMEs) in Kenya

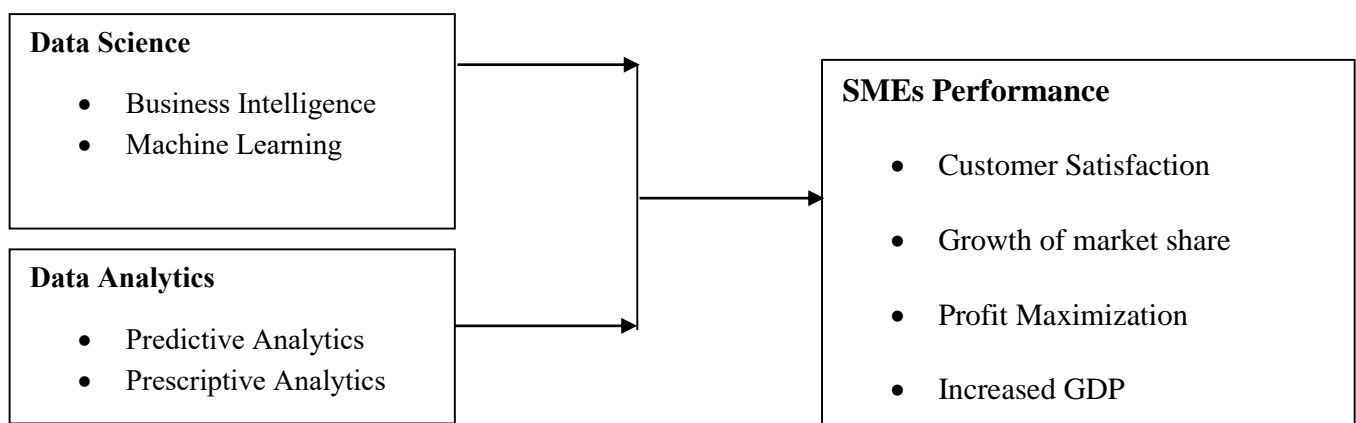**Independent Variable**   **Dependent Variable**

Figure 1: **Conceptual Framework**

Research Methodology

A descriptive survey design was used in this study. The target population was 287 respondents comprising managers of SMEs in Nairobi. The sample for the study was 260 respondents selected using the stratified sampling technique. Questionnaires were used to collect data as shown in Table 3.1.

Table1 Sampling size

Sub-County	Target Population	Sample Size	Percentage (%)
Eastlands	16	14	5.57
Dagoretti North	14	10	4.88
Lang'ata	20	19	6.97
Kibra	17	14	5.92
Roysambu	20	19	6.97
Kasarani	11	10	3.84
Ruaraka	20	19	6.97
Embakasi South	14	14	4.88
Embakasi North		14	6.27
Embakasi Central	18	13	4.53
Embakasi East	13	14	5.92
Embakasi West	17	19	6.62
Makadara	19	10	4.18
Kamuknji	12	19	6.97
Mathare	20	14	5.57
Starehe	16	19	6.97
Dagoretti North	20	19	6.97
Total	287	260	100

Source: Author

Research Findings and Discussions

Table 2 presents data including two key variables, Business Intelligence and Machine Learning, along with their respective mean and standard deviation values. The mean value for Business Intelligence was 3.9 (std. dv = 0.851) indicating that on average, the SMEs in the study exhibited a relatively high level of Business Intelligence utilization in their operations. A mean value above 3 suggests that the majority of SMEs in the sample actively employed Business Intelligence practices to gather insights and make informed decisions. The mean value for Machine Learning is 3.7(std. dv = 0.851) indicating that, on average, SMEs in the study exhibited a reasonably high level of Machine Learning adoption. While the mean is slightly lower than that of Business Intelligence, it still reflects a notable utilization of Machine Learning techniques.

Statement	Mean	Std Dev.
Business Intelligence	3.9	0.851
Machine Learning	3.7	0.928
Average	**3.8**	**0.8895**

Table 3 below provides descriptive results that focus on the impact of Data Analytics on sustainability of SMEs' performance in Kenya following the COVID-19 pandemic. The table includes two crucial variables, Predictive Analytics and Prescriptive Analytics, along with their respective means and standard deviation values, offering insights into the extent of their utilization among the SMEs in the study. The mean score of 3.73 signifies that the SMEs have a relatively strong adoption of Predictive Analytics. This suggests that a considerable number of SMEs actively used Predictive Analytics to forecast future trends to inform their decision-making and strategic planning. The standard deviation of 0.850 implies moderate variability in the responses regarding Predictive Analytics. While many SMEs employ this practice, there may be some diversity in the extent of its application across the sampled SMEs.

The mean score of 3.85 indicates that the SMEs robustly adopted Prescriptive Analytics to provide specific recommendations and actions based on data analysis. The standard deviation of 0.684 suggests relatively low variability in the responses concerning

Prescriptive Analytics implying that the majority of SMEs exhibited a consistent pattern of adopting Prescriptive Analytics.

Statement	Mean	Std Dev.
Predictive analytics	3.73	0.850
Prescriptive Analytics	3.85	0.684
Average	**3.79**	**0.767**

Table 3: Descriptive Results Data Analytics and Sustainability of SMEs' Performance In Kenya after COVID-19

5.0 Conclusions and Recommendations.

Descriptive results presented on Tables 2 and 3 shed light on the utilization of Data Science and Data Analytics, respectively, in enhancing the sustainability of SMEs' performance in Kenya post-COVID-19. The findings indicate that the SMEs demonstrated notable adoption of Business Intelligence, with a mean score of 3.9, suggesting active utilization to gather insights and make informed decisions. Similarly, the study reveals a reasonably high level of Machine Learning adoption, with a mean score of 3.7. Moving to Data Analytics, the results highlight a strong average adoption of Predictive Analytics (mean of 3.73), indicating widespread use for forecasting future trends, albeit with some variability. These SMEs showcase a robust adoption of Prescriptive Analytics, with an average mean score of 3.85, suggesting consistent utilization for providing specific recommendations and actions based on data analysis. These findings collectively underscore the significance of advanced data-driven techniques in SMEs, portraying a positive landscape for leveraging Data Science and Analytics to enhance sustainability in the post-COVID-19 business environment.

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