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ARTICLE

Examining the Nexus between Knowledge Management Processes and Firm Sustainability: The Mediating Role of Innovation among SMEs in Ghana

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ABSTRACT

This study examines how knowledge management processes (KMP) enhance firm sustainability (FS) via the mediating role of innovation (INV) among small and medium-sized enterprises (SMEs) in Ghana. A cross-sectional survey using quantitative data gathered information from 360 employees across ten SMEs in Ghana that were implementing knowledge management practices. Using Structural Equation Modeling (SEM) in SmartPLS 4, the study revealed that KMP significantly predicts both innovation ($\beta = 0.777$, $p < 0.001$) and firm sustainability ($\beta = 0.568$, $p < 0.001$). In contrast, innovation exerts a direct positive effect on sustainability ($\beta = 0.329$, $p < 0.001$). Moreover, innovation partially mediates the KMP–FS relationship (indirect effect $\beta = 0.255$, $p < 0.001$), indicating that firms achieve stronger sustainability outcomes when knowledge is strategically converted into innovative practices. Theoretically, the study integrates the Resource-Based View (RBV) and Dynamic Capabilities View (DCV), advancing the understanding of how intangible knowledge resources translate into sustainable performance through innovation. Practically, the results provide actionable guidance for managers and policymakers: SMEs should invest in digital knowledge systems, promote knowledge-sharing cultures, and align innovation initiatives with sustainability objectives. This study contributes to the limited empirical evidence from emerging economies

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by positioning innovation as the dynamic capability that transforms knowledge assets into a sustainable competitive advantage.

Keywords: Knowledge Management Process; Innovation; Firm Sustainability; Dynamic Capability; SMEs

1. Introduction

In today's knowledge-driven economy, organizations increasingly recognize it as a critical strategic resource that enhances innovation, competitiveness, and long-term sustainability[1]. The effective management of knowledge encompassing its creation, sharing, and application enables firms to generate and maintain a competitive advantage while responding to dynamic market and environmental conditions. These firms must respond to evolving customer demands while navigating technological disruption to maintain growth and competitive advantage[2, 3]. Therefore, strategic management of knowledge resources and the ability to innovate have become essential for firms seeking to thrive in unstable environments.

Firm sustainability, broadly defined as the ability of a business to meet current needs without compromising future prospects, has emerged as a critical priority in contemporary organizational strategies[4]. Modern sustainability frameworks go beyond financial performance, emphasizing environmental stewardship, social responsibility, and long-term resilience[5]. Existing literature indicates that firm sustainability is closely tied to profitability, efficiency, and competitiveness, particularly in environments where innovation is rapidly changing the landscape of business operations[6, 7]. However, despite the increasing emphasis on sustainability, a significant gap remains in how firms can effectively integrate knowledge management practices with innovation strategies to enhance their sustainability.

Theoretical frameworks, such as the Resource-Based View (RBV) and Dynamic Capabilities View (DCV), underscore the strategic value of intangible assets, including knowledge. These theories suggest that firms that can strategically manage knowledge resources are more likely to achieve sustainable competitive advantages[8]. However, while prior studies have examined the link between knowledge management and firm performance[9, 10], the mediating role of innovation in driving firm sustainability remains relatively underexplored. Most existing studies examine direct effects, providing limited insight into the mechanisms that link knowledge management to firm sustainability. This presents a significant theoretical gap, as innovation is often the mechanism through which knowledge is translated into tangible outcomes, driving both firm performance and sustainability[11]. The specific role of innovation in this process is crucial to understanding how firms leverage their knowledge assets for long-term success. However, it has not been sufficiently theorized or empirically validated in the context of firm sustainability.

This study, therefore, investigates how innovation functions as a mediating variable between the knowledge management and firm sustainability, aiming to close this conceptual and empirical gap[12]. Innovation, particularly in the form of process improvements, new product development, and organizational transformation, is crucial for enabling firms to not only adapt to market changes but also reduce their environmental footprint and fulfill social responsibilities[7]. Thus, innovation serves as a bridge between knowledge management and firm sustainability, transforming internal knowledge into sustainable business practices[13]. Despite this understanding, the mechanisms by which knowledge management fosters innovation and, in turn, drives sustainability outcomes remain poorly understood, limiting the practical application of these insights in organizational settings.

In light of this, the current research seeks to formulate three research goals: (1) to investigate the direct correlation between Knowledge Management Processes (KMP) and Firm Sustainability (FS); (2) to investigate the effect of KMP on Innovation (INV); and (3) to investigate the mediation effect of Innovation in the correlation between KMP and FS. These aims are directly derived from the recognized research gap, as earlier studies have primarily focused on direct effects without adequately explaining how knowledge assets are converted into sustainable results. Through this response, the study contributes to the Resource-Based View (RBV) and the Dynamic Capabilities View (DCV), as well as practical implications for SMEs in emerging economies. Theoretically, it extends the existing knowledge management

and organizational behavior literature by providing a more nuanced understanding of how knowledge resources are converted into sustainable practices through innovation. This contributes to the RBV and Dynamic Capabilities frameworks by offering empirical evidence of the critical role that innovation plays in translating knowledge management into long-term sustainability.

Practically, the findings of this research will provide actionable insights for managers, particularly in SMEs, who are looking to integrate sustainability into their core business strategies. By highlighting the importance of innovation as a mediator, this study will help firms understand how to manage their knowledge resources better to foster innovation and achieve sustainability. The unique contribution of this research lies in its focus on the often-overlooked role of innovation in the knowledge management–sustainability nexus. It provides a fresh perspective on how firms can strategically align their internal processes to meet the growing demand for sustainable business practices.

2. Literature Review and Hypothesis Development

Knowledge management (KM) is the systematic process of creating, sharing, and applying knowledge within an organization to achieve its objectives [14, 15]. The KM process typically involves stages like knowledge creation, capture, storage, sharing, and application [16]. Effective KM practices enable organizations to capitalize on existing knowledge, eliminate duplication, and foster continuous improvement. Raudeliūnienė and Matar [17] emphasize the growing significance of KM in the knowledge economy, noting that it reduces product manufacturing time and enhances operational efficiency. Effective knowledge management allows organizations to streamline production processes, accelerate innovation, and improve efficiency to achieve both short-term productivity and long-term stability [18]. KM practices are crucial for creating organizational readiness for change and ensuring business survival [19]. By continuously capturing, sharing, and applying knowledge, organizations can adapt to market changes, technological advancements, and competitive pressures [20]. Enhancing a culture of learning and knowledge sharing is crucial for sustaining an organisation and ensuring its long-term viability [21]. Moreover, KM practices facilitate collaboration, innovation, and decision-making, contributing to the organization's long-term success [22, 23]. This is confirmed by Wu et al. [18], who discovered that knowledge coupling was a key driver of organizational resilience, while Smuts and Van der Merwe [24] illustrated that sustainability partnerships enhance the KM-sustainability platform. Likewise, Alam et al. [25] found that integrating KM tasks with green technology enhances SME operational outcomes, particularly in emerging economies. These outcomes clarify the dynamic and responsive nature of KM, enabling organizational sustainability.

Firm sustainability (FS) refers to a company's capacity to generate long-term value by integrating economic, environmental, and social objectives into its strategy and operations [26]. Sustainable firms are resilient in the face of market changes, actively reducing their ecological impact while contributing positively to society. Research has consistently indicated that sustainability enhances firms' competitiveness, profitability, and stakeholder trust [7]. Despite this, the integration of sustainability with KM remains under-explored, particularly how knowledge processes contribute to sustainability through innovation [27]. Innovation (INV), broadly defined as the process of translating ideas into valuable outcomes (new products, processes, or services), is a crucial mediator in the knowledge-sustainability linkage [28]. Firms that manage knowledge effectively are more likely to foster a culture that supports innovation, allowing them to adapt to changes, develop environmentally friendly solutions, and remain competitive in evolving markets [29].

Recent studies focus on innovation within this intersection. Xiao et al. [30] and Morina [31] explain how systematic KM activities lead to consistent innovation results, while Shahid et al. [32] demonstrate how eco-innovation creates interlinkages among KM processes and sustainability performance. Furthermore, Awwad et al. [33] explain how green product innovation has a direct, positive impact on environmental sustainability. Together, these studies illustrate that innovation is not just an offshoot of KM, but also the primary vehicle that turns knowledge assets into persistent firm performance.

2.1. Theoretical Framework

This research is based on two complementary frameworks: the Dynamic Capabilities View (DCV) and the Resource-Based View (RBV). RBV contends that companies achieve persistent competitive advantage through the

use of scarce, valuable, imitable, and non-substitutable resources [34, 35]. Knowledge, as a socially embedded and intangible asset, meets these criteria and has long been recognized as a central asset for building organizational competitiveness and sustainability [18, 36]. In the SME environment, Knowledge Management Processes (KMP) acquisition, sharing, and use enable companies to leverage this strategic asset by preventing duplication, fostering collaboration, and integrating sustainability into fundamental operations. From an RBV point of view, companies with sound management of their knowledge assets are more likely to attain superior environmental, social, and economic performance [37].

However, RBV is criticised for being comparatively static and not responsive enough to how companies evolve in the context of turbulent and dynamic environments [38]. DCV supplements RBV by positing that valuable resources are insufficient for competitiveness, but rather dynamic capabilities to constantly reconfigure and refresh such resources in the face of change [39]. Innovation is a paradigmatic dynamic capability, enabling companies to sense opportunities, seize them by developing new products, processes, or services, and convert knowledge into sustainable performance outcomes [40]. In this respect, innovation brings the potential of KM to reality in the form of an agency that converts acquired knowledge into sustainable and competitive practices.

The combination of RBV and DCV thus gives this study a solid theoretical underpinning. RBV accounts for why knowledge assets are strategic in and of themselves for sustaining (H1), while DCV opens the way to understand how innovation serves as a dynamic capability that mediates the knowledge–sustainability link (H2–H4). This two-theory framework has been more commonly applied in sustainability and SME studies such as Alam et al. [25], Xiao et al. [30], and Awwad et al. [33], as both the traditional acknowledgement of the fallacy of static resources and dynamic capabilities alone have emerged. Rather, the dynamic interaction best describes how firms, specifically SMEs in the developing world, are capable of leveraging knowledge to achieve sustainable competitive advantage.

2.2. Knowledge Management Process and Firm Sustainability

The role of Knowledge Management Processes (KMP) in driving firm sustainability (FS) has garnered growing interest. However, explicit empirical links remain scarce, especially in Small and Medium-sized Enterprises (SMEs) operating in developing economies. However, prior research demonstrates that knowledge management broadly supports organizational performance [41, 42]. Few studies have revealed the mechanisms by which specific KMP elements, such as knowledge acquisition, knowledge sharing, and knowledge application, translate into environmental, social, and economic sustainability outcomes [25, 43]. According to Dyllick and Hockerts [44], firm sustainability refers to the management of essential financial, environmental, and social assets in a manner that meets the present and future needs and demands of stakeholders. In this context, KM processes, including knowledge creation, capture, storage, retrieval, distribution, and application, are essential for stimulating and sustaining organizational sustainability [45]. For example, Cong [45] has pointed out that when organizations are committed to KM, their workforce is encouraged to create, buy, share, and use knowledge, thus achieving improved, sustainable performance. This work aligns with the previous study by Al-Dmour et al. [46], which established that KM has a positive effect on explaining firm performance and that decision quality plays a mediating role. Such insights call for the need to incorporate KM into the strategic management framework to increase sustainability.

In addition, numerous studies highlight the aspects considered crucial determinants of organizational learning, thereby underscoring the importance of organizational sustainability and performance. These aspects include knowledge acquisition, knowledge sharing, and knowledge application [47]. This view is also mentioned by Kara et al. [48], who note that engaging top management can create a firm-wide culture of knowledge sharing, which is critical to sustainability. Knowledge management enhances processes and outcomes, fosters innovation, and ensures viability in the modern environment. Also, Hussain et al. [49] demonstrate that organizational knowledge management is a significant driver of organizational success, enabling companies to develop new, competitive products and services while promoting sustainability. This is particularly relevant in small and medium enterprises (SMEs), where effective KM practices can enhance innovation capabilities and competitive advantage [49, 50].

Several scholars highlight the importance of KM in fos-

tering firm sustainability. For instance, Sagar[7] emphasizes that KM fosters resilience and environmental responsiveness. Similarly, Carp et al.[26] argue that firms that continuously build and apply their knowledge base are better equipped for sustainable development. This view is supported by Hussain et al.[51], who note that robust KM practices enhance an organization's ability to navigate complex and dynamic environments, thereby contributing to a sustained competitive advantage. Based on the above arguments, the study proposes the following hypothesis:

H1. *Knowledge Management Process (KMP) has a positive effect on Firm Sustainability.*

2.3. Knowledge Management Process and Innovation

The interplay between Knowledge Management (KM) processes and innovation is a critical area of study, as it highlights how effective knowledge management can foster a culture of innovation within organizations. Innovation refers to creating new value, that is, developing new goods or services or improving existing ones that help sustain competitiveness in the current markets[31]. Existing studies have established that KM supports innovation, but few have examined how structured KM practices lead to systematic innovation outcomes in SMEs. KM enables idea generation, experimentation, and the synthesis of diverse insights, which are elements foundational to innovation[30, 41]. This relationship is significant in SMEs where flexibility and learning are central to competitiveness.

Despite the theoretical link between KM and innovation, empirical clarity is lacking regarding how KM mechanisms like collaboration, knowledge storage, and accessibility shape innovation outcomes in practice. For instance, studies show that KM has a positive correlation with innovation in enterprises, which proves that enterprises that manage knowledge are likely to be innovative[31]. As such, it argues that the KM Value Proposition entails KM processes to develop intellectual capital that supports organizational innovation, emphasizing that a KM solution facilitates innovation[52]. Additionally, the article examines the impact of collaborative culture on enhancing KM processes, and its findings include innovation that suggests a constructive organizational culture can complement KM processes, thereby increasing innovation capacity[53]. The above supports the argument that a culture that fosters the sharing of knowledge and information is crucial for innovation. Besides, KM can affect other dimensions of innovation performance other than technology. It examines the extent to which KM impacts innovative processes and organizational innovation, thus extending the knowledge of the role of KM towards developing the integrated innovation approach[54]. The assertion that Knowledge Management (KM) practices are critical drivers of innovation is well supported in the literature. Arsawan et al.[12] argue that effective KM practices provide a strong foundation of knowledge essential for developing new products and services.

This view is similar to that of Chaudhary and Kumar[55], who specify that organizations with effective KM techniques are better positioned to leverage knowledge and learning, thus enhancing innovation prosperity. That is why Mishra and Uday Bhaskar[56] deepened their understanding of using KM to bring together different employees and create effective teamwork, pointing out that sharing knowledge is one of the goals of effective KM. Sharing contributes to cross-pollination, a process that is vital to the development of innovative ideas. It fosters communication and brings together experts from disparate organizations, eliminating barriers to sharing ideas and best practices; this, in the end, enhances the achievement of business results. Based on the preceding discussion, the study proposes the following hypothesis:

H2. *The Knowledge Management Process (KMP) has a positive effect on Innovation (INV).*

2.4. Innovation and Firm Sustainability

The relevance of innovations to firm sustainability cannot be overstated, as such business organizations may need to seize new opportunities prevailing in the market, address emerging customer needs, and fend off competitors. Following Dyllick and Hockerts[44], sustainability was defined as the simultaneous satisfaction of current stakeholders' needs and the firm's obligation to future generations and the planet. This balance is strategic for firms that aim to sustain themselves in a competitive world. Some of the critical arguments from the literature agree that innovation is at the core of firm sustainability. Innovation enables firms to reduce their

environmental footprint, improve efficiency, and develop socially responsible products. Several studies, including Awwad et al.[33], Chaudhary and Kumar[55], and Mady et al.[57], show that innovation leads to sustainability by promoting eco-friendly practices and market responsiveness. However, few studies have measured this linkage within a structural framework that accounts for prior KM practices.

Adomako and Nguyen[58] examine co-innovation behaviour in the context of the competitive landscape for sustainable innovation and explain how firms' adaptability and resilience are improved. Furthermore, the findings of Bhadra et al.[59] indicate that firms engaged in sustainability-oriented innovation tend to achieve higher market valuations and superior financial performance, reinforcing the notion that innovation is not merely a cost, but a strategic investment in long-term sustainability. This is mentioned in the work of Zeng et al.[60], which discusses how firms that manage the innovation paradox within sustainable ecosystems can leverage ambidextrous capabilities to enhance their sustainability outcomes. Innovation can be regarded as one of the critical sources of sustenance for a firm in a given business environment, contributing to positive change through efficiency, waste elimination, and value addition through the development of new income streams.

Polder et al.[61] emphasize that firms must excel not only in generating ideas for new sustainable technologies but also in all stages of the innovation process, including market introduction. This aligns with the notion that managing innovation is crucial for firms seeking to achieve long-term sustainability. To support firm growth, innovative solutions, along with operational improvements, include corporate social responsibility and a balanced scorecard. According to Keroti[62], through these strategies, firms can reverse the balance between organizations and society by presenting business strategies that are consistent with the social fabric, thereby ensuring firm sustainability. Of all strategies, the balanced scorecard is particularly helpful in that it maps performance indicators in four key areas: financial, customer, internal process, and learning and growth, which are crucial to innovation and sustainability[63]. Furthermore, the application of innovation in business models is becoming increasingly valued as a driver of sustainability.

Those characteristics can include technological characteristics, geographical location, and intensity of competition, among others. As pointed out by Faisal et al.[64], the nature of the industry plays a significant role in determining the effectiveness of technological initiatives and enhancing firm sustainability. This implies that while firms are under pressure to innovate, they must ensure that their adopted strategies align with the contexts in which they operate. Internal capabilities in the era of sustainable innovation are also a prerequisite for promoting firm sustainability. According to Ketata et al.[65], innovation sustainability is influenced by several firms' internal resources and external antecedents. Building on the theoretical and empirical evidence, the study hypothesises that:

H3. *Innovation (INV) has a positive effect on Firm Sustainability (FS).*

2.5. Innovation as a Mediator

The role of innovation as a mediator in the relationship between Knowledge Management (KM) processes and firm sustainability is increasingly recognised in academic research. The mediation effect of innovation indicates that the influence of KM processes on firm sustainability is significantly enhanced through an organization's capacity to innovate. This perspective aligns with the findings of Zhang et al.[10], who argue that effective KM processes lead to improved resource utilization, subsequently fostering innovation. Such innovation is vital for driving sustainable growth, as it enables organizations to adapt to evolving market conditions, develop new products, and enhance operational efficiency. Zhang et al.[15] further support this notion by asserting that innovation, propelled by well-managed knowledge, is essential for maintaining a firm's competitive advantage. They highlight that organizations proficient in KM are more likely to generate innovative solutions that contribute to firm sustainability, mainly by developing environmentally friendly products and adopting socially responsible practices.

This assertion is mentioned by Shehzad et al.[53], who explore how KM processes influence corporate sustainable performance through green innovation, emphasizing the necessity of effective KM strategies to achieve sustainability objectives. Moreover, Polder et al.[61] emphasize that for innovation to mediate the relationship between KM and firm sustainability effectively, it must be deeply integrated into the organization's strategic framework. This integration en-

sures that the knowledge generated through KM processes is consistently translated into innovative practices that drive sustainable growth. The importance of this integration is further supported by Li and Han [66], who found that absorptive capacity significantly mediates the relationship between KM and innovation performance, underscoring the need for organizations to cultivate an environment conducive to knowledge sharing and innovation.

Despite the growing body of literature connecting KM, innovation, and performance, several important gaps remain. Most prior studies have focused on large firms in developed economies, leaving a dearth of empirical evidence from small and medium-sized enterprises (SMEs) in emerging markets. In addition, while it is well established that KM facilitates innovation, the mediating role of innovation in the relationship between knowledge management processes (KMP) and firm sustainability (FS) remains underexplored, particularly within Sub-Saharan Africa.

This study addresses these research gaps by integrating the Resource-Based View (RBV), Dynamic Capabilities View (DCV), and Knowledge-Based View (KBV) to explain how intangible knowledge resources can be transformed into sustainable outcomes through innovation. By empirically testing this framework among SMEs in Ghana, the study contributes novel evidence on how firms in resource-constrained contexts can leverage KM and innovation to achieve sustainability, thereby extending both theoretical understanding and managerial practice.

The conceptual model for this study is presented in **Figure 1**, which depicts innovation as a mediating variable between knowledge management processes and firm sustainability.

H4. *Innovation (INV) Mediates the Relationship Between the Knowledge Management Process (KMP) and Firm Sustainability (FS).*

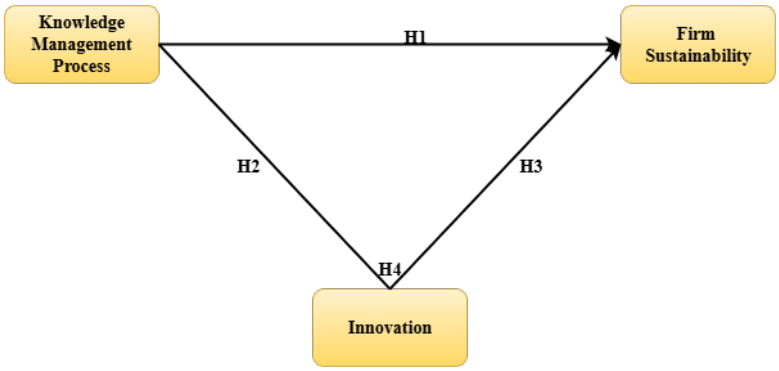

Figure 1. Conceptual model.

Source: The author's own construct based on RBV and DVC theories.

3. Methodology

This study employed a quantitative, cross-sectional survey design to empirically examine the relationships among Knowledge Management Processes (KMP), Innovation (INV), and Firm Sustainability (FS). The use of Structural Equation Modeling (PLS-SEM) through SmartPLS 4 was applied to assess both direct and mediating effects simultaneously.

3.1. Research Design and Sampling Justification

This study adopted a quantitative, cross-sectional survey design to investigate the relationships between Knowledge Management Processes (KMP), Innovation (INV), and Firm Sustainability (FS) among Small and Medium-sized Enterprises (SMEs) in Ghana. A structured survey methodology was employed to collect primary data from employees across multiple departments. The study was conducted in the Greater Accra Region, which hosts the highest concentration of SMEs in the country and is characterized by high entrepreneurial activity, industrial diversity, and accessibility for research [67]. A total of ten (10) SMEs recognized for implementing formal knowledge management practices were purposively selected. Selection was based on documented engagement in KM-related strategies, including knowledge acquisition, sharing, and utilization systems, as well as the

presence of designated KM or innovation officers. This approach ensured that the chosen SMEs were relevant to the research objectives. Within each SME, a stratified random sampling technique was used to capture responses from diverse departments, such as operations, research and development, marketing, and administration, ensuring representation across hierarchical levels and functions.

The study targeted employees, managers, and knowledge officers directly involved in knowledge and innovation activities. A total of 550 questionnaires were distributed electronically, of which 410 were returned, and 360 were deemed valid, yielding a 65.45% usable response rate. On average, each SME contributed between 30 and 40 valid responses, ensuring balanced firm-level representation. To verify adequacy, the minimum required sample size was determined following Kock[68] and Hair Jr. et al.[69]'s guidelines. A power analysis (G*Power: $f^2 = 0.15$, $\alpha = 0.05$, power = 0.95) indicated a minimum of 138 respondents for the most complex model (five predictors). The achieved sample of 360 thus exceeds this threshold, providing robust statistical power for PLS-SEM.

3.2. Data Collection

Data were collected using a structured electronic questionnaire developed from validated scales from prior literature[41, 42]. The instrument consisted of closed-ended questions measured on a 5-point Likert scale (1 = strongly disagree) to (5 = strongly agree). It comprised four main sections presented in **Appendix A**. Specifically, **Appendix A.1** captures respondents' demographic information, **Appendix A.2, Table A1** details items measuring the Knowledge Management Process (KMP), and **Appendix A.3, Table A2** outlines items on Innovation. **Appendix A.4, Table A3** presents items assessing Firm Sustainability (FS). To ensure transparency and replicability, the survey design, administration, and validation processes were carefully structured as follows:

Common Method Bias (CMB) Control: Several procedural and statistical measures were implemented to reduce CMB. Procedurally, (i) temporal separation was applied by distributing predictor and criterion items in different sections of the questionnaire, (ii) respondent anonymity and confidentiality were assured to minimize evaluation apprehension, and (iii) neutral wording was used to limit social desirability and acquiescence bias. Statistically, the Kaiser-Meyer-Olkin (KMO) test confirmed sampling adequacy (KMO = 0.874), and Harman's single-factor test showed that the first factor explained less than 40% of total variance, indicating that CMB was not a major issue.

Pilot Testing and Instrument Refinement: Before the main data collection, a pilot test involving 30 respondents was conducted to evaluate item clarity, construct comprehension, and survey flow. Feedback from the pilot resulted in minor wording and sequencing adjustments to improve content validity. The pilot test yielded satisfactory internal consistency (Cronbach's $\alpha > 0.70$), confirming the reliability of the instrument.

Sampling and Survey Administration: The final survey was administered electronically to 10 purposively selected SMEs located in the Greater Accra Region of Ghana, recognized for their active knowledge management practices. Each firm contributed between 30 and 40 valid responses, totaling 360 usable questionnaires out of 550 distributed (response rate = 65.45%). Purposive sampling was deemed appropriate because the target respondents, managers, supervisors, and knowledge officers, possessed specialized insights into knowledge management, innovation, and sustainability processes.

Follow-up reminders were sent to non-respondents to enhance the response rate, and electronic administration was adopted to ensure cost efficiency and rapid data turnaround. This approach aligns with prior empirical designs examining knowledge-based processes in SMEs.

3.3. Measurement of Variables

The Knowledge Management Process (KMP) was measured using nine items that reflected three dimensions: knowledge acquisition, knowledge sharing, and knowledge utilisation. This is adapted from studies by Raudeliūnienė et al.[16] and Prietula and Gleason[70], and demonstrates the firm's ability to generate, disseminate, and apply knowledge internally and externally. Innovation was measured using nine items grouped under three categories: new products, new processes, and new services, indicating the state of creative advancement within the given organization. This scale is closely related to the research of Arsawan et al.[12], who investigated the appropriateness of innovation in achieving competitive advantage, and Zahedi et al.[71], who focused on the effects of innovation on performance. Firm Sustainability

was measured using nine categories, categorised into three aspects: economic, environmental, and social aspects of sustainability, as outlined in studies by Sagar[7] and Dyllick and Hockerts[44]. These measures provide sound theoretical guidance for analysing the relationship between knowledge management, innovation, and sustainability within organizational settings.

To enhance the primary construct, several control variables, including firm size, firm age, industry type, and employee tenure, were included to mitigate potential omitted variable bias and improve the robustness of the structural equation model. These control variables were included in the model to account for structural heterogeneity and potential confounding effects on both innovation and firm sustainability. Their inclusion aligns with previous empirical studies, with a strong emphasis on organizational outcomes. The reliability and validity of each construct were confirmed through Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE), with all indicators meeting the recommended threshold. Discriminant was also assessed using the Fornell-Larcker Criterion and the HTMT ratio.

3.4. Ethical Considerations

Ethical approval was obtained from a university-affiliated review board. Participants provided informed electronic consent and were assured of confidentiality, anonymity, and voluntary participation. Data was stored securely, and all procedures complied with applicable data protection regulations.

3.5. Endogeneity and Causal Validity

To mitigate endogeneity concerns, particularly reverse causality and omitted variable bias, we draw on theoretical foundations from the Resources-Based View and Dynamic Capabilities View to justify the directional path from knowledge management processes to innovation and subsequently to sustainability. We also added several control variables (firm size, age, industry type, and employee tenure) to the structural equation model to reduce omitted variable bias. Additionally, we conducted a Durbin-Wu-Hausman test to detect endogeneity in the structural path, and the results did not indicate a significant bias.

4. Results

4.1. Demographics

Table 1 presents a summary of the demographic characteristics of the respondents. Demographics included gender, age, educational qualification, and years of experience. Of the 360 respondents, 57.8% were male, while 42.2% were female. A significant proportion (29.4%) were aged 31–40 years, followed by 26.4% aged 21–30 years, reflecting a youth workforce. Aged 41–50 years accounted for 16.1%, those between 51–60 years made up 11.4%, while 8.9% were below 20 years, and 7.8% were 61 years and above. In terms of education, 46.7% of respondents hold a bachelor's degree, while 17.2% have a graduate-level qualification (Master's or PhD). A notable 21.9% possess a diploma, and 14.2% have completed high school education. In terms of position within the organization, the majority of respondents (73.6%) are categorized as other staff, with 9.7% serving in managerial positions, 12.2% as administrators, and 4.4% as business owners.

When considering tenure within their organizations, 46.7% of respondents have been with their company for 1–5 years, followed by 25% who have worked for 6–10 years. Only 13.6% have over 11 years of service, while 14.7% are relatively new, having been with the organization for less than a year. The number of employees in these organizations also varies, with 29.4% employing between 11 and 15 staff members and 20.8% employing 6 and 10 employees. Smaller firms with 1–5 employees make up 11.7%, while those with more than 31 employees account for only 6.7%. In terms of establishment age, 43.9% of the firms have been in existence for 11–15 years, with 32.2% between 6–10 years, and only 8.9% operating for more than 16 years.

4.2. Measurement Model Assessment

To confirm the measurement model, indicator reliability, internal consistency, convergent validity, and discriminant validity were assessed using the criteria outlined by Hair Jr. et al.[69]. All the outer loadings were higher than the 0.70 cutoff, thereby confirming item reliability. Cronbach's alpha ranged from 0.851 to 0.902, and composite reliability (CR) ranged from 0.889 to 0.934, both of which were higher than the 0.70 cutoff, thereby confirming inter-

nal consistency. Average Variance Extracted (AVE) values, ranging from 0.548 to 0.636, were greater than 0.50, thereby ensuring convergent validity, as shown in **Figure 2**. Discriminant validity was also established in several ways. The Fornell-Larcker criterion was used to test whether the square root of each construct's AVE was higher than its correlations with the other constructs, thereby setting the criterion. Cross-loadings were also below the conservative threshold of 0.85, further supporting discriminant validity. Cross-loading analysis further validated that all items loaded higher on their respective constructs than on any other construct, confirming the uniqueness of each construct. **Table 2** provides detailed results. Furthermore, the path coefficient reported indicates that KMP has a positive and significant direct effect on FS ($\beta = 0.568$, $p < 0.001$) and on INV ($\beta = 0.777$, $p < 0.001$), whereas INV also has a positive and significant effect on FS ($\beta = 0.329$, $p < 0.001$), as shown in **Figure 3**.

Following Fornell and Lacker, discriminant validity is confirmed when these diagonal values are greater than the corresponding inter-construct correlations, indicating that each construct shares more variance with its own indicator than other constructs, as shown in **Table 3**.

Table 1. Demographic characteristics.

Characteristics	Frequency	Percentage
Gender		
Male	208	57.8
Female	152	42.2
Total	360	100.0
Age		
Below 20	32	8.9
21–30	95	26.4
31–40	106	29.4
41–50	58	16.1
51–60	41	11.4
61 and above	28	7.8
Total	360	100.0
Level of Education		
High school	51	14.2
Diploma	79	21.9
Bachelor's	168	46.7
Graduate (Master's & PhD)	62	17.2
Total	360	100.0
Position in Organization		
Owners	16	4.4
Managers	35	9.7
Administrators	44	12.2
Other staff	265	73.6
Total	360	100.0
Number of Years in the Organization		
Less than a year	53	14.7
1–5 years	168	46.7
6–10 years	90	25.0
11 years and above	49	13.6
Total	360	100.0
Number of Employees		
1–5	42	11.7
6–10	75	20.8
11–15	106	29.4
16–20	38	10.6
21–25	44	12.2
26–30	31	8.6
31 and above	24	6.7
Total	360	100.0

Table 1. *Cont.*

Characteristics	Frequency	Percentage
Period of Firm Establishment		
1–5 years	54	15.0
6–10 years	116	32.2
11–15 years	158	43.9
16 years and above	32	8.9
Total	360	100.0

Source: Demographic Characteristics from field survey.

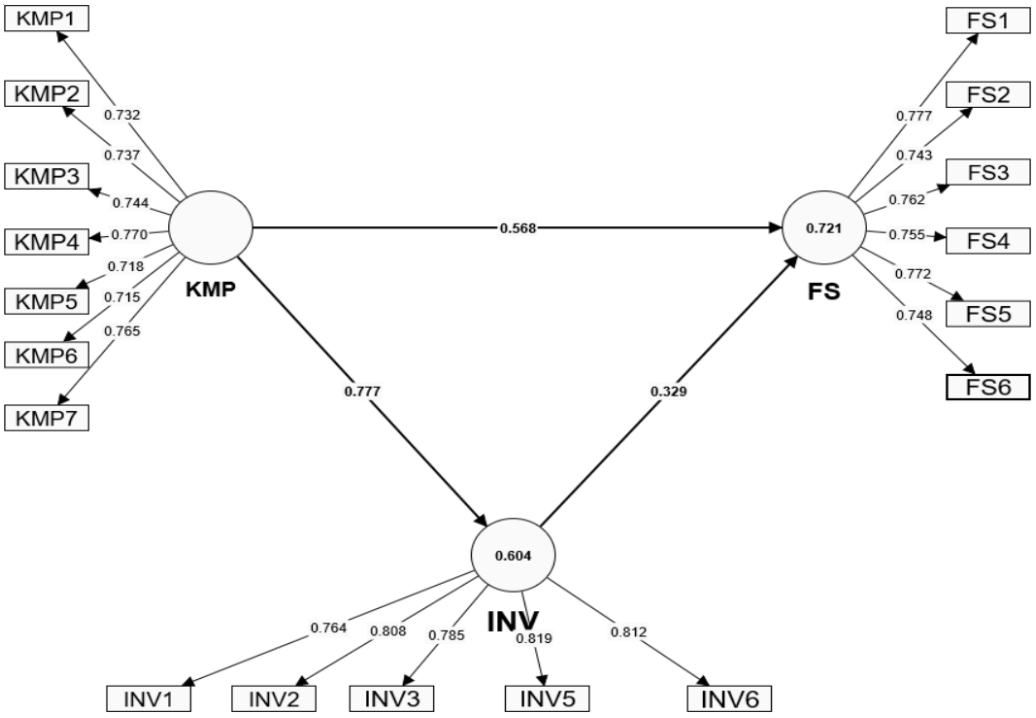

Figure 2. Measurement model results.

Source: The author's analysis using SmartPLS 4.

Table 2. Measurement model assessment.

Constructs	Items	Loadings	VIF	*t* Statistics	Cronbach's Alpha	Composite Reliability (rho_c)	AVE
FS	FS1	0.777	1.773	32.844	0.853	0.891	0.577
	FS2	0.743	1.758	28.985			
	FS3	0.762	1.746	31.320			
	FS4	0.755	1.782	27.658			
	FS5	0.772	1.840	30.787			
	FS6	0.748	1.674	31.243			
INV	INV1	0.764	1.762	28.353	0.857	0.897	0.636
	INV2	0.808	1.986	34.155			
	INV3	0.785	1.776	31.123			
	INV5	0.819	2.034	45.721			
	INV6	0.812	1.906	42.805			
KMP	KMP1	0.732	1.713	28.168	0.863	0.895	0.548
	KMP2	0.737	1.738	27.038			
	KMP3	0.744	1.716	26.261			
	KMP4	0.770	1.779	36.226			
	KMP5	0.718	1.619	23.364			

Table 2. *Cont.*

Constructs	Items	Loadings	VIF	*t* Statistics	Cronbach's Alpha	Composite Reliability (rho_c)	AVE
KMP	KMP6	0.715	1.694	24.561	0.863	0.895	0.548
	KMP7	0.765	1.861	34.124			

Note: KMP = Knowledge Management Process; INV= Innovation; FS = Firm Sustainability.
Cα ≥ 0.7; CR ≥ 0.7; AVE ≥ 0.5; loadings ≥ 0.6.
Source: The author's analysis using SmartPLS 4.

Table 3. Fornell-Larcker discriminant validity.

Constructs	FS	INV	KMP
FS	**0.900**		
INV	0.750	**0.850**	
KMP	0.800	0.770	**0.830**

Note: The diagonal values (**0.900**, **0.850**, and **0.830**) represent the square roots of the Average Variance Extracted (AVE) for each construct, Firm Sustainability (FS), Innovation (INV), and Knowledge Management Processes (KMP), respectively.
Source: The author's analysis using SmartPLS 4.

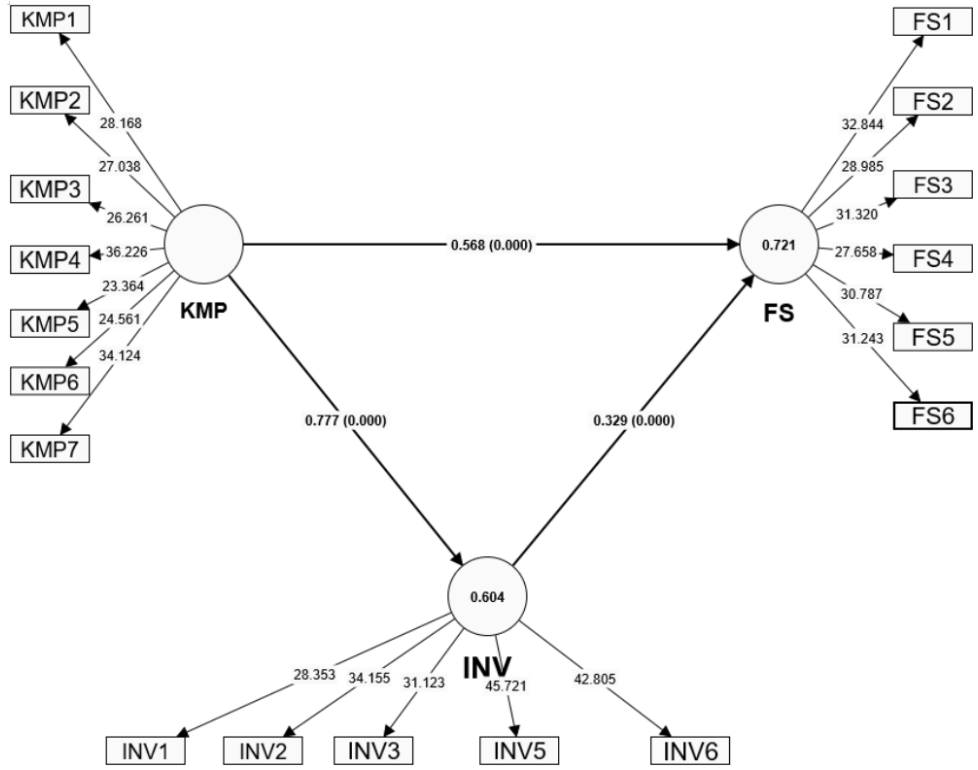

Figure 3. Path model significance results.

Source: The author's analysis using SmartPLS 4 output.

4.3. Coefficient and Predictive Relevance

The quality of the relationship in this model is assessed using R^2 and Q^2, where an R^2 value above 0.67 indicates substantial explanatory power, and values between 0.33 and 0.67 suggest moderate explanatory power. In contrast, values above 0.19 indicate a little sparing yet significant relationship. For the same case, the R^2 values for FS and INV are 0.721 and 0.604, respectively, suggesting substantial and moderate explanatory power, with FS showing the strongest relationship with its predictors. Additionally, the Q^2 values, being greater than zero and notably high, support the fact that the model has predictive importance. The Q^2 value for FS is 0.675, and for INV, it is 0.601, which attests to the model's validity in predicting effects for both the constructs under study, as shown in **Table 4**.

Table 4. Coefficient and predictive relevance.

Constructs	R-square (R^2)	(Q^2)
FS	0.721	0.675
INV	0.604	0.601

Source: The author's analysis using SmartPLS 4.

4.4. Structural Model Assessment

The structural model was subsequently cross-validated using bootstrapping with 5,000 resamples, as recommended by Hair Jr. et al.[69], to test the significance of path coefficients. The model accounted for a significant variance in Firm Sustainability (FS; $R^2 = 0.721$) and Innovation (INV; $R^2 = 0.604$), demonstrating good explanatory power.

Direct effects revealed that KMP had a positive impact on FS ($\beta = 0.568$, $p < 0.001$) and INV ($\beta = 0.777$, $p < 0.001$). Thus, INV strongly predicted FS ($\beta = 0.329$, $p < 0.001$). The indirect effect of KMP on FS through INV was also significant ($\beta = 0.255$, $p < 0.001$), thereby establishing partial mediation. The total impact of KMP on FS (direct and indirect) was $\beta = 0.823$ ($p < 0.001$), indicating that KM processes are significantly responsible for firm sustainability, both directly and indirectly, through innovation.

Predictive relevance (Q^2) calculated using blindfolding with a deletion of 7 was greater than 0 (FS = 0.51; INV = 0.47), indicating that the model possesses high predictive ability. To evaluate the overall fit of the model, the standardized root mean square residual (SRMR) was calculated, yielding a value of 0.064, which is below the recommended threshold, indicating a good model fit. The results are summarized in **Table 5**.

4.5. Kaiser-Meyer-Olkin (KMO) Test and Cronbach's Alpha

The data presented in **Table 6** reflect the outcome of the KMO and Cronbach's alpha tests. Each of the variables, KMP (7 items), INV (5 items), and FS (6 items), exceeded the minimum KMO value of 0.60. Specifically, INV had the lowest KMO value at 0.849, while KMP had the highest at 0.893. These values indicate that our questionnaires were appropriate for our study's intended unit of measurement. Additionally, all variables exceeded the minimum Cronbach's alpha result of 0.70, indicating good internal reliability.

Table 5. Structural model results: direct, indirect, and total effects.

Direct Effects							
Constructs	**Path Coefficient**	**Mean (M)**	**STDEV**	***t* Statistics**	***p*-Values**	**Decision**	**Effect**
INV → FS	0.329	0.329	0.041	8.006	0.000	Supported	Direct
KMP → FS	0.568	0.568	0.040	14.262	0.000	Supported	Direct
KMP → INV	0.777	0.778	0.022	36.086	0.000	Supported	Direct
Indirect Effect							
KMP → INV → FS	0.255	0.256	0.033	7.808	0.000	Partially mediated	Indirect
Total Effect							
KMP →FS (Total effect)	0.823	0.824	0.036	22.861	0.000	Supported	Indirect

Note: KMP = Knowledge management Process; INV = Innovation; FS = Firm Sustainability.
SRMR = (Standardized Root Mean Squared Residual) = 0.064, indicating acceptable model fit.
Bootstrapping was performed with 5,000 subsamples.
Source: The author's computation using SmartPLS 4.

Table 6. Kaiser-Meyer-Olkin (KMO) test and Cronbach's alpha.

Variables	Number of Items	KMO	Cronbach's Alpha
KMP	7	0.893	0.863
INV	5	0.849	0.857
FS	6	0.863	0.853

Source: The author's analysis using SmartPLS 4.

4.6. Robustness Check

To validate the consistency of the results, we conducted multiple robustness checks, which included re-estimating the model using bootstrapping with 10,000 iterations, splitting the sample by firm size, and comparing structural equation modelling (SEM) across subgroups. We also tested the model with and without control variables to observe variations in the path coefficient. These results remained consistent across tests, confirming the robustness of the structural relationships and mediating effects.

5. Discussions of Results

The study revealed a strong positive relationship between Knowledge Management Processes (KMP) and Firm Sustainability (FS). This finding is significant, with a path coefficient of $\beta = 0.568$ and a p-value of less than 0.001, indicating that the proper implementation of KMP directly enhances the sustainability of firms. The importance of knowledge management, particularly for small and medium-sized enterprises (SMEs), is underscored by this result, aligning with previous studies that have demonstrated how effective knowledge management enables firms to adapt, innovate, and optimize operations continually. By facilitating the creation, sharing, and application of knowledge, firms are better equipped to manage their resources efficiently, thereby contributing to their long-term sustainability and success. This supports the existing literature, such as the works of Sagar[7], Wu et al.[18], and Saunila et al.[27], which argue that knowledge management plays a critical role in enabling firms to meet their environmental and social responsibilities while maintaining economic viability. Recent studies by Wu et al.[18] and Saunila et al.[27] confirm that knowledge integration and sustainability collaborations enable companies to achieve both economic and environmental goals, thereby supporting their leadership role in sustainability initiatives.

A particularly notable aspect of the findings is the mediating role of innovation in the relationship between KMP and FS. The results indicate that innovation partially mediates this relationship ($\beta = 0.255$, $p < 0.001$), suggesting that KMP exerts both direct and indirect effects on sustainability. This finding aligns with the assertion that KM lays the groundwork for innovation by supplying the intellectual capital and organizational learning necessary to generate creative solutions and continuous improvement. The independent pathway from Innovation (INV) to Firm Sustainability (FS) is also found to be positive and significant ($\beta = 0.329$, $p < 0.001$), confirming innovation's direct contribution to sustainable performance. This explicitly addresses the research goal of determining the direct effect of innovation on firm sustainability. Hence, innovation operates not only as a mediator but also as a standalone driver of sustainability outcomes.

This reinforces existing findings that innovation acts as a catalyst for eco-efficiency and sustainable development. Studies like those by Arsawan et al.[12], Zahedi and Khanachah[52] demonstrate that firms that integrate knowledge-driven innovation are more likely to enhance environmental performance and achieve strategic renewal. Similarly, Chaudhary and Kumar[55] emphasize that eco-innovation bridges the KM-sustainability link, while Awwad et al.[33] establish that green product and process innovation directly strengthen environmental sustainability. These results support the notion that knowledge management enables innovation, and innovation, in turn, translates that knowledge into practical, sustainability-oriented actions.

Furthermore, the study highlights the significant role that innovation plays in directly influencing firm sustainability, with a path coefficient of $\beta = 0.329$ and a p-value of less than 0.001. This finding is consistent with the broader literature, which emphasizes that innovation is key to maintaining a firm's competitive advantage while contributing to sustainability. By driving the development of eco-friendly products, improving resource efficiency, and addressing societal issues through innovation, firms can achieve both financial success and sustainability goals. This outcome reinforces earlier research by Sagar[7], who found that firms that balance innovation with environmental stewardship are more likely to sustain long-term growth. Additionally, Ketata et al.[65] suggest that innovative firms are better positioned to respond to market demands and regulatory changes aimed at promoting sustainability, further supporting the findings of this study. There is also supporting global evidence for this argument, with Morina[31] demonstrating that KM practices systematically lead to systematic innovation outcomes, and Xiao et al.[30] discussing how innovation enables companies to prosper through global shocks in their pursuit of sustainable development goals.

The mediating role of innovation also advances the-

oretical understanding of how knowledge-based resources are operationalized through dynamic capabilities. The study demonstrated that innovation is not just an outcome of knowledge management but a critical link that enhances the impact of KMP on sustainability[13]. By fostering a culture of innovation, firms can translate their knowledge assets into practical, sustainable solutions that address the challenges posed by evolving market conditions and environmental concerns. This aligns with the findings of Zhang et al.[10], who argue that firms that manage knowledge effectively are better equipped to utilize their resources for innovation, which in turn supports sustainable growth. The integration of innovation into the strategic framework of organizations is essential for ensuring that the knowledge generated through KMP is consistently applied in ways that drive sustainability, as supported by the works of Polder et al.[61, 72]. Alam et al.[25] reinforce that KM practices combined with technological innovation and absorptive capacity enhance SMEs' sustainability. This indicates that innovation is not merely an outcome of KM but a critical bridge connecting organizational knowledge to sustainable competitiveness.

Generally, the results provide valuable insights into the relationships between KMP, innovation, and firm sustainability. They highlight the importance of integrating knowledge management with innovation to achieve sustainable outcomes, particularly in dynamic and competitive environments where firms must continuously adapt to remain viable. The findings are consistent with the Resource-Based View (RBV) theory, which posits that firms that effectively manage valuable, rare, and inimitable resources such as knowledge and innovation capabilities are more likely to achieve sustained competitive advantages. In this context, knowledge management and innovation are viewed as crucial drivers of sustainability, providing firms with the tools they need to navigate complex market demands and contribute to long-term environmental and social well-being. By empirically validating these theoretical perspectives in the context of SMEs in an emerging economy, this study extends RBV and DCV to include innovation-driven sustainability as a distinct strategic outcome.

6. Conclusions

This study provides a comprehensive examination of the interconnected relationships among Knowledge Management Processes (KMP), Innovation, and Firm Sustainability, with a specific focus on Small and Medium-sized Enterprises (SMEs) operating within an emerging economy context. The findings offer substantial theoretical, managerial, and practical insights, particularly by demonstrating the pivotal and dual role of knowledge management and innovation as enablers of sustainable organizational performance. By empirically establishing innovation as a mediating mechanism between KMP and FS, the study contributes to the expanding body of literature that underscores the strategic alignment of knowledge assets and innovation capabilities as essential to achieving long-term competitiveness and sustainability.

One of the core conclusions drawn from this research is that effective knowledge management serves as a cornerstone for firm sustainability. The results reveal that firms that systematically create, share, and apply knowledge are more likely to enhance their resilience and achieve sustained growth. This finding reinforces the Resource-Based View (RBV), affirming that knowledge is a valuable, rare, and inimitable resource that underpins sustainable competitive advantage, particularly when strategically oriented toward sustainability objectives. Simultaneously, the study extends the Dynamic Capabilities View (DCV) by illustrating that innovation functions as a dynamic capability that enables organizations to reconfigure and transform their knowledge into actionable, sustainable solutions.

Moreover, the results affirm that the full potential of knowledge management is realized when firms cultivate innovation as a core organizational value. Innovation acts as a transformative bridge that operationalizes knowledge into new products, processes, and business models that promote economic, social, and environmental sustainability. This finding advances existing theory by integrating RBV and DCV into a coherent framework that captures how knowledge-based resources are activated through innovation to generate sustainability outcomes, especially within resource-constrained environments typical of SMEs in emerging economies.

The theoretical contribution of this research lies in its contextual and conceptual novelty. Unlike prior studies that predominantly focused on large corporations or developed economies, this study offers empirical validation from Ghanaian SMEs, thereby enriching scholarly understanding of how knowledge and innovation interplay to drive sustainability in

emerging market settings. It also broadens the Knowledge-Based View (KBV) by positioning sustainability as a strategic outcome of effective KM and innovation integration, extending the theoretical discourse beyond traditional notions of performance and competitiveness.

The practical and managerial implications of these findings are far-reaching. Managers are encouraged to institutionalize formal knowledge-sharing platforms, such as digital repositories, innovation workshops, and cross-functional learning teams, to facilitate the continuous flow of knowledge and ideas. SMEs should embed innovation within their organizational culture by fostering experimentation, creativity, and risk-taking behaviours that transform knowledge into tangible sustainability initiatives. Additionally, collaboration with external partners, including suppliers, universities, and policy institutions, can expand firms' innovation capacity and access to resources critical for sustainable development. Policymakers should create enabling environments through innovation incentives, digital infrastructure support, and sustainability-focused training to help SMEs operationalize KM for sustainability.

Furthermore, aligning innovation efforts with sustainability objectives is crucial for responding to increasing regulatory, environmental, and consumer pressures. Managers must therefore strategically integrate KM and innovation practices into corporate sustainability frameworks, ensuring that knowledge-based decisions translate into measurable improvements in energy efficiency, resource utilization, and social responsibility.

Notwithstanding these contributions, certain limitations merit consideration. The study's cross-sectional design restricts causal inference, and its contextual focus on Ghanaian SMEs may limit generalizability to other economies. Future research should employ longitudinal or multi-country designs to observe dynamic changes in KM–innovation–sustainability relationships over time. Additionally, examining moderating factors such as leadership style, digital transformation, and organizational culture would provide a more nuanced understanding of how internal and external conditions shape the knowledge–innovation–sustainability nexus. Incorporating emerging technologies such as artificial intelligence (AI), big data analytics, and green digital transformation into future models could also enhance understanding of how firms can harness technological enablers to strengthen sustainability performance.

6.1. Theoretical Implications

Theoretical contributions of this study are multidimensional, providing both empirical verification of existing frameworks and new additions to the literature in knowledge management, innovation, and sustainability.

Firstly, the study empirically verifies the Resource-Based View (RBV), as it demonstrates that Knowledge Management Processes (KMPs) are valuable, rare, imitable, and non-substitutable assets. The strong positive impact of KMP on firm sustainability validates that knowledge assets are not just the target of competitive advantage, but also essential in sustaining environmental and social performance. This builds upon RBV by adding sustainability as a performance measure, which implies that long-term survival for businesses today depends on maximizing intangible assets, not just to ensure efficiency and profitability, but also to enhance nature's and society's resilience [18].

Secondly, the research extends the Dynamic Capabilities View (DCV) by demonstrating that innovation acts as a mediator of the impact of KMP on sustainability. Innovation, being a dynamic capability, enables companies to perceive opportunities, utilize them with new approaches, and re-engineer knowledge into sustainable practices. This provides theoretical proof that innovation actualizes the potential of knowledge resources into existence, thus expanding DCV to highlight the point that knowledge management is not constitutive but enabling in the formation of dynamic capabilities [33, 39].

Third, the research contributes to the Knowledge-Based View (KBV) of the firm by explicitly positioning sustainability as a strategic benefit of knowledge management. Although KBV has traditionally linked knowledge with innovation and efficiency, this study extends the framework by demonstrating that, when combined with innovation, knowledge yields triple-bottom-line results encompassing economic, social, and environmental aspects [25]. This shift changes KBV from a limited competitive advantage mindset to one that positions knowledge as a source of power, driving accountable and sustainable business models.

Fourth, the study offers a more complete understanding of the relationship between innovation and sustainability. By

confirming innovation as a mediator in an empirical sense, the study bridges two literatures that are generally considered in isolation. The findings suggest a cyclical process in which knowledge generates innovation, which in turn generates sustainability, creating feedback loops that amplify the process[30, 31]. This is contrary to linear cause–and–effect theory and favours a more comprehensive, system-based theory of organizational development.

Lastly, the research makes a contextual theoretical contribution, as it focuses on SMEs in an emerging economy. Most of the literature has focused on large companies in developed economies; however, research indicates that even small firms are capable of achieving sustainability through the application of KMP and innovation. This indicates the responsiveness of RBV, DCV, and KBV to varying firm sizes and institutional environments, focusing on resource recombination and frugality innovation as key drivers for SMEs in the context of scarcity[25].

6.2. Practical/Managerial Implications

The practical and managerial implications of this study are substantial, particularly for SMEs in emerging economies that face resource constraints but must still pursue sustainability.

First, the findings demonstrate that KMP has a significant positive impact on firm sustainability ($\beta = 0.568$, $p < 0.001$). Managers should therefore prioritize the development of robust knowledge management systems that facilitate the systematic creation, sharing, and application of knowledge. Such systems can be operationalized through digital repositories, collaborative knowledge platforms, and continuous learning programs that facilitate real-time exchange of information. This approach helps prevent knowledge silos, enhances collective problem-solving, and strengthens firms' adaptive capacity to address environmental and market changes.

Second, since innovation partially mediates the KMP-sustainability relationship ($\beta = 0.255$, $p < 0.001$), managers must ensure that accumulated knowledge is effectively translated into innovative practices. This requires cultivating an organizational culture of creativity, experimentation, and calculated risk-taking, where employees are empowered and rewarded for proposing new ideas. Implementing cross-functional innovation teams, internal incubators, and targeted R&D investments will enable SMEs to convert knowledge into environmentally friendly products, processes, and services that enhance competitiveness and sustainability.

Third, the study affirms that innovation has a direct and significant impact on sustainability ($\beta = 0.329$, $p < 0.001$). Managers should thus align innovation strategies explicitly with sustainability objectives, ensuring that new initiatives are economically viable, socially responsible, and environmentally sound. For example, SMEs may adopt energy-efficient technologies, waste minimization practices, and eco-design principles that simultaneously reduce operational costs and improve corporate reputation. This finding echoes emerging evidence from Xiao et al.[30] and Awwad et al.[33], who found that sustainability-oriented innovation enhances market differentiation and long-term performance.

Fourth, cross-functional collaboration is critical to embedding sustainability throughout the organizational value chain. Managers should integrate departments such as R&D, operations, and marketing to ensure alignment between innovation initiatives and sustainability objectives. For resource-constrained SMEs, such collaboration maximizes the utility of existing knowledge assets, prevents duplication of efforts, and accelerates the transformation of ideas into viable solutions.

Fifth, the study underscores the strategic importance of external partnerships as complements to internal KM and innovation systems. Managers should proactively engage with suppliers, universities, government agencies, and non-governmental organizations to access new technologies, research expertise, and financial resources. Collaborations with universities can drive joint innovation in green technologies, while government programs can provide fiscal incentives or grants to support sustainable innovation. This is consistent with Alam et al.[25], who highlight that cross-sector partnerships enhance SMEs' innovation capacity and environmental performance.

Sixth, firms should restructure their performance measurement and reward systems to align with sustainability-oriented KM and innovation outcomes. Managers should introduce sustainability KPIs, such as the percentage of green products, reductions in energy use, or the number of knowledge-sharing initiatives implemented. Performance evaluation and incentives must reward not only financial outcomes but also collaborative efforts, knowledge sharing,

and contributions to sustainable innovation achievements.

Finally, leadership commitment is vital for embedding sustainability-oriented KM and innovation practices into the organizational culture. SME leaders must model knowledge-sharing behaviours, champion sustainability initiatives, and invest in employee training that enhances both technical and creative competencies. Leadership-driven communication and visible engagement with sustainability goals create a culture where innovation and knowledge continuously feed into one another, ensuring the long-term viability and competitiveness of the firm.

6.3. Limitations and Prospects for Further Study

Although this study significantly contributes to the knowledge on the interrelationship among Knowledge Management Processes (KMP), innovation, and firm sustainability, it has some notable limitations.

Firstly, the cross-sectional nature of the data limits the ability to make causal inferences. Since data were gathered at a single point in time, the study cannot track how KMP and innovation affect sustainability dynamically over time. Future research should employ longitudinal designs to investigate how these relationships change over time, especially in fast-paced business environments.

Second, a confirmatory assumption by the survey respondent invites potential bias where responses are self-reported in surveys. Even after controlling for procedural and statistical issues, common method variance and social desirability remain challenging to overcome. Future studies could employ mixed-methods surveys, interviews, and archival data, combining these approaches to include objective measures such as financial outcomes or environmental impact data, thereby increasing validity and reliability.

Third, innovation was uniquely isolated as the only mediator in this study. Such a method might overlook other organizational variables that affect the KMP sustainability relationship. Future studies are advised to examine other mediators and moderators, including organizational culture, leadership style, digital orientation, and absorptive capacity, which might affect how knowledge is translated into sustainable outcomes.

Fourth, the acquisition of knowledge from outside through collaborations was not fully explored. For small and medium-sized businesses in emerging economies, partnerships with universities, suppliers, or government bodies often provide access to technologies and knowledge that cannot be developed in-house. Future studies may examine how external collaborations, networks, and open innovation platforms support the KM–innovation–sustainability nexus.

Fifth, the research did not break down the results of sustainability. Although sustainability was quantified through a multidimensional concept, further research could investigate how companies prioritize and rank economic, environmental, and social components within industries, thereby providing a more nuanced representation of trade-offs and synergies.

Lastly, new technologies like artificial intelligence, big data, and digital platforms were excluded from this research. These technologies are increasingly influencing KM practices through predictive analytics, automated knowledge sharing, and innovation accelerators. Further research could investigate the intersection of digital transformation and KM in fostering innovation and sustainability, particularly among resource-constrained SMEs.

Author Contributions

Conceptualization, J.K.B. and V.E.A.; methodology, P.A.S., J.K.B., and J.G.; formal analysis, P.A.S., J.K.B., and J.G.; data curation, V.A.O., J.K.B., and L.K.B.C.; writing—original draft preparation, V.A.O., J.K.B., and V.E.A.; visualization, V.A.O., P.A.S., and L.K.B.C. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

All procedures in this study were conducted according to the accepted standards of academic integrity. Ethical clearance was obtained from the University of Ghana Business School IRB, with Approval No. UGBS/2024/IRB/027. Participation in the study was completely voluntary. Informed consent was sought from all respondents in advance of data collection. The anonymity and confidentiality of all participants and their organizations were strictly observed; no personal information whatsoever was collected that would lead to the identification of any person.

Informed Consent Statement

Informed consent was obtained from all participants involved in the study.

Data Availability Statement

Data will be available upon request.

Conflicts of Interest

All authors declare no conflict of interest.

Appendix A. Survey Questionnaire

Appendix A.1. Section 1: Demographic Information

Please tick [√] in the applicable box or provide an answer when completing this questionnaire.

1. What is your gender?
   - □ Male
   - □ Female
   - □ Prefer not to say
2. What is your age group?
   - □ Below 20
   - □ 21–30
   - □ 31–40
   - □ 41–50
   - □ 51–60
   - □ 61+
3. What is your highest level of education?
   - □ High school
   - □ Diploma
   - □ Bachelor's degree
   - □ Master's degree
   - □ Doctorate
4. What is your role in the company?
   - □ Owner
   - □ Manager
   - □ Administrator
   - □ Staff
5. How long have you worked in your current organization?
   - □ Less than 1 year
   - □ 1–3 years
   - □ 4–6 years
   - □ 7–10 years
   - □ More than 10 years
6. Which category does your organization fall into?
   - □ Manufacturing
   - □ Service
   - □ Technology
   - □ Others

Appendix A.2. Section 2: Knowledge Management Process (KMP)

Please indicate your level of agreement with the following statements regarding the knowledge management process (KMP) within your organization.

Table A1. Knowledge Management Process (KMP).

Item	Statement	1	2	3	4	5
Knowledge Acquisition						
1	Our organization regularly gathers information by studying feedback from customers, suppliers, and competitors.					
2	We frequently update our knowledge base to reflect emerging industry trends.					
3	Employees are motivated to learn new things to enhance their job performance.					
Knowledge Sharing						
4	Employees in my organization freely share their knowledge and expertise.					
5	There are tools and systems within my organization designed to share knowledge.					
6	In my organization, employees who contribute knowledge are rewarded.					
Knowledge Utilization						
7	The knowledge we gain is applied in our day-to-day operations.					
8	My managers utilize the knowledge shared to inform their business decisions.					
9	We often depend on stored knowledge to address business challenges.					

Note: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

Appendix A.3. Section 3: Innovation

Please indicate your level of agreement with the following statements regarding Innovation within your organization.

Table A2. Innovation.

Item	Statement	1	2	3	4	5
Product Innovation						
1	Our organization introduces new or enhanced products and services regularly.					
2	My organization designs products and services to respond to customers' needs.					
3	Product innovation is a key focus for our planning process.					
Process Innovation						
4	My organization makes regular upgrades to our internal operations to increase how quickly work is done.					
5	Digital technologies are incorporated into our work operations.					
6	My organization focuses on boosting the efficiency of work operations.					
Organizational Innovation						
7	My organization introduces new ways of managing and planning our work.					
8	My organization responds quickly to shifts in the market and the environment.					
9	Members of my organization are motivated to be innovative.					

Note: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

Appendix A.4. Section 4: Firm Sustainability

Please indicate your level of agreement with the following statements regarding Firm Sustainability.

Table A3. Firm Sustainability.

Item	Statement	1	2	3	4	5
Economic Sustainability						
1	My organization has strong and stable finances.					
2	We continually seek new ways to enhance our financial situation.					
3	Business activities are established to generate consistent profits over a long period.					
Environmental Sustainability						
4	We take steps to reduce waste and emissions at our operation.					
5	Recycling and utilizing renewable materials are integral to the production of goods and services.					
6	Our corporate mission also includes promoting sustainability.					
Social Sustainability						
7	We encourage people to act ethically and be socially responsible.					
8	My organization believes in diversity and inclusivity.					
9	We strive to support both our employees and the communities in which we operate.					

Note: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.

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