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Determinants of Big Data Analytics Adoption Among Small and Medium-Sized Enterprises in Ghana

Seth Owusu
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Walden University

College of Management and Human Potential

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Seth Owusu

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Walden University
2026

Abstract

Determinants of Big Data Analytics Adoption Among Small and Medium-Sized
Enterprises in Ghana

by

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MPhil, Walden University, 2025

MBA, Management College of Southern Africa, 2014

BBA, University of Professional Studies, 2009

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

Walden University

February 2026

Abstract

Big data analytics (BDA) has the potential to drive sustainability through improved decision-making, innovation, and competitiveness; however, small and medium-sized enterprises (SMEs) in Ghana face significant challenges in adopting this technology. The specific research problem is whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. Grounded in the technology-organization-environment framework, the resource-based view, and institutional theory, the purpose of this descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The participants comprised 120 SMEs registered with the Ghana Enterprise Agency. They completed a validated instrument adapted from the data mining domain, hotel managers' intentions to adopt robotics technologies, and organizational digitization models. The results of the multiple linear regression were significant, $F(3, 116) = 17.118, p < .001, R = .554, \text{adjusted } R = .289, R^2 = .307$. The findings indicated that technological readiness, organizational support, and external pressures significantly influence SMEs' adoption of BDA, with correlation coefficients of .434, .471, and .387, respectively. SME owner-managers and stakeholders must prioritize technological inclusion to enhance SME resilience and stimulate sustainable economic development in developing business environments. Implications for positive social change include the potential for government leaders and policymakers within the Ghana SME sector to make an impact by promoting a culture of data literacy and technological advancement, ultimately fostering innovation and competitiveness.

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Dedication

This document is dedicated to my deceased Mum, Victoria Yaa Kessewaa, for her sacrifices. May the Almighty God take your soul, Mama. I also dedicate this to my three children, Michelle, Agudie, and Odeneho, whom I sacrificed their precious time to prepare for this document. I would like to again dedicate this to my lovely wife, Gertrude “Baby” Baffoe, for her support, words of motivation, and encouragement throughout the journey. I could not have been where I am without you. Your prayers and cries were heard, and I say a big thanks to you, my LOVE. To my Dad, Seth K. Owusu, and to my two soldiers, Elvis and Edwin, thank you.

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Chapter 1: Introduction to the Study

Big data analytics (BDA) directly impacts today's data-driven economy, particularly among businesses in the developed world. Today's businesses heavily leverage advanced technologies such as BDA, robotics, and artificial intelligence (AI) to enhance operational processes and secure a competitive edge (Zheng et al., 2021). These technologies support improved decision-making, operational efficiency, and market responsiveness. However, despite these benefits, small and medium-sized enterprises (SMEs) often lag behind larger organizations in adopting BDA (Maroufkhani et al., 2023). The disparity highlights a pressing need to empirically examine the factors influencing SMEs' adoption of BDA for sustainable growth and competitiveness.

The specific research problem the study seeks to examine is whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The Ghana Commercial Bank Sector report (2023) indicated that most SMEs in Ghana face challenges in adopting BDA. The social change implication of the study was to promote a culture of data literacy and technological advancement within the SME sector in Ghana. Highlighting the factors driving BDA adoption may encourage SMEs to invest in areas that synergize with their competitiveness.

The chapter includes an overview of the study's background, the problem statement, the purpose of the study, the research questions and hypotheses, and the theoretical foundation. Chapter 1 outlines the conceptual framework, nature of the study,

definitions, assumptions, scope, delimitations, limitations, and the significance of the study before summarizing key points and transitioning to Chapter 2.

Background of the Study

BDA has emerged as a transformative catalyst in the contemporary business environment, fostering innovation and enhancing organizational competitiveness. BDA is the methodology for acquiring, archiving, and analyzing complex datasets to derive meaningful patterns and actionable insights (Asiri et al., 2024; Fattah & Arief, 2023; Lutfi et al., 2023). By facilitating data-driven decision-making, BDA enables businesses to optimize operational efficiency, elevate customer satisfaction, and augment profitability (Sridharlakshmi et al., 2024; Thekkoote, 2022). These qualities are especially pertinent in contemporary dynamic marketplaces where swift adaptation to trends is crucial. The deliberate incorporation of BDA into corporate operations can be a crucial differentiator in attaining sustainable growth and market relevance.

Organizations implementing BDA can enhance internal operations, such as procurement and inventory management, by leveraging data insights to forecast demand more precisely and minimize inefficiencies. BDA tools help enterprises prevent stock shortages or overproduction by analyzing historical sales trends, consumer behavior, and external market factors. Mikalef et al. (2020) underscored that BDA is crucial for businesses in leveraging information systems to achieve operational objectives and meet customer expectations. The ability to convert complex data into strategic decisions makes BDA an essential resource for achieving sustained performance and agility.

Consequently, understanding the application of BDA by firms underscores its pivotal role in contemporary commercial strategies.

SMEs face a unique challenge in adopting BDA compared to large enterprises. Research indicates that while large enterprises have successfully leveraged BDA, SMEs often face challenges that hinder adoption, such as limited resources, expertise, and infrastructure (Kgakatsi et al., 2024). This disparity highlights the importance of understanding the determinants of BDA adoption among SMEs. Even though several studies have been conducted on BDA adoption, they have predominantly focused on large organizations and developed economies, leaving a significant gap in understanding the factors influencing SMEs' adoption of BDA in developing economies like Ghana.

Technological, organizational, and environmental factors have been recognized as key determinants influencing SMEs' adoption of BDA. For instance, Aldossari et al. (2023), Maroufkhani et al. (2023), and Babalghaith and Aljarallah (2024) emphasized that technological readiness, top management support, and competitive pressure significantly influence BDA adoption decisions across various economic contexts. These findings demonstrated that both internal capabilities and external pressures shape decision-making in SMEs. Although these studies provide valuable insights, they are largely based on data from developed economies where infrastructure and digital resources are more readily available.

The focus leaves a notable gap in the literature concerning middle-income countries like Ghana, where contextual and political landscapes differ significantly. Hence, understanding what drives BDA adoption among Ghanaian SMEs is essential to

developing strategies that foster digital innovation and competitiveness in resource-constrained settings. Indeed, cultural dynamics, human capital, economic trends, and development contribute to businesses' decision-making when adopting any form of capital infrastructure. These contextual determinants are necessary for developing strategies that foster digital innovation and enhance competitiveness among SMEs operating in a resource-constrained milieu, delineating such research in a regional context.

Furthermore, addressing the gap in the literature is critical because SMEs form the backbone of economies worldwide, particularly in developing regions. In Ghana, SMEs contribute significantly to employment and gross domestic product (GDP) (Adjabeng & Osei, 2022; Al-Afeef, 2020; Tsatsenko, 2020), yet their inability to adopt advanced technologies like BDA limits their growth potential and global competitiveness (Ghana Commercial Bank report, 2023). By identifying the determinants of BDA adoption, this study can inform policymakers, technology providers, and SME leaders on creating supportive environments for adoption. Such insights can lead to improved resource allocation and innovative policy interventions that empower SMEs to adopt BDA.

The study's findings could support positive social change by enabling SMEs to harness the power of BDA for informed decision-making, efficient operations, increased profitability, and more significant contributions to economic development. These improvements are particularly significant in underexplored contexts, where empirical research and practical insight into BDA adoption remain limited. The research

contributes to academic literature and practice by providing empirical insights into the transformative potential of BDA and the factors that influence SME adoption in underexplored contexts. The study will equip SME owner-managers and policymakers with the knowledge to harness BDA's transformative potential for sustainable growth and disruptive competitiveness.

Problem Statement

The social problem is that Ghanaian SMEs have not adopted BDA for organizational growth and sustainability. Several studies on SMEs' adoption of BDA revealed critical factors such as ease-of-use technology, competitiveness, relative advantage, data variety and velocity, government support, and rational decision-making culture (Bruitjies & Njenga, 2024; Lutfi et al., 2023; Maroufkhani et al., 2023). SMEs lag behind other organizations in adopting digitalization and digital processes (Adomako et al., 2021; Jayadatta & Majeed, 2024), and Ghanaian SMEs are no exception. Addressing the social problem is critical for SMEs' growth and sustainability, bolstering Ghana's digital transformation, economic resilience, and progress.

Notwithstanding the numerous studies on SMEs and BDA adoption, there is very little literature on the extent to which factors influencing BDA adoption among SMEs in Ghana include technological readiness, organizational support, and external pressures (Chong & Lim, 2022; Kgakatsi et al., 2024; Maroufkhani et al., 2023). The existing literature has generally examined BDA adoption, primarily focusing on large corporations and cloud business intelligence adoption (Bertello et al., 2021; Jiwat & Zhang, 2022; Maroufkhani et al., 2023). These unique factors have not been examined in

the context of SMEs' adoption of BDA in Ghana (Aghimien et al., 2021). This study's results contribute to filling a gap by offering a detailed examination of the factors influencing BDA adoption among Ghanaian SMEs.

The specific research problem is whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The Ghana Commercial Bank Sector report (2023) found that most SMEs in Ghana face challenges in adopting BDA. What influences the adoption has remained underexplored, posing critical questions. Didas (2023) and Maroufkhani et al. (2023) underscored that the lack of BDA adoption among SMEs hampers innovation, growth, and competitiveness and further poses a broader economic concern for the country's development. A striking example can be drawn from South Africa, where Seseni and Mbohwa (2021) reported that SMEs account for 98.5% of the country's business, with most SMEs adopting BDA experiencing success, highlighting the transformative potential of BDA. Contributing to filling the knowledge gap may inform strategic interventions and policies that support BDA adoption among Ghanaian SMEs.

Purpose of the Study

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The proliferation of BDA has revolutionized many large enterprises, enhancing operational efficiency and strategic decision-making capabilities. However, BDA adoption among SMEs, particularly in developing countries such as Ghana, remains underexplored (Kusi-Sarpong et al., 2021). While extensive research

highlights the advantages of BDA (Dahiya et al., 2022; Garmaki et al., 2016; Jiwat & Zhang, 2022; Maritz et al., 2020), there is a notable scarcity of studies examining the specific factors influencing its adoption among SMEs in Ghana.

Several existing studies on BDA adoption have focused on developed economies, overlooking the distinct constraints SMEs encounter in underdeveloped, developing, and middle-income countries. Researchers such as Bertello et al. (2021), Jiwat and Zhang (2022), and Maroufkhani et al. (2023) have investigated the adoption of BDA predominantly in technologically sophisticated nations. Conversely, studies concentrating on the Ghanaian context, characterized by distinct infrastructural and economic conditions for SMEs, are scarce (Aghimien et al., 2021; Kusi-Sarpong et al., 2021). The disparity in the literature limits a thorough comprehension of the BDA adoption process in developing contexts. Due to the varied constraints SMEs encounter in Ghana, such as inadequate digital infrastructure and limited financial resources, their experiences may differ from those of enterprises in more developed environments. Consequently, context-specific research is necessary to examine the determinants of Ghanaian SMEs' adoption of BDA within their distinct operational contexts.

Prior research has recognized technological, top management, and competitive pressures influencing BDA adoption among large and small firms. These three factors are considered essential predictors of BDA adoption across multiple locations (Alaskar et al., 2021; Iranmanesh et al., 2023; Maroufkhani et al., 2023; Thanabalan et al., 2024). Furthermore, Arthur and Locher (2024) and Dorhetso and Quarshie (2023) emphasized that SMEs constitute the foundation of every economy. Therefore, with adequate support,

SMEs in Ghana could use BDA to augment decision-making, promote operational efficiency, and foster innovation. Nonetheless, without empirical knowledge of the local manifestations of these characteristics, governments and business leaders may have difficulty formulating strategies to promote BDA adoption. Addressing this research gap can yield significant insights to facilitate digital transformation in Ghana's SME sector and enhance overall economic development.

Technological readiness, organizational support, and external pressures are the study's independent variables (IVs), and the dependent variable (DV) is BDA. Technological readiness, which includes the availability of technological infrastructure and skilled personnel, is crucial for BDA adoption. Iranmanesh et al. (2023), Maroufkhani et al. (2023), and Medeiros and Maçada (2022) identified a significant need for technological readiness in organizations' adoption of BDA, emphasizing the pivotal roles of physical and skilled personnel for successful implementation in some regions. However, there is limited empirical evidence on how technological readiness affects Ghanaian SMEs. Similarly, while organizational support is recognized as a key driver of technology adoption, its role in BDA adoption in the context of Ghana is underexplored (Abadie et al., 2023). Additionally, the influence of external pressures, such as competition and regulatory requirements, on BDA adoption among Ghanaian SMEs is lacking. Hence, the study on the determinants of BDA adoption among SMEs in Ghana.

Research Questions and Hypotheses

The geographical area for this research study is Ghana. The study's IVs are technological readiness, organizational support, and external pressures, while the DV is BDA. The study's research questions and hypotheses are as follows:

RQ1: To what extent does technological readiness influence SMEs' adoption of BDA in Ghana?

H₀₁: There is no significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

H₁₁: There is a significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

RQ2: To what extent does organizational support influence BDA adoption among SMEs in Ghana?

H₀₂: There is no significant influence of organizational support on SMEs' adoption of BDA in Ghana.

H₁₂: There is a significant influence of organizational support on SMEs' adoption of BDA in Ghana.

RQ3: To what extent do external pressures influence SMEs' adoption of BDA in Ghana?

H₀₃: External pressures do not significantly influence SMEs' adoption of BDA in Ghana.

H₁₃: External pressures significantly influence SMEs' adoption of BDA in Ghana.

Theoretical Foundation

The theoretical foundation for this study includes the technology-organization-environment (TOE) framework, the resource-based view (RBV), and the institutional theory. The TOE framework was first published in 1990 by Louis G. Tornatzky and Mitchell Fleischer (Awa et al., 2017). The framework has evolved as a robust theoretical model for understanding the adoption and implementation of technological innovations within organizations. The framework posits that technological, organizational, and environmental factors significantly influence an organization's decision to adopt and use new technologies (Tornatzky & Fleischer, 1990; Wiener et al., 2020). Applying this framework in the study provided a structured approach to investigating the multifaceted nature of technology adoption. The theory helped the researcher to systematically examine how each of these dimensions influences SMEs' adoption of BDA in Ghana.

Supporting this framework further is the RBV, developed by Birger Wernerfelt and Jay Barney in 1980 (Barney & Arikan, 2005). The RBV postulates that an organization's technological and human resources are critical for gaining a competitive advantage (Assensoh-Kodua, 2019; Lubis, 2022; Nayak et al., 2023). The theory aligns with the study's objective of investigating how technological readiness (infrastructure, internet, and skilled personnel) impacts BDA adoption. By integrating the RBV, the study could elucidate how Ghanaian SMEs can leverage their internal resources to facilitate BDA adoption, enhancing operational efficiency and strategic decision-making capabilities.

Lastly, institutional theory originated in sociology with the work of Max Weber and was further developed by Philip Selznick in the 1940s and 1950s (Selznick, 2011). The institutional theory provided insights into how external pressures, such as competition and regulatory requirements, influence organizational behavior and technology adoption (Lutfi et al., 2022, 2023; Selznick, 2011; Soares et al., 2021). The theory provides a valuable roadmap on why an SME may feel compelled or otherwise to implement BDA, even when internal systems do not support adoption. The theory is pertinent to understanding the role of external pressures on BDA adoption among SMEs in Ghana.

Institutional theory affirms that organizations can adopt new technologies to conform to external expectations and pressures, and is congruent with the study's investigation of how external pressures impact SMEs' decision to adopt BDA (Lutfi et al., 2022). Lutfi et al. (2022) emphasized that external pressure significantly shapes organizational decisions, reinforcing the importance of considering these factors in technology adoption research. Understanding the influence of external pressures is crucial for developing strategies to help SMEs navigate their external environment. These theoretical perspectives collectively provide a robust framework for investigating the determinants of BDA adoption among SMEs in Ghana, aligning with the study's problem, purpose, and research questions.

Conceptual Framework

SMEs integrating BDA benefit enormously by unlocking innovation, competitiveness, and sustainability in terms of performance. BDA tools are disruptive

tools that enable SMEs to gain comprehensive insights from data, enabling them to make informed decisions on customer behavior, market trends, and resource allocation (Asiri et al., 2024). As a result, many researchers have used the TOE to examine the adoption of BDA among SMEs. The TOE framework introduced by Tornatzky and Fleischer (1990) identified that technological, organizational, and environmental variables drive businesses' adoption of BDA.

Similarly, the RBV offers a valuable theoretical perspective for understanding the adoption of BDA among businesses. The RBV theory posits that an organization's technological and human resources are critical for gaining a competitive advantage (Assensoh-Kodua, 2019; Lubis, 2022; Nayak et al., 2023). The RBV theory aligns with this study on determining how infrastructure and employee expertise impact BDA adoption. Institutional theory, developed by Philip Selznick in the 1940s and 1950s, is instrumental in research of this nature. Institutional theory provides insights into how external pressures, such as competition and regulatory requirements, influence organizational behavior and technology adoption (Lutfi et al., 2023; Soares et al., 2021). The theory also explains in substantial detail how external pressures influence business adoption of BDA.

The logical connection between TOE, RBV, and institutional theory forms the basis for the study. For example, the TOE framework's technological dimension aligns with RBV's emphasis on infrastructure, IT expertise, and skills. In contrast, the environmental dimension, which constitutes external pressures, aligns with the institutional theory of government requirement and competition. The organizational

context within TOE is influenced by RBV, which focuses on organizational readiness and decision-making dynamics (Lutfi et al., 2022). As highlighted by TOE, environmental pressures correspond with external influences such as market trends and regulatory policies discussed in the institutional theory.

The conceptual framework directly informs the study's methodology, including research questions, instrument development, and data analysis. Integrating TOE, RBV, and institutional theory ensures that the survey instruments capture a range of factors, from technological capabilities to external pressures. The framework also guides the development of hypotheses by linking theoretical constructs to measurable variables and shapes the analytical approach to uncovering patterns and relationships. By grounding the study in an established framework, the research achieves both theoretical rigor and practical relevance, ensuring meaningful insights into the factors influencing BDA adoption among SMEs in Ghana.

Nature of the Study

This study employed a quantitative descriptive survey to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The quantitative descriptive survey can be traced back to the philosophical movement known as "positivism," associated with Auguste Comte (Burkholder et al., 2020; Lenzer, 2017). The concept of positivism emphasizes the use of empirical, numerical observations to understand real-world phenomena. Positivism provides a reliable and systematic approach for undertaking research by rejecting subjectivity, such as emotions, experiences, and beliefs.

The quantitative descriptive survey allows researchers to accurately describe and summarize features of the study population using numerical data, providing an objective picture of trends and patterns. Burkholder et al. (2020), Jarauscha and Hardy (2016), and Mohajan (2020) noted that a quantitative descriptive survey enables researchers to obtain measurable, objective data to test hypotheses, ascertain trends, and generalize outcomes to a population through statistical analyses. The research design enables a comprehensive, systematic examination of the factors influencing BDA adoption, providing valuable insights into how SMEs can better leverage BDA to gain a competitive advantage.

The study employed a structured survey developed by Huang et al. (2012), Nguyen et al. (2024), and Pizam et al. (2022) to collect data from a representative sample of SMEs (owner-managers, IT experts, and other decision-makers). The study instrument measures variables related to technological readiness, organizational support, external pressures, and BDA adoption. The data were analyzed using the International Business Machine Statistical Package for Social Sciences (IBM SPSS) software, version 30, to test the proposed hypotheses and examine the extent of the influence between the independent and the dependent variables (IBM Corp., 2024). The study's findings may help fill the research gap, provide empirical evidence, and develop strategies to enhance the effective use of BDA among SMEs in Ghana.

I collected primary quantitative data by administering a structured survey adapted from Huang et al. (2012), Nguyen et al. (2024), and Pizam et al. (2022) to a sample of respondents to solicit their views on the determinants of BDA adoption among SMEs in

Ghana. Primary data are firsthand data collected from the sampled population (Burkholder et al., 2020), including purposively sampled owner-managers of SMEs, IT experts, and workers whose job descriptions put them in a position to provide insightful data. Given the technical nature of the research study, these participants were considered to have in-depth knowledge of the factors that influence decision-making regarding capital expenditure.

The DV, which represents BDA, was measured as a continuous scale. The IVs, which are organizational support, technological readiness, and external pressures, were also measured on a continuous scale. Huang et al. (2012), Nguyen et al. (2024), and Pizam et al. (2022) measured the variables in their research instruments using a Likert scale with anchors ranging from strongly disagree to strongly agree. Descriptive statistics was used to summarize the critical variables related to the DV and the IVs. The data were presented in tables and figures to give more meaning to respondents' responses.

Multiple linear regression analysis (MLRA) was used to examine the extent of the IVs' influence on the DV. The MLRA aids in determining which of the IVs are a significant predictor of the DV when other factors are controlled. I tested multiple regression assumptions to ensure the reliability and validity of the results, and conducted a pretest of the research surveys to determine whether the research instrument best answers the research questions. The secondary data sources were peer-reviewed articles on determinants of BDA adoption among SMEs, conference papers, seminars, and reports from the various sampled SMEs.

Definitions

In this section, I provide basic definitions for the terminology used in this study. This helps readers to gather a better understanding of the various variables and terminologies applied in the research.

Big data analytics: Big data analytics is a tool for acquiring, archiving, and analyzing complex datasets to derive meaningful patterns and actionable insights (Asiri et al., 2024; Fattah & Arief, 2023; Lutfi et al., 2023).

External pressures: External pressures are environmental factors that have the potential to influence organizations' adoption of new technologies (Hsu et al., 2014).

Organizational support: Organizational support is the degree to which an organization, by its values, beliefs, vision, and mission, allocates scarce resources for the adoption of new technologies with the view of achieving competitive advantage (Maroufkhani et al., 2023).

Strategic edge: Strategic edge is an approach that gives organizations an upper hand over their competitors through leveraging unique capabilities, resources, or strategies (Lei & Slocum, 2005).

Structural adaptability: Structural adaptability is the ability of an organization's systems to adjust to changes in response to external shocks and new technological advancements (Killick, 1990).

Sustainability development: Sustainability development is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Ozili, 2022).

Technical proficiency: Technical proficiency is a term used to describe an entity's ability to effectively and efficiently use technological tools to perform task accurately (Ghaleb et al., 2021).

Technological readiness: Technological readiness is defined as both internal and external components that measure an organization's maturity or readiness to adopt and use new technology for sustainable development (Ghaleb et al., 2021; Maroufkhani et al., 2023).

Assumptions

One of the primary assumptions of this research was the credibility and honesty of the researcher and the participants' responses. Delin et al. (1994) described research assumptions as fundamental beliefs or ideas that researchers consider accurate but require no further explicit proof. Three critical assumptions underpin this research work. The first assumption is about the respondents of this study. Participating respondents, such as owner-managers of SMEs and IT professionals, provided an accurate, equitable, and comprehensively honest response to the research questions. The assumption is essential as it focuses on the reliability of the data collected, which significantly impacts the study's findings. Since owner-managers and decision-makers are primarily hesitant to provide information regarding their business operations, the idea was that participants would feel sufficiently assured of anonymity and confidentiality to respond candidly.

The second assumption relates to the research instrument used to collect the data. The assumption was that the research instruments were valid and reliable for measuring the drivers of BDA adoption among SMEs. I relied on the ability of the research

instrument to effectively capture the nuanced factors such as organizational support, technological readiness, and external pressures. To mitigate potential challenges regarding the research instrument, the research instrument was pre-tested through a pilot study and refined to ensure clarity and alignment with the study's objectives.

Lastly, it is assumed that no moderating and mediating factors impact the decision of participating respondents to adopt BDA. This belief is that all factors remain reasonably constant during the study period. To draw meaningful conclusions, the stability of these factors was essential as they may impact the decision-making process of SMEs. Contrarily, changes to these factors could introduce variability that may complicate the interpretation of results. By acknowledging these assumptions, the study established a foundation for examining the determinants of BDA adoption among SMEs in Ghana. The researcher ensured that limitations arising from any of these assumptions were transparently addressed.

Scope and Delimitations

The study investigated the determinants of BDA adoption among SMEs. Primarily, the scope of this study was limited to SMEs in Ghana registered with the Ghana Enterprise Agency (GEA). The study examined whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. Using technological readiness, organizational support, and external pressures as IVs. Technological readiness variables comprise infrastructure, internet connectivity, software availability, IT expertise, and skills. At the same time, organizational support encompasses variables such as organizational culture, strategic resource allocation,

strategic vision, and mission. The external pressures (environmental factors) constitute competition, regulatory requirements, and customer demand.

The study used a quantitative descriptive survey, which does not allow respondents to descriptively express their views on variables. Respondents for the study were limited to owner-managers of SMEs, IT experts, and individuals whose job description positions them at the strategic management level. The study excludes large organizations, corporations, and government agencies. Moreover, individuals at lower-level positions were excluded as respondents since they may not be involved in the decision-making process of the randomly selected businesses.

This study was guided by specific delimitations defining its scope and boundaries. According to Theofanidis and Fountouki (2018), delimitations are the boundaries within a research study. Delimitation constitutes the modules that outline the scope of the research. Hence, this study focused on SMEs in Ghana and those registered with GEA. Due to resource and time constraints, the study was not extended to neighboring West African countries and Africa as a whole. However, the study's findings could be generalized to other countries outside Ghana within the same SMEs and industries, whose definitions best fit those adopted in this study.

Limitations

The study had limitations related to its design. A quantitative descriptive survey was adopted, which imposes a limitation regarding external validity (Bryman, 2016). The limitation becomes even more essential because the analysis was correlational instead of causal, detracting from internal validity. The study was based on a deductive approach, so

factors more relevant to the target setting were missed. Additionally, the study focuses only on SMEs in Ghana; however, the findings could be generalized to other countries in the West African region or the African continent.

The study had a limitation in terms of sampling methodology. Simple random sampling is known to be resource-intensive, which could impact the research study. The simple random sampling technique used in selecting SMEs for the study is time-consuming, labor-intensive, and expensive. Moreover, there may be an inefficiency in the heterogeneity of the sample population. The sampling technique could not guarantee that the SMEs selected really represent the diversity of SMEs; some important businesses may be underrepresented or missed entirely. The heterogeneity of the population may lead to lower precision and possibly biased results.

Another limitation was the researcher's reliance on self-reported data from SMEs. Self-reported data could introduce biases such as social desirability bias, where respondents might overstate their use of BDA to align with organizational support for BDA. Future research should consider using a mixed methods approach to capitalize on existing factors and explore more situated ones, thus maximizing ecological validity (Bryman, 2016). Addressing these methodological limitations through triangulation and alternative data sources strengthened the reliability and validity of the research findings.

Significance of the Study

The research study is highly relevant to today's rapidly evolving technological landscape. SMEs are critical to the development of every economy and represent a significant portion of the nation's GDP and employment (Kühlert et al., 2024). The study

is essential for policymakers, business owners, and technology providers. The study filled the identified gap by providing empirical insights into how technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The research study provided an understanding of how BDA can influence SMEs' operations, competitiveness, and growth. This research provides actionable insights that help SMEs leverage data-driven decision-making to enhance efficiency, innovation, and market responsiveness.

Significance to Theory

The significance of this study to theory is that the research contributes to the academic discourse on technology adoption in developing economies, particularly within the context of SMEs. Existing literature on BDA has predominantly focused on large corporations and developed countries, leaving a gap in understanding its implications for smaller businesses in less developed regions. This study provides empirical evidence from Ghana, enriching the global understanding of factors influencing SMEs' adoption of BDA. The findings could be extrapolated to similar contexts in other developing countries, making this research not only locally relevant but also globally significant.

Moreover, the study contributed to expanding the conceptual understanding of the factors influencing SMEs' adoption of BDA. Existing technology adoption theories, such as the TOE, offer fundamental constructs for examining BDA adoption. The model has predominantly been developed and validated in mostly developed economies with technologically advanced settings. As a result, they may not capture the socio-economic, infrastructural, and cultural realities of SMEs in sub-Saharan Africa and in Ghana within

the scope of this study. For instance, informal business practices, limited skilled labor, or poor internet connectivity may play a critical role in adoption decisions but remain underexplored in conventional models. The study, therefore, uncovered new variables that extend the current theories.

Significance to Practice

As Ghana aims to strengthen its digital economy by introducing national identification cards and tax identification numbers (TIN) for individuals and organizations, integrating BDA in SMEs can catalyze broader digital transformation initiatives. By understanding the drivers of SMEs adoption, BDA stakeholders can provide actionable plans to overcome barriers to adoption, such as limited technological infrastructure, technical expertise, financial constraints, and unaligned strategic vision and mission. Addressing these factors, the study supports the development of targeted strategies and policies that can accelerate the adoption of BDA, thus fostering a more robust and competitive SME sector. Moreover, the study offers evidence-based recommendations to policymakers in designing policies that foster an enabling environment for BDA adoption. The study benefits technology providers by tailoring their solutions to meet the specific needs of SMEs in Ghana, ensuring affordability, scalability, and user-friendliness.

Ghana has a ministry for science, environment, and technological innovation and development, focusing on sustainable development. However, policy interventions lack micro-level insights into SMEs' adoption behavior of technology. The study provides empirical evidence for targeting support programs and resource allocations for SMEs.

This study prompts policymakers to design incentives, grants, or capacity-building programs that directly bring to bear the influences of BDA adoption among SMEs. Non-governmental agencies (NGOs) and donor partners could use the findings to tailor scalable and context-sensitive interventions. The study findings contribute to building an enabling environment where SMEs can thrive through data innovation and adoption strategies.

Significance to Social Change

The social change implication of the study is that it promotes a culture of data literacy and technological advancement within the SME sector in Ghana. Highlighting the factors that drive SMEs to adopt BDA, encourage them to invest in new technologies, skill development, and training for their workforce to achieve a competitive advantage for sustainability. This study empowers SMEs to leverage data-driven insights for improved decision-making and operational efficiency. Data-driven insights enhance SMEs' competitiveness and sustainability, leading to economic growth.

Another potential positive social change implication of the study is the influence on education and skill development in data literacy among SMEs. The study helps to promote an inclusive digital transformation in Ghana's business ecosystem by equipping businesses with the need to innovate, compete, and thrive in a digital world. As noted, BDA can improve supply chain efficiency, customer engagement, and product development, enhancing creativity and sustainability. Therefore, by identifying pathways to BDA adoption, the study aligns with a broader goal of sustainable development, economic empowerment, and digital equity.

Summary and Transition

In this chapter, I discussed the background of this quantitative descriptive survey to examine the determinants of factors influencing SMEs' adoption of BDA in Ghana. The chapter covered the problem statement, the purpose of the study, research questions and hypotheses, the nature of the study, and limitations. The chapter highlighted the study's significance to theory, practice, and social change. Chapter 2 provides an extensive literature review on BDA, SMEs, and the impact of BDA on businesses.

Chapter 2: Literature Review

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The specific research problem was that it is unknown whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The Ghana Commercial Bank Sector report (2023) revealed that most SMEs in Ghana face challenges in adopting BDA. What influences the adoption has remained underexplored, posing critical questions. This study is crucial as it sought to examine whether technological readiness, organizational support, and external pressures influence BDA adoption among SMEs and may make recommendations pertinent to SMEs' technology adoption.

Chapter 2 describes the literature search strategy and provides robust fundamental theoretical frameworks that underpin BDA adoption. The literature search strategy helped me identify essential articles supporting the specific research problem and providing an exhaustive literature review. The chapter additionally defines and includes the features of SMEs as per the International Organization for Small Business and the Ghana Chamber of SMEs. The chapter considers theories such as the TOE, RBV, and the institutional theory. Chapter 2 provides an in-depth review of the literature on BDA published by other researchers, as well as seminars and reports from recognized sources. The chapter ends with a summary and connects to Chapter 3: Research Method.

Literature Search Strategy

In conducting this research, I sought articles, seminars, and reports to identify the relevant literature on the factors influencing BDA adoption. With this in mind, I made a comprehensive search by using keywords such as big data analytics (BDA), small and medium-sized enterprises (SMEs), small businesses, BDA adoption, BDA utilization, technological readiness, organizational support, external pressures, developing countries, TOE framework (technology-organization-environment), resource-based view (RBV), institutional theory, digital transformation, digital intelligence, data-driven decision making, business intelligence, innovation in SMEs, data management, competitive advantage, SMEs performance, emerging economies, technology adoption, and cloud adoption.

The search was conducted in Walden University Library databases, including ABI/INFORM collection, Business Source Complete, ProQuest eBook Central, and EBSCOhost (Business Source Complete). Other databases used are Google Scholar, IEEE Xplore, ScienceDirect (Elsevier), SpringerLink, JSTOR, Web of Science, Scopus, EBSCO eBooks, Edgar, Emerald Insight, Scholar Works, UNESCO Digital Library, Wiley Online Library, Taylor & Francis Online, ACM Digital Library, and SAGE Journals.

Using the search terms BDA and SMEs in the Walden library database revealed 361 research studies. A further search was conducted using a streamlined title, limiting results to peer-reviewed articles, bringing the total number of studies to 96. A stricter search criterion was used by including the geographical context of the study, which

resulted in zero articles. However, among the 12 articles on technology adoption among SMEs in Ghana, only five were specifically relevant to the search terms. An additional search criterion combining the foundational theories revealed only one article.

This research examines works concentrating on BDA adoption from 2019 to 2025. Research articles published within 5 years reflect the latest investigations and emerging developments, thus offering modern insights into BDA adoption factors. The time frame mostly captures recent literary works on BDA and SMEs. However, seminal works and other relevant published studies prior to 2019 were included to provide historical context and establish the theoretical foundations for the study. Research from modern times and seminal works creates a thorough literature review that merges present-day significance with past studies to establish a holistic study of SMEs' adoption of BDA in Ghana.

Theoretical Foundation

This study's theoretical foundation is essential in providing a structured approach to investigating the determinants of BDA adoption among SMEs. According to Kivunja (2018), the theoretical framework helps establish the credibility, acceptability, and generalizability of the research study. Chukwuere (2021) argued that theoretical frameworks critically enable researchers to think about the research problem and choose the most appropriate research methodology from analysis to conclusion. The theoretical framework provides the roadmap for the research process, data collection, and analysis.

The theoretical framework guides researchers in relating and interpreting the research variables. Crawford (2020) inferred that the theoretical framework provides a

structured foundation facilitating the effective positioning of the research study. By grounding the research in theory, the framework ensures coherence between data findings and the research structure. Ultimately, the theoretical framework positions the research study effectively, ensuring logical consistency and meaningful interpretation of results.

The theoretical framework for this study includes the technology-organization-environment (TOE) framework (Tornatzky & Fleischer, 1990), the resource-based view (RBV) (Miller, 2019), and the institutional theory (Selznick, 2011). These theories offer a unique lens for investigating factors influencing BDA adoption. These well-established theories comprehensively create a robust foundation for understanding the multiple factors influencing big data adoption among SMEs in Ghana. The combined approach strengthens the study's framework from multiple interconnected dimensions.

Integrating insights from multiple theories captures external and internal factors influencing BDA adoption, comprehensively examining the phenomenon. Theories such as the technology-organization-environment framework, the resource-based view, and institutional theory offer a structured lens for guiding research design, data collection, and interpretation (Varpio et al., 2020). Applying these theories enhances the study's ability to generalize findings and identify key determinants of BDA adoption. Combining these theoretical perspectives strengthens the analysis of BDA adoption among SMEs in Ghana, ensuring a more robust and well-rounded understanding.

Technology Organization-Environment (TOE) Framework

Currently, many researchers have used the TOE theory to examine BDA adoption among businesses. The TOE theory was developed by Louis G. Tornatzky and Mitchell

Fleischer in 1990 (Awa et al., 2017). The theory is an important framework in information systems research. The framework provides an all-encompassing theoretical model underpinning the integration of technological advancements in organizations (Igwe et al., 2024; Iranmanesh et al., 2023; Lutfi et al., 2023). Using the TOE framework in grounding research offers an in-depth understanding of technology adoption factors.

The framework presents a well-coordinated approach to examining the factors impacting BDA adoption among SMEs in Ghana. According to the proponents of the framework, technological, organizational, and environmental factors influence an organization's decision to adopt innovative technologies (Wiener et al., 2020). The three aspects of the framework help reveal the challenges and benefits within an organization, offering insights for decision makers. As such, the framework strengthens the analytical rigor of this research study, enhancing the study's contribution to the literature on technology adoption among SMEs.

The three aspects of the TOE theory involve technological, organizational, and environmental context, which provide an elaborate understanding of the interorganizational and operational contexts through which businesses operate. Evaluating these elements provides a complex interplay in unearthing factors that impact an organization's decision to adopt innovative technologies. Al Hadwer et al. (2021) mentioned that these aspects are a holistic tool for organizational-level research, examining internal and external capabilities that influence the successful adoption of technological advancements. Therefore, in evaluating an organization's preparedness for adopting BDA, these systematic structural aspects effectively offer a crucial assessment.

The characteristics of technological variables involve internal and external elements, essential to an organization's adoption of BDA. Critical elements of technological context include complexity, adoption costs, compatibility, perceived advantage, security risks, and data quality (Maroufkhani et al., 2020). These elements either promote or hinder an organization's adoption of technology based on technological readiness, which rests on infrastructure and technical expertise as the basic resources (Maroufkhani et al., 2020). By understanding these factors, SMEs can assess their technological capabilities and deliberately invest in development areas to improve their readiness for BDA implementation and enhance market competitiveness.

Organizational variables significantly influence the decision to implement BDA. Lai et al. (2018) and Tornatzky and Fleischer (1990) identified structure, organizational size, culture, and resource availability as primary features of an organization's adoption process. Organizations with sufficient financial and technological competencies are further motivated to engage in BDA infrastructure and worker training, stimulating continuous adoption. These features nurture an ecosystem beneficial for flawlessly incorporating technological innovations into business operations.

On the contrary, SMEs may face considerable impediments to embracing BDA due to limited resources. Gangwar et al. (2023) underscored that limited financial resources, technical know-how, and infrastructure obstruct smaller businesses from resourcefully using BDA technologies. Also, an organization's structural and cultural environment meaningfully affects the adoption of BDA (Maroufkhani et al., 2020).

Understanding these characteristics is essential for overcoming adoption obstacles and devising approaches that accelerate an effective and efficient deployment of BDA.

Another important element in formulating an organization's strategic plan and directing its decision-making process is top management. Top management establishes an organization's strategic plan through collaboration and integration (Sun et al., 2020). Sun et al. (2020) argued that top management must envision promoting the organization's trajectory regarding innovation and technological progress. The researchers' argument implies that robust support from top management is imperative for successful change management when adopting new technologies, which require capital expenditure and long-term investment. Senior executives facilitate the resolution of technology adoption problems by allocating limited resources and endorsing initiatives, augmenting organizational competitiveness.

An awareness of the potential benefits of adopting BDA enables senior leaders to manage organizational change effectively by demonstrating vision and commitment and instilling employee confidence in the new technology (Gupta et al., 2020). Senior management also facilitates the integration of resources and activities, and reengineering processes required for BDA implementation (Komathi & Sim, 2024; Salah & Ayyash, 2024; Samat et al., 2024). Organizational issues are crucial in determining the successful implementation of BDA.

Government rules, competition, and other outside variables are some environmental factors that could impact an organization's adoption of BDA. The external forces pressure businesses to respond to technological advancement (Baig et al., 2023;

Tornatzky & Fleischer, 1990). These outside forces may encourage or oppress SMEs to use BDA tools for sustainable development. The decision to accept and apply the changes from suppliers, trading partners, and external stakeholders' underscores an organization's agility to remain competitive.

Government regulations and policies fall under external pressures, which are critical in influencing businesses' adoption of BDA. Wessels and Jokonya (2022) asserted that these elements should be made to support businesses' access to information technology while upholding businesses' freedom in strategic decisions. The researchers maintained that government regulations and policies should act as catalysts rather than limitations in motivating SMEs. Given this, government regulations and policies can ease small businesses' challenges in adopting BDA, resulting from skilled labor and infrastructure availability. A conducive policy framework can improve SME competitiveness by promoting the implementation of BDA solutions. While environmental factors are critical, internal organizational capabilities explored through the RBV can further explain how firms can sustain competitive advantage through BDA adoption.

Resource-Based View (RBV) Theory

The RBV theory is one of the foundational theories for the research study that is concerned with internal organizational capabilities. The theory was formulated by Birger Wernerfelt and Jay Barney during the 1980s and 1990s, assuming resource heterogeneity and resource immobility among firms (Miller, 2019). According to Assensoh-Kodua (2019), Lubis (2022), and Nayak et al. (2023), technological and people resources are

essential elements for organizations to achieve a competitive edge. Businesses with enhanced technological and people resources can survive the turbulent business environment (Hussain et al., 2024). The researchers emphasize the importance of leveraging internal strengths for BDA adoption to maintain sustainability.

The proponents of the RBV theory emphasized that effective resource management enhances a business's ability to create and maintain competitiveness. Chen et al. (2024) and Wade and Hulland (2004) acknowledged that strategic resource management enables organizations to optimize technical preparedness and employee proficiency. For SME leaders, safeguarding these assets is essential to thwart competitors from duplicating their inventions. The defensive strategy directly impacts BDA adoption's technological and organizational elements inside the TOE framework, emphasizing SMEs' need to enhance their internal competencies.

The RBV offers a significant framework for analyzing the impact of technological readiness, characterized by technological infrastructure and proficient personnel, on adopting BDA. According to Chen et al. (2024), RBV underscores the strategic significance of internal resources, highlighting the necessity of using current technological capabilities to bolster innovation and competitiveness. The researchers further alluded that valuable, unique, rare, inimitable, and non-substitutable assets are a firm's critical assets to achieving sustained competitive advantage. The findings align with the study's aim of comprehending whether technological readiness influences SMEs' adoption of BDA in Ghana.

The RBV theory provides insights into dynamics at the SME level by emphasizing both tangible assets and human capital competencies. The tangible assets and human resource competencies are explained to provide innovative outcomes for organizations that effectively resource them (Assensoh-Kodua, 2019). Hussain et al. (2024) further established that technology and human resources enrich operational efficiency, facilitating a guided decision-making process. The RBV theory supports examining how SMEs can establish and maintain their competitive edge through the efficient management and use of internal resources. Comprehending these resource-driven factors influencing BDA adoption offers a systematic method for improving SMEs' technological and organizational competencies.

Institutional Theory

The institutional theory provides a rich lens for looking at what influences organizations. The institutional theory was coined from sociology and accredited to the works of Max Weber and Philip Selznick during the 1940s and 1950s (DiMaggio & Powell, 1983; Putnam & Mumby, 2013; Selznick, 2011). DiMaggio and Powell (1983) asserted that institutional theory considers the processes in which regulations, norms, beliefs, and routines shape the behavior of organizations. The central theme of the theory surrounds how an organization's micro and macro environments impact decisions to adopt change. The theory has been used to investigate systems ranging from micro to macro interactions of organizations (Glynn & Abzug, 2002). Regarding this study, the institutional theory serves to unearth how competition, regulatory requirements, and customer demand influence business decisions to adopt technology.

The institutional theory is essential in examining the role of external pressures on technology adoption among businesses. The theory explained that businesses adopt BDA due to the consequential impact of external pressures (Lutfi et al., 2022; Soares et al., 2021). Even though the adoption may not benefit the business, the external pressures resulting from government regulation, change in customer demands, industry expectations, and mimetics may influence a business's adoption. The phenomena align with the study's investigation on how external pressures affect business decisions to adopt BDA. Moreover, understanding the external variables that influence SMEs' decisions is vital to crafting policies that support SMEs in navigating environmental challenges (Soares et al., 2021). The viewpoint of the institutional theory postulates a holistic approach for examining the determinants of BDA adoption among SMEs in Ghana, positioning the study's problem, purpose, and research questions.

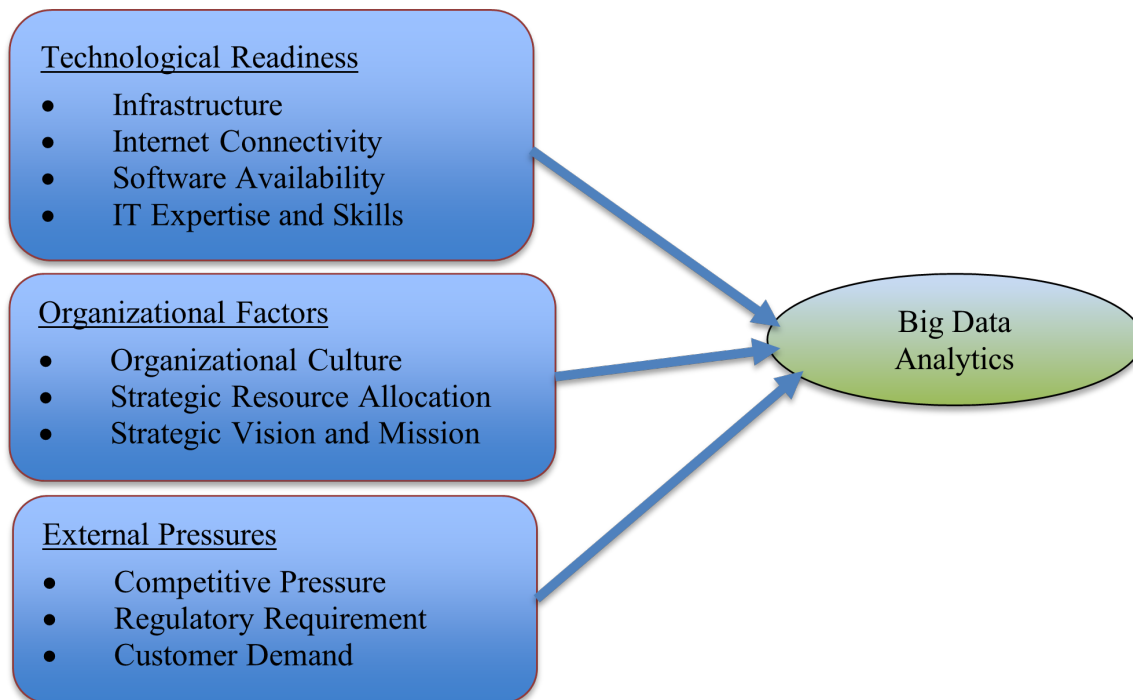
Conceptual Framework

SMEs significantly contribute to the economic development of all countries. SMEs contribute about 60% of GDP and 70% of total employment in low-income countries (Mugano, 2024; Mugano & Dorasamy, 2024). SMEs' economic contribution highlights the need to examine their operations to enhance innovation, growth, and sustainability. As key innovation producers and a foundation for a successful innovation framework, SMEs must adapt to current technological innovations to strategically improve operations.

Many researchers have studied the impact of BDA adoption among businesses, focusing mainly on performance. Al-Azzam et al. (2023), Bertello et al. (2021), and

Maroufkhani et al. (2023) underscored how data-driven decision-making enhances efficiency and competitiveness. Similarly, Adewusi et al. (2024) affirmed that BDA, as a tool for business intelligence, enables effective data capturing, storage, exploration, and interpretation. However, SMEs are constrained from enjoying the benefits of BDA adoption, hindering their growth and sustainability, especially in Ghana.

The conceptual framework is a lens through which to identify and analyze the variables influencing BDA adoption among SMEs. The conceptual framework provides a theoretical lens for understanding how internal and external factors influence adoption decisions. The study categorizes internal and external variables as factors influencing BDA adoption into three primary dimensions: (a) technological, (b) organizational, and (c) external pressures (environmental factors). Figure 1 diagrammatically illustrates the conceptual framework with the related relationship between them as independent and dependent variables.

Figure 1*Conceptual Framework***Literature Review**

This section comprises an exhaustive literature review of the study's key variables and keywords from the problem statement. The section aims to provide insight into the dependent and independent variables, highlighting the gaps in the literature regarding BDA adoption among SMEs. Attention will be given to syntheses from previous research studies on BDA adoption, linking the theoretical foundations of the study to the variables. The literature review section will examine any contrasting views on factors influencing BDA adoption among SMEs. I will review research studies on the contribution of BDA to business performance. The section will consider theoretical and empirical literature.

Big Data Analytics (BDA)

The increasingly vast amount of data generated in today's digital economy necessitates advanced analytical capabilities, making BDA an essential tool for optimizing operations, improving customer experiences, and identifying market trends. Babalghaith and Aljarallah (2024) explained that BDA involves analyzing extensive, complex datasets to find unknown patterns and valuable insights. Ferraris et al. (2019) and Grover et al. (2018) mentioned how BDA strengthens strategic agility because this technology aids businesses in spotting market patterns and refining their operational structure. The analysis shows how BDA functions as an essential factor for business expansion through data-based decision systems.

Many researchers have defined BDA in different ways. Babalghaith and Aljarallah (2024) posited that BDA examines large and complex data sets to uncover hidden trends, patterns, correlations, and insights. The primary objective of BDA is to manage and analyze vast amounts of structured and unstructured data to support data-driven decision-making and enhance organizational performance (Maroufkhani et al., 2023). Organizations integrating BDA into their business strategies can continuously extract meaningful trends, improving responsiveness to market demands and optimizing resource allocation.

BDA requires organizations to handle difficult data assets through analysis to create usable information. Maroufkhani et al. (2020) explained that big data consists of three fundamental features: volume, velocity, and variety. Volume refers to the sheer size of data generated, velocity captures the speed at which data is produced, and variety

encompasses the different types of data, including structured, semi structured, and unstructured formats. Rani and Vigneswari (2016) indicated that veracity emphasizes data security and accuracy during its life cycle period. Business leaders who want to stay competitive must develop analytical competencies and the capacity to sustain them for data-driven decision processes.

The analytical methods of BDA play a specific role, from understanding historical trends to recommending actions. Sivarajah et al. (2017) identified five analytical methods of BDA: (a) descriptive, (b) inquisitive, (c) predictive, (d) prescriptive, and (e) pre-emptive analytics. The researchers categorized the analytical methods of BDA as helping make sense of big data and enabling its application in decision-making. These methodologies are integral to transforming raw data into meaningful insights for businesses. Similarly, Mikalef et al. (2020) justified that the choice of analytical tools impacts the type of insights generated, highlighting the importance of selecting tools that align with business objectives and the nature of the data. By effectively leveraging BDA, businesses can navigate data complexities, enhance decision-making, and maintain a competitive edge in their respective markets.

The Impact of BDA on Businesses

The impact of BDA adoption on organizational performance has been explored, but the specific effects on various dimensions of firm performance remain underexplored. Studies have demonstrated that BDA adoption enhances overall business outcomes by improving operational efficiency. Bertello et al. (2021), Huang et al. (2020), Müller et al. (2018), and Vitari and Raguseo (2020) examined the impact of BDA on the performance

of organizations. The researchers concluded that BDA adoption enhances organizational performance, fostering immediate operational improvements and long-term business growth. The researchers' findings strengthen the impact of BDA streamlining processes and enhancing competitive position in a dynamic market.

Additionally, BDA enhances organizational performance by improving operational efficiency and effectiveness. A study conducted by Aljumah et al. (2021) illustrated that BDA drives an organization's operational efficiency and effectiveness while generating strategic value for competitive advantage over time. Understanding the nuanced impact of BDA adoption on different aspects of organizational performance is crucial for organizations aiming to leverage analytics for operational benefit, long-term strategic growth, and sustainability. The findings align with the greater argument and other findings that data-driven insights enhance competitiveness by enabling informed decision-making and resource optimization.

BDA improves organizational performance by fostering competitive advantage, operational efficiency, and customer satisfaction, especially in dynamic business environments. Lin et al. (2024) studied how BDA analytics affect firms' performance using a quantitative method. The researchers predicted that environmental dynamism moderates the relationship between reactive resilience and firm performance, strengthening competitive advantage, operational efficiency, and dynamic capabilities. Hence, BDA significantly improves firms' performance.

Similarly, a connection exists between BDA capabilities and the competitive performance of businesses. Song et al. (2022) examined the connection between BDA

capabilities and competitive performance. The authors argued that the success of BDA relies on an organization's infrastructure and ability to integrate value-driven business models. The researchers' findings highlighted the multifaceted impact of BDA on organizational success. In dynamic and uncertain environments, as Lin et al. (2024) observed, BDA supports firms in adapting to changes and bolsters their competitive advantage and operational resilience. These dynamic positions BDA as essential for developing SMEs' capabilities to compete in the ever-changing business environment.

BDA significantly impacts SMEs' market and financial performance, although resource constraints present unique challenges compared to larger organizations. Maroufkhani et al. (2020) studied 171 Iranian small and medium manufacturing firms using partial least squares and showed that BDA enhances SMEs' market and financial performance. The findings suggest that SMEs can harness analytics to drive business growth and competitiveness despite their size. However, the extent to which SMEs can maximize BDA benefits depends on their ability to overcome financial and technological limitations.

In contrast, other researchers highlighted the disparities between SMEs and large firms in BDA adoption. Maroufkhani et al. (2023) and Mikalef et al. (2020) examined the critical differences between large organizations and SMEs in BDA adoption. The researchers revealed that large firms benefit from dedicated research and development teams, access to skilled talent, and pre-allocated budgets for training. SMEs often face resource limitations that restrict their ability to invest in new technologies. The findings underscored that the disparity is driven primarily by resource availability. These

distinctive factors are essential for designing targeted strategies that address SMEs' unique challenges, enabling the organization to harness BDA for sustained growth and competitive advantage.

Organizational structure and decision-making processes affect businesses' adoption of BDA. With noticeable differences between large organizations and SMEs, hierarchical structures limit top management visibility into frontline operations; SMEs benefit from flatter structures that allow for close oversight and faster decision-making (Ghobadian & Galliar, 1996). Large organizations adapt more slowly to market changes due to entrenched processes (Omol, 2024). Whereas SMEs are generally more agile and responsive to change (Quaye et al., 2024), decision-making processes differ significantly, with large organizations relying on extensive, data-driven decision chains. In contrast, SMEs often depend on intuitive decision-making. These differences necessitate a distinct approach to studying BDA adoption in SMEs.

Much of the literature on BDA has focused on large organizations, as there is growing recognition of the need to study its adoption in SMEs. Researchers have primarily examined the factors influencing BDA adoption in SMEs, such as technological readiness, organizational culture, and external environmental pressures in some developing and developed countries (Lai et al., 2018; Verma & Chaurasia, 2019). The studies highlighted factors influencing BDA adoption, such as the impact on organizational performance and operational value creation. These factors have great potential to contribute to SMEs' long-term sustainability and their ability to meet and exceed evolving customer expectations.

However, limited attention has been given to examining the factors influencing SMEs' adoption of BDA in the Ghanaian context. This study seeks to bridge the gap by determining whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. Drawing on established theoretical frameworks, the research combines the TOE framework (Tornatzky & Fleischer, 1990), RBV theory (Miller, 2019), and institutional theory (DiMaggio & Powell, 1983; Putnam & Mumby, 2013) for a nuanced perspective on the determinants of BDA adoption. Moreover, integrating these frameworks might help address contextual gaps in current research while offering empirical insights tailored to the unique dynamics of Ghanaian SMEs.

Technological Readiness

Technological readiness plays a crucial role in decision-making related to BDA adoption among large and small firms. Internal and external technological resources form part of the technological readiness of businesses. The ability of organizations to accept innovative practices through digital tools for reaching long-lasting targets defines their technological readiness status (Ghaleb et al., 2021). The researchers further mentioned that the organization's preparedness involves tangible and intangible resources with the capacity to enable successful technological acceptance.

The internal and external technological assets significantly influence a firm's ability to adopt BDA. Gangwar et al. (2023) and Maroufkhani et al. (2020) discovered that technological assets largely influence a firm's ability to adopt BDA to enhance decision-making and operational efficiency. The researcher's findings affirmed the

philosophical perspective of the RVB theory, which emphasized that firms' distinctive competencies represent their most valuable assets (internal and external), which are key in the decision-making process. Organizations must ensure effective management of their technological readiness to maintain a competitive advantage.

Technological readiness is a unique capability that enhances an organization's ability to outwit its competitors. Firms with advanced technological capabilities can easily adopt emerging innovations, rationalize operations, increase customer satisfaction, and ultimately gain a strategic edge (Khayyam et al., 2025). Investments in digital infrastructure, employee training, and IT adaptability were found to help organizations attain sustained growth and market leadership (He et al., 2023). For example, companies leveraging artificial intelligence and BDA can anticipate market trends and optimize decision-making, outperforming competitors reliant on traditional methods (Maroufkhani et al., 2023). Therefore, prioritizing technological readiness is essential for organizations seeking long-term success in an increasingly digital economy.

Furthermore, when evaluated alongside organizational and environmental support, technological readiness critically influences firms' adoption of BDA. Verma and Chaurasia (2019) conducted an empirical study to examine adopters and nonadopters of BDA using a structured survey of 231 firm managers. The researchers focused on technological, organizational, and environmental contexts; complexity and relative advantage strongly affected firms' adoption of BDA. These findings reinforce the importance of technological infrastructure and capabilities as foundational enablers for

successful BDA integration with firms preparing to transition toward data-driven operations.

One of the core principles of RBV theory is that a firm's unique capabilities are the primary source of its competitive advantage. The firm's unique capabilities include technical expertise, infrastructure, and operational abilities that the firm can leverage to achieve sustained success that is difficult for competitors to replicate. Grant (1996) and Nordhaug and Gronhaug (1994) concluded that a firm's resources enable it to derive value and generate returns for competitive, sustainable development. Building on the findings, technological readiness encompassing the firm's resources is integral to performing tasks and maintaining its strategic position in the market. Technological readiness considers four features: (a) infrastructure, (b) internet connectivity, (c) software availability, and (d) IT expertise and skills.

Infrastructure

Infrastructure, as in the technological readiness of BDA adoption, plays a critical role. The infrastructure consists of the physical and digital foundations necessary for a firm to adopt technology for storing, processing, and analyzing vast amounts of data (Lai et al., 2018; Lutfi et al., 2023). Infrastructure includes the firm's financial capacity to bear the cost of procuring, learning, and integrating new systems into its operations. An adequate infrastructure supports the demands of data-driven operations while minimizing disruptions during integration.

Researchers have studied the critical role of infrastructure in technology adoption, providing empirical literature on the subject matter. Research conducted by Lai et al.

(2018) and Lutfi et al. (2023) reported that inadequate infrastructure, such as cloud computing and high internet speed, affects an organization's ability to implement new and advanced technologies. At the same time, insufficient financial resources were found to limit investment in high-performing tools such as hardware, software, and training (Lutfi et al., 2023). The factors collectively emphasized the significance of technological readiness as the determinant of an organization's ability to leverage BDA effectively.

Infrastructural components provide the primary platform for an organization to adopt BDA. SMEs' inability to afford new technology may hinder the technological innovativeness of the business (Zeebaree et al., 2020). Businesses require robust hardware, software, networking capabilities, and data management tools to handle the scale and complexity of big data effectively to adopt BDA (Aldossari et al., 2023). Large organizations can invest substantial financial resources to obtain cutting-edge technologies, but SMEs often experience constraints due to financial resources, which impede SMEs' capacity to compete technologically (Babalghaith & Aljarallah, 2024). These gaps disadvantage SMEs, reducing their ability to capitalize on the transformative potential of BDA.

Addressing the financial limitation gap is vital for promoting widespread BDA adoption and providing cost-effective solutions to empower SMEs to adopt BDA. SMEs are known to operate with a limited IT budget and outdated systems, if any, to handle the enormous technological advancement (Babalghaith & Aljarallah, 2024; Majeed et al., 2024). For instance, platforms like Amazon Web Services (AWS), Google Cloud, and Microsoft Azure enable SMEs to access on-demand resources without incurring

substantial capital expenditure (Majeed et al., 2024). Many of these services' unavailability in developing countries like Ghana may hinder SMEs' ability to adopt BDA.

The complete development of information technology infrastructure is an essential requirement that enables organizations of all sizes to adopt BDA solutions. Basic IT resources and human technical capabilities lay the groundwork for properly implementing advanced innovations. Lai et al. (2018) and Maheshwari et al. (2021) demonstrated a strong association between IT infrastructure and BDA adoption effectiveness in every organizational structure. Maheshwari et al. determined that organizations with strong infrastructural capabilities will highly adopt disruptive technologies to augment competitiveness. The future success of SMEs in a data-driven market depends on investments in IT infrastructure because this enhances their ability to use BDA for better decisions and competitive advantages.

Empirical research has underscored the moderating influence of IT infrastructure on the link between BDA adoption and organizational effectiveness. Wang et al. (2021) examined efficiency improvements in the banking sector, indicating that a strong IT infrastructure is directly associated with superior organizational performance. Wang et al.'s findings suggested that financial institutions with advanced IT systems can optimize the advantages of BDA, resulting in enhanced decision-making and operational efficiency. The findings indicate that IT infrastructure is an essential facilitator in actualizing the complete potential of BDA across diverse sectors.

Divergent viewpoints underscore the essentiality of IT infrastructure in using BDA for competitive advantage. Davradakis and Santos (2019) contended that a robust IT infrastructure is crucial for integrating data-driven strategies, especially inside international financial institutions. Chen (2020) endorsed the findings by confirming that conventional banks with organized IT infrastructures effectively execute BDA, obtaining a competitive advantage. Culcheshk et al. (2025) emphasized that firms with sophisticated IT capabilities are more adept at leveraging BDA prospects. Hence, IT infrastructure is a critical element of effective BDA adoption.

The relationship between IT infrastructure, BDA adoption, and organizational competitiveness is complex and dynamic. The moderating effect of overall IT infrastructure can either accelerate an organization's competitive advantage through successful BDA integration or become a barrier that limits potential gains. With the ongoing evolution of technology, infrastructure remains a pivotal factor in this relationship (Hamed et al., 2024; Kissi, 2024). The dynamic emphasizes the importance of continuous investment in IT infrastructure, as it directly impacts an organization's ability to leverage BDA and retain a competitive market position.

Internet Connectivity

A reliable, high-speed network ensures seamless data transfer between systems, applications, and users. Advanced network infrastructure supports real-time data collection and analysis, enabling organizations to derive actionable insights promptly (Chen et al., 2018). Internet connectivity plays a key role by enhancing economic activities through education, communication, and access to amenities at a cheaper cost

(Hjort & Tian, 2021). Hjort and Tian studied the positive impact of internet connectivity on developing countries, analyzing 153 studies. Generally, the researchers concluded that internet connectivity positively influences life. The findings are consistent when applied to organizations because internet connectivity allows organizations to communicate, store, and analyze data promptly and effectively.

Technology adoption among organizations has experienced revolutionary changes because of the availability of internet connectivity for access. High-speed internet accessibility allows organizations to perform real-time data generation and analysis (Aranda-Jan & Qasim, 2023), which is critical for implementing BDA successfully. Reliable internet connections help businesses execute data collection and processing tasks through cloud-based BDA platforms to enhance operational decision processes and effectiveness (Japutra et al., 2022; Jula et al., 2024; Utami et al., 2022). Accessibility enables businesses to leverage consumer data, translating insights into strategies that improve customer engagement, optimize services, and achieve competitive advantage.

Robust internet connectivity provides real-time data processing and remote access to cloud-based analytics tools. For instance, Rathod et al. (2025) highlighted that stable and high-speed internet infrastructure facilitates seamless data transmission, which is critical for the functionality of BDA platforms. Rathod et al. tested that organizations with reliable internet connectivity can integrate cloud-based analytical tools more effectively, improving strategic and operational efficiency and responsiveness. Given its indispensable function, internet infrastructure influences BDA implementation and

connects directly to broader environmental and external factors shaping technology adoption.

On the contrary, the lack of connectivity limits access to advanced cloud-hosted tools, reducing firms' competitive edge in data-driven industries. Japutra et al. (2022) argued that the unavailability of internet access significantly hinders an organization's ability to adopt BDA. The findings of Rathod et al. are consistent with those of Japutra et al. because internet connectivity is critical in adopting BDA. The backbone for successful BDA implementation is internet connectivity, underscoring its importance as a critical enabler of digital transformation and innovation.

Even though literature provides the relevant role of internet connectivity to business, SMEs often face challenges securing high-speed internet due to budgetary constraints. Japutra et al. (2022) and Xiao et al. (2024) highlighted the noteworthiness of internet connectivity in facilitating business processes, but many SMEs struggle to invest in reliable networks, which hinders BDA adoption. Olomu et al. (2023) examined the adoption impact of technology innovations on the performance of some firms in Nigeria; the researchers concluded that internet connectivity influences business adoption of technology. The findings underscored the necessity of stable and high-speed internet for businesses to effectively acquire, store, and analyze data for informed decision-making.

Beyond business operations, internet connectivity also contributes to broader economic development. Guerriero (2015) emphasized that improved connectivity enhances a nation's GDP, connects remote populations to markets, and fosters innovation across industries. Additionally, high-speed internet connectivity facilitates citizens'

access to government services and improves business interactions. However, despite these benefits, the digital divide remains a pressing issue, as many SMEs struggle with affordability and infrastructure limitations, which can delay their adoption of BDA and other technological advancements.

Consequently, without reliable internet connectivity, the effectiveness of BDA tools is severely compromised, as delayed or incomplete data transfer can lead to inaccuracies in analysis and decision-making. Imran et al. (2021) and Xiao et al. (2024) discussed advanced network capabilities, such as software-defined networking (SDN) and 5G technology, heightening data transmission rates and reducing latency. These technologies are often beneficial for SMEs; however, adopting them requires substantial investment, which may not be feasible (Guerriero, 2015). Despite the considerable discussions about the cost-related challenges of network upgrades, there is less attention to exploring innovation financing models or collaborative approaches that could make advanced network infrastructure more accessible to SMEs (Imran et al., 2021). Following the cost-benefit value, internet connectivity may influence SMEs' adoption of BDA in Ghana.

Software Availability

Organizations need access to specialized software and tools tailored to BDA processes, such as data mining, machine learning, and predictive analytics platforms (Ma, A., 2020; Rehman & Rajkumar, 2022). Tools like Tableau, Statistical Analysis Systems (SAS), and Python-based frameworks empower companies to extract insights from data (George, 2021). Technological readiness requires these tools' availability and integration

with existing systems (Olateru-Olagbegi et al., 2020). Software availability, compatibility, and affordability may significantly influence SMEs' readiness and ability to acquire and implement BDA solutions effectively.

Adopting appropriate software tools is critical for transforming raw data into actionable insights. George (2021) emphasized that tools like Tableau, SAS, and Python-based frameworks are essential to facilitate data-driven decision-making. Specifically, these tools support data cleaning, preprocessing, advanced analytics, and visualization, ensuring businesses can extract meaningful patterns and trends from complex datasets (Gong et al., 2024). For example, Tableau enables intuitive data visualization, while Python-based frameworks like Pandas streamline data manipulation tasks (Lutfi et al., 2022). By leveraging these tools, organizations can enhance their analytical capabilities, ultimately driving more informed and strategic decisions.

The effect of software technology on project success for business is rapidly evolving, resulting in socio-economic transformation. Olateru-Olagbegi et al. (2020) examined software technology adoption in research institutes in Southwest Nigeria. The researchers found a strong positive correlation between access to software tools and project success, emphasizing tools like Microsoft Excel as the highest ranked, with a mean value of 4.5. Olateru-Olagbegi et al.'s findings underscored the impact of accessible and user-friendly software in facilitating and enhancing efficiency. Businesses become more productive and efficient with readily available software, increasing productivity and a competitive edge.

Software compatibility with existing infrastructure, data security, and ease of integration are significant considerations. Rehman and Rajkumar (2022) studied the complexities in decision-making for enterprise software products and the influence of technological factors using focused groups and discussions. The researchers prioritized that these factors influence the choice between on-premises and cloud computing models, impacting the long-term adoption of software products and vice versa (Gong et al., 2024). The findings emphasized that technical features, data security, privacy, and backup are critical in selecting software that influences decision-making in most businesses (Tsiu et al., 2024). Rehman and Rajkumar underscored the essential role of software availability and its technological context in successful BDA adoption.

The real challenge of software for SMEs is the initial outlay of financial commitment. Financial constraints remain an obstacle that hinders SMEs' ability to adopt BDA tools effectively (Tsiu et al., 2024). Bhuiyan et al. (2024) discussed the challenges SMEs face in integrating new software with existing systems, whether upgrading or developing enterprise systems. Some of these challenges hinder SMEs' adoption of technology for effective and efficient decision-making, even though several studies highlighted the opportunities that exist for SME adoption (Babalghaith & Aljarallah, 2024; Engelstätter & Sarbu, 2013; Kim et al., 2017). Overcoming these barriers remains an important priority for achieving sustainable adoption among SMEs.

IT Expertise and Skills

IT expertise and skills are a precursor to every business's successful technology adoption and implementation. According to Hamed et al. (2024) and Thanabalan et al.

(2024), IT expertise and skills refer to an IT professional's in-depth knowledge and experience. IT expertise encompasses technical and non-technical skills, ensuring the organization adapts to evolving technological landscapes and maintains a competitive advantage (Hamed et al., 2024). To gain a competitive edge resulting from talent, organizations should possess the requisite resources to attract and retain expertise.

IT expertise and skills are key resources for adopting new technologies in today's evolving technological environment. The success of BDA adoption relies on the skills and expertise of IT employees assigned to perform the necessary organizational functions, including IT innovations. Hameed and Counsell (2014) conducted a meta-analysis study investigating the correlation between organizational characteristics and the espousal of IT innovations. The researchers underscored that IT expertise and skills are pivotal to successful adoption and innovation. Nam et al. (2015) provided empirical evidence supporting the conclusion that IT expertise positively influences the adoption of various information technology innovations, such as BDA. The researchers asserted that IT professionals' expertise and skills are better equipped to implement and manage new technologies, ensuring a smoother transition and maximizing adoption benefits.

Conversely, organizations face challenges in adopting technology. The adoption of technology by organizations becomes challenging because they lack professionals who both understand and can effectively handle these technologies (Gong et al., 2024). IT adoption rates remain low among SMEs because they have insufficient IT expertise, especially when they cannot afford or maintain skilled professionals with technological know-how (Maguire et al., 2007). As a result, organizations with enough funding and

information technology experts can fully leverage and supervise new technologies, leading to lasting competitive benefits.

Vastly resourced organizations can access and train top-level IT professionals to work within their organizations. Such organizations adopt technology more readily because their understanding of benefits enables them to make effective decisions. The failure to harness technology benefits stems from organizational expertise shortages, thus making such business operations worthless, according to Maroufkhani et al. (2023). McKinsey & Company (2018) showed that companies obtain better technological return rates from sustained employee training programs since these teams excel at the digital landscape transition. Companies that obtain expertise can use technological innovation to achieve operational efficiency and market leadership in modern competitive environments.

Organizational Support

Every organization's decision-making process hinges on internal stakeholders, which solely depend on the organizational structure, resource allocation strategies, and strategic vision. Organizational support refers to the level at which an organization deploys its scarce resources to adopt new technology like BDA to achieve a competitive advantage (Maroufkhani et al., 2023). Maroufkhani et al. mentioned that organizational support directly affects SMEs' adoption of BDA. Even though many organizations operate as legal entities, the top management does the decision-making process (Iranmanesh et al., 2023). Top management and key stakeholders need adequate support

to ensure organizational employees have the tools and training to operate effectively and efficiently.

Organizational support champions technology initiatives among SMEs through decision-making and resource allocation. Several research studies have highlighted top management's critical role in BDA adoption (Iranmanesh et al., 2023; Maroufkhani et al., 2023). The researchers highlighted the significant influence of organizational support in influencing BDA adoption, driving collaboration, and facilitating the integration of new systems. Supportive organizational management encourages BDA adoption, enhancing productivity and competitive advantage.

Innovations, particularly those involving technology, often require substantial resources for successful implementation. According to the RBV theory, the managerial framework determines the strategic resources a firm can exploit to achieve a competitive advantage (Iranmanesh et al., 2023; Ma, H., 2000). Therefore, lacking top management support can lead to significant failures due to insufficient technological resources and external support mechanisms (Maroufkhani et al., 2023). For instance, organizations without managerial backing may struggle to allocate resources effectively, resulting in poor adoption outcomes.

In contrast, top management support can mitigate the challenges associated with a lack of technological orientation by acting as a compensatory mechanism. High levels of support from top management enhance the openness to adopting technology, thereby amplifying its direct influence on innovation success (Al-Emran & Griffy-Brown, 2023; Iqbal et al., 2024). The innovative success of top management support highlights the

leadership commitment to fostering an environment where technology adoption is prioritized, even in resource-constrained settings (Babalghaith & Aljarallah, 2024). The presence of proactive and engaged top management thus becomes a pivotal factor in driving successful innovation outcomes through BDA adoption.

Top management support is integral to an organization's decision-making to adopt new technology. Yussof et al. (2025) investigated whether organizational support affects the acceptance and use of E-learning among academic staff of higher learning institutions in Sabah. The study's findings revealed that organizational support significantly influences academic staff's decision to adopt e-learning. A similar study was conducted by Bag et al. (2023) using covariance-based structural equation modeling (CB-SEM) to examine determinants of blockchain technology adoption and SME performance, and interpreted that top management support (TMS) strongly influences SMEs' adoption of blockchain. These findings are consistent with Babalghaith and Aljarallah (2024), who concluded that TMS organizational support influences BDA adoption among SMEs in Saudi Arabia. Considering these findings, TMS is essential in an organization's decision to adopt technology, including BDA.

Organizational Culture

Organizational culture consists of the values, beliefs, and norms developed over time and manifested in how organization members achieve the firm's goals (Brown, 1995). Organizational culture shapes how organizations perceive and respond to market patterns, including adopting new technologies. A shared belief that values innovation, continuous learning, and data-driven decision-making is more akin to adopting BDA.

Denison and Mishra (1995) identified four critical cultural traits that define organizational culture: (a) involvement, (b) consistency, (c) adaptability, and (d) mission. These traits provide a strong foundation for successfully integrating BDA into an organization.

Involvement represents the extent of participation within that organization, with a higher level of involvement fostering a stronger sense of ownership and responsibility among members. Consistency represents the internalized values and norms that act as an implicit control system, ensuring a cohesive and integrated organizational structure (Brown, 1995). Adaptability signifies the organization's ability to adjust its norms and beliefs to respond effectively to external changes (Denison & Mishra, 1995). The mission trait embodies the organization's purpose, long-term vision, and sense of meaning (Babalghaith & Aljarallah, 2024). These elements reflect that culture is a key determinant of an organization's readiness for change, with the need for alignment between technological initiatives and cultural values.

Organizational culture is significant in organizations' decision-making regarding technology adoption. Jackson (2011) and Cabrera et al. (2008) argued that organizational culture continues to influence the success or failure of technology assimilation. Organizations fostering a data-centric culture tend to achieve better outcomes from BDA investments (Cabrera et al., 2008). The culture encourages employees to trust and integrate data insights into decision-making processes (Brown, 1995). However, a culture that resists change may struggle to adopt BDA due to the organization's conflicting goals.

Notwithstanding, creating an adaptive culture involves addressing employees' fear of displacement, providing effective communication about the benefits of BDA, and involving all internal stakeholders in the decision-making process. Melitski et al. (2010) examined technology adoption and organizational culture in public organizations. The researchers concluded that culture shapes a public organization's adoption of technology. Similarly, Denison and Mishra (1995) found a relationship between organizational culture and individuals' willingness to adopt technology. Together, the studies emphasized that cultivating a supportive and participatory culture substantially enhances the likelihood of successful technology integration, including BDA adoption.

Strategic Resource Allocation

Strategic resource allocation is a fundamental strategic process that involves an organization's ability to judiciously invest its scarce resources to achieve a sustainable competitive edge. Maritan and Lee (2017) opined that strategic resource allocation involves allocating physical, technological, financial, and human resources that support organizations' strategies. Given that resources are scarce, the heart of resource allocation lies in the efficient approach to realizing synergistic output. However, effective resource allocation is not merely about resource distribution but a purposeful alignment that drives sustained value.

SMEs often face financial and human resource constraints, making strategic allocation a critical approach for efficiently using resources. According to Bower (1972, 2017), organizations efficiently function by implementing a resource-based view system, which only views firms' interests to increase wealth competitively. Bower undertook a 2-

year investigation of resource allocation among large firms. The researcher found no adequate models for the resource allocation process for the top managers of the studied firms. This lack of models has influenced organizations' ability to allocate resources for efficient operations.

BDA adoption requires investment in infrastructure, tools, and talents. Gupta and George (2016) highlighted the essential need for organizations to prioritize investments in infrastructure, tools, and talents to support a firm's strategic goals. For businesses like SMEs, prioritizing investment involves balancing the business's short-, medium-, and long-term operational needs. Yao et al. (2024) and Zhang et al. (2024) detected that resource misallocation hampers SMEs' implementation of technological innovations. SMEs lack the structures to evaluate and allocate resources effectively for BDA projects. Research gaps remain in identifying best practices for resource allocation that maximize return on investment (ROI) and align with the strategic objectives of SMEs.

Strategic Vision and Mission

An organization's strategic vision and mission play a key foundational role in guiding the adoption of BDA. According to Papulova (2014), vision is generally the future pictorial view of a business, while mission is the space for strategy creation. An organization's mission deals with the organization's present and future directions. The vision and mission are the components that define the organization's purpose, taking into consideration the needs of current and future stakeholders (Daskalova & Ivanova, 2021). Vision must clearly articulate the purpose and expected outcomes of the organization and organizational initiatives with broader business goals.

Strategic alignment between an organization's vision, mission, and technology adoption is essential for maximizing the value of innovations like BDA. Lakoju and Serrano (2017) emphasized that organizations' alignment of vision and mission statements must ensure that technology adoption delivers value that supports the organization's goals by increasing the likelihood of successful performance. For instance, identifying strategic goals before implementing BDA projects can provide a clearer view of the benefits and reduce time and implementation costs. Therefore, aligning BDA adoption with organizational goals increases the likelihood of successful integration and long-term operational efficiency.

An organization's strategic vision and mission guide the planning and decision-making process in advancing technological adoption. Daskalova and Ivanova (2021) stated that strategic vision and mission guide the planning and decision-making processes by ensuring that BDA adoption integrates into the broader strategic framework of the organization. Maroufkhani et al. (2023) argued that many SMEs adopt a reactive approach driven by external pressures rather than proactive strategic planning. This insight highlights a gap in the literature as more studies are needed to explore how SMEs can integrate BDA into strategic visions while addressing immediate operational challenges.

External Pressures

Based on the TOE framework, the environment is the external pressure or the organization's ecosystem. Lutfi et al. (2022) mentioned that competitive pressure and government regulations can affect organizations' decisions to adopt BDA. These factors

are outside the organization and significantly influence the organization's business operations. External pressures can work as facilitators or inhibitors in the organization's adoption of innovative technology to augment effective operations (Lai et al., 2018). For instance, Hsu et al. (2014) argued that organizations facing intense pressure from trading partners and the government are more likely to adopt innovative technologies.

Government policies should incentivize organizations to adopt technologies. The government grants tax rebates in Ghana for individuals and organizations that purchase and import electric vehicles.

External pressure may moderate the influence of factors affecting SMEs' adoption of BDA. Maroufkhani et al. (2020) determined that environmental factors significantly moderate the influence of organizational readiness and top management support in decision-making related to BDA adoption among SMEs. This study's external pressures are competitive pressure, customer demand, and regulatory (government) requirements (Daskalova & Ivanova, 2021). The significant effect of external pressure is not limited only to relationships but also moderates relationships, among other factors.

Competitive Pressure

Competitive pressure refers to the perceived influence of an organization's competitors that forces a business to embrace new technology to sustain its competitiveness (Hsu et al., 2014; Lai et al., 2018). Considering the environment in which businesses operate, every business wants to survive in the market by serving and exceeding customers' needs. Exceeding customers' needs have created keen competition, requiring businesses to innovate continuously by adopting and using new technologies.

As a result, firms that fail to integrate emerging technologies risk losing their competitive edge, making technology adoption a strategic necessity.

Empirical studies highlighted the impact of competitive pressure on technology adoption. Ataei et al. (2024) posited that competitive pressure pushes organizations to leverage BDA for better and more efficient decision-making, effective operations, and innovative aptitude. If a business leader knows that their peers are using a certain technology, a sense of crisis will strike the business to acquire and use technology not to lose the competitive edge. The sense of urgency from peer influence fosters a proactive approach to technology adoption, ensuring that firms remain competitive in an increasingly data-driven business landscape.

The literature revealed that competitive pressure influences businesses to adopt BDA. Wamba et al. (2020) argued that competitive pressure prompts SMEs to adopt BDA. An industry's intense competition for an entire sector may exert pressure to adopt technology, serving as a critical driver of industrial transformation. This competitive environment heartens SMEs to stay wary, meticulously observing the actions of their competitors to ensure they keep pace with technological advancements (Hasani et al., 2023). Similar studies have alluded that competitive pressure significantly affects technology adoption among SMEs (Jain et al., 2024; Maroufkhani et al., 2020). The findings suggest that the significant impact of competitive pressure on SMEs' adoption of BDA in the decision-making process aims to achieve sustainable development.

Contrary to other research findings revealing the significant influence of SMEs on BDA adoption, there exists in other jurisdictions where competitive pressure has an

insignificant influence. Lutfi et al. (2022) examined the influencing factors of BDA adoption in the digital transformative era using Jordanian SMEs. The researchers employed PLS-SEM to analyze the responses of 123 participants, and they concluded that the pressure of competition has an insignificant influence on SMEs' adoption of BDA. However, Lautenbach et al. (2017) asserted that increasing BDA usage among competitors pressurizes owner-managers of SMEs to capture business analytics and intelligence to gain and maintain a competitive market status. The inverse findings in the literature regarding the influence of competitive pressure necessitate further studies.

Regulatory Requirement

A supportive regulatory environment is crucial in encouraging businesses to adopt BDA by providing the necessary infrastructure, legal frameworks, regulatory guidelines, and policy incentives (Sun et al., 2020). In this context, the regulatory requirement refers to government incentives, commercial laws, and supportive policies that promote the integration of big data technologies within organizations (Zhu et al., 2004). As proposed in the institutional theory by DiMaggio and Powell (1983), the institutional environment provides rule-like norms and social expectations for suitable organizational make-ups, functions, and practices. Government regulations may encourage or deter businesses from adopting technology.

Policies related to legislation, technological standards, and governmental encouragement can significantly influence the adoption of BDA. Lai et al. (2018) mentioned that regulations in the form of government policies, legislations, and standards set out could significantly influence business adoption of technology, including BDA.

For instance, legislative bodies in regions like the United States and the European Union have established specific guidelines to safeguard organizational data. In the United States, however, no all-encompassing federal legislation ensures the privacy and protection of personal data. There is a combination of legislation at both state and federal levels, administrative regulations, and industry-specific self-regulation guidelines (Boyne, 2018). Legislation at the federal level primarily protects data within a sector-specific context. Conversely, the European Union has a comprehensive data protection directive that guides all businesses.

Previous studies have emphasized the impact of regulatory frameworks in motivating organizations to embrace information technology. Lutfi et al. (2022) investigated factors influencing BDA adoption among Jordan SMEs and found, among other factors, that government support influences SMEs' adoption of big data. Similarly, Maroufkhani et al. (2023) and Park and Kim (2021) agreed that government relations as an environmental factor influence SMEs' adoption of BDA. However, Waqar and Paracha (2024) found no significant influence between government regulations and private firms' adoption of BDA in Islamabad. These findings suggest that government regulations are context-dependent, necessitating a more nuanced investigation into how regulatory environments shape BDA adoption among SMEs.

Customer Demand

Customers in this context are external trading partners of an organization. Customer demand is the needs and expectations of users of an organization's products and services (Sebastian-Coleman, 2022). Understanding and exceeding customer demand

is essential to satisfying customers over time and remaining competitive. Businesses must identify customer demands and strive to exceed them to enhance customer satisfaction and loyalty (Nwosu et al., 2024). The literature revealed that organizations prioritizing customer-centric strategies by leveraging data analytics, customer feedback, and market trends are better positioned to anticipate and respond to evolving demands.

Organizations with BDA may push their counterparts to adopt the same to aid in sharing and collaborating on information for effective decision-making and strong relationships (Verma & Chaurasia, 2019). Verma and Chaurasia (2019) conducted a study using 231 firm managers to determine whether trading partner pressure significantly influences BDA adoption. The researchers specified that trading partner pressure impacts firms' adoption of BDA. Organizations are more likely to adopt BDA to meet the expectations and requirements of their trading partners, fostering continuous integration of data among the firms for effective and efficient sharing of technical know-how.

A prior study in the hospitality industry reveals a contrasting finding regarding the influence of trading partner pressure on BDA adoption among SMEs. Sharma et al. (2023) focused on the impact of trading partner pressure in the hospitality industry. The findings indicated that trading partner pressure is the least influential determinant of BDA among the 17 factors studied. The studies by Sharma et al. (2023) and Verma and Chaurasia (2019) invariably contrasted the influence of customer demand or trading partner pressure on BDA adoption among SMEs. The literature gap regarding the extent

of the relationship between customer demand and BDA adoption among SMEs provides a basis for a study that could fill the identified gap.

Developing Countries Using BDA Among SMEs Compared to Ghana

BDA is a game-changer for businesses worldwide, providing organizations with tortious insight to synergize decision-making, enhance operational efficiency, and gain competitive advantage (Jenkinson et al., 2024). As developed economies have hurriedly embraced BDA, developing economies have been uneven in adoption, particularly among SMEs. Given that SMEs drive economic activities in both developed and developing economies, their slow adoption of BDA presents a challenge. Constraints on technological infrastructure and resources hinder the ability of SMEs in developing economies to integrate BDA into their operations effectively.

Most economic activities in developed and developing economies rest on SMEs, yet their uptake in adopting technologies like BDA remains limited. Muhunzi et al. (2024) employed a narrative review study design to investigate the opportunities and challenges of BDA in the healthcare sector in developing economies. The researchers found, among others, that fragmentation of healthcare data, lack of interoperability, data security, privacy, and confidentiality concerns are some key barriers to adoption. Limited resources, inadequate regulatory framework, reliable power, and internet infrastructure further impede businesses from leveraging BDA effectively.

Consequently, some studies indicate a growing interest in BDA adoption among SMEs in developing countries, driven by increasing digitalization and the affordability of cloud-based analytics platforms. For instance, studies on BDA in Egypt and Nigeria

revealed that SMEs are using analytics for supply chain optimization, customer segmentation, and predictive maintenance (Egwuonwu et al., 2023; Ibrahim et al., 2024; Oranefo et al., 2024). Similarly, Mwangi et al. (2023) examined the impact of technology such as BDA on SMEs in Kenya. The researchers concluded that SMEs leveraging the adoption of BDA as a tool for market analysis and competitive intelligence in the retail and agribusiness sectors perform better than their counterparts who do not adopt technology for business operations. Mwangi et al. further revealed that 68% of SMEs surveyed for the impact of digital transformation in Kenya had adopted digital transformation in cloud computing, data analytics, and other mobile applications.

The successes of other developing nations in adopting BDA provide actionable lessons. According to Mwangi et al. (2023), technology adoption has a profound association with improved revenue growth, enhanced operational efficiency, and increased customer satisfaction. Faruque et al. (2024), Sharabati et al. (2024), and Wujarso (2023) further emphasized these benefits with additional benefits such as a reduction in business expenses and increased competitiveness. Ultimately, BDA adoption among businesses has helped increase the economic activities of many developing nations, connecting and bringing clients together worldwide.

Most studies on factors influencing SMEs' adoption of BDA in developing countries provide numerous variables. Waqar and Paracha (2024) studied private firms' intention to adopt BDA in Pakistan with 156 participants. Their research indicated that IT infrastructure, data quality, technological complexity, and financial readiness strongly influence firms' adoption of BDA. Similar studies were conducted by Lutfi et al. (2022),

using Jordanian SMEs to investigate the drivers of BDA adoption. After employing the partial least squares structural equation model (PLS-SEM), the researchers concluded that competitive advantage, complexity, security, top management support, organizational readiness, and government support significantly influence SME adoption. Lai et al. (2018) generalized that perceived benefit and top management support significantly influence SMEs' adoption of BDA in China, while competitors' and government policies significantly moderate the adoption relationship. These studies revealed that factors influencing BDA may vary across contexts and geopolitical regions, highlighting the multifaceted nature of BDA adoption.

A literature review indicated some key drivers influencing BDA adoption among SMEs. Aldossari et al. (2023) empirically used systematic literature and expert review to document the drivers of BDA adoption among SMEs. The researchers analyzed a wide range of studies, finding that top management support, training, relative advantage, compatibility, security, IT infrastructure, complexity, adaptability, government policies, competency, digital transformation tools, collaboration, and decision quality most influence BDA adoption among SMEs. These factors highlight the multifaceted nature of BDA adoption, suggesting that a successful transition requires internal capabilities and external support mechanisms in integrating BDA by SMEs.

By synthesizing and analyzing a broad range of existing studies, Aldossari et al. (2023) provided a comprehensive framework for understanding the multidimensional influences of BDA, offering valuable insights for both researchers and practitioners aiming to leverage SMEs' data-driven capabilities. Considering the cultural dynamics,

business environment, disparity in infrastructure, and economic activities of these developing countries, this study is necessary to determine which variables drive Ghanaian SMEs in BDA adoption.

Characteristics of SMEs

SMEs have emerged as the backbone of modern economies. As Bateman (2000) and Robertson (1990) explained, the 20th and 21st-century economies have seen the rise of neoliberalism and globalization, which have positioned SMEs as key drivers of thriving economic efficiency, and social and sustainability development in developed and developing economies. SMEs have significantly surpassed large-scale industries in developing economies (Keskgn et al., 2010). SMEs are favored for their ability to adapt quickly, operate with lower capital requirements while using intensive labor, and maintain low management costs, enabling them to produce goods more affordably (Aldossari et al., 2023). With this, SMEs are in every corner of every economy. However, regarding this study, it is important to define SMEs to align the focus and objective of the research study.

Authors and authorities have defined SMEs differently. The European Union (EU) defined SMEs as any enterprise involved in economic activity with fewer than 250 persons with an annual turnover not exceeding EUR 50 million or an annual balance sheet total not exceeding EUR 43 million (European Commission, 2005). In America, the Small Business Administration defines SMEs using three main standards: (a) number of employees (less than 500), (b) industry (non-manufacturing and manufacturing businesses), and (c) an average annual receipt under \$7,500,000 (United States Small

Business Administration, 2023). The Organization for Economic Co-operation and Development (OECD) categorized SMEs into:

- Micro enterprises – fewer than 10 employees
- Small enterprises – 10 to 49 employees; and
- Medium-sized enterprises – 50 to 249 employees (OECD, 2004a; OECD, 2004b).

The National Board for Small-Scale Industries (NBSSI) is the government agency in Ghana that promotes and develops SMEs. The agency considers an SME any enterprise with fewer than 10 employees, a fixed asset, such as machinery and equipment, and not more than 10 million Ghana cedis (NBSSI, 20). Storey (1994) posited that there is no single definition of SMEs. However, the number of employees, profitability, annual receipts, and capital withholdings stand out from the various definitions. The NBSSI definition applies to this study because the geographical scope is Ghana.

Contribution of SMEs to Economic Development

SMEs play a significant role in the economic development of every country. SMEs are considered the backbone of the growth of both developed and developing economies (Sana et al., 2020). According to the World Bank (2019), SMEs represent about 90% of businesses and more than 50% of employment worldwide. SMEs contribute up to 40% of GDP in developing economies and hold about 50% of employment (World Bank, 2019). For instance, in Sub-Saharan Africa, most non-agricultural employment is provided by SMEs, creating opportunities for marginalized groups, including youth and women (Yeboah & Flynn, 2021). The findings ultimately

reinforce the relevance of SMEs in reducing unemployment, promoting inclusive economic growth, and providing essential services to complement development.

Through innovation and entrepreneurship, SMEs contribute to economic growth by providing new products, creating employment, and enhancing productivity (Anes et al., 2022; Hasan et al., 2024). Naturally, SMEs are habitually agile and innovative, leveraging their size and flexibility to adapt to market changes and introduce new products or services. Surya et al. (2021) underscored the role of SMEs in boosting economic dynamism by driving competition and innovation. SMEs are at the forefront of the technology sector, developing disruptive technological innovations that spur industrial transformation and enhance productivity at all levels. Their capacity for innovation is particularly crucial in developing economies, where traditional industries often dominate, and diversification is essential for sustainable growth.

Economic development significantly depends on SMEs because they represent a considerable source of GDP contribution and workforce employment in various countries. SMEs in Ghana generate 70% of the GDP while employing 90% of Ghanaian workers, yet encounter recurring challenges that obstruct their maximum performance (Ministry of Finance, 2024). Limited infrastructure quality, limited finance access, and insufficient technical capabilities present major obstacles for SMEs (Shaikh et al., 2021). The combination of obstacles impacts innovation while controlling business expansion, which blocks SMEs from optimally using market opportunities. Supportive measures consisting of specific programs, financial aid, and professional training programs will enable SMEs to unlock the potential for greater economic development. Through

policymakers' work, governments establish necessary support systems for SME success, which leads to economic durability and sustainability goals.

Gaps in the Literature

The study of BDA among organizations has gained prominence in academia and industry. Despite the significant literature on BDA, critical gaps still exist that require attention. Previous studies have focused on large firms in developed economies (Maroufkhani et al., 2023), overlooking the unique factors influencing BDA adoption among SMEs premised on the TOE framework, RBV, and institutional theory. The gap in the literature on BDA adoption and SMEs needs a comprehensive framework that entails internal and external determinants, ensuring a holistic understanding of the phenomenon.

Research on BDA repeatedly investigates organizational factors and technology aspects while omitting vital elements of human capital resources, internet resources, and customer behavior that influence SMEs' adoption of BDA. SMEs face resource limitations in obtaining skilled professionals to interpret and manage BDA applications (Maroufkhani et al., 2020; Mosbah, 2024; Willetts et al., 2022). Studies about BDA adoption by SMEs lack crucial information on developing employee competencies, training personnel, organizing knowledge transfers, and acquisition strategies for skills. Willetts and Atkins (2023) explained that SMEs obtain specialized training and up-to-date knowledge by creating educational and industrial alliances. Examining training programs and external relationship building by SMEs would reveal essential insights about raising BDA adoption levels.

Security and ethical concerns surrounding BDA adoption among SMEs remain underexplored. Oranefo et al. (2024), Tsiu et al. (2024), and Soomro et al. (2024) acknowledged security and ethical considerations as potential barriers that hinder the adoption of BDA. Limited research remains on how SMEs constrained by resources can develop strategic, cost-effective solutions to security and ethical concerns while maintaining compliance with regulatory standards. Investigating how SMEs can strategically develop cost-effective methodologies to address security and ethical concerns is essential for responsible data practices. Understanding security and ethical concerns sets the stage for exploring how organizational leadership and culture influence the ethical adoption of BDA.

Another significant gap in the literature with BDA and SMEs is related to longitudinal studies. Many research studies are cross-sectional, which provides a snapshot in time rather than a long-term perspective. There is a longitudinal study to understand BDA's effect on the evolution of BDA adoption and its long-term impact on SMEs (Gurău & Ranchhod, 2020). Research studies are needed to uncover valuable insights into sustainable competitive advantage and decision-making process capabilities.

Research studies about BDA adoption have been developing over the years. Four crucial gaps exist that need additional research because they do not provide sufficient detail in the field: (a) external environmental, (b) longitudinal impacts, (c) security and ethical considerations, and (d) training and competency-building strategies. Research teams should work on constructing full-scale analytical frameworks to deeply assess human and governmental regulation impacts and create a reliable performance

assessment methodology. Scientific research can achieve a better understanding of how BDA can assist SMEs in getting competitive advantage and sustainability through additional analysis.

Summary and Conclusions

The chapter offered a comprehensive literature review on determinants of SMEs' adoption of BDA. The chapter included headings on the literature search strategy, the theoretical foundation of the theories employed in the study, and the conceptual framework. The literature search strategy provides a trail of keywords and databases used to search for secondary sources of materials such as articles and research studies. The literature on BDA revealed the need for continuous research in BDA and SMEs in South Saharan Africa because the literature search showed few studies in that geographical sector.

There is a detailed review in Chapter 2 regarding the theoretical foundation employed in the study. The TOE framework provided the basis for investigating the determinants of BDA with a key emphasis on technological readiness, organizational support, and environmental factors. Applying this framework provided a structured approach to investigating the multifaceted nature of technology adoption. Although there is extensive literature on RBV, there is a gap in the inclusiveness of the theory with TOE and institutional theory, as well as the interplay in promoting SMEs' adoption of BDA. With the historical development of these theories and how they link to each IV in the conceptual framework, the study holistically examined their relationship.

The chapter comprised empirical literature on other developing countries' adoption of BDA and the drivers in these countries. The literature indicated relative advantage, compatibility, and top management support as factors influencing SMEs' adoption of BDA. Findings revealed that environmental factors mostly moderate BDA adoption among SMEs, while financial constraint limits are considered barriers to SMEs' adoption of BDA. The systematic literature review pointed out the critical role of BDA in firms' performance for large businesses and SMEs.

Chapter 2 contains the definition of SMEs and the contribution of SMEs to economic development. The literature review revealed an enormous research gap regarding BDA, the lack of longitudinal studies, security and ethical concerns, and human development programs. Researchers also discussed how future studies could further examine integrating human and governmental regulations to establish robust performance metrics. The literature review showed that while some variables influence BDA adoption in some countries, these same variables, on the other hand, moderate the relationship in different countries. This study contributes to filling the gap by examining the determinants influencing BDA adoption among SMEs in Ghana. The implications for positive social change include the potential for SME owner-managers to promote a culture of data literacy and technological advancement within the SME sector in Ghana.

Chapter 3 provides a detailed description of the study's design and methodology. The study's research design and methodology, outlining the investigation methods for the research questions, are discussed in Chapter 3. The sections comprise the research paradigm, methodology rationale, and data collection methods. Chapter 3 includes the

selection approach for participants and the method used to analyze data alongside ethical measures designed to safeguard research integrity. The study framework becomes fully understandable through these elements, demonstrating its operational design for researching the identified gap.

Chapter 3: Research Method

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The specific research problem addressed in this study is whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. This study addressed the gap in the literature on the limited research on what influences SMEs' adoption of BDA in Ghana. Significantly, the study contributes to promoting a culture of data literacy and technological advancement within the SME sector in Ghana.

The chapter highlighted the factors that drive SMEs to adopt BDA and encouraged them to invest in new technologies, skill development, and workforce training to achieve a competitive advantage for sustainability. Chapter 3 explains the research design, rationale, methodology, sample size, approach, and sampling technique. Trustworthiness is critical to every research study. Therefore, I focused on validity and reliability, with a particular emphasis on trustworthiness, confirmability, internal validity, external validity, construct validity, and ethical procedures. Instrumentation for data collection was included in this chapter, with a data analysis plan and the framework for recruiting participants for the study. Chapter 3 concludes with a summary and preview of Chapter 4.

Research Design and Rationale

The variables for this quantitative descriptive survey study consisted of the dependent and the independent variables. Watson (2015) asserted that variables are

anything that may be measured in quantitative research. Pierce (2013) and Warner (2021) classified variables into two main types: (a) DV, which represents the outcome that the study seeks to explain or predict, and (b) IV, the variable that influences the measurement of the dependent variable. This study's DV is BDA, measured continuously. The IVs are organizational support, technological readiness, and external pressures. The IVs get measured on a continuous scale.

Adequately addressing the research problem involves choosing the right research design. Quantitative descriptive survey was employed. The primary aim of the research design is to address the research questions and control variance (Dulock, 1993; Myers et al., 2013). In essence, the research design provides a framework and strategies for obtaining the most appropriate answers to the research questions. The research design informs the researcher on the best possible data collection method and techniques that most consistently answer the research problem.

The quantitative descriptive survey with MLRA aligns with the purpose of the research in examining whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. Quantitative descriptive surveys trace back to the philosophical movement of "positivism," associated with Auguste Comte, which emphasized using empirical, numerical observations to understand real-world situations (Burkholder et al., 2020; Lenzer, 2017). The design comprehensively allowed the researcher to gather quantifiable data from a large sample to facilitate statistical analysis and generalize findings. As a result, the design guarantees

methodological rigor while generating evidence-based insights that enhance academic knowledge and useful tactics for BDA adoption.

The time and resource constraints influenced the quantitative descriptive survey. A substantial amount of effort was used to conduct the pilot test, distribute the survey instrument to participants, and conduct follow-ups to maximize response rates. The study design relied on collecting numerical data from a large sample to examine the extent of the significant relationships among the study variables. However, the study's set timetable precludes the possibility of longer data collection or more than one follow-up round of participation from respondents who are difficult to contact. Resource limitations, such as financial restrictions, impacted following up on all participants' representativeness, limiting follow-ups, the use of sophisticated survey platforms, compensated sampling services, or incentives to promote participation.

Despite the constraints, a quantitative descriptive survey study allows for a comprehensive and systematic examination of the dependent and independent variables, providing valuable insights into how SMEs can better leverage BDA for competitive advantage. According to Burkholder et al. (2020), a quantitative descriptive survey allows the researcher to accurately describe and summarize features of the study population using numerical data, providing an objective picture of the trends and patterns. The study employed a structured survey to collect primary data from a representative sample of SMEs, ensuring the measurement of variables related to technological readiness, organizational support, external pressures, and BDA adoption.

The study design was consistent with the research approaches that advance knowledge in the discipline. Quantitative descriptive design enables a systematic collection and analysis of empirical data to identify patterns, relationships, and trends relevant to the study phenomenon. Empirical evidence was needed to refine and validate the theoretical and conceptual frameworks. By quantifying perceptions, readiness levels, and adoption influence, the design supports theory testing and development while providing practitioners and policymakers with evidence-based insights for decision-making. Ultimately, the approach strengthens the empirical foundation of the discipline, fostering both scholarly advancement and practical impact.

Methodology

The study examined whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana to support organizational sustainability in the current uncertain business environment. Several challenges, including limited resources, technological infrastructure, and strategic direction, constrain SMEs (Babalghaith & Aljarallah, 2024). Understanding what influences SMEs' adoption of BDA will reveal what policymakers, government institutions, and the telecommunications industry need to do to provide resources to support adoption. The research methodology must be well-defined to address the study's objectives with rigor, reliability, and validity.

The study adopted a quantitative descriptive survey design with a multiple-sampling approach to achieve the research objectives. A quantitative descriptive survey enables the researcher to collect measurable data from a heterogeneous sample

population whose work descriptions, positions, and skills equip them to provide data relevant to the research theme. The quantitative descriptive approach is robust, ensuring a data-driven understanding of the dynamics shaping BDA adoption within the SME sector in Ghana. An established structured questionnaire based on a technology adoption framework, such as TOE, was used to examine how technological readiness, organizational support, and external pressures influence BDA adoption among Ghanaian SMEs.

Population

The target population for the study included all registered SMEs in the National Board for Small-scale Industries – Ghana (NBSSI) database, now GEA. The GEA was set up by Act 434 of 1981 and operationalized in 1985 with the utmost body to oversee the operations and activities of small-scale industries in Ghana. In 1991 and 1994, the board was established to integrate the Ghana Enterprise Development Commission (GEDC) and the cottage industries into the GEA to help further support and strengthen the small business activities in Ghana. The GEA background underscores the relevance of using their database as the foundation for identifying the study's target population.

The study's primary target population included owner-managers, IT experts, and other workers in the selected SMEs. Participants from the randomly selected SMEs whose job description puts them in a position to provide insightful data regarding decision-making, investment, innovation, and leadership were considered the most suitable for this study. A total of 30 SMEs were randomly selected, and four participants

were purposively sampled from each SME for the study. With this, the total number of participants for the study was 120.

The sample size for the study was determined through a rigorous statistical calculation to ensure adequate power for meaningful analysis. Based on G*Power 3.1.9.7, for a multiple linear regression with a priori power analysis to compute the sample size, a total sample size of 90 participants was sufficient. The effect size parameters are 0.15, alpha at 0.05, power at 0.95, and three predictors (Appendix A). However, an additional 30 participants were included to address potential non-responses and incomplete data. An additional 30 participants were to safeguard the study from attrition but also strengthen the reliability and generalizability of the findings. Consideration was given to participants who work full-time in the sampled SMEs.

Sampling and Sampling Procedures

This research study employed two techniques: (a) random probability sampling and (b) non-probability sampling of purposive techniques. A random probability sampling technique was employed to select SMEs for the study. The random sampling technique allows every member of the population framework to have an equal chance and opportunity to be included in the study (Bhandari, 2023; Dattalo, 2009). I requested from GEA the list of all SMEs under the institution's definition as adopted in this research study. A sample frame was established by comprehensively listing all the SMEs within the target population and assigning numbers to each. A random number was generated through a lottery to select 30 SMEs for the study.

The purposive sampling technique, or judgmental sampling, was used to sample participants who provided the most relevant insights for the research study. Etikan and Bala (2017) defined purposive technique as one that relies on the researcher's judgement to identify participants most capable of contributing to the research objectives. Per the G*Power 3.1.9.7 sample size calculation, a total of 120 participants were included. Four participants were chosen based on their job description, skills, and experience from the 30 randomly selected SMEs, which directly align with the study's focus. The deliberate selection of research participants is to ensure that data collection is rich, focused, and highly relevant to the core research questions.

Even though purposive sampling is a non-probability method, the technique was highly valuable for targeting individuals with specific knowledge in the study area. Nyimbili and Nyimbili (2024) and Campbell et al. (2020) posited that although purposive sampling is a non-representative subset of the larger population, it allows researchers to target knowledgeable participants. Given the subject matter, purposive sampling was ideal, as subject matter experts in decision-making regarding technology investments and adoption were interviewed to achieve the study's objective. By focusing on these key participants, the research yielded more precise and actionable findings aligned with the study goals.

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

The recruitment, primary data collection, and participant selection procedure involves how participants were requested to join the research study and the subsequent data collection method. A letter was sent to the director of GEA to request the list and

location of SMEs whose definitions fall within what this research study adopts. Targeting SMEs registered with the GEA assures the selected business is credible and meets the definition adopted in this research study. The GEA director was assured of the confidentiality and purpose of the requested information through a consent letter. The obtained information was purposefully used for this research study.

A sample framework was developed to select SMEs using a random sampling technique. Upon obtaining the list of sampled SMEs, the researcher sends an email with a follow-up call to all selected SMEs to introduce them and provide the purpose of the study. A follow-up consent letter was sent to the owner-managers, IT experts, and employees with the relevant information and experience, assuring them of the confidentiality and use of any information they will provide for the research. Throughout the research process, I maintained and protected participants' identities and privacy so that the research outputs and publications revealed no participants' information.

Pilot Study

The pilot study tests the feasibility and design of the larger-scale research study. A pilot study is a test version of the full-scale study in preparation for a complete study (Bujang et al., 2024). The significance of a pilot study lies in its ability to help improve the efficiency and quality of the primary research study. Kunselman (2024) found that pilot studies provide significant information regarding whether a large-scale study should be conducted. Pilot studies help to bridge the gap that may arise due to improper planning. The deficits that are likely to occur in the research design of this proposed

descriptive survey can be anticipated and dealt with when a preliminary study is conducted.

Based on this, I undertook a pilot study with a sample size of five participants from the study area. The study instrument was given to purposefully sampled participants (owner-managers, IT experts, and others). The pilot testing activity also helped test the validity and reliability of the research instrument. The pilot testing accurately measures what the research instrument sought to achieve and produces a consistent result. Refining the entire research data collection process before full-scale deployment strengthens the methodological rigor and enhances the credibility of the research findings.

The research instrument was pretested to determine the time it takes to complete the questionnaires. The pretest enabled me to identify any gaps related to the clarity of the research instruments and whether the research questions are free from ambiguities. Kumar et al. (2013) mentioned that the pretesting process of the research instrument should involve five persons, as it usually does not need to be large. The criteria for selecting the five participants for the pilot study was based on a purposive sampling technique like that of the main study. The process helped assess whether the recruitment strategies are practical and whether participants fully understand the consent process. The pilot study data is separate from the main study data collection and analysis.

Instrumentation and Operationalization of Constructs

The survey instrument for the study integrates validated measures adapted from prior research instruments by Huang et al. (2012), Nguyen et al. (2024), and Pizam et al. (2022). Huang et al. (2012) instrument, titled factors influencing data mining tools was

initially developed for use in the data mining (DT) domain, demonstrated strong content validity and reliability through rigorous testing and refinement. The instrument was initially pretested by experienced data mining technicians and subsequently administered to office workers in SMEs. Principal component analysis supported the instrument's construct validity, while confirmatory factor analysis further confirmed convergent, construct, and discriminant validity. Reported composite reliability scores ranged from 0.80 to 0.96, indicating a high level of internal consistency.

Similarly, through an online platform, Pizam et al. (2022) developed an instrument on hotel managers' intentions to adopt robotics technologies- model. The research instrument was tested among hotel managers across 11 countries in North and South America, Europe, Asia, and the Middle East. The results confirmed the factor structure and demonstrated adequate reliability and validity. Nguyen et al. (2024) contributed the third instrument on organizational digitization – measurement model. The instrument was used to assess organizational digitalization, focusing on stakeholder roles, organizational culture, and leadership commitment to digital transformation. Nguyen et al.'s instrument was validated through responses from CEOs and general managers of major hotel companies in Vietnam. The authors also reported acceptable levels of factor structure, reliability, and validity, and permitted its use by student researchers without prior approval. The developers of all the adopted research instruments have explicitly authorized their use by students and researchers, either with or without formal permission (Appendix B). Access to these instruments was facilitated through the APA PsycTests database.

All three instruments are conceptually grounded in the technology–organization–environment (TOE) framework and have been previously applied in empirical studies examining technology adoption among SMEs. For the current study, minor contextual modifications were made to ensure relevance and clarity for SMEs operating in Ghana. A pilot study was conducted to help refine the questionnaire, assess face validity, and ensure cultural alignment. Internal consistency reliability was evaluated using Cronbach’s alpha, with a coefficient of 0.70 or higher deemed acceptable. Exploratory factor analysis was employed to assess construct validity, while convergent and discriminant validity was examined to enhance the robustness of the measurement model.

Data Analysis Plan

Collected data were analyzed using IBM SPSS version 30. IBM SPSS provides a compelling set of tools aimed at social science research (IBM Corp., 2024). Wagner (2019) stated that SPSS provides a robust interactive platform for performing various statistical tests and generating charts, making data meaningful to users. The software offers statistical tests such as multiple regression analysis, which was essentially used to analyze data for this study. By leveraging SPSS’s analytical capabilities, the study ensures a systematic and statistically sound approach to answering the research questions and validating the proposed hypotheses.

Research of this nature requires an extensive analysis plan to answer the research questions effectively. The research questions that informed and directed this study, along with their corresponding hypotheses, are as follows:

RQ1: To what extent does technological readiness influence SMEs' adoption of BDA in Ghana?

H₀₁: There is no significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

H₁₁: There is a significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

RQ2: To what extent does organizational support influence BDA adoption among SMEs in Ghana?

H₀₂: There is no significant influence of organizational support on SMEs' adoption of BDA in Ghana.

H₁₂: There is a significant influence of organizational support on SMEs' adoption of BDA in Ghana.

RQ3: To what extent do external pressures influence SMEs' adoption of BDA in Ghana?

H₀₃: External pressures do not significantly influence SMEs' adoption of BDA in Ghana.

H₁₃: External pressures significantly influence SMEs' adoption of BDA in Ghana.

MLRA was used to examine the relationship between the DV-BDA and the three IVs (technological readiness, organizational support, and external pressures). The analytical approach provides a clear understanding of the influence of each predictor and contributes to the study's broader goal of identifying critical determinants of BDA

adoption. Using a well-established statistical tool and method, the research enhances its credibility, reliability, and capacity to inform data-driven recommendations for SMEs and policymakers. The study findings connect with the study's results to broader research on technology adoption and provide a foundation for future empirical investigations.

The MLRA, as a statistical technique, ensures a comprehensive and robust data analysis. The MLRA technique allows for estimating relationships among variables with reason and results (Uyanık & Güler, 2013). The DV, BDA, were modeled as a function of the IV, such as technological readiness, organizational support, and external pressures. The modeling will help examine and assess the relative importance of each factor. Key MLRA assumptions such as linearity, homoscedasticity, normality of residuals, and the absence of multicollinearity was tested to ensure validity and reliability. To verify the authenticity of the assumptions, the variance inflation factor (VIF), residual plots, and the Durbin-Watson test were conducted to diagnose the test.

Data cleaning is essential to achieving effective data for analysis. The data cleaning process involves comprehensively streamlining data by removing errors and ensuring consistency and accuracy in the dataset (Jony et al., 2015). High-quality data is key to achieving reliable research findings because errors in data can lead to misleading conclusions, minimizing the accuracy of statistical findings. Erroneous, defective, and inconsistent data lead to low-quality outcomes, negatively impacting the research findings. Therefore, the purpose of the data cleaning was to increase the quality of data, leading to reliable research outcomes.

To increase the effectiveness of the study outcomes, data collected from the administration of the research instruments was cleaned as follows:

- (a) Collected data was categorized into nominal, discrete, ordinal, and continuous.
- (b) The data was put into structured and unstructured groups.
- (c) Each variable was statistically analyzed, including the demographic variables.
- (d) The collected responses were categorized into composite averages as average technological readiness (AverageTR), average organizational support (AverageOS), average external pressures (AverageEP), and average big data analytics (AverageBDA)
- (e) Durbin-Watson and variance inflation tests will be performed to test the reliability and validity of the data.
- (f) MLRA assumptions such as linearity, homoscedasticity, normality of residuals, and multicollinearity was tested.
- (g) If any of these assumptions fail, Spearman's correlation analysis will be performed. Spearman's correlation analysis provides a non-parametric alternative to assess the strength and direction of monotonic relationships between variables.

The collected data were validated and presented using tables, charts, and graphs. Presenting data with charts, tables, and graphs breaks down the complexity of what the data entails. Visualizing data effectively communicates what the data represents, highlighting trends, relationships, and outliers, which may not be visible in raw data.

When data is effectively presented, conclusions are drawn to comprehend the research work clearly.

Threats to Validity

Many factors can undermine the accuracy and reliability of research findings, potentially leading to incorrect conclusions. In research, threats are any events or extraneous variables that confound the DV (Giannattasio, 1999). These variables can influence the research outcome, invalidating the study's findings. Threats such as participant selection differences, history, instrumentation, and maturation can compromise the validity of the research result if not treated. The aforementioned variables can undermine the integrity of the research outcome by introducing biases that thwart the relationship between measured variables.

Literature on validity includes internal, external, construct, and statistical conclusion validity as threats that can distort research findings. According to Campbell and Stanley (1963), addressing threats to validity provides trustworthiness, reproducibility, and meaningful research. Imperatively, the study design must be thoughtfully rigorous to minimize the potential threats of extraneous variables in the research study. Safeguarding validity strengthens users' confidence and validates the outcome of the research study. Addressing threats to validity effectively enhances the research's contributions to a broader body of knowledge.

External Validity

Validity in a research study is crucial because it impacts the generalizability of research findings. External validity pertains to the extent to which the study findings are

generalized beyond the research study's specific condition (Cuncic, 2024). A key concern of external validity rests on the sample size used in collecting data; just as a threat to the validity of the research study, ensuring that such threat is addressed is meaningful to extend the application of the study findings beyond the immediate study sample and setting. Threats to external validity, such as selection bias and situational factors, can be improved by increasing sampling diversity, ensuring transparency in the selection process, and conducting the study in natural settings.

In this research study, the sample size threat was dealt with using G*Power 3.1.9.7 with a priori power analysis to compute the sample size. The G*power 3.1.9.7 software is a statistical power analysis tool used to determine the appropriate sample size for a study (Kang, 2021). I employed the effect size of 0.15, alpha at 0.05, power at 0.95, and the subsequent number of predictors equaling three were used to determine the sample size. These variables are the set standards, ensuring the ethical use of participants by avoiding unnecessarily large or small samples. The methodology provides clear evidence that assures users of the study of the extensive strategies undertaken by the researcher to deal with external threats.

Another potential issue that the study may encountered was participants' bias. Participant bias occurs when participants try to provide answers to research questions that may not reflect the actual situation on the ground (Fink, 2024). Participants alter their behavior because they must provide information about themselves and their business decision-making process. Such a decision may impact the generalizability of the research data and the resulting findings. Participant bias was addressed by assuring participants

that the data collected will be used purposefully for this research study and that no part will be used for other purposes. A test study was conducted to test the research study's results before helping to alleviate external validity.

Internal Validity

Internal validity is the level at which the observed outcomes truly represent the population of interest in the study. Ensuring internal validity is essential for drawing reliable conclusions from the research study. Internal validity helps to eliminate alternative explanations for the study findings (Cuncic, 2024). The main idea of internal control is to measure how well the results reflect the studied population, most importantly in establishing a causal relationship between the research variables. Ensuring internal validity means designing a study with strong control, consistency, and careful measurement. Without these, the study may identify unintended relationships deviating from their outcomes.

Internal validity threats, such as attrition, are feasible when a sampled participant decides not to complete the study. Participants dropping out of the research study is possible, resulting in a biased sample of the only participants who choose to continue the study. Another threat may result from a situation where an outcome variable can be from some other type of another variable outside what is been measured. Referred to a confounding variable, this extraneous variable systematically influences the independent variable, potentially distorting the research results. Internal validity depends largely on the study's procedures and how carefully it is performed.

Resolving these two identified threats is crucial to the validity and reliability of the research findings. Regarding attrition, research participants were assured of the confidentiality of any information they offer in this study. Providing assurance and information enhanced participants' understanding of the importance and potential benefits of the research study. The confounding threat was resolved through randomization of SMEs, ensuring that confounding is evenly distributed across the study SMEs. Adequate quality control measures were put in place through a thorough pilot study, pre-testing of study instruments, and data analysis techniques to increase reliability and validity of the study.

Construct Validity

The absence of construct validity can lead to false conclusions about the relationship between the research variables. Construct validity is often used to determine how well a test measures what it is supposed to measure (Piedmont, 2024). In this regard, constructing validity is essential in research studies to establish the overall validity and reliability of a specific testing methodology. Poor operationalization of the study variable is one major construct validity threat that hinders research studies. To address this problem, all variables used in the research study were well-defined by using validated instruments that have already been tested for reliability and accuracy.

Furthermore, the assumptions of multiple linear regression were tested in the study. Using multiple linear regression analysis in research requires the researcher to test all the assumptions of the statistical techniques. Testing assumptions assures that the research variables best fit the study's purpose (Verma & Abdel-Salam, 2019; Verma &

Chaurasia, 2019). The assessment of convergent and discriminant validity ensures that the constructs are accurately measured and demonstrate a strong correlation between the different measures of the same construct. By testing the correlation of the results from the survey, I was able to effectively measure the construct validity.

Subject bias emanating from participants' expectations about the research study threatens construct validity. According to Sjøberg and Bergersen (2023), subject bias is the influence of research participants' expectations, perceptions, or behavior on the result of the study. Participants' responses can potentially distort how best a construct is being measured. For instance, if participants respond with the belief expected rather than truthfully and honestly, the data collected may not reflect the underlying construct. A confidentiality assurance letter and validated, triangulated research instruments were employed to mitigate subject bias threats. The strategy helped improve the likelihood of the construct validity threat happening.

Ethical Procedures

The Walden University Institutional Review Board (IRB) consists of individuals responsible for ensuring that privacy, confidentiality, and ethical standards regarding the research study are met. The IRB ensures that all Walden University research studies comply with the institution's ethical standards and federal regulations (Walden University, n.d.). The IRB is committed to upholding high ethical standards in participant recruitment, data collection, participant rights, safety, and confidentiality. Walden affiliate research studies require review and approval from the IRB for data collection. Understanding the overview of the IRB ethics approval checklist is necessary to ensure

that each participant recruited for the study has consented to the procedures and processes involved in the research study.

In upholding the integrity of the study, ethical issues regarding recruitment were addressed to eschew undue influence. Each selected SME was provided with a letter clearly defining the objective of the research study. The letter provides information regarding the use of data that was collected and its purpose. Most importantly, participants were notified and assured of the privacy and anonymity of any information collected. Research participants' names were not requested; however, demographic information, such as age, years of experience, position, and years in the current position, was collected.

Participants who consented to continue the study had their information deleted from the research database. The privacy and confidentiality of participants are a significant concern for the researcher. Therefore, the data obtained from the participants for this research study had been considerably encrypted and archived for a minimum of 5 years. Notwithstanding, any concerns by participants were addressed, including protection from any harm through informed consent.

A partner organization agreement was signed to allow for a third party to transmit the survey link to the randomly selected SMEs. The strategy helped the researcher avoid direct contact and personal information about the selected SMEs. The survey link was distributed through WhatsApp, emails, and text messages. Disclosures were made to the participants, including the anonymity of participants' responses collected during the survey and the ethical requirements of Walden University. The IRB approval number

provided for this research is 11-06-25-1177892. The research participants were provided with complete information on how to contact me anytime issues of confidentiality, privacy, or data protection requirements arise. Walden University contact information was provided for any enquiries regarding ethical concerns.

Summary

In Chapter 3, I detailed the research methodology, emphasizing the reason for selecting the theoretical foundation, research participants, and the population size. I employed quantitative descriptive survey with multiple regression analysis to examine how technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA. While random sampling was used to select SMEs, purposive sampling techniques were employed to sample the participants from the selected SMEs. Ethical considerations in this section were given much attention, as well as the reliability and validity of the research. Chapter 3 effectively provided detailed procedure for data cleaning. Threats to validity were external, internal, and construct validity, which were pivotal in the discussion of Chapter 3.

Chapter 4 is the preceding chapter, where the research study results were presented together with the pilot study. Chapter 4 contained the demographic characteristics of participants, data collection, data analysis, evidence of trustworthiness, study results, and a summary. Data was presented in tables, charts, and percentages where necessary to provide a succinct understanding of the collected data. Detailed survey results were provided in full within the appendices.

Chapter 4: Results

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The specific research problem addressed in this study is whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The study operationalized these three variables to examine their individual and collective effects on BDA adoption among SMEs in a developing country setting, such as Ghana. Using empirical statistical tools, the study addressed the gap in the literature and in practice on whether TOE influences SMEs in developing economies' adoption of BDA. I developed three research questions for the study with corresponding hypotheses.

RQ1: To what extent does technological readiness influence SMEs' adoption of BDA in Ghana?

H_01 : There is no significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

H_11 : There is a significant influence of technological readiness on SMEs' adoption of BDA in Ghana.

RQ2: To what extent does organizational support influence BDA adoption among SMEs in Ghana?

H_02 : There is no significant influence of organizational support on SMEs' adoption of BDA in Ghana.

*H*₁₂: There is a significant influence of organizational support on SMEs' adoption of BDA in Ghana.

RQ3: To what extent do external pressures influence SMEs' adoption of BDA in Ghana?

*H*₀₃: External pressures do not significantly influence SMEs' adoption of BDA in Ghana.

*H*₁₃: External pressures significantly influence SMEs' adoption of BDA in Ghana.

In this chapter, I reported the study's pilot study, data collection, and detailed analysis of participants' responses. Detailed information regarding participants' demographic characteristics was presented using tables and charts. Descriptive and inferential statistics were employed, along with statistical tests such as multiple linear regression and hypothesis testing, and the assumptions of MLRA. I summarized the study's findings and provided a transition to Chapter 5.

Pilot Study

A pilot study was conducted with a sample size of five participants from the Greater Accra region of Ghana. The survey instruments were purposefully given to five participants to evaluate the research questions, clarity, feasibility, and the time required to complete the instruments. The participants involved in the pilot testing met the inclusion criteria as established for the main study. Participants were informed that participation was voluntary and were provided with informed consent. The link to the survey instruments was shared with participants by emailing the research flyer and sending a test

message. The participants took approximately 20 minutes to complete the survey, providing feedback on the clarity of the research variables.

The collected data for the pilot study were analyzed using the IBM SPSS version 30 (IBM Corp., 2024). Cronbach's alpha was used to test the internal consistency and reliability of the scales. The results showed acceptable reliability, with Cronbach's alpha of .749 and a standardized alpha of .750, exceeding the recommended threshold of .70 (Table 1). Additionally, the pilot study revealed some typographical errors in the research instrument, which were addressed. The pilot study helped in identifying the effectiveness of the research instruments. The data and results obtained from the pilot study were not included in the analysis of the main study.

Table 1

Cronbach's Alpha for the Pilot Study

Cronbach's Alpha	Reliability statistics Cronbach's Alpha based on standardized items
.749	.750

Note. $N = 5$.

Data Collection

The research instruments, as adapted from Huang et al. (2012), Nguyen et al. (2024), and Pizam et al. (2022), were captured on a Google Forms document. For ethical reasons, a link to the research instrument was emailed to the partner organization member to distribute the instrument through text messages and emails to the randomly sampled SMEs. The data collection process was initiated after obtaining an IRB approval. The

process took place from November 7 to November 20, 2025, with a total of 135 respondents participating in the study, excluding the five pilot participants.

No significant deviation from the original study plan was observed in Chapter 3. The initial plan was to send out the link containing the study instruments to 30 SMEs, from which four responses would be collected, totaling 120. However, due to some SMEs' reluctance to respond to the survey instrument, the initial sample frame was revised to include an additional 15 SMEs, resulting in a total of 45 SMEs. The partner organization member, therefore, sent the link to all 45 SMEs to obtain a reasonably complete response from participants. A total of 135 responses were received. The response rate constituted 100% of which 88.89% ($N = 120$) were valid after the data cleaning exercise. The disqualification of 11.11% ($n = 15$) of the responses was due to incomplete survey answers.

Due to a higher-than-expected response rate, data from 120 participants were included in the final analysis. The statistical power and responsiveness of the sample study were both improved by the valid responses. While aligning with the study's quantitative design and sampling approach, the higher sample size enhanced the dependability of the findings (Monti et al., 2024). The 120 participants enhanced trust in the study's findings' generalizability and offered a stronger foundation for answering the research questions.

Baseline Demographic Characteristics

The demographic characteristics of the participants were analyzed based on the responses provided by the participants through the survey instruments. All participants

agreed to participate in the research voluntarily before they could proceed. The demographic statistics included age, gender, educational level of participants, business category, number of employees, years of experience in the business, and position within the business. The demographic characteristics provided a baseline for the participants in this research study.

Table 2 illustrates the age and gender statistics of respondents. The analysis shows that most respondents, 35.8% (34), were between 26 and 32 years old, while 31.7% were between 33 and 40 years old. Participants aged 49 years and above accounted for only 3.3%. The gender statistics comprised 65.8% males and 34.2% females. According to these statistics, most SMEs meeting the inclusion criteria had predominantly male, youthful workforces.

Table 2*Age and Gender Statistics*

	<i>N</i>	%
18 – 25 years	20	16.7%
26 – 32 years	43	35.8%
33 – 40 years	38	31.7%
41 – 48 years	15	12.5%
49 years and above	4	3.3%
Female	41	34.2%
Male	79	65.8%

Note: *N* = 120.

Table 3 presents the positions held by the research participants in the sampled SMEs. 40.8% of the respondents were other employees, 18.3% owner managers, and 16.7% were Supervisors. Managers who were not owners of the sampled business accounted for 12.5%, and IT professionals accounted for 11.7%. According to these statistics, the majority of respondents are other employees involved in SME decision-making.

Table 3*Position in Business*

	<i>N</i>	%
IT Professional	14	11.7%
Manager (Not owner)	15	12.5%
Other Employee	49	40.8%
Owner Manager	22	18.3%
Supervisor	20	16.7%
Total	120	100%

Table 4 presents the participants' educational backgrounds. Most participants held a bachelor's degree (44.2%), 41.7% held a master's degree, 5.0% held a diploma, and 4.4% held a higher national diploma. The educational background of the participants indicates that, predominantly, they are well-educated, with over 85% holding at least a bachelor's degree or higher. Also, the analysis shows that the sampled participants have higher levels of literacy and critical thinking skills, and potentially better management skills, than the general population.

Table 4*Educational Background*

	<i>N</i>	%
High School Diploma	2	1.7%
Diploma (2 years)	6	5.0%
Higher National Diploma (3 years)	4	3.3%
Bachelor's degree	53	44.2%
Master's degree	50	41.7%
Ph.D.	4	3.3%
Professional Certificate	1	0.8%
Total	120	100%

Tables 5 and 6 illustrate the number of years a respondent has spent in the business and the number of employees in the business, respectively. Participants with 2–3 years in the business accounted for 50%, those with 4–6 years for 20.8%, and those with 7–11 years for 17.8%. Relative to the sampled SMEs, those with 41 employees or more and those with 21–40 employees constituted the largest groups, at 36.7% and 34.1%, respectively (Table 6). Based on the analysis, insights gained from these participants are more reflective of recent industry trends and the evolving business challenges faced by employees.

Table 5*Years Working in Business*

	<i>N</i>	%
2 – 3 years	60	50.0%
4 – 6 years	25	20.8%
7 – 11 years	21	17.5%
12 years and above	14	11.7%
Total	120	100%

Table 6*Number of Employees*

	<i>N</i>	%
Less than 10 employees	20	16.7%
11 - 20 employees	15	12.5%
21 - 40 employees	41	34.1%
41 employees and above	44	36.7%
Total	120	100%

Table 7 indicates the category of business to which the sampled SMEs belong. 21.7% of the sampled SMEs belong to the information technology, software, and telecommunication sector, 16.7% to the transportation and logistics sector, and 15.8% to the retail and wholesale category. Health and medical services constituted 15%, mining and construction accounted for 12.5%, and the least were others with 5% which were not explicitly stated in the survey instruments. In this case, the *other* business refers to all categories of businesses that are not listed in Table 7. The largest categories, which include information technology, software, and telecommunications, and transportation and logistics, indicate that many of the respondents' SMEs are in service-oriented businesses.

Table 7*Category of Business*

	<i>N</i>	%
Agribusiness and Agriculture/farming	10	8.3%
Education and training	6	5.0%
Health and medical services	18	15.0%
Information technology/Software/telecoms	26	21.7%
Mining and construction	15	12.5%
Others	6	5.0%
Retail/Wholesale	19	15.8%
Transportation and logistics	20	16.7%
Total	120	100%

Proportionality to Larger Population

One hundred and twenty responses were received from 135 participants who were sent the survey instruments for the research study. The response rate constitutes 88.89% (120), and these were fully completed. There were over 595 SMEs that met the inclusion criteria; however, I conducted a random sample of 22.69% of the SMEs. The 22.69% were informed by the G*Power determinants of the minimum sample size for the research study.

Study Results

This section of the study presents the results of the data obtained from the research participants on the determinants of BDA adoption among SMEs in Ghana. The section presents the empirical analysis drawn from the examination of data gathered from the study participants, using a quantitative descriptive survey with MLRA. The findings are presented clearly and methodically, free from interpretation or conjecture, and are

logically arranged in accordance with the study's objectives and hypotheses. The analysis of data was presented using tables and figures.

The demographic features of the participants were analyzed and presented at the beginning of the chapter, followed by a description of the pilot study. The descriptive statistics, which describe the primary features of the data, are presented in the results section. The important factors impacting BDA adoption among SMEs are then determined and evaluated through inferential statistical analysis. Together, these analyses provide the empirical basis for the discussion chapter that follows, in which the results are evaluated in light of theoretical frameworks, current research, and practical and policy implications.

Descriptive Statistics

The DV and IVs were measured using a seven-point Likert scale, with values ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*) (Appendix C). To ensure the effective analysis of the survey items, I coded the research instrument items as shown in Appendix D. The coded items were then uploaded into IBM SPSS version 30 with the corresponding scale unit of measurement (IBM Corp., 2024). The study employed MLRA; hence, interval ratio variables were required. The Likert scale measurement provides the most effective way of measuring respondents' responses.

To define the study construct, measures of central tendency were computed, considering the mean scores, and dispersion using the standard deviation. The central tendency was determined for the IVs using averages (Average technological readiness (AverageTR), Average organizational support (AverageOS), and average external

pressures (AverageEP), and the DV BDA (AverageBDA). Table 8 shows the mean and standard deviation for the variables in the research. The means ranged from 3.10 to 3.63, while the standard deviations ranged from 1.138 to 1.289. The range for the central tendency was relatively equal among the IVs, with lower scores for the DV.

Table 8

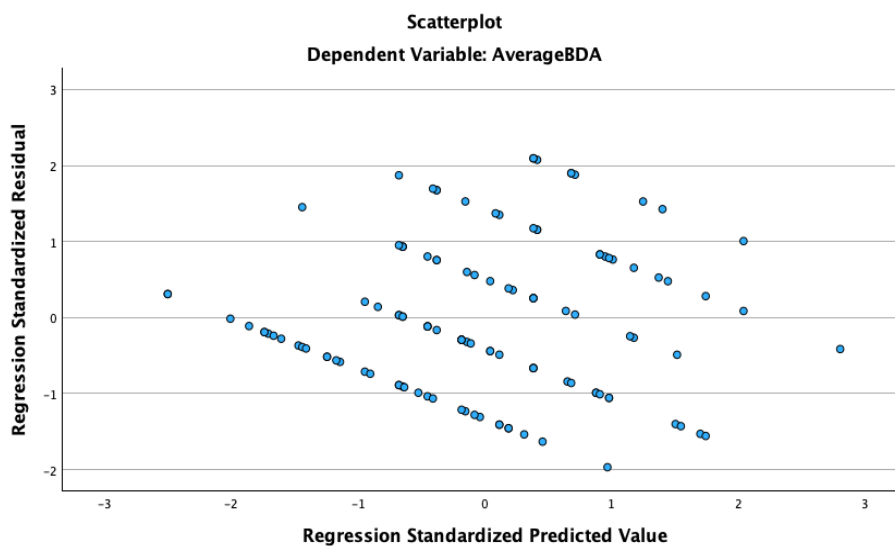
Descriptive Statistics

	Median	Mean	Mode	SD
AverageBDA	3.00	3.45	2	1.289
AverageTR	3.00	3.10	2	1.286
AverageOS	4.00	3.63	4	1.138
AverageEP	3.00	3.16	3	1.179

Note: $N = 120$.

Statistical Assumptions

Missing data and outliers. Figure 2 was used to inspect missing values and outliers. The scatterplot shows a discernible trend of standardized residuals, indicating the absence of missing data and outliers. Regarding this, the number of valid sampled responses, as earlier screened to 120, was maintained.

Figure 2*Scatterplot of the Standardized Residuals**Note: N = 120.*

Assumption of independence of errors. The Durbin-Watson statistic was used to verify the assumption of independence of errors. Table 9 presents the model summary, including the Durbin-Watson statistic of 2.549. According to Warner (2021), Durbin-Watson statistics within the range of 0 to 4 indicate no significant autocorrelation. Therefore, a value of 2.549 suggests there is a good level of independence among the residuals.

Figure 3*Multiple Regression Model Summary*

<i>R</i>	R^2	Adjusted R^2	SE	<i>p</i>	Durbin-Watson
.554	.307	.289	1.087	<.001	2.549

Note. Predictors: AverageEP, AverageOS, AverageTR, dependent variable: AverageBDA.

Assumption of Multicollinearity. Table 10 presents the multiple regression coefficients of the study variables, including the variance inflation factor (VIF), which indicates the extent to which the variation of a regression is bloated due to multicollinearity (Warner, 2021). The VIF values are below the standard threshold of 5, indicating that all predictors are sufficiently autonomous of each other. Even though AverageEP with a p -value of .051 is slightly higher than the threshold. The marginal increase does not invalidate its substantive contribution to the model. In other words, the marginal value in p -value does not affect the overall prediction of the IV (external pressures). The multiple regression model summary indicates that the model is significant at $p < .001$ (Table 9).

Table 9

Multiple Regression Coefficients

Predictor	<i>B</i>	Sig	SE	Beta	<i>t</i>	VIF
AverageTR	.213	.024	.093	.213	2.291	1.440
AverageOS	.353	.001	.100	.311	3.526	1.306
AverageEP	.192	.051	.097	.175	1.971	1.323

Note: $F(3, 116) = 17.118$, $p < .001$, $R = .554$, Adjusted $R^2 = .289$, $R^2 = .307$, Durbin-

Watson = 2.549. Dependent variable: AverageBDA. $N = 120$.

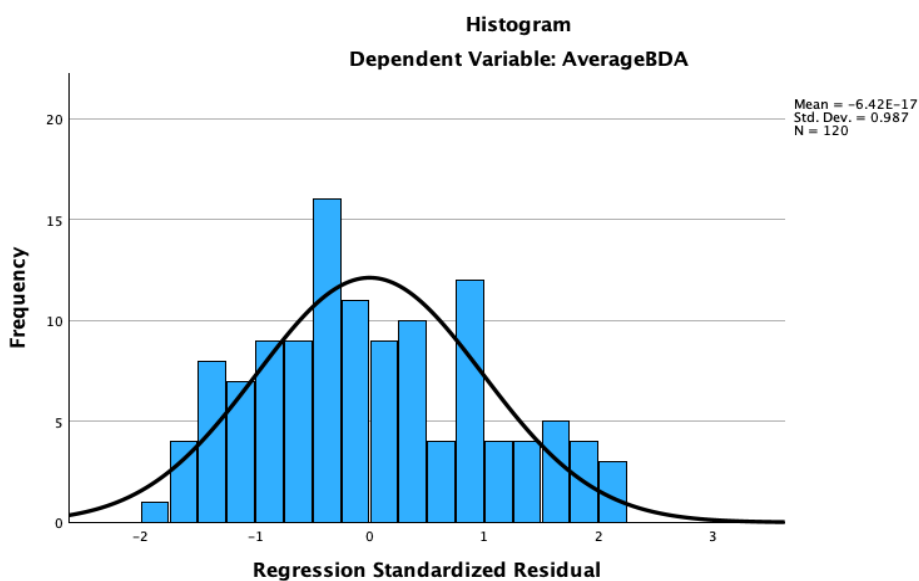
Assumption of normality. The point histogram in Figure 3 shows a normal distribution of the dependent variable. The measures of normality are centered around the central tendency; the mean, median, and mode are all located at the center of the distribution (Table 8). The figure showed a peak not at zero, indicating the tendency of a

skewed distribution. Figure 4 is the normal ($P-P$) plot, which provides supporting evidence that this assumption is met with no significant deviation from normality.

Because the points in Figure 4 appear to lie on a diagonal from the bottom left to the top right of the straight line, they do not significantly deviate.

Figure 4

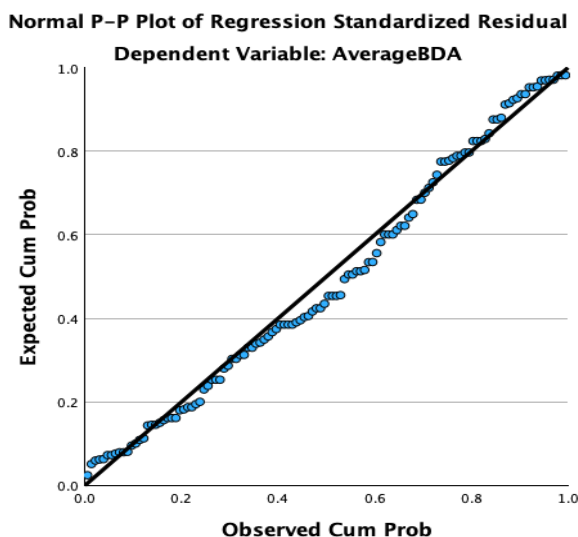
Histogram of the Regression Standardized Correlation



Note: $N = 120$.

Figure 5

Normal Probability Plot (P-P) of the Regression Standardized Residual



Note: N = 120.

The assumption of linearity. The scatter plot in Figure 2 shows a relationship in the dependent variables. The points are grouped around a straight line, indicating that the assumptions of linearity were met.

Statistical Inferential Analysis

This research study focused on using multiple linear regression analysis to examine whether TOE influences the adoption of BDA by SMEs. The effect size of 0.15, alpha level of 0.05, and power of 0.95 were employed to ensure that the study possessed sufficient statistical strength. I employed multiple linear regression to help examine the extent to which the three predictor variables significantly influence the outcome variable. The Pearson correlation coefficient test was conducted to answer the research questions, indicating the strength of the relationship between the two variables. According to

Warner (2021), Pearson's product-moment correlation or Pearson's correlation coefficient is a parametric test that provides information about the strength of the relationship between two quantitative variables. The strength of the relationship is measured with values ranging from -1.0 to +1.0, with a value of ± 1.0 indicating a perfect positive or negative linear relationship.

Three research questions were posed, along with their respective hypotheses, examining the extent to which technological readiness (TR), organizational support (OS), and external pressures (EP) influence SMEs' adoption of BDA. The three IVs were highlighted in the study analyses as AverageTR, AverageOS, and AverageEP. The DV is denoted in the analysis as AverageBDA. The regression model for the study was $BDA = \beta_0 + \beta_1 * TR + \beta_2 * OS + \beta_3 * EP + e$, where BDA is the dependent variable, β_0 is the intercept; β_1 , β_2 , and β_3 are the regression coefficients of TR, OS, and EP, and "e" is the error not explained, accounting for the variability in BDA adoption by the model.

Table 11 presents the Pearson's correlation coefficients for the study variables, highlighting the correlations between the various variables in the study. The model's overall relationship is statistically significant, $F(3, 116) = 17.118, p < .001, R = .554$, adjusted $R = .289, R^2 = .307$ (Table 10). The R^2 value of .307 means that the IVs explain 30.7% of the variance in the dependent variable.

Table 10*Pearson's Correlation Coefficient Among the Study Variables*

	AverageTR	AverageOS	AverageEP
AverageOS	.451		
AverageEP	.462	.365	
AverageBDA	.434	.471	.387

Note. Correlation is significant at the 0.01 level (2-tailed).

Research Question 1 (RQ1)

The first research question was to what extent technological readiness influences the adoption of BDA by SMEs in Ghana. The research question examines key elements, including infrastructure, internet connectivity, software availability, and IT expertise and skills. The objective is to examine how these elements, collectively referred to as TR, influence SMEs' adoption of BDA. The null hypothesis for RQ1 stated that there is no significant influence of technological readiness on the adoption of BDA by SMEs.

Based on Table 11, TR is a statistically significant predictor of BDA adoption among SMEs in Ghana. Per the model's formula, the coefficient of TR, which is β_1 , is .434, interpreted to be moderately positive strength ($\beta_1 = .434$, $N = 120$, $p < .001$). The finding indicated that TR contributes to explaining the variation in BDA adoption within the regression model. In this regard, the null hypothesis is rejected, and the alternative hypothesis (H_1) is supported, stating that there is a significant influence of technological readiness on the adoption of BDA by SMEs in Ghana.

Research Question 2 (RQ2)

The second research question is to what extent organizational support influences BDA adoption among SMEs in Ghana. In this study, organizational support includes organizational culture, strategic resource allocation, and strategic vision and mission. The hypothesis stated that there is no significant influence of organizational support on the adoption of BDA by SMEs in Ghana. Table 11 shows a significant relationship between OS and BDA adoption among SMEs. The regression coefficient, $\beta_2 = .471$, $N = 120$, $p < .001$, indicates a moderate positive effect, meaning that higher levels of organizational support are associated with greater adoption of BDA. The alternative hypothesis is supported, while the null hypothesis is rejected.

Research Question 3 (RQ3)

This research question examined the extent to which external pressures influence the adoption of BDA by SMEs in Ghana. The null hypothesis is that external pressures do not significantly influence the adoption of BDA by SMEs. The components of EP, as per this research study, were competitive pressure, regulatory requirements, and customer demand. According to Table 11, the regression coefficient for EP ($\beta_3 = .387$, $N = 120$, $p < .001$), which indicates a weak to moderate positive effect, suggesting that higher levels of external pressure are associated with increased BDA adoption. Based on the analyses presented in Table 11, it is evident that all three IVs reveal statistically significant relationships with the adoption of BDA. The findings lead to the rejection of the null hypotheses of the three research questions. Indicating that a change in any of the variables will have a proportionate change in SMEs' adoption of BDA.

Summary

The study's three research questions aimed to determine whether TR, OS, and EP influence the adoption of BDA by SMEs. The study broke down the research question into three, indicating the extent to which each of the IVs influences BDA adoption among SMEs. The objective of the study was achieved using the MLRA, providing positive correlation coefficients to determine the strength of the influence. The null hypotheses associated with the study's research questions were rejected.

Chapter 4 addressed the data collection section, pilot study analysis, participants' response rate, and demographic features of the participants. A total sample size of 120 was used. The descriptive statistics indicated that 34.2% of participants were female, while 65.8% were male. Fifty percent of the participants have been in the business for at most 2–3 years, with only 17.5% for 7–11 years. Furthermore, most of the selected SMEs have over 41 employees, with the smallest group having 11–20 employees, accounting for 12.5% of the sample.

Without any significant violation, the overall model was statistically significant at $p < .001$, indicating a strong relationship between the predictors and the outcome variable. TR, OS, and EP were found to have a significant moderate positive correlation with the outcome variable. Detailed discussions of the study findings will be made in Chapter 5. The study's limitations, recommendations, and potential positive social change impact will be presented in Chapter 5, along with the study's conclusions.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. This study employed a quantitative descriptive survey with MLRA to examine whether TR, OS, and EP influence the adoption of BDA by SMEs. The research study is highly relevant to today's ever-changing technological landscape. The ever-critical contribution of SMEs to economic growth, as measured by GDP and employment, makes it essential to address the identified gap by providing empirical insights into the extent to which TR, OS, and EP influence their adoption of BDA.

The analysis of data collected from the 120 study participants using quantitative survey instruments presents empirical evidence that answers the research questions. The analyses revealed that all three predictor variables have a significant influence on SMEs' adoption of BDA. The three predictors explain 30.7% of the variance in the BDA adoption among the participating SMEs in the study. The correlation coefficients for the predictors were all positive, indicating that as the value of a predictor increases, the value of the other variable also increases. This chapter presents an interpretation of the study findings. Chapter 5 also covers the study's limitations, provides recommendations for future research, discusses the implications for positive social change, and concludes with a summary.

Interpretation of Findings

This study primarily focused on examining whether TR, OS, and EP influence BDA adoption among SMEs in Ghana, using MRLA. MRLA was considered an appropriate analytical technique to evaluate the extent to which multiple IVs (TR, OS, and EP) jointly and individually predict a single continuous outcome variable (BDA). Uyanık and Güler (2013) stated that MLRA techniques enable the estimation of relationships among variables with reason and result. The MLRA provides strength and direction for the relationship. However, using the technique requires researchers to test assumptions. No serious violation of any of the MLRA assumptions was found in the data. Based on the regression model: $BDA = \beta_0 + \beta_1 * TR + \beta_2 * OS + \beta_3 * EP + e$, the relationship between each predictor variable and the outcome variable was assessed using the Pearson product-moment correlation coefficient.

The descriptive statistics (Table 8) revealed an important landscape for Ghanaian SMEs considering the adoption of BDA. OS has the highest-rated construct, with a mean of 3.63. The mean value indicated that primary stakeholders (owner-managers, supervisors, managers, and others) of SMEs are supportive and willing to allocate strategic resources to adopt BDA effectively. OS support in adopting BDA aligns with the RBV theory, where the proponents of the theory emphasized the idea that effective strategic management enables an organization to optimize technological preparedness to achieve a competitive advantage (Chen et al., 2024; Hussain et al., 2024; Miller, 2019; Wade & Hulland, 2004). In this regard, OS is considered essential for the adoption of technological advancements in Ghanaian SMEs.

TR and EP have the mean values of 3.10 and 3.16, respectively, with TR having the lowest mean. Even though OS exists, TR, such as infrastructure, internet connectivity, software availability, and IT expertise and skills, are critical. The findings underscore the importance of the study constructs, which corroborate prior studies outlining the potential importance of TR and EP in BDA adoption (Lai et al., 2018; Maheshwari et al., 2021). Additionally, the findings affirm both the TOE framework theory and the institutional theory, which recognizes the integration of technological advancements (Igwe et al., 2024; Iranmanesh et al., 2023; Lutfi et al., 2023), and how regulations, norms, and beliefs (DiMaggio & Powell, 1983) shape SMEs' adoption. Notably, the study constructs, which demonstrate mean values between 3.10 and 3.63, are deemed influential in the adoption of BDA by SMEs.

The analyses of the study results indicated that TR has a significant influence on SMEs' adoption of BDA in Ghana. The Pearson correlation coefficients (Table 11) for the study variables indicated the direction, along with the coefficient values of the predictors ($\beta_1 = .434$, $N = 120$, $p < .001$). The coefficient value indicates the extent to which the predictor variables influence the outcome variable. Pearson's correlation of $\beta_1 = .434$ denotes a moderate positive relationship between the predictor (TR) and the outcome variable (BDA). In this regard, the null hypothesis is rejected, and the alternative hypothesis, which states that there is a significant influence of TR on SMEs' adoption of BDA in Ghana, is accepted. Enhancements in TR are associated with a greater likelihood of adoption of BDA tools among SMEs.

The finding is consistent with the studies by Gangwar et al. (2023) and Maroufkhani et al. (2020), which found that technological assets largely influence a firm's ability to adopt BDA. Moreover, the study's findings supported the philosophical perspective of the RBV, which emphasizes that firms' distinctive competencies represent their most valuable assets (both internal and external) and are key to decision-making. Organizations must ensure effective management of their technological readiness to maintain a competitive advantage. The significant influence of TR underscores that BDA adoption among Ghanaian SMEs is not a straightforward task; it is a resource-intensive capability that requires investment in both technology and human capital.

The question of the extent to which OS influences BDA adoption among SMEs is answered. The results further revealed that OS has a significant influence on SMEs' adoption of BDA in Ghana (Table 11). The correlation coefficient for the variable in question, as in the model, is $\beta_2 = .471$ ($N = 120$, $p < .001$), providing the strongest predictor in the study model. In this case, the null hypothesis is unequivocally rejected. Within the TOE framework, OS highlighted the characteristics of firms (Lai et al., 2018). OS encompasses organizational culture, strategic resource allocation, and the strategic vision and mission of SMEs. The culture, resource allocation, and strategic vision and mission of SMEs are usually centered around their stakeholders; the strategic intent of stakeholders is the most valuable resource.

The findings are understood within the TOE framework, particularly in the organizational context, which emphasizes the characteristics of firms in adopting new technologies. Additionally, the finding aligns with the RBV theory of the firm, which

posits that an organization's unique internal capabilities are critical for achieving a competitive advantage (Chen et al., 2024). SMEs with strong OS are more likely to adopt BDA, even if they have lower technological readiness, whereas SMEs with low OS but high technological readiness will likely stagnate.

The question was as follows: to what extent do external pressures influence SMEs' adoption of BDA in Ghana? The EP (AverageEP) in Table 10 shows a standardized beta of 0.175 with a p-value of 0.051, which is slightly above the minimum threshold of 0.05. Given the sample size ($N = 120$) and the correlation coefficient of $\beta_3 = .387$, the result is interpreted as practically significant. Per the variance inflation factor (VIF), there is no multicollinearity, which suggests that EP contributes unique variance to the model. Therefore, EP has a significant influence on SMEs' adoption of BDA, rejecting the null hypothesis.

The significant influence of EP is best understood through the institutional theory. The institutional theory posits that firms are influenced and shaped by their external environment (Lutfi et al., 2022; Selznick, 2011; Soares et al., 2021). In light of this study, the EP consisted of competitive pressure, regulatory requirements, and customer demand. Although the EP contributes to the influence of SMEs on BDA, the results further indicate that Ghanaian SMEs are partially adopting BDA in response to competitive pressure, regulatory requirements, and customer demand.

The weaker influence of EP suggests that the BDA market in Ghana remains in a reasonably early stage of adoption. The lack of a saturated BDA market suggests that the pervasive "adopt or die" approach, driven by competitiveness, has not yet become the

predominant one. The adoption process is predominantly shaped by internal aspirations and organizational backing rather than external influences. This suggests that although competitive pressures are present, they do not serve as immediate catalysts for adoption at this preliminary phase.

Nevertheless, the findings on TR, OS, and EP align with existing literature. Aldossari et al. (2023), Lai et al. (2018), and Lutfi et al. (2022) found that TR, OS, and EP influence organizations' adoption of technology for competitive use. The findings further confirm Maroufkhani et al. (2023), and Babalghaith and Aljarallah (2024) study that technological readiness, top management support, and competitive pressure significantly influence BDA adoption decisions across various economic contexts. These findings validate the study's integrated analytical model, which draws on the TOE framework, RBV theory, and institutional theory. The model demonstrated nuance in analyzing BDA adoption in developing countries such as Ghana.

Limitations of the Study

There are limitations that must be recognized, despite the study's important contributions to highlighting the factors impacting SMEs' adoption of BDA. For the study's results to be interpreted effectively, these limitations must be acknowledged. Understanding the limitations also gives future researchers the chance to expand on and improve the findings of this study. The limitations of this quantitative descriptive survey, in addition to those identified in Chapter 1, are categorized into three areas: design, population, and measurement.

Design Limitations

Regarding the research design, the study employed a quantitative descriptive survey, which is characterized by using numeric values in collecting participants' responses. The study captured data at a single point in time, which limits the researcher's ability to observe how the variables in the survey evolve. The category of SMEs in the study was not fairly represented. Time and money constraints limited the analysis; therefore, I had to stay focused and work extra hours to bring this study to completion.

Population Limitations

The study is limited by its population and geographical scope. The study primarily focused on SMEs in Ghana, with those in the GEA database. The SMEs in the database do not represent all SMEs in Ghana, limiting the homogeneity of the features of SMEs in Ghana. The sample size of $N = 120$ respondents was statistically sufficient to perform statistical analysis. However, the results cannot be generalized to large corporations, as SMEs operate in a different cultural and economic context.

Measurement Limitations

This study relied solely on self-reported data collected via a seven-point Likert scale. The Likert scale gauges against participants' expectations, emotions, and experiences. Participants' perceptions regarding the survey study were not included in this study. These constraints limit the ability to obtain actual investments made by SMEs in TR and OS. I was unable to overcome this constraint since I had to rely solely on the measurement scales.

Recommendations

This study holds essential relevance for SMEs, governments, policymakers, and future researchers. SMEs are critical businesses in every economy, contributing to economic growth, GDP, and employment (Zafar & Mustafa, 2017). The study's findings revealed that TR, OS, and EP all significantly influence BDA adoption, with OS being the strongest predictor among SMEs in Ghana. The study is grounded in the TOE framework, RBV theory, and the institutional theory, providing a strong lens for determining factors influencing SMEs' adoption of BDA. The study recommendations are categorized into three specific stakeholders: SME owner-managers, policymakers, government leaders, and future researchers.

SME Owner Managers

SME owner-managers must prioritize strategic leadership, as OS was the strongest predictor variable. Leadership must champion data initiatives and invest in technological tools to enhance the adoption and use of BDA. Leadership must not view technological advancement as a functional business activity but consider IT as a strategic leadership operation to survive a changing competitive business environment. Given that TR influences SMEs' adoption of BDA, investing in human capital alongside infrastructure must be a top priority for owner-managers. Balancing upskilling employees and infrastructure acquisition is paramount for achieving a sustainable competitive edge. SMEs must form collaborative networks to share the costs associated with software development and licenses. Collaborative networks will enable SMEs to learn from one another, thereby transforming competitive pressure into opportunities for growth.

Policymakers and Government

The literature cited the lack of digital infrastructure as hindering the business of developing countries in adopting BDA. Lai et al. (2018) and Lutfi et al. (2023) found that inadequate infrastructure, including cloud computing and internet speed, affects an organization's ability to implement new and advanced technologies. The descriptive statistics showed the lowest mean for TR, indicating its bottlenecks. The government should consider partnering with the private sector to provide cost-effective digital network infrastructure, helping to enable SMEs to adopt BDA technologies. The government should provide tax incentives for SMEs that invest in digital infrastructure to encourage technological adoption. The government, through the Ministry of Trade and Communications and the Ministry of Technology and Innovation, should launch awareness campaigns and training programs for SMEs on BDA and its relevance to business operations, creating a supportive regulatory environment to encourage technology adoption.

Future Research

As noted in the limitations, future researchers should extend the findings of this study by leveraging its empirical strengths and addressing the gaps identified in the literature review in Chapter 2. Although the study integrated TOE, RBV, and the institutional theory, which provided a robust examination of the factors influencing BDA adoption among SMEs, the cross-sectional study limits the ability to capture changes in adoption over time. Therefore, employing longitudinal studies to track SMEs' adoption of BDA over a period of 1 to 5 years will bridge the gap in limitations. Longitudinal

studies reveal how OS evolves as a firm begins to see the return on investment from initial data investment.

While the MLRA provided strong evidence of the influence of SMEs' adoption of BDA, it lacks the depth of "how". Future researchers should employ mixed methods, integrating interviews and case studies to unearth other specific variables that influence adoption. The geographical scope of the study is limited to SMEs in the GEA database; future researchers should consider expanding the scope to include all SMEs in Ghana, with a larger sample size that is heterogeneous in structure. Future researchers should consider examining other mediating and confounding factors that act as catalysts in influencing BDA adoption. The gaps in the literature, as revealed in Chapter 2, indicate that security and ethical concerns remain underexplored. Future researchers should consider examining the extent to which security and ethical concerns impact SMEs' adoption of BDA.

Implications

Understanding the significance of these implications is essential to drive positive social change and influence policy initiation, development, and implementation in technology adoption. The study statistically validates the TOE framework, coupled with the RBV and institutional theory, providing substantial implications beyond mere description. The findings of this study present significant implications not only for the SMEs themselves but also for individuals, organizations, families, and the broader society. This section included the study's potential implications for individuals, organizations, families, society, and policy.

Individual

At the individual level, the results of this study suggest that SME owners, managers, and employees in Ghana are crucial to the adoption of BDA. Adoption decisions and efficient use are greatly influenced by factors including digital literacy, analytical abilities, and attitudes toward technology. To improve individual competence and trust in BDA tools, SMEs should focus on capacity-building programs, professional training, and provide avenues for ongoing learning. In SMEs, empowering people with pertinent skills can boost productivity, creativity, and data-driven decision-making leading to sustainability.

Family

Literature suggests that BDA adoption can help increase business stability and financial sustainability for families, especially those whose principal sources of income are SMEs. Better data-driven decision-making could boost household economic security, lower business failure rates, and improve SME performance. Families may also have an indirect impact on adoption by influencing the long-term planning, investment choices, and risk tolerance of entrepreneurs. Emphasizing the value of family support networks promotes skill improvement, openness to technology, and reinvestment in company expansion.

Organizations

For SMEs in Ghana to successfully implement BDA, internal determinants such as resource availability, organizational readiness, data culture, and leadership commitment must be addressed at the organizational level. Businesses are more likely to

use BDA for a competitive advantage if they invest in suitable infrastructure, knowledgeable staff, and encouraging management techniques. To improve efficiency, innovation, and market responsiveness, SMEs should incorporate BDA into their strategic planning, match analytics projects with corporate objectives, and cultivate a culture that prioritizes evidence-based decision-making.

Society and Policy

The study suggests that wider institutional and environmental elements, including digital infrastructure, regulatory frameworks, financing availability, and government assistance programs, are important predictors of BDA adoption among SMEs in Ghana from a sociological and policy standpoint. These results can be used by policymakers to create focused initiatives to reduce adoption hurdles, such as public-private partnerships, training programs, subsidies, and incentives. In addition to increasing SMEs' competitiveness, strengthening national data ecosystems and policies that support them can boost economic growth, create jobs, and promote sustainable development.

Theoretical Implications

The results validate the significance of the TOE framework, RBV, and the institutional theory in comprehending technology adoption in SMEs. The validation of the three underpinning theories extends their significance within the low-income and developing countries, specifically in Ghana. This study bridges the historical gap, demonstrating that the TOE framework is not culture-bound but continues to maintain exploratory power in developing economies. The study enriches the RBV theory by providing empirical evidence that intangible resources are critical determinants of

technology adoption, more so than tangible resources. The findings extend the RBV by suggesting that an organization's vision, mission, and culture act as a primary antecedent that mobilizes other resources. With institutional theory, the study contributes to enriching the theory by acknowledging that the strength of the theory varies depending on the maturity of the market and the specific technology being introduced. Therefore, stakeholders must apply the institutional theory dynamically.

Implications for Practice

This study provides practical implications grounded in its statistical evidence. The findings showed that OS was high while TR was low-rated. The situation exhibits a capability gap. Which means that while OS is willing to adopt BDA, there is an infrastructural deficit. In this sense, a practical strategy must move from merely desiring analytics to actively building the necessary digital backbone. Stakeholders must invest in advanced technological tools to practically benefit from BDA adoption. Although the study established the importance of EP, this variable does not exert a significant dominance. Government leaders and policymakers should formulate policies that will benefit and encourage SMEs to adopt BDA.

Implications for Social Change

The study focused on SMEs, which constitute the foundation of every economy. The implications for positive social change are that it enhances the use and adoption of BDA among SMEs. BDA adoption at the individual level generates a demand for a workforce proficient in data literacy and analytical reasoning, resulting in workforce upskilling and enhanced employability, which eventually provides financial benefits to

families. SMEs' stability is strongly linked to their profitability and household welfare; as these enterprises enhance operations and increase profitability with BDA, employees' standard of living improves. Organizationally, adopting BDA facilitates a transition to evidence-based management, encouraging rational decision-making that improves competitiveness, decreases failure rates, and stabilizes the local labor market. The extensive adoption of BDA by SMEs can stimulate national economic growth. At the policy level, enhancing technological readiness through infrastructure development is crucial to democratize technology access, ensuring that the advantages of data-driven innovations benefit smaller enterprises and foster inclusive economic growth nationwide.

Conclusions

The purpose of this quantitative descriptive survey study was to examine whether technological readiness, organizational support, and external pressures influence SMEs' adoption of BDA in Ghana. The results of the analysis revealed that TR, OS, and EP have a significant influence on SMEs' adoption of BDA. Among the three predicted variables, OS is the strongest predictor of BDA, while EP is considered to have the lowest coefficient value. The study was grounded in the TOE framework, RBV theory, and the institutional theory, bridging the gap in the information systems literature in developing economies.

The study illuminated the complex ecosystem in which Ghanaian SMEs operate, a landscape characterized by high managerial ambitions yet limited infrastructural realities. The findings of the study indicate that while OS demonstrate a high-level ambition and interest to leverage BDA, their efforts are often constrained by inadequate technological

infrastructure and capacity gaps. The tension between the OS's willingness to adopt and the actual reality underscores the challenges SMEs face in translating strategic intent into data-driven practices. Ultimately, cultivating a data-driven culture within these firms is crucial for establishing a more inclusive economy, closing the digital divide, and ensuring that the benefits of technological progress are accessible to all, thereby facilitating sustainable development in Ghana.

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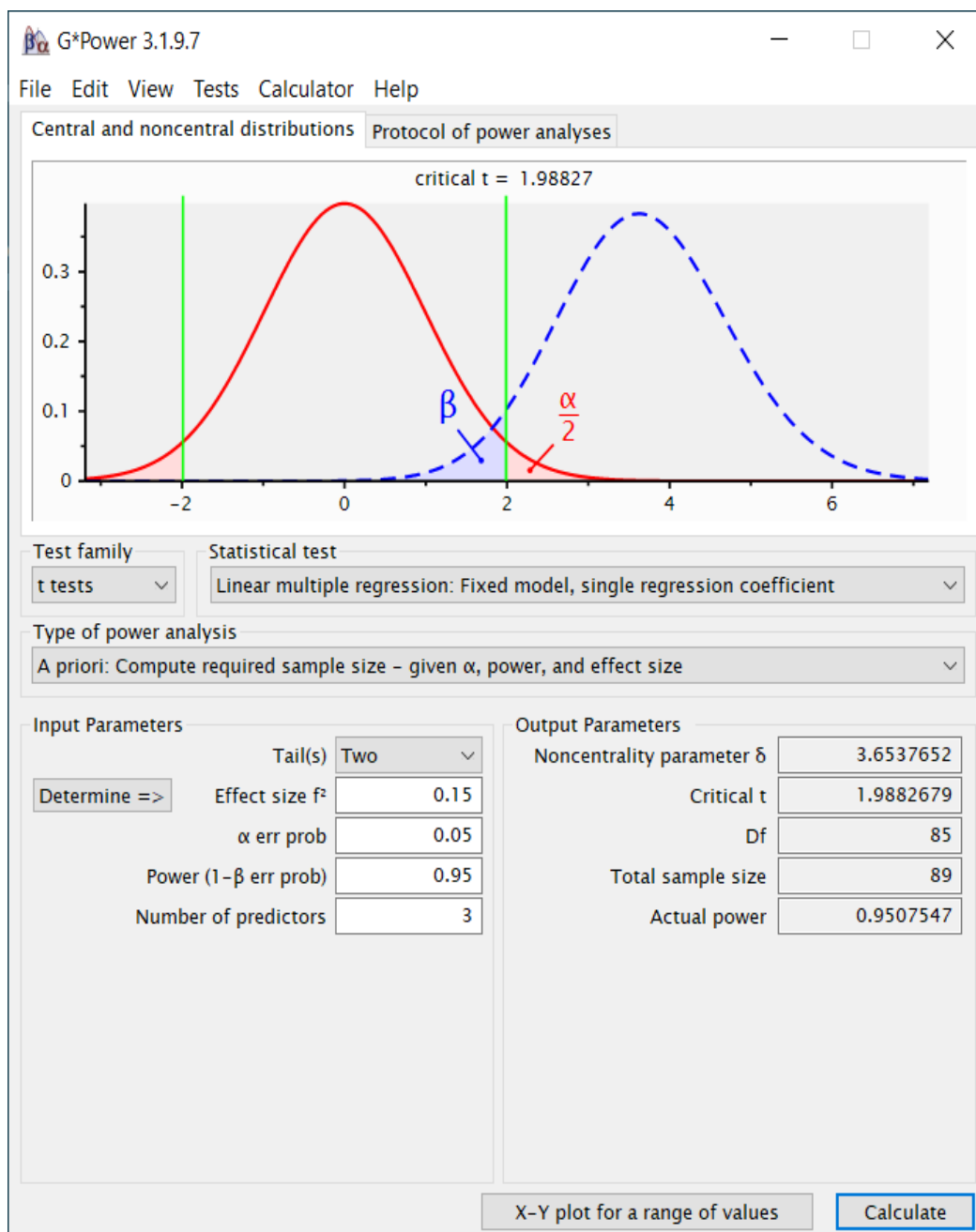
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Appendix A: G*Power Analysis Detailing Sample Size



Appendix B: Research Instrument Permission Statement

APA PsycTests®

Hotel Managers' Intentions to Adopt Robotic Technologies--Model

Note: Test name created by APA PsycTests

APA PsycTests Citation:

Pizam, A., Ozturk, A. B., Balderas-Cejudo, A., Buhalis, D., Fuchs, G., Hara, T., Meira, J., Revilla, M. R. G., Sethi, D., Shen, Y., State, O., Hacikara, A., & Chaulagain, S. (2022). Hotel Managers' Intentions to Adopt Robotic Technologies--Model [Database record]. Retrieved from APA PsycTests. doi: <https://dx.doi.org/10.1037/t88832-000>

Instrument Type:

Inventory/Questionnaire

Test Format:

Items are rated using a 7-point Likert scale.

Source:

Pizam, Abraham, Ozturk, Ahmet Bulent, Balderas-Cejudo, Adela, Buhalis, Dimitrios, Fuchs, Galia, Hara, Tadayuki, Meira, Jessica, Revilla, Mercedes Raquel García, Sethi, Deepa, Shen, Ye, State, Olimpia, Hacikara, Ahmet, & Chaulagain, Suja. (2022). Factors affecting hotel managers' intentions to adopt robotic technologies: A global study. *International Journal of Hospitality Management*, Vol 102, 1-15. doi: <https://dx.doi.org/10.1016/j.ijhm.2022.103139>, © 2022 by Elsevier. Reproduced by Permission of Elsevier.

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Factors Influencing the Adoption of Data Mining Tools Questionnaire

Note: Test name created by PsycTESTS

PsycTESTS Citation:

Huang, T. C.-K., Lui, C.-C., & Chang, D.-C. (2012). Factors Influencing the Adoption of Data Mining Tools Questionnaire [Database record]. Retrieved from PsycTESTS. doi: <https://dx.doi.org/10.1037/t34054-000>

Instrument Type:

Inventory/Questionnaire

Test Format:

The 42 items on the Factors Influencing the Adoption of Data Mining Tools Questionnaire are rated on a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7).

Source:

Huang, Tony Cheng-Kui, Liu, Chuang-Chun, & Chang, Dong-Cheng. (2012). An empirical investigation of factors influencing the adoption of data mining tools. *International Journal of Information Management*, Vol 32(3), 257-270. doi: <https://dx.doi.org/10.1016/j.ijinfomgt.2011.11.006>, © 2012 by Elsevier. Reproduced by Permission of Elsevier.

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APA PsycTests®

Organizational Digitalization--Measurement Model

Note: Test name created by APA PsycTests

APA PsycTests Citation:

Nguyen, N., Dang-Van, T., Vo-Thanh, T., Do, H.-N., & Pervan, S. (2024). Organizational Digitalization--Measurement Model [Database record]. Retrieved from APA PsycTests. doi: <https://dx.doi.org/10.1037/t95011-000>

Instrument Type:

Inventory/Questionnaire

Test Format:

All items are assessed using a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Source:

Adapted from Nguyen, Ninh, Dang-Van, Thac, Vo-Thanh, Tan, Do, Hai-Ninh, & Pervan, Simon. (2024). Digitalization strategy adoption: The roles of key stakeholders, big data organizational culture, and leader commitment. *International Journal of Hospitality Management*, Vol 117, 1-11. doi: <https://dx.doi.org/10.1016/j.ijhm.2023.103643>. © 2023 by The Author(s). Reproduced under a Creative Commons Attribution 4.0 International Deed (<https://creativecommons.org/licenses/by/4.0/deed.en>).

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Appendix C: Survey Instrument

Determinants of Big Data Analytics Adoption Among Small and Medium-Sized Enterprises in Ghana

Anonymous Survey Consent Form

You are invited to complete an anonymous survey for a Walden University doctoral study. To provide your informed consent, please review the information below and continue on to the survey if you choose to proceed.

Your role:

- is completely voluntary and can end at any time you wish
- is anonymous (your name will not be requested)
- involves completing a questionnaire
- involves little or no risk

Privacy:

To protect your privacy, the researcher will not collect, track, or store your identity or contact info. In place of a consent signature, your completion of the questionnaire would indicate that you consent to your responses being analyzed in the study.

Data will be kept secure by using password-protected devices and platforms. Data will be kept for a period of at least 5 years, as required by the university.

Once the doctoral student graduates, the study's results will be posted online in [Scholarworks](#) (a searchable publication of Walden University research).

Contacts and Questions:

Questions about the study can be emailed to the student researcher via seth.owusu@waldenu.edu. If you want to talk privately about your rights as a participant or any negative parts of the study, you can call Walden University's Research Participant Advocate at 612-312-1210 or email IRB@mail.waldenu.edu. Walden University's ethics approval number for this study is 11-06-25-1177892.

You might wish to retain this consent form for your records. You may ask the researcher or Walden University for a copy at any time using the contact info above.

By clicking here, I am agreeing to participate. *

Agree

⋮

Section A: Demographic Characteristics

Description (optional)

1. Gender *

Male

Female

I prefer not to say

:::

2. Age: *

- 18 – 25 years
- 26 – 32 years
- 33 – 40 years
- 41 – 48 years
- 49 years and Above

3. Position in Business *

- Owner Manager
- Manager (Not owner)
- IT Professional
- Supervisor
- Other Employee

:::

4. Educational Background *

- High school Diploma
- Diploma
- Higher National. Diploma
- Bachelors Degree
- Masters Degree
- Ph.D.
- Professional Certificate
- Others

5. How long have you been working in this particular business *

- 2 – 3 years
- 4 – 6 years
- 7 – 11 years
- 12 years and Above

⋮

6. How many employees are in your business *

- Less than 10 employees
- 11 – 20 employees
- 21 to 40 employees
- 41 employees and Above

7. Which of these categories best describe your business *

- Agribusiness and Agriculture/Farming

- Retail/Wholesale
- Transportation and logistics
- Information technology/Software/telecommunication
- Healthcare and medical services
- Mining and construction
- Education and training
- Others

:::

Section B: Technological Readiness, Organizational Support, and External Pressures

Description (optional)

1. Our employees are experienced with IT. *

- Strongly Disagree
- Disagree
- Disagree slightly

- Neither disagree nor agree
- Agree slightly
- Agree
- Strongly agree

2. Our employees have a strong technical IT skills. *

- Strongly Disagree
- Disagree
- Disagree slightly
- Neither disagree nor agree
- Agree slightly
- Agree
- Strongly agree

4. We invested a large number of resources in digitalization strategy. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

5. Our leaders consider big data capacity to be important. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree

 - Agree slightly
 - Agree
 - Strongly agree
-

6. Our leaders actively explore opportunities for big data capability. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

7. We integrate digitalization strategy to corporate level strategy. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

8. We integrate digitalization strategy to business level strategy. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly

 - Agree
 - Strongly agree
-

...

9. We invested a large number of resources in big data strategy. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

10. We have a data driven culture. *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

11. Our big data system aims to meet customer needs. *

- Strongly Disagree
- Disagree
- Disagree slightly
- Neither disagree nor agree
- Agree slightly

- Agree
- Strongly agree

:::

12. My company is concern about potential regulatory policies on technology adoption. *

- Strongly Disagree
- Disagree
- Disagree slightly
- Neither disagree nor agree
- Agree slightly
- Agree
- Strongly agree

13. Our big data system prescribes data best suited to solving customer needs. *

- Strongly Disagree
- Disagree
- Disagree slightly
- Neither disagree nor agree
- Agree slightly
- Agree
- Strongly agree

:::

14. Our firm and supplier work together to achieve benefit for both sides. *

- Strongly Disagree
- Disagree
- Disagree slightly
- Neither disagree nor agree
- Agree slightly
- Agree

Strongly agree

15. Our firm and suppliers discuss future strategies with each other. *

Strongly Disagree

Disagree

Disagree slightly

Neither disagree nor agree

Agree slightly

Agree

Strongly agree

⋮

16. Our firm and supplier discuss the development of new products with each other. *

Strongly Disagree

Disagree

Disagree slightly

Neither disagree nor agree

Agree slightly

Agree

Strongly agree

⋮

17. We use big data analytics in our business *

Strongly Disagree

Disagree

Disagree slightly

Neither disagree nor agree

Agree slightly

Agree

Strongly agree

18. We currently use advanced big data analytics tools in our business *

- Strongly Disagree
 - Disagree
 - Disagree slightly
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

⋮

19. Data outputs regularly inform our strategic decisions. *

- Strongly disagree
 - Disagree
 - Neither disagree nor agree
 - Agree slightly
 - Agree
 - Strongly agree
-

Thank you for your time and participating in this survey

Appendix D: Coded Research Instrument Items

Section B: Technological Readiness, Organizational Support, and External Pressures							
Research Question #	Code	Research Question #	Code	Research Question #	Code	Research Question #	Code
1	Item TR1	6	ItemOS1	11	ItemEP1	17	ItemBDA1
2	ItemTR2	7	ItemOS2	12	ItemEP2	18	ItemBDA2
3	ItemTR3	8	ItemOS3	13	ItemEP3	19	ItemBDA3
4	ItemTR4	9	ItemOS4	14	ItemEP4	Average BDA	AVBDA
5	ItemTR5	10	ItemOS5	15	ItemEP5		
Average TR	AVTR	Average OS	AVOS	16	ItemEP6		
				Average EP	AVEP		