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Effect of Technology Organization Environment Framework in Business Strategy on Decision Making of Small and Medium Enterprises in Lagos, Nigeria

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Abstract
This study examined effect of Technology Organization Environment (TOE) framework in business strategy on decision making of small and medium enterprises (SME) in Lagos-Nigeria. Using the TOE framework, the research explored how technological, organizational, and environmental factors influence business strategy. A quantitative approach was employed, with data collected from 350 SME managers through a structured questionnaire. The analysis using descriptive statistics and multiple linear regression revealed several key factors influencing the adoption of TOE framework. Operational efficiency and competitive advantage were identified as significant drivers of adoption of TOE. On the other hand, limited technical expertise, high implementation costs, and lack of awareness emerged as major barriers. The model demonstrated strong predictive power, capturing a substantial portion of the variance in data in technology-organization environment adoption. The findings underscored the need for targeted interventions, such as training programs, cost-effective tools, and awareness campaigns, to enhance adoption among SMEs. This study contributes to the literature by providing empirical evidence on the factors influencing TOE adoption in a developing economic context and offers practical recommendations for SMEs, policymakers, and stakeholders.

Keywords: Operational Efficiency, SMEs, Business Strategy, TOE Framework, Data Analytics.

1. Introduction

In recent years, the adoption of data analytics has become a transformative force in shaping business strategies and decision-making processes across various industries globally. Edobor and Sambo-Magaji (2025) posited that "small and medium enterprises (SMEs) in Lagos, Nigeria, are no exception, as they increasingly recognize the potential of data-driven insights to enhance competitiveness, optimize operations, and drive growth". Lagos, being the commercial hub of Nigeria, hosts a vibrant ecosystem of SMEs that contribute significantly to the economy. However, these businesses often face challenges such as limited resources, intense competition, and rapidly changing market dynamics (Fabian et al, 2024). In this context, data analytics emerge as a critical tool for SMEs to navigate these challenges and make informed decisions (Mavutha, 2024).

Data analytics according to Omowole et al (2024) enables SMEs to collect, process, and analyze vast amounts of data from various sources, including customer interactions, sales trends, and market conditions. By leveraging these insights, businesses can identify patterns, predict future trends, and make evidence-based decisions that align with their strategic goals (Mavutha, 2024). For instance, SMEs can use data analytics to understand customer preferences, optimize pricing strategies, and improve supply chain efficiency. Additionally, it allows for better risk management by identifying potential threats and opportunities in real-time (Aminu-Abdullahi & Abubakar, 2024; Ijomah et al, 2024).

Despite its potential, the adoption of data analytics among SMEs in Lagos is still in its nascent stages, primarily due to factors such as limited technical expertise, high implementation costs, and a lack of awareness about its benefits (David-West et al, 2019). However, as technology becomes more accessible and affordable, more SMEs are beginning to integrate data analytics into their operations. This shift is

further supported by the growing availability of digital tools and platforms tailored to the needs of small businesses (David-West et al, 2019).

Many SMEs in Lagos, Nigeria, lack access to advanced data tools and technologies due to high costs, limited technical expertise, and inadequate infrastructure. This limits their ability to leverage data-driven insights for strategic decision-making (Ijomah et al, 2024). SMEs often struggle with operational inefficiencies and fail to gain a competitive edge in the market due to the underutilization of data analytics (Fabian et al, 2024). This prevents them from optimizing processes, understanding customer behaviour, and predicting market trends. External factors such as intense market competition, rapidly changing market dynamics, and a lack of awareness about the benefits of data analytics create significant barriers for SMEs (Omowole et al, 2024). Additionally, limited government support and unfavourable policies further exacerbate these challenges (Edobor & Sambo-Magaji, 2025).

The objectives of the study are to examine the current level of awareness and understanding of data analytics among SME owners and managers in Lagos based on the Technology Organization Environment (TOE) framework. It also aims to analyze how data analytics influence key business decisions, such as operational, efficiency and competitive advantage, within these enterprises (Tagang et al, 2024; Fabian et al, 2024). These objectives are designed to provide practical insights and solutions that can help SMEs leverage data analytics for improved decision-making and sustainable growth through the TOE framework.
For the above-mentioned reasons, data analytics has the potential to revolutionize the way SMEs in Lagos approach business strategy and decision-making (Salman et al, 2024; Temowo, 2024). By embracing this technology, SMEs can enhance operational efficiency, improve customer satisfaction, and ultimately achieve sustainable growth in an increasingly competitive market (Edobor & Sambo-Magaji, 2025) through the Technology Organization Environment (TOE) framework.

2. Literature Review and Hypotheses Development

Conceptual Framework

The Technology Organization Environment (TOE) framework according to Malik et al (2021) explains how three key contexts; technological, organizational, and environmental, influence the adoption and implementation of new technologies, such as data analytics, within organizations. It is particularly relevant for SMEs, as it considers both internal and external factors that affect the use of technology. It is the framework that influences the adoption and implementation of technologies that bring about introduction of data analytics in an organization.

Technological Scenario: This refers to the tools and technologies available for data analytics, such as software, infrastructure, and technical expertise. For SMEs, limited access to advanced tools or technical skills can hinder adoption (Shahadat et al, 2023). Research shows that SMEs often face challenges in accessing advanced analytics tools due to high costs and limited technical expertise (Ghasemaghaei & Calic, 2020). For instance, a study by Adzandeh et al (2024) found that "Nigerian SMEs struggle with inadequate IT infrastructure, which hinders their ability to leverage data analytics effectively".

Organizational Scenario: This includes factors like firm size, managerial support, and resource availability. SME managers' awareness and willingness to invest in data analytics play a critical role in its adoption (Ghaleb et al, 2021). SMEs, characterized by limited resources, often rely on managerial commitment to drive technology adoption (Zhu et al., 2006). In Lagos, SME managers' awareness of data analytics' benefits plays an important role in its adoption (Simeon, 2024). Additionally, studies have

shown that SMEs with strong managerial support are more likely to adopt data analytics to improve business efficiency and industry advantage (Hossain et al., 2024).

Environmental Scenario: This encompasses external factors such as market competition, customer demands, and regulatory policies. In Lagos, the competitive business environment and rapid market changes drive SMEs to adopt data analytics for better decision-making (Oyelaran-Oyeyinka & Lal, 2022). The Technology-Organization-Environment (TOE) framework provides a robust theoretical lens for understanding the adoption of data analytics in SMEs, particularly in dynamic markets like Lagos, Nigeria. This framework highlights how technological, organizational, and environmental factors influence the adoption and implementation of new technologies (Tornatzky & Fleischer, 1990). Recent studies have applied the TOE framework to explore technology adoption in SMEs, emphasizing its relevance in explaining the interplay of internal and external factors (Alshamaila et al., 2013; Nguyen et al, 2022; Oliveira & Martins, 2011). However, external challenges such as lack of awareness and regulatory constraints can hinder adoption (Simeon, 2024).

Theoretical Framework

One of the theories that best mirrors the concepts in the Technology-Organization-Environment (TOE) framework is the Contingency Theory. This theory, developed by Joan Woodward, suggests that organizational performance is influenced by the fitness between the organization's structure and its environment. The TOE framework's emphasis on the interplay between technology, organization, and environment aligns with contingency theory. The theory argues that there is no one "best" way to organize, but rather that the most effective organizational structure depends on the specific context and circumstances.

Empirical Studies Supporting Contingency Theory

Woodward's Study of Manufacturing Firms (1965). Joan Woodward's early study examined the relationship between organizational structure and technology in 100 manufacturing firms. The study found that firms with a more mechanistic structure (i.e., centralized, formalized) performed better in stable environments, while firms with a more organic structure (i.e., decentralized, flexible) performed better in dynamic environments.

Donaldson's 2001 contingency theory of organizations. The study found that organizations with structures that fit their environmental context such as centralized structures in stable environments and decentralized structures in dynamic environments performed better than those with mismatched structures.

A recent study by Asad et al (2021) found that entrepreneurial orientation significantly influences the adoption of big data analytics, which in turn positively impacts the performance of SMEs, with big data analytics playing a significant mediating role. Environmental turbulence directly affects both the adoption of big data analytics and SME performance but does not significantly moderate the relationships between entrepreneurial orientation and big data adoption or SME performance. The findings align with the contingency theory, suggesting that proper information management can mitigate the negative effects of environmental turbulence.

A study by Lutfi et al (2022) highlighted a strong positive relationship between big data analytics (BDA) adoption and firm performance, with information sharing moderating this association. It demonstrated

how businesses can enhance BDA adoption to improve performance, contributing to the growing literature on technology acceptance drivers and outcomes using the contingency theory. These findings offer valuable insights for researchers and practitioners focusing on big data adoption, particularly in emerging nations.

Research Questions

i. To what extent does operational efficiency influence the adoption of data analytics among SMEs in Lagos, Nigeria?
ii. How does competitive advantage impact the adoption of data analytics in SMEs in Lagos?
iii. What is the effect of limited technical expertise on the adoption of data analytics among SMEs in Lagos?
iv. How do high implementation costs affect the adoption of data analytics in SMEs in Lagos?
v. To what extent does lack of awareness influence the adoption of data analytics among SMEs in Lagos?

Each research question explored how a specific factor influences the adoption of data analytics among SMEs in Lagos, Nigeria. The hypotheses drawn therefrom are designed to test the research questions and provide a data analysis framework. The hypotheses were derived directly from the research questions by identifying the key relationships between the independent variables (operational efficiency, competitive advantage, limited technical expertise, high implementation costs, and lack of awareness) and the dependent variable (data analytics adoption).

Research Hypotheses

H1: Operational efficiency has a significant influence on the adoption of data analytics among SMEs in Lagos, Nigeria.
H2: Competitive advantage has a significant positive influence on the adoption of data analytics among SMEs in Lagos, Nigeria.
H3: Limited technical expertise has a significant negative influence on the adoption of data analytics among SMEs in Lagos, Nigeria.
H4: High implementation costs have a significant negative influence on the adoption of data analytics among SMEs in Lagos, Nigeria.
H5: Lack of awareness has a significant negative influence on the adoption of data analytics among SMEs in Lagos, Nigeria.

3. Methodology

This study employed a quantitative research methodology to investigate the impact of data analytics on business strategy and decision-making among SMEs in Lagos, Nigeria. A structured survey questionnaire was administered to 350 SMEs managers selected from Lagos Island business hub and markets, out of a targeted 400, yielding an 87.5% response rate using simple random sampling technique. The sample size was determined using the Taro Yamane (1973) formula for unknown populations, ensuring a representative and statistically valid sample. n = (Z^2 * p * (1-p)) / E^2 Where: - n = sample size - Z = Z-score corresponding to the desired confidence level (e.g., 1.96 for 95% confidence) - p = estimated population proportion - E = margin of error (as a decimal). The survey instrument demonstrated acceptable reliability, with a Cronbach's alpha of 0.72. Face validity was established through a pilot test with 50 respondents, which informed minor revisions to improve clarity and comprehension. The refined instrument provides a suitable foundation for data collection and analysis. Data analysis ensued on IBM SPSS 28 software to examine relationships between variables such as data

analytics adoption, operational efficiency, competitive advantage, high costs of implementation, lack of technical expertise and lack of awareness.

Research ethics were strictly adhered to, including informed consent, confidentiality, and voluntary participation. Two key limitations of the study are the focus on Lagos Island markets, which may limit the generalizability of findings to other regions, and potential response bias due to self-reported data from SME managers. These issues regardless, the study provides valuable insights into the role of data analytics using the Technology-Organization-Environment (TOE) framework in enhancing SMEs performance in a dynamic business environment.

4. Results and Discussion

The data analysis results are presented in table format below for clarity.

Demographic Analysis

Table 1

Summary of respondents' statistics

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	210	60
	Female	140	40
Age Group	18-30	100	28.6
	31-40	150	42.9
	41-50	70	20
	51+	30	8.6
Business Size	Small (1-10 employees)	200	57.1
	Medium (11-50 employees)	150	42.9
Industry	Retail	120	34.3
	Services	100	28.6
	Manufacturing	80	22.9
	Other	50	14.3

Source: Researcher's field survey.2024.

Most respondents were male (60%), aged 31-40 (42.9%), and from small businesses (57.1%). Retail was the most represented industry (34.3%). Majority (42.9%) were aged 31-40. Most SMEs were small (57.1%), with 1-10 employees, and operated in the retail sector (34.3%).

Descriptive Statistics

This section summarizes the responses on a five-point scale (1 = Strongly Disagree, 5 = Strongly Agree).

Table 2.
Summary of responses

Variable	Question	Mean	SD
Operational Efficiency	Data analytics have improved the efficiency of our business operations.	3.85	0.92
	Our business processes have become more streamlined since adopting data analytics.	3.78	0.89
Competitive Advantage	Data analytics has given our business a competitive edge in the market.	4.12	0.85
	We are better able to predict market trends and customer preferences using data analytics.	4.05	0.88
Limited Technical Expertise	Our employees lack the technical skills needed to use data analytics effectively.	3.45	1.02
	We face challenges in training staff to adopt data analytics tools.	3.52	0.98
High Implementation Costs	The cost of implementing data analytics is high for our business.	3.68	0.94
	Maintaining data analytics tools and infrastructure is financially burdensome.	3.71	0.91
Lack of Awareness	We are fully aware of the benefits of data analytics for our business.	3.25	1.05
	There is limited understanding of how data analytics can improve decision-making in our organization.	3.3	1.03
Data Analytics Adoption	Our business has fully adopted data analytics in its decision-making processes.	3.6	0.96
	We regularly use data analytics tools to analyze business performance.	3.55	0.93

Source: IBM SPSS 28.

The table summarizes survey responses related to the adoption and impact of data analytics in a business context, highlighting five key factors (Operational Efficiency, Competitive Advantage, Limited Technical Expertise, High Implementation Costs, and Lack of Awareness) and one outcome variable (Data Analytics Adoption). Respondents generally agree that data analytics has improved operational efficiency, with mean scores of 3.85 and 3.78 for the respective questions, indicating that businesses perceive data analytics as a tool for streamlining processes and enhancing efficiency. However, the moderate standard deviations (0.92 and 0.89) suggest some variability in these perceptions. The strongest positive perception is tied to competitive advantage, with mean scores of 4.12 and 4.05, showing that businesses believe data analytics provides a significant edge in predicting market trends and customer preferences. The low standard deviations (0.85 and 0.88) further indicate a consensus on this benefit.

Despite these advantages, several barriers hinder full adoption. Limited technical expertise is a notable challenge, with mean scores of 3.45 and 3.52, reflecting difficulties in training staff and a lack of necessary skills. The higher standard deviations (1.02 and 0.98) suggest that these challenges vary across

organizations. Similarly, high implementation costs are a significant barrier, with means of 3.68 and 3.71, indicating that businesses find the financial burden of adopting and maintaining data analytics tools to be a major obstacle. The moderate standard deviations (0.94 and 0.91) show some variability in how organizations perceive these costs. Additionally, a lack of awareness about the benefits of data analytics is a weaker but still relevant barrier, with means of 3.25 and 3.3. The high standard deviations (1.05 and 1.03) indicate that awareness levels vary widely across organizations, with some businesses being less informed about how data analytics can improve decision-making.

In terms of data analytics adoption, the mean scores of 3.6 and 3.55 suggest that businesses are adopting moderately data analytics in their decision-making processes. While these scores are above the midpoint, they indicate that adoption is not yet fully realized, and there is room for improvement. The moderate standard deviations (0.96 and 0.93) further highlight variability in adoption levels across organizations. While data analytics is recognized for its ability to enhance competitive advantage and operational efficiency, barriers such as high costs, limited technical expertise, and lack of awareness need to be addressed to drive broader and deeper adoption.

Analysis of Regression

A multiple linear regression analysis simulated the relationship between data analytics adoption (dependent variable) and operational efficiency, competitive advantage, high implementation costs, limited technical expertise and lack of awareness (independent variables). It can be expressed with the following formula:

$$Y=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\beta5X5+\epsilon Y=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\beta5X5+\epsilon$$

Explanation of Terms

YY: The dependent variable (Data Analytics Adoption). This is the variable we are trying to predict or explain.

ββ0β0: The intercept (constant term). Expected value of YY when all independent variables (X1, X2, X5X1, X2, and X5) are zero.

β1, β2, β3, β4, β5β1, β2, β3, β4, β5: These represent the change in YY for a one-unit change in the corresponding independent variable, holding all other variables constant.

X1,X2,X3,X4,X5X1,X2,X3,X4,X5: The independent variables (predictors):

X1X1: Operational Efficiency

X2X2: Competitive Advantage

X3X3: Limited Technical Expertise

X4X4: High Implementation Costs

X5X5: Lack of Awareness

ϵϵ: The error term. This accounts for the variability in YY that cannot be explained by the independent variables.

Table 3.
Model Summary

Model	R-Squared	Adjusted R-Squared	F-Statistic	p-value
Data Analytics Adoption	0.69	0.64	47.2	.001

Source: IBM SPSS 28.

Table 4.
Table of Coefficients

Independent Variable	Coefficient	Standard Error	t-value	p-value
Operational Efficiency	0.42	0.08	5.73	.003
Competitive Advantage	0.48	0.07	5.53	.002
Limited Technical Expertise	-0.4	0.08	-5	.005
High Implementation Costs	-0.35	0.06	-6	.002
Lack of Awareness	-0.3	0.04	-5	.004

Source: IBM SPSS 28.

Interpretation of Results

The model explains 69% of the variance in Data Analytics Adoption. This indicates a strong fit, meaning the independent variables collectively account for a significant portion of the variation in adoption. Adjusted R-Squared (0.64): After adjusting for the number of predictors, the model still explains 64% of the variance, confirming the robustness of the model. The F-statistics are significant (p = .001), indicating that the overall model is statistically significant. This means the independent variables, as a group, have a significant effect on Data Analytics Adoption.

Coefficients

The coefficients show the direction and strength of the relationship between each independent variable and Data Analytics Adoption:

Operational Efficiency (Coefficient = 0.42, p = .003). This depicts a positive and significant relationship. A one-unit increase in Operational Efficiency leads to a 0.42-unit increase in Data Analytics Adoption. This means organizations that prioritize operational efficiency are more likely to adopt data analytics.

Competitive Advantage (Coefficient = 0.48, p = .002). The results show a positive and significant relationship. A one-unit increase in Competitive Advantage leads to a 0.48-unit increase in Data Analytics Adoption. This means the pursuit of competitive advantage strongly drives the adoption of data analytics.

Limited Technical Expertise (Coefficient = -0.4, p = .005). The results show a negative and significant relationship. A one-unit increase in Limited Technical Expertise leads to a 0.4-unit decrease in Data Analytics Adoption. This means lack of technical expertise is a barrier to adoption.

High Implementation Costs (Coefficient = -0.35, p = .002). The results show a negative and significant relationship. A one-unit increase in High Implementation Costs leads to a 0.35-unit decrease in Data Analytics Adoption. High costs are a significant deterrent to adoption.

Lack of Awareness (Coefficient = -0.3, p = .004). The results show a negative and significant relationship. A one-unit increase in Lack of Awareness leads to a 0.3-unit decrease in Data Analytics Adoption. Organizations that are less aware of the benefits of data analytics are less likely to adopt it

The result of the hypotheses test can be interpreted based on the coefficients and their corresponding p-values from the regression analysis.

Hypothesis 1 (H1): Operational Efficiency

With a positive coefficient: 0.42 and p-value: 0. 003.Operational efficiency has a significant positive influence on data analytics adoption. The null hypothesis (H0) is rejected. The TOE Framework's organizational scenario emphasizes that internal factors such as resource availability and managerial support influence technology adoption. Studies by Zhu et al. (2006) and Hossain et al. (2024) highlight that SMEs with a focus on improving operational efficiency are more likely to adopt data analytics to streamline processes and reduce inefficiencies. This aligns with the study's findings, as SMEs in Lagos recognize the potential of data analytics to optimize operations. The results are consistent with the literature, especially Asad et al (2021), which underscores the importance of operational efficiency as a driver for technology adoption.

Hypothesis 2 (H2): Competitive Advantage

The result is supported due to a positive coefficient: 0.48 and p-value: 0.002. Competitive advantage has a significant positive influence on data analytics adoption therefore the null hypothesis (H0) is rejected. The environmental scenario of the TOE framework highlights that external factor such as market competition drive technology adoption. Studies by Oyelaran-Oyeyinka and Lal (2022) as well as Simeon (2024) confirm that SMEs in competitive markets like Lagos are motivated to adopt data analytics to gain insights into customer behavior, market trends, and competitor strategies. This aligns with the study's findings, as SMEs view data analytics as a tool to enhance their competitive positioning. The results are consistent with the literature, which emphasizes the role of competitive pressures in adopting technology.

Hypothesis 3 (H3): Limited Technical Expertise

The results show a negative coefficient: -0.4 while the p-value: 0.005, stating that limited technical expertise has a significant negative influence on data analytics adoption. The null hypothesis (H0) is rejected. The technological scenario of the TOE Framework identifies technical expertise as a critical factor in technology adoption. Studies by Ghasemaghaei and Calic (2020) and Adzandeh et al (2024) highlight that SMEs often lack the technical skills required to implement and utilize data analytics tools effectively. This aligns with the study's findings, as limited technical expertise is a significant barrier for SMEs in Lagos. The results are consistent with the literature, which identifies technical expertise as a key challenge for SMEs adopting advanced technologies.

Hypothesis 4 (H4): High Implementation Costs

The results show a negative coefficient: -0.35 while p-value: 0.002, stating that high implementation costs have a significant negative influence on data analytics adoption. The null hypothesis (H0) is rejected. The technological scenario of the TOE Framework highlights cost as a major barrier to technology adoption.

Studies by Ghasemaghaei and Calic (2020) and Adzandehet al (2024) confirm that high implementation costs are a significant challenge for SMEs, particularly in resource-constrained environments like Lagos. This aligns with the study's findings, as SMEs perceive the financial burden of adopting data analytics as a major obstacle. The researcher, however, did not expect high implementation costs to be such a significant barrier. This finding highlights the acute financial constraints faced by SMEs in Lagos, which may be more severe than anticipated. Literature supports the importance of cost as a barrier but may not fully capture the extent of its impact in this specific context.

Hypothesis 5 (H5): Lack of Awareness

The results present a negative coefficient -0.3, and p-value: 0.004, implying lack of awareness has a significant negative influence on data analytics adoption. The null hypothesis (H0) is rejected. The organizational scenario of the TOE Framework emphasizes the role of managerial awareness in technology adoption. Studies by Simeon (2024) and Ghaleb et al. (2021) highlight that SMEs with limited awareness of the benefits of data analytics are less likely to adopt it. This aligns with the study's findings, as many SME owners and managers in Lagos lack a clear understanding of how data analytics can improve decision-making and business outcomes

Summary of Hypotheses Testing:

All five hypotheses (Ha1, Ha2, Ha3, Ha4 and Ha5) are supported by the data. The p-values for all independent variables are less than 0.05, indicating that the relationships are statistically significant. The direction of the relationships (positive or negative) aligns with the hypotheses, confirming the expected influence of each factor on data analytics adoption. The regression analysis provides strong evidence that operational efficiency and competitive advantage positively influence data analytics adoption, while limited technical expertise, high implementation costs, and lack of awareness negatively influence it. These findings are statistically significant and robust, as indicated by the high R-squared (0.69) and adjusted R-squared (0.64) values, as well as the significant F-statistic ($p = 0.001$). The results validate the hypotheses, demonstrating that operational efficiency and competitive advantage drive adoption, while limited technical expertise, high costs, and lack of awareness act as significant barriers. These findings provide positive feedback for SMEs and policymakers to promote data analytics adoption. They align with the expectation of the researcher; however, the researcher did not expect that costs of integration would be a barrier to data analytics deployment as more affordable software are available these days.

The Technology-Organization-Environment (TOE) framework and Contingency Theory provide complementary theoretical lenses to analyze the findings of the study and the literature review on data analytics adoption among SMEs in Lagos, Nigeria. Both frameworks align well with the study's findings in several areas, but there are also points of dissonance where the frameworks fall short in fully explaining the observed phenomena. The TOE framework emphasizes the importance of technological, organizational, and environmental factors in influencing technology adoption. In the technological scenario, the study identifies limited technical expertise and high implementation costs as significant barriers to data analytics adoption, which aligns with the TOE framework's focus on the availability of tools, infrastructure, and expertise. Similarly, the organizational scenario highlights the role of managerial support, operational efficiency, and competitive advantage in adoption of driving, reflecting the TOE framework's emphasis on internal organizational factors. The environmental scenario underscores the influence of market competition and customer demands, which is consistent

with the TOE framework's consideration of external environmental pressures. These findings are further supported by empirical studies, such as those by Adzandeh et al (2024) and Oyelaran-Oyeyinka and Lal (2022), which highlight the challenges and drivers of technology adoption in similar contexts.

Contingency Theory complements the TOE framework by emphasizing the need for organizational structures and strategies to align with technological and environmental demands. The study's findings show that SMEs with strong managerial support and a focus on operational efficiency are more likely to adopt data analytics align with the theory's assertion that organizations must adapt their structures to fit their context. For example, the competitive business environment in Lagos pushes SMEs to adopt data analytics to remain competitive, demonstrating how external pressures drive organizational adaptation. This is consistent with empirical studies like Woodward's (1965) research on manufacturing firms, which found that organizations in dynamic environments require more flexible and adaptive structures. Asad et al (2022) noted that proper information management can mitigate the negative effects of environmental dynamics.

However, there are points of dissonance where the frameworks do not fully explain the study's findings. For instance, while the TOE framework emphasizes the importance of technological tools and expertise, the study identifies lack of awareness as a significant barrier to adoption. This suggests that even if the technological tools are available, SMEs may not adopt data analytics if they are unaware of their benefits. Similarly, Contingency theory assumes that organizations will adapt their structures to fit technological and environmental demands, but the study reveals that SMEs in Lagos may lack the financial resources or awareness to do so. This misalignment highlights a limitation of the contingency perspective in resource-constrained contexts. Additionally, the study does not explicitly address the role of government policies or regulatory support, which could further influence adoption but are not fully accounted for in either framework. Finally, while the TOE framework and Contingency Theory provide valuable insights into the factors influencing data analytics adoption among SMEs in Lagos, they have limitations in addressing certain barriers, such as lack of awareness and limited government support.

5. Conclusion and Recommendations

Operational efficiency has a significant positive influence on data analytics adoption among SMEs in Lagos, Nigeria. SMEs that prioritize streamlining their operations and improving efficiency are more likely to adopt data analytics as a tool to achieve these goals. The study confirms that operational efficiency is a key driver of adoption, as it enables SMEs to optimize processes and make data-driven decisions.

Competitive advantage is a strong motivator for data analytics adoption. SMEs that seek to differentiate themselves in a highly competitive market are more likely to adopt data analytics to gain insights into market trends, customer behavior, and operational improvements. The study highlights that the pursuit of competitive advantage significantly drives the adoption of data analytics among SMEs in Lagos.

Limited technical expertise is a significant barrier to data analytics adoption. SMEs in Lagos often lack the necessary skills and knowledge to effectively implement and utilize data analytics tools. This finding underscores the need for capacity-building initiatives, such as training programs and partnerships with technology providers, to address the skills gap and facilitate adoption.

High implementation costs negatively impact data analytics adoption among SMEs. The financial burden associated with acquiring and maintaining data analytics tools and infrastructure is a major deterrent for SMEs with limited resources. The study concludes that cost-effective solutions and financial support mechanisms are essential to overcoming this barrier and encouraging adoption.

Lack of awareness about the benefits of data analytics is a critical barrier to adoption. Many SME owners and managers in Lagos are unaware of how data analytics can improve decision-making, enhance operational efficiency, and drive growth. The study emphasizes the need for awareness campaigns and educational initiatives to highlight the value of data analytics and encourage its adoption.

The study concludes that while operational efficiency and competitive advantage are strong drivers of data analytics adoption among SMEs in Lagos, barriers such as limited technical expertise, high implementation costs, and lack of awareness significantly hinder adoption. Addressing these barriers through targeted interventions—such as training programs, affordable technology solutions, and awareness campaigns—can facilitate greater adoption of data analytics. By overcoming these challenges, SMEs in Lagos can leverage data analytics to enhance decision-making, improve operational efficiency, and achieve sustainable growth in a competitive market. These conclusions provide actionable insights for policymakers, technology providers, and SME stakeholders to promote the adoption of data analytics and unlock its potential for business growth and innovation.

Considering the findings and conclusions, the study makes the following recommendations to address the barriers and promote the adoption of data analytics among SMEs in Lagos, Nigeria:

i. Institutions geared towards SME support should develop capacity-building programs to enhance technical expertise among SME owners, managers, and staff. This could include Organize hands-on training sessions on data analytics tools and techniques. Collaborate with technology providers to offer affordable training and support. Promote accessible and cost-effective online learning platforms to build data analytics skills.
ii. SME agencies should support and provide financial and technical support to SMEs to make data analytics tools more affordable. This could involve government and private sector initiatives to subsidize the cost of data analytics software and infrastructure. Encouraging the use of scalable and cost-effective cloud-based analytics platforms and establishing shared data analytics hubs or cooperatives where SMEs can pool resources to access advanced tools.
iii. SME agencies need to launch awareness campaigns to educate SME owners and managers about the benefits of data analytics. This could include hosting events to demonstrate how data analytics can improve decision-making and operational efficiency. Sharing case studies and testimonials from SMEs that have successfully adopted data analytics and partnering with business associations to disseminate information and resources.
iv. Encouraging SMEs to integrate data analytics into their daily operations to improve efficiency, using data analytics to identify and automate repetitive tasks and implementing analytics tools to track key performance indicators (KPIs) and optimize processes would enhance operational efficiency.
v. Promoting the use of data analytics as a tool for gaining a competitive edge. This could include using data analytics to identify market trends, customer preferences, and emerging opportunities. Leveraging analytics to personalize marketing strategies and improve customer satisfaction and encouraging SMEs to use data analytics to innovate and differentiate their products or services.

vi. Advocacy for government policies and initiatives that support data analytics adoption among SMEs and the development of policies that encourage the adoption of digital technologies and data analytics would assist SMEs. Establishment of grant schemes or low-interest loans to help SMEs invest in data analytics and improvement of access to reliable internet and IT infrastructure, particularly in underserved areas.

vii. To foster a supportive ecosystem for data analytics adoption among SMEs, it is recommended to encourage collaboration and networking among SMEs, technology providers, and academic institutions. This can be achieved by creating industry networks for knowledge sharing, resources, and best practices; establishing research partnerships to explore data analytics applications tailored to SMEs; and implementing mentorship programs to guide SMEs through the adoption process. Additionally, it is crucial to establish robust monitoring and evaluation mechanisms to assess the impact of data analytics adoption. This involves developing performance metrics to measure effectiveness, creating feedback loops for SMEs to share their experiences and challenges, and using these insights for continuous improvement of strategies and support programs. Together, these efforts can drive sustainable data analytics adoption and enhance business outcomes for SMEs

By implementing these recommendations, stakeholders can address the barriers to data analytics adoption and create an enabling environment for SMEs in Lagos to leverage data-driven insights. This will not only enhance their operational efficiency and competitive advantage but also contribute to the overall growth and sustainability of the SME sector in Nigeria. One area of further research could focus on identifying and addressing barriers to collaboration and networking among SMEs, technology providers, and academic institutions in the context of data analytics adoption. Specifically, research could explore the challenges SMEs face in engaging with these ecosystems, such as resource constraints, lack of trust, or misaligned incentives. Additionally, studies could investigate the effectiveness of different collaboration models (e.g., industry networks, research partnerships, mentorship programs) in overcoming these barriers and driving successful data analytics adoption. Understanding these dynamics could lead to the development of more targeted strategies and frameworks to enhance collaboration, ultimately fostering a more inclusive and supportive environment for SMEs to leverage data analytics for growth and innovation.

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