

Artificial Intelligence Adoption, Digital Capability Development, And Sme Resilience: A Conceptual Framework

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1. Introduction

Small and medium enterprises (SMEs) play a critical role in economic development, employment, and innovation, especially in emerging economies (Acs, Autio, & Szerb, 2017). In Nigeria, SMEs dominate the private sector but face persistent challenges such as limited access to finance, weak infrastructure, and intense competition, which threaten their sustainability (Odebunmi et al., 2017). These challenges are further amplified by rapidly evolving, technology driven markets that demand continuous adaptation. In response, organizational resilience has become essential for SME survival and growth. Organizational resilience refers to a firm's ability to anticipate, adapt to, and recover from disruptions while maintaining core operations (Duchek, 2020). Digital transformation plays a key role in strengthening this capability by improving decision making, operational flexibility, and responsiveness (Vial, 2019; Warner & Wager, 2019). In particular, artificial intelligence (AI) enables SMEs to automate processes, generate insights, and respond more effectively to environmental changes (Dwivedi et al., 2021; Cockburn, Henderson, & Stern, 2018). However, the benefits of AI depend on complementary digital capabilities such as skills, infrastructure, and strategic alignment (Teece, 2018; Warner & Wager, 2019). While prior studies have focused on technology adoption and performance outcomes, limited attention has been given to how AI adoption and digital capability development enhance SME resilience, with digital capability development strengthening this relationship. This study addresses this gap by developing a conceptual framework grounded in Dynamic Capabilities Theory and the Resource Based View to explain how these factors drive organizational adaptability and sustained performance (Barney, 1991; Teece, 2018). The study is particularly timely given growing scholarly

interest in how AI and strategic foresight can be combined to strengthen SME resilience amid persistent uncertainty in emerging economy contexts (Carayannis et al., 2025).

2. Literature Review

2.1 Artificial Intelligence Adoption in SMEs

Artificial intelligence (AI) adoption refers to the strategic integration of AI driven technologies, such as machine learning, predictive analytics, and natural language processing, into organizational processes to enhance decision making, operational efficiency, and customer engagement (Dwivedi et al., 2021; Ransbotham et al., 2020). SMEs are increasingly leveraging cloud platforms, open source AI tools, and AI enabled services to access capabilities that were once exclusive to large firms (Verhoef et al., 2021). AI adoption allows SMEs to process large volumes of data, extract actionable insights, and automate routine tasks, which strengthens responsiveness and innovation in dynamic markets (Davenport & Ronanki, 2018). Recent studies suggest that AI adoption supports functions ranging from demand forecasting and customer relationship management to automated service delivery, thereby improving competitive positioning and operational agility (Dwivedi et al., 2021). Despite these advantages, SMEs encounter significant barriers to AI adoption, including limited financial resources, lack of technical expertise, organizational readiness gaps, and unclear strategic alignment (OECD, 2021). African SMEs, in particular, face challenges related to digital infrastructure, institutional support, and skills shortages among employees (OECD, 2021). Studies in West African contexts indicate that managerial competence, digital readiness, and organizational culture significantly influence whether AI adoption translates into meaningful

performance gains (Okigbo, Mbamalu, & Iruogu, 2025). Scholars argue that AI adoption should therefore be studied in combination with organizational capabilities, as successful integration depends not only on technology availability but also on the firm's ability to deploy and leverage AI strategically (Verhoef et al., 2021). Emerging empirical work highlights that AI adoption among SMEs tends to follow a phased trajectory shaped by firm level readiness and environmental context. Arachie et al. (2025) found that firms in West Africa with structured AI implementation plans reported measurably higher operational efficiency and competitive responsiveness compared to those that adopted AI tools without accompanying strategic frameworks. Arroyabe et al. (2024) similarly demonstrated, in a study of over 12,000 SMEs across the European Union, that internal digital and innovation capabilities were far more influential in determining successful AI adoption than external environmental support alone. These findings underscore that AI adoption is most effective when treated not as a standalone technological intervention but as part of a broader organizational transformation strategy (Cimino et al., 2025). The increasing accessibility of generative AI tools has also begun to reshape how SMEs approach knowledge work, customer interaction, and content creation. Even resource constrained firms now have access to AI powered tools that support market research, financial forecasting, and inventory management at relatively low cost (Carayannis et al., 2024). However, accessibility alone does not guarantee value creation, as firms must also possess the organizational readiness to integrate, govern, and scale AI tools effectively (OECD, 2021). This dynamic reinforces the need to examine AI adoption not in isolation but in conjunction with the digital capabilities that condition its impact on SME resilience.

2.2 Digital Capability Development

Digital capability development is the process through which organizations cultivate the skills, infrastructure, and strategic alignment necessary to effectively utilize digital technologies, including AI, for competitive advantage (Warner & Wager, 2019; Vial, 2019). Digital capabilities encompass

workforce competencies in technology use, robust IT infrastructure, and managerial expertise to integrate digital tools into core processes (Verhoef et al., 2021). These capabilities enable SMEs to convert technology adoption into actionable organizational outcomes, such as improved decision making, operational efficiency, and innovation. Dynamic Capabilities Theory frames digital capabilities as strategic assets that allow firms to sense opportunities, seize technological advancements, and reconfigure internal processes in response to environmental changes (Teece, 2018). In the SME context, digital capability development is a critical enabler of AI adoption and technology driven transformation (Verhoef et al., 2021; Warner & Wager, 2019). Firms investing in digital infrastructure, employee training, and strategic alignment are better positioned to deploy AI and other emerging technologies effectively, translating adoption into tangible resilience and performance improvements (Vial, 2019). Nigerian empirical studies show that SMEs face significant constraints in accessing finance and infrastructure, which limits their ability to invest in digital technologies (Odebunmi et al., 2017). However, firms that develop digital capabilities demonstrate greater operational flexibility and resilience when implementing AI technologies (Ashiru et al., 2023). These findings underscore that digital capability development is not merely a technical requirement but a strategic resource that underpins long term adaptability, innovation, and resilience. Research demonstrates that digital capabilities must be understood as layered constructs comprising foundational, operational, and transformational levels (Verhoef et al., 2021). Foundational capabilities refer to basic digital literacy and IT access, while operational capabilities involve the application of digital tools to execute business processes. Transformational capabilities represent the highest order, enabling firms to leverage digital technologies to reimagine business models and generate new sources of value (Khurana et al., 2022). For SMEs, the transition from foundational to transformational digital capability is a significant organizational learning challenge requiring sustained investment in people, processes, and technology.

Firms that manage this transition effectively develop stronger adaptive capacity, which translates into measurably higher resilience outcomes (Kontchou & Adeleye, 2022). A recent study of Chinese SMEs found that both organizational agility and digital capability positively influenced digital transformation performance, with top management support playing a critical moderating role in enabling this progression (Zhang, Liu & Chen, 2024). The role of leadership in digital capability development deserves particular attention. Research indicates that digital transformation in SMEs is significantly shaped by the digital orientation of founders and top management teams, who influence the pace, depth, and strategic direction of technology integration (Vial, 2019). A growing body of literature confirms that digital leadership is central to cultivating the organizational culture and workforce mindset necessary for successful capability building (Gyamerah et al., 2025; Konopik et al., 2022). Ashiru, Nakpodia, and You (2023) found that Nigerian SMEs led by digitally oriented managers reported stronger outcomes in both technology adoption and operational resilience during the COVID 19 disruption period. This reinforces that human capital, particularly at the leadership level, is a central component of digital capability development. The external environment also plays a significant role in shaping digital capability development among SMEs. Government policy, industry associations, and digital infrastructure providers all influence the pace and quality of capability building in emerging economies (OECD, 2021). The OECD (2024) reported that despite progress in digital adoption among SMEs globally, the digitalization gap between large enterprises and SMEs has continued to widen, particularly in developing regions where broadband access, AI skills, and institutional support remain inadequate. In Nigeria, this gap is especially pronounced, pointing to the need for targeted policy interventions that go beyond providing access to technology and deliberately address the capability constraints that prevent SMEs from leveraging their digital investments effectively (Odebunmi et al., 2017; Okigbo, Mbamalu, & Iruogu, 2025). Scholars have further argued that absorptive capacity, defined as

the firm's ability to recognize, assimilate, and apply external knowledge, is a critical mechanism through which SMEs translate exposure to digital tools and training into genuine capability gains (Muller, Buliga, & Voigt, 2021; Sancho-Zamora et al., 2022).

2.3 SME Resilience

Organizational resilience is the firm's capacity to anticipate, prepare for, respond to, and recover from disruptive events while maintaining core operations and competitive advantage (Somers, 2021; Kontchou & Adeleye, 2022). SMEs are particularly vulnerable to shocks due to resource constraints, limited redundancies, and smaller operational buffers, making resilience a strategic necessity (Lengnick-Hall et al., 2020). Resilient SMEs exhibit adaptive behavior, proactively sense changes in the environment, reallocate resources efficiently, and innovate in response to disruptions. The integration of AI tools and digital capability development strengthens these processes, enabling firms to maintain continuity and seize opportunities amidst uncertainty (Dwivedi et al., 2021; Verhoef et al., 2021). Dynamic Capabilities Theory provides a theoretical lens for understanding SME resilience, emphasizing the ability to sense opportunities and threats, seize them through resource mobilization, and reconfigure internal processes to sustain competitive advantage (Teece, 2018; Kontchou & Adeleye, 2022). Empirical evidence from African SMEs indicates that firms investing in AI and digital capability development demonstrate higher adaptability, faster crisis response, and enhanced innovation outcomes (Dwivedi et al., 2021). This highlights that SME resilience is an emergent capability resulting from the alignment of technological adoption, organizational competence, and strategic agility, rather than a static characteristic. Firms that strategically combine AI adoption with robust digital capabilities are therefore better positioned to withstand disruptions and sustain long term growth. Scholars have increasingly moved toward a multidimensional conceptualization of organizational resilience that distinguishes between proactive and reactive dimensions (Duchek, 2020). Proactive resilience refers to a firm's capacity to identify potential disruptions before they materialize

and build the organizational slack, knowledge reserves, and adaptive routines needed to respond effectively. Reactive resilience, by contrast, refers to the speed and quality of response after a disruption has already occurred. Khurana et al. (2022) found, in a study of SMEs undergoing digital transformation during a crisis, that resilience increasingly emerged as a second order dynamic capability, meaning that firms developed it through the deliberate orchestration of digital capabilities, business model innovation, and absorptive capacity rather than through individual technology adoption alone. This insight is directly relevant to the Nigerian SME context, where resource constraints make it imperative that resilience building efforts are strategic and sequenced rather than reactive and ad hoc. Carayannis et al. (2025) advanced the understanding of SME resilience by demonstrating that the integration of AI with strategic foresight tools, including scenario planning and horizon scanning, provides SMEs with a proactive, data driven framework for navigating uncertainty. Their findings showed that firms that combined AI powered predictive analytics with structured foresight practices were better equipped to anticipate market disruptions and maintain operational continuity compared to those relying on AI adoption alone. This reinforces the position that resilience is not simply a consequence of technology acquisition but reflects the quality of the organizational practices and capabilities that surround that technology. The human dimension of resilience is also central, as Lengnick-Hall, Beck, and Lengnick-Hall (2020) argue that organizational resilience is fundamentally rooted in the cognitive, behavioral, and relational capital of a firm's people, making investment in employee digital skills and adaptive capacity a high leverage resilience building strategy for SMEs. Empirical studies from sub-Saharan Africa further illuminate the specific resilience challenges and opportunities facing SMEs in developing economy contexts. Kontchou and Adeleye (2022) found that West and Central African SMEs that adopted digital tools for financial management, supply chain monitoring, and customer communication reported higher resilience scores across multiple disruption scenarios compared to non-digital peers. Ashiru,

Nakpodia, and You (2023) similarly documented that Nigerian SMEs with established digital infrastructure were better equipped to pivot operations during the COVID 19 pandemic. A systematic review of SME resilience during the COVID 19 crisis by Chhatwani et al. (2022) identified digital technology adoption alongside entrepreneurial orientation and network engagement as among the four most consistently reported enablers of resilience across diverse geographic and sectoral contexts. Collectively, this evidence affirms that resilience in SMEs is a developable capability significantly strengthened by deliberate investment in AI adoption and complementary digital competencies.

3. Conceptual Framework

Drawing from the literature review, a proposed framework was developed to examine the relationship between AI Adoption, Digital Capability Development, and SME Resilience. AI adoption incorporates technologies such as generative AI, predictive analytics, and intelligent automation into organizational processes, enabling SMEs to better interpret data and respond to environmental changes. Digital capability development, including digital skills, technological infrastructure, and strategic alignment, supports the effective integration and use of these technologies. AI adoption enhances information processing and predictive capacity, while digital capability development strengthens the effect of AI adoption by ensuring alignment with organizational goals (Vial, 2019; Verhoef et al., 2021). This interaction improves organizational adaptability, enabling SMEs to anticipate disruptions, respond effectively, and recover from shocks. Consequently, SME resilience is conceptualized as an outcome of AI adoption, with digital capability development strengthening this relationship. The proposed framework is consistent with existing conceptual models of digital transformation in SMEs, which emphasize that technological change must be accompanied by organizational learning and capability development to produce sustainable performance gains (Vial, 2019). Cimino et al. (2025)

extended Dynamic Capabilities Theory by offering a process level explanation of how firms translate their sensing, seizing, and transforming capabilities into resilience and performance outcomes through AI adoption, supporting the argument that capability development is not a passive by product of technology use but an active and deliberate organizational process. The framework contributes to this literature by explicitly positioning digital capability development as a moderating variable rather than a parallel or independent pathway, thereby offering a more precise account of the conditions under which AI adoption generates resilience outcomes. The framework also acknowledges that the moderating effect of digital capability development is likely to vary across different dimensions of resilience. Foundational

digital capabilities such as IT infrastructure and basic digital literacy may primarily strengthen reactive resilience, while higher order capabilities such as AI fluency, data governance competence, and strategic digital alignment are more strongly associated with proactive resilience (Duchek, 2020; Teece, 2018; Carayannis et al., 2025). Future empirical research should therefore seek to unpack these differential effects to generate more actionable findings for SME managers and policymakers. Figure 1 depicts the proposed framework where AI adoption drives the need for digital capability development, which in turn strengthens SME resilience. This structure highlights that organizational resilience is maximized when AI adoption is supported by complementary digital capabilities rather than being a direct result of technology alone.

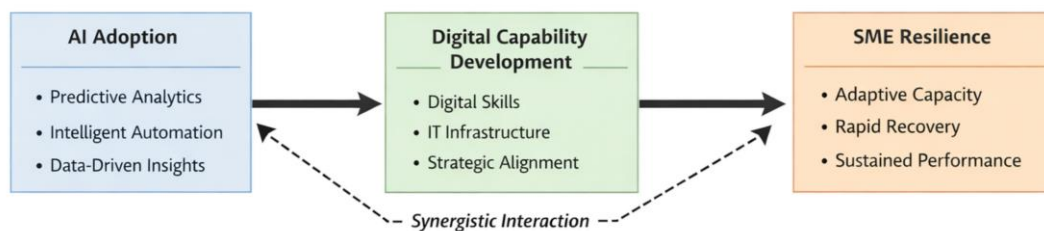


Figure 1: Digital Capability as a Moderator of AI Adoption and SME Resilience

4. Theoretical Foundation

This study is anchored on Dynamic Capabilities Theory (DCT) and the Resource Based View (RBV), which provide complementary explanations for how firms achieve and sustain competitive advantage. The Resource Based View posits that organizational performance depends on the possession and effective deployment of valuable, rare, inimitable, and non substitutable resources (Barney, 1991). In the context of SMEs, digital technologies and capabilities, including artificial intelligence tools and digital skills, can be conceptualized as strategic resources that enhance firm performance and adaptability (Vial, 2019). However, RBV has been critiqued for its limited explanation of how firms

adapt to rapidly changing environments, particularly in technology driven contexts (Teece, 2018). Dynamic Capabilities Theory extends RBV by emphasizing the firm's ability to integrate, build, and reconfigure internal and external competences in response to environmental change (Teece, 2018). This perspective highlights three core capabilities: sensing opportunities and threats, seizing opportunities through resource mobilization, and transforming organizational processes to maintain competitiveness. In this study, AI adoption provides SMEs with the tools to sense market and operational changes, while digital capability development enables firms to seize and transform by integrating technological tools into operations effectively (Warner & Wager, 2019; Dwivedi et al., 2021). Digital capabilities, such as skilled personnel, technological infrastructure, and strategic alignment,

serve as critical resources that enable SMEs to translate AI adoption into enhanced resilience outcomes. Integrating DCT and RBV provides the theoretical justification for treating digital capability development as a moderating variable that strengthens the effect of AI adoption on SME resilience, as illustrated in Figure 1. Together, these theories explain how SMEs can develop adaptive, responsive, and resilient organizational processes through the strategic deployment of AI technologies supported by complementary digital capabilities. The theoretical integration pursued in this study also responds to growing calls in the management literature for contextually grounded frameworks of technology adoption in resource constrained settings (Teece, 2018). Classical applications of RBV focus on asset possession as the primary driver of competitive advantage, which is of limited relevance to SMEs that may lack substantial technological assets. Dynamic Capabilities Theory addresses this limitation by shifting attention from asset stocks to asset development processes, which aligns more closely with the realities of SME development in emerging economies (Warner & Wager, 2019). A recent empirical study of Turkish SMEs by Khurana et al. (2022) demonstrated that digital capability functioned as a sensing mechanism within the DCT framework, with business model innovation serving as the seizing pathway and absorptive capacity enabling the transforming function, thereby collectively producing measurable resilience improvements. By framing AI adoption as a trigger for dynamic capability development rather than a substitute for it, the current study offers a theoretically coherent and practically useful account of how SMEs can leverage technology to build resilience despite resource constraints. The framework also engages with organizational learning theory, which provides additional theoretical grounding for the moderating role of digital capability development. Organizational learning theory emphasizes that firms develop capabilities through cycles of experience, reflection, and knowledge integration over time (Muller, Buliga, & Voigt, 2021). In the context of AI adoption, digital capability development can be understood as the organizational learning process through which firms

acquire the knowledge and skills needed to use AI tools effectively. Sancho-Zamora et al. (2022) demonstrated that absorptive capacity, as a measure of this organizational learning function, significantly moderates the relationship between innovation strategy and firm performance in SMEs. Firms that manage this learning process effectively are better positioned to derive sustained resilience benefits from their AI investments (Vial, 2019; OECD, 2021). This alignment between organizational learning theory and DCT further reinforces the conceptual coherence of the proposed framework and its applicability to the Nigerian SME context.

5. Empirical Review

Recent studies show that AI adoption in SMEs significantly enhances organizational adaptability and resilience. AI tools such as predictive analytics, intelligent automation, and data driven decision support enable SMEs to sense market changes, respond rapidly to disruptions, and maintain operational continuity (Dwivedi et al., 2021; Arachie et al., 2025). Evidence from Nigerian SMEs indicates that firms that adopted AI based solutions during periods of volatility, including the COVID 19 pandemic, were better able to manage supply chain disruptions, customer engagement, and remote operations (Ashiru, Nakpodia, & You, 2023). These findings suggest that AI adoption strengthens SMEs' capacity to anticipate, adapt, and recover from shocks, aligning directly with the concept of SME resilience. However, the effectiveness of AI adoption depends on complementary digital capability development, including digital skills, technological infrastructure, and strategic alignment (Warner & Wager, 2019; Verhoef et al., 2021). Nigerian empirical studies show that SMEs with higher digital readiness, measured through staff digital competencies, IT infrastructure, and strategic IT planning, achieve greater operational flexibility and resilience when implementing AI technologies (Odebunmi et al., 2017). Without these capabilities, even advanced AI tools may fail to produce meaningful improvements in resilience (Odebunmi et al., 2017). Collectively, the evidence underscores that digital capability development acts as a moderator, enhancing the effect of AI adoption on

SME resilience, which justifies the focus of this study on their interactive influence. Iyamah and Oguh (2024) examined the impact of AI infrastructures on SME performance in Edo State, Nigeria, and found that firms with more developed IT infrastructure and AI deployment structures reported higher scores on both operational efficiency and crisis adaptability measures. Their study reinforced the argument that the resilience benefits of AI adoption are contingent on the quality of accompanying digital infrastructure rather than simply the adoption of technology tools. Arachie et al. (2025) similarly assessed the technological readiness of small businesses in West Africa for AI powered transformation and found a significant positive association between organizational readiness scores and resilience indicators, identifying preparedness as a prerequisite for deriving resilience benefits from AI investment. Cross national evidence also contributes important empirical context. Ransbotham et al. (2020) analyzed AI adoption patterns across more than 3,000 firms in 112 countries and found that firms in developing economies face distinctive constraints related to data quality, talent availability, and infrastructure reliability that significantly limit the resilience benefits of AI adoption. Firms that invested in targeted capability development programs to address these specific constraints reported stronger AI adoption outcomes and higher resilience scores. Carayannis et al. (2025) further demonstrated, through real world data from SMEs in multiple countries, that the integration of AI tools with structured foresight methodologies produced measurably higher resilience outcomes than AI adoption alone, particularly in volatile and uncertain market environments. These findings collectively validate the moderating role of digital capability development proposed in the current study. Evidence relating to the sectoral dimensions of AI adoption and resilience also warrants consideration. Okigbo, Mbamalu, and Iruogu (2025) examined digital marketing and AI adoption among Nigerian SMEs across multiple industries and found that firms in the trade and services sectors demonstrated higher AI adoption rates and more pronounced resilience improvements compared to manufacturing firms,

partly due to lower infrastructure requirements for customer facing AI tools. This sectoral variation suggests that the moderating effect of digital capability development may not be uniform across industries and that future research should account for sector specific differences in infrastructure requirements, adoption barriers, and capability development pathways. The systematic review conducted by Chhatwani et al. (2022), drawing on 49 SME resilience studies published between 2013 and 2023, further identified digital technology adoption as one of four consistently reported enablers of SME resilience, reinforcing the empirical foundation for the relationships examined in this study.

6. Discussion

This study emphasizes the relationship between AI adoption, digital capability development, and SME resilience. AI adoption equips SMEs with technologies such as predictive analytics, intelligent automation, and generative AI, enabling them to sense and respond to changes in dynamic environments. However, the effectiveness of AI in fostering resilience depends on the presence of strong digital capabilities. Digital capability development, which includes digital skills, technological infrastructure, and strategic alignment, moderates the impact of AI adoption by allowing organizations to deploy these technologies effectively, thereby enhancing their adaptability and ability to recover from disruptions. In practice, SMEs with strong digital capabilities can translate AI adoption into tangible resilience outcomes, whereas firms with limited digital capabilities may struggle to leverage AI effectively. This indicates that resilience does not result solely from adopting advanced technologies but from how effectively organizations align and deploy them. Therefore, empirical validation should focus on measuring AI adoption, digital capability levels, and resilience outcomes to test the moderating role of digital capabilities. The digital divide documented by the OECD (2024) between large enterprises and SMEs in terms of AI adoption and digital capability is particularly relevant here, as it suggests that the moderating effect of capability development is amplified in resource constrained contexts where the gap between

technology access and organizational readiness is most pronounced. The discussion also highlights an important paradox that SME managers and policymakers must confront. While digital capability development is identified as the key moderating condition for AI driven resilience, the very resource constraints that make resilience essential for SMEs are the same constraints that make capability development most difficult. This is well documented in the SME literature and has been described as a digital readiness trap in which firms that most need the resilience benefits of AI adoption are least equipped to develop the capabilities required to realize them (OECD, 2021; Odebunmi et al., 2017). Addressing this trap requires not only firm level investment in capability building but also systemic interventions at the policy and institutional level to lower the cost and complexity of digital capability development for SMEs in emerging economies. Arroyabe et al. (2024) demonstrated that policy environments offering strong institutional support for innovation and digital adoption can partially compensate for internal capability gaps, suggesting that external institutional factors can serve as complements to internal capability development efforts. The moderating role of digital capability development also has important implications for how SMEs should sequence their technology and capability investments. The framework implies that firms should prioritize foundational digital capability development before or alongside AI adoption rather than treating capability building as an afterthought. Organizations that invest in digital skills training, IT infrastructure upgrades, and strategic alignment processes before deploying AI tools are more likely to achieve meaningful resilience improvements (Teece, 2018; Vial, 2019). Cimino et al. (2025) demonstrated that firms whose AI adoption was preceded by structured internal capability development achieved superior outcomes across technological, economic, and sustainability performance dimensions, providing direct empirical support for this sequencing argument. This offers practical guidance for SME managers navigating the complexity of digital transformation under resource constraints. It is also important to acknowledge the potential for feedback effects within the proposed

framework. While the model positions digital capability development as a moderator of the AI adoption and resilience relationship, empirical evidence suggests that the relationship is likely bidirectional over time. Firms that achieve resilience gains through AI adoption may reinvest those gains in further capability development, creating a positive feedback loop that progressively deepens their digital maturity and resilience capacity (Warner & Wager, 2019; Ashiru, Nakpodia, & You, 2023). Khurana et al. (2022) documented evidence of such feedback dynamics in SMEs navigating crises, where early resilience gains enabled subsequent rounds of digital capability investment that produced even stronger adaptive outcomes. Future longitudinal research should seek to capture these dynamic interactions to provide a more complete account of how AI adoption and digital capability development co evolve over time in resilient SMEs.

7. Research Implications and Directions for future Studies

This study provides a basis for future empirical research by proposing that digital capability development moderates the relationship between AI adoption and SME resilience. Future studies should adopt quantitative approaches to test this relationship by measuring the extent of AI adoption, the level of digital capability development, and resilience outcomes among SMEs. AI adoption can be assessed through the use of tools such as predictive analytics and intelligent automation, while digital capability development may be measured through digital skills, technological infrastructure, and strategic alignment. SME resilience may be evaluated using indicators such as adaptability, recovery capacity, and continuity of operations. Empirical testing across SMEs in Nigeria and other developing economies will help to validate the strength and direction of this moderating effect. Furthermore, future research may explore how contextual factors such as industry type, firm size, and environmental uncertainty influence the role of digital capability development in shaping the impact of AI adoption on resilience. Qualitative studies involving interviews with SME owners and managers can provide deeper insights into how digital capabilities support the effective use of AI in

practice. From a practical standpoint, the findings suggest that policymakers and SME support institutions should focus on strengthening digital skills and infrastructure to enhance the benefits of AI adoption. Theoretically, this study extends existing literature by demonstrating that the effect of AI adoption on SME resilience depends on the level of internal digital capabilities, thereby reinforcing the importance of organizational readiness in achieving sustainable outcomes. The study also opens avenues for comparative cross national research examining how the proposed framework operates across different institutional environments. The moderating effect of digital capability development is likely to be stronger in contexts with weaker digital infrastructure and less developed innovation ecosystems, where the gap between AI adoption and organizational readiness is most pronounced. Comparative studies spanning multiple African countries, or comparing African SMEs with counterparts in other emerging economies, could yield valuable insights into how contextual factors shape the AI adoption, capability development, and resilience relationship (Kontchou & Adeleye, 2022; Arachie et al., 2025). Ransbotham et al. (2020) identified substantial cross national variation in the conditions under which AI adoption produces performance improvements, reinforcing the value of contextually disaggregated research designs that account for the institutional and infrastructural heterogeneity present across developing economy SME populations.

Methodologically, future research should consider employing structural equation modeling or moderated regression approaches to formally test the moderating role of digital capability development and examine potential mediating pathways through which AI adoption influences resilience. Longitudinal designs would allow researchers to track how capability development and resilience co evolve as firms deepen their AI adoption. Carayannis et al. (2025) employed a mixed methods design combining real world SME data with theoretical modeling to examine AI and foresight integration, suggesting that mixed methods approaches are well suited to capturing the complexity of the

relationships examined in this study. Future empirical work drawing on Nigerian and broader sub-Saharan African SME populations would make a particularly significant contribution given the current underrepresentation of African contexts in the global AI adoption and resilience literature. From a policy perspective, the study suggests that government and institutional support programs targeting SME digitalization should be designed to address capability gaps alongside technology access. Programs that provide AI tools without accompanying support for skills development, infrastructure improvement, and strategic planning are unlikely to generate lasting resilience improvements. Policy frameworks should therefore adopt a capability first orientation that prioritizes the development of human capital, IT infrastructure, and digital governance frameworks as prerequisites for sustainable AI adoption (OECD, 2021; OECD, 2024). Institutional arrangements that enable SMEs to access digital capability building resources through industry associations, technology partners, and public private partnerships may prove especially effective in contexts where individual firms lack the resources to invest in capability development on their own.

8. Conclusion

This study examined the relationship between AI adoption, digital capability development, and SME resilience. It established that while AI adoption provides SMEs with tools to respond to environmental changes and disruptions, its effectiveness in enhancing resilience depends on the level of digital capability development within the organization. Digital capabilities enable firms to utilize AI strategically, thereby strengthening their ability to adapt, recover, and sustain operations in uncertain environments. The study contributes to existing knowledge by showing that the impact of AI adoption on SME resilience is not automatic but is influenced by the organization's internal capacity to deploy and align digital resources effectively. It therefore highlights the need for SMEs to invest not only in advanced technologies but also in the development of digital skills, infrastructure, and strategic orientation. By emphasizing the moderating

role of digital capability development, the study provides a clearer understanding of how SMEs can achieve resilience and long term sustainability in a rapidly evolving business environment. The conceptual framework developed in this study offers a theoretically grounded and empirically testable model that can guide future research and inform practical decision making among SME managers, investors, and policymakers. The integration of Dynamic Capabilities Theory and the Resource Based View provides a robust theoretical foundation for understanding how SMEs can build adaptive, technology enabled resilience in the face of persistent uncertainty (Barney, 1991; Teece, 2018). The insights generated by Carayannis et al. (2025) on AI and strategic foresight, alongside Khurana et al. (2022) on digital capability and business model innovation as pathways to resilience, provide a strong empirical anchor for the theoretical arguments advanced in this paper.

As AI technologies become increasingly accessible and the competitive environment for SMEs continues to intensify, the ability to develop and leverage digital capabilities alongside AI adoption will become an increasingly critical determinant of long term firm survival and growth. Future research should build on the framework proposed here by conducting rigorous empirical tests across diverse SME populations using both quantitative and qualitative methodologies to capture the complexity of the AI adoption and resilience relationship. The insights generated from such research will be essential for designing effective support programs, developing evidence based policy interventions, and helping SME managers make informed strategic decisions about technology investment and capability development in an increasingly AI driven business environment.

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