

KNOWLEDGE-SHARING AND GREEN INNOVATION IN SMES: A HYBRID BIBLIOMETRIC REVIEW

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Abstract. This systematic literature review and bibliometric analysis aims to explore the roles of knowledge-sharing and green innovation in the context of Small and Medium-sized Enterprises. The study examined 68 articles retrieved from the Scopus database as of September 8, 2025. Three major findings emerged based on this review: a direct path via green knowledge-sharing, by enhancing absorptive and technological capabilities, as well as an integrative path mediated by several factors, such as leadership, organizational culture, and external networks. The findings also reveal a rising trend in publications from 2020 to 2023, spurred by the COVID-19 pandemic, followed by a decline in 2024 and 2025. Geographically, the United Kingdom, China, and Italy were the top contributors. The study concludes that knowledge-sharing is a fundamental element for Small and Medium-sized Enterprises innovation, and its effectiveness is highly contextual. Theoretical implications point to the importance of integrating the Resource-Based View and Knowledge-Based View, while practical implications emphasize the role of Small and Medium-sized Enterprises managers in promoting a digital culture and encouraging open collaboration.

Keywords: Knowledge-sharing, Green Innovation, Small and Medium-sized Enterprises, Sustainable Innovation, Bibliometric Analysis

1. Introduction

Small and Medium Enterprises (SMEs) play an important role in the global economy but face significant pressures due to climate change, technological disruption, and sustainability demands (Riana et al., 2023). Innovation has become essential for maintaining competitiveness, particularly green innovation, which involves the development of environmentally friendly products and processes (Audretsch et al., 2023; Esponda Pérez and Galindo, 2025). However, the innovation capabilities of SMEs are still relatively low, mainly due to limited internal and external resources (Riana et al., 2023). In particular, internal resource limitations often hinder SMEs from adopting green practices effectively (Kim and Shim, 2018; Lin and Lai, 2021). Knowledge sharing has emerged as a salient concept in the strategic management and innovation literature, denoting the process through which individuals and organization exchange of knowledge, ideas, and information among individuals and organizations (Paredes Chacín et al., 2024; Riana et al., 2023). Knowledge-sharing is identified as an important catalyst that enables SMEs to access external knowledge, enhance innovation capabilities, and build collaborative advantages (Curado, 2018; Paredes Chacín et al., 2024). Despite its importance, the correlation between knowledge-sharing and green innovation has not been studied comprehensively. Previous studies tend to examine these themes separately, focusing on themes, such as social capital (Kim and Shim, 2018), human resource management systems (Curado, 2018), or green human resource management (GHRM) as a mediator of competitive advantage (Esponda Pérez and Galindo, 2025) without elaborating on the underlying integrative mechanisms. Furthermore, the dominant methodological approaches in existing research are often linear and reductionist, failing to capture the

multidimensional configuration of factors that shape green innovation in the context of SMEs (Curado, 2018; Poorkavoos et al., 2016). This creates a literature gap that hinders a comprehensive understanding of how knowledge-sharing can effectively drive green innovation.

This study is particularly relevant as it integrates two important concepts: knowledge-sharing and green innovation for SME sustainability, which have often been addressed separately in previous scientific studies. The primary objective is to investigate the existing body of literature concerning the interplay between these two concepts in SMEs, and to assess their continuing importance as areas warranting further academic inquiry. Theoretically, this study contributes to the development of the Resource-Based View (RBV) theory by analyzing how knowledge-sharing can drive green innovation in SMEs. Methodologically, this study employs a comprehensive synthesis through the application of a structured literature review framework, integrated with bibliometric techniques, to address three core research questions:

RQ1: How does Knowledge-sharing influence Green Innovation in SMEs?

RQ2: How does the Knowledge-sharing and Green Innovation concept in SMEs evolved?

RQ3: What are the theoretical and practical implications identified in the existing literature, and what directions do they suggest for future research?

The SLR method is suitable for mapping research trends, gaps, and future research directions. It ensures that conclusions are drawn from a broad and representative sample of studies and highlights areas that require further investigation (Snyder, 2019). The bibliometric approach enhances the review by quantifying publication trends and evaluating the scholarly influence of research outputs related to this domain. The study examined peer-reviewed articles indexed in Scopus and published on September 8, 2025, with data visualization carried out using VOSviewer to reveal key patterns and co-occurrence networks.

2. Literature Review

The role of knowledge-sharing (KS) in driving innovation in small and medium-sized enterprises (SMEs) has developed rapidly, both in terms of theoretical frameworks and empirical perspectives. Several studies conceptualize innovation as a dynamic process influenced by the interaction between internal capabilities and external pressures (Curado et al., 2018). Three main frameworks are often used to explain this phenomenon: the Resource-Based View (RBV), Knowledge-Based View (KBV), and Dynamic Capabilities Theory (DCT). The RBV and DCT emphasize the importance of developing dynamic capabilities to achieve sustainable competitive advantage, while KBV highlights knowledge as a critical strategic resource that enables SMEs to overcome resource limitations and expand their innovation potential (McAdam et al., 2014). Empirical evidence suggests that SMEs often rely on external stakeholders to acquire new knowledge, overcome internal knowledge limitations, develop and improve capabilities, recognise emerging opportunities and challenges, as well as develop more adaptive and innovative solutions (Shahzad et al., 2025; Tiberius et al., 2021). In the context of green innovation, Esponda Pérez and Galindo (2025) examined the moderating role of green knowledge-sharing in the relationship between green human resources management and green competitive advantage, showing that green knowledge-sharing significantly influences green innovation outcomes. These effects are not neutral and depend on the type of knowledge shared and the specific contextual environment.

Other empirical studies reveal that knowledge-sharing plays an important mediating role in the correlation between leadership factors and innovation. Afriyie et al. (2020) emphasize the role of absorptive capacity, which refers to an organization's ability to acquire, assimilate, transform, and exploit external knowledge through knowledge-sharing, thereby improving

innovation performance. On the other hand, institutional context also plays a significant role. Hänle et al. (2023) show that government policies and regulations can reduce the liability of foreignness barriers for SMEs operating across countries. Harel et al. (2021) highlighted the importance of managerial roles in facilitating knowledge-sharing and open innovation tools, rather than relying on excessive managerial control. Social capital factors have also been identified as key determinants of knowledge-sharing, covering structural, relational, and cognitive dimensions (Kim and Shim, 2018), as well as the role of gatekeepers who facilitate knowledge flow between entities (Mitchell et al., 2014). However, the relationship between SMEs and external institutions is often generic and superficial, leading to an implementation gap (De Zubielqui et al., 2015).

In the context of digitalization, Schildt et al. (2024) emphasized that digital innovation is not only influenced by technological aspects, but also by institutional complexity and ecosystem collaboration. These findings align with Poorkavoos et al. (2016), which reveal that innovation is not the result of a single factor, but rather a complex configuration of variables, including networks, flexibility, and organizational structure. Isa et al. (2024) added the dimension of dynamic capabilities and found that while knowledge-sharing enhances innovation capabilities (IC), it negatively affects performance when mediated by IC in the case of Indonesian batik SMEs, contrasting with previous findings, which reported predominantly positive effect. From a KBV perspective, Khraishi et al. (2023) found that internal knowledge creation capability (IKCC) strengthens absorptive capacity and improves offshoring innovation performance. Nonetheless, excessive formality in knowledge-sharing practices can hinder the effectiveness of global innovation. In the sustainability domain, the literature reveals a significant gap. Most previous studies have focused more on general or product innovation, with limited attention to how knowledge-sharing supports green innovation. In fact, Esponda Pérez and Galindo (2025) emphasized the importance of cross-organizational learning and environmental knowledge transfer for the success of green innovation efforts. Supporting this view, Iqbal and Piwowar-Sulej, (2023) found that sustainability-oriented leadership can drive frugal innovation through the mechanisms, such as knowledge diversity and entrepreneurial bricolage practices.

3. Method

In academic research, systematic literature reviews combined with a bibliometric approach are widely used to quantitatively assess literature, thereby revealing trends, patterns, and key research entities within a field of study. By utilising frameworks, such as *PRISMA*, this approach ensures a comprehensive and replicable literature review process, resulting in a clear and transparent mapping of the research landscape (Hadi et al., 2020). The inclusion criteria used in this study were: (1) articles published September 8, 2025, (2) publications in English, and (3) studies focusing on the issue of knowledge-sharing and green innovation in SMEs. Bibliometric analysis was conducted using *VOSViewer* to visualize bibliographic data, including citation networks, inter-author collaborations, and keyword co-occurrences, thereby revealing the intellectual structure and dynamics of developments in the field of research. The combination of bibliometric analysis and systematic review allows researchers to synthesize empirical findings while mapping the research landscape, including identifying key contributors and emerging trends (Ni and Abdullah, 2025). The combined approach provides a more comprehensive understanding of the evolution, historical trajectory, and future direction of the field, which is especially valuable for interdisciplinary studies seeking deeper insights (Wang and Hong, 2025).

The initial phase of the identification process involved selecting appropriate keywords using a top-down (macro-level) methodology. This began with a broad search scope that was gradually

refined to target more specific themes. Due to the limited prior research on knowledge-sharing and green innovation in SMEs, a refined keyword search strategy was adopted. The Scopus database was selected as the primary source due to its wide application in conducting literature reviews, expert identification, and research trend analysis. A search was conducted on September 8, 2025 using the specified keywords across article titles, abstracts, and keywords. The search terms included: "knowledge-sharing" OR "green knowledge-sharing" OR "knowledge transfer" OR "green knowledge transfer") AND ("innovation" OR "green innovation" OR "green innovation strategy" OR "process innovation" OR "green process innovation" OR "product innovation" OR "green product innovation" OR "open innovation" OR "green open innovation") AND ("SMEs" OR "SME" OR "small and medium enterprise" OR "small business" OR "medium-sized business"). This search yielded a total of 497 documents, spanning various academic disciplines and covering research published from 2006 to 2025 (see Figure 1).

The first screening stage was based on document type, which included conference papers (97), book chapters (37), conference reviews (28), reviews (11), books (4), short surveys (1), and editorials (1), resulting in a total of 97 documents being eliminated and 318 eligible documents. The second screening filtered by subject area, retaining only publications within Business, Management, and Accounting (86 articles), while discarding those from unrelated fields. Further screening removed 2 non-English articles and 16 inaccessible articles, resulting in a final dataset of 68 articles for in-depth analysis. These selected articles were used to address the following research questions:

RQ1: How does knowledge-sharing influence green innovation in SMEs?

RQ2: How does the knowledge-sharing and green innovation concept in SMEs evolved?

RQ3: What are the theoretical and practical implications identified in the existing literature, and what directions do they suggest for future research?

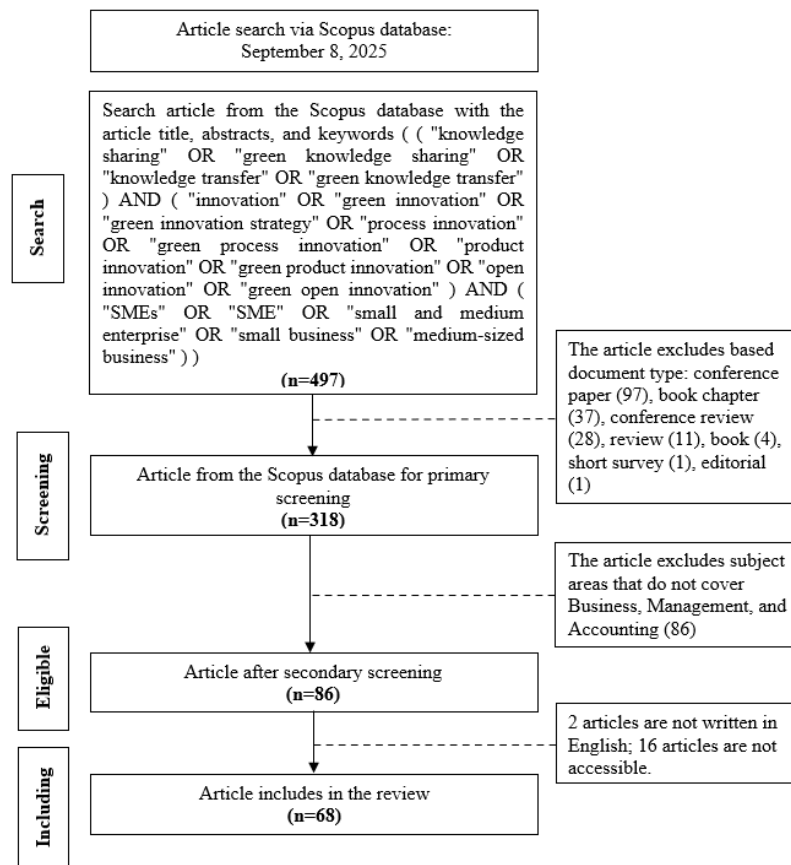


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Flow Diagram

4. Results and Discussion

This study presents findings based on 68 articles sourced from the Scopus database, focusing on knowledge-sharing and green innovation in small and medium-sized enterprises (SMEs). The data were obtained by identifying the number of articles published, publications throughout the year, and journal sources. This study also highlights the most influential elements in this field, including authors, affiliations, and countries involved.

RQ1: How does knowledge-sharing influence green innovation in SMEs?

Knowledge-sharing (KS) serves as a fundamental catalyst that significantly influences green innovation (GI) in small and medium-sized enterprises (SMEs). It enables organizations to acquire, combine, and internalize knowledge from both internal and external sources, which enhances their ability to develop environmentally friendly products and processes (Audretsch et al., 2023). Within this framework, knowledge-sharing not only functions as a medium for information transfer but also as a strategic mechanism connecting internal, external, and integrative factors to accelerate the adoption and implementation of green innovation. Specifically, knowledge-sharing that focuses on environmental knowledge has a significant impact on GI. Esponda Pérez and Galindo (2025) found that green knowledge-sharing moderates the correlation between green human resource management (GHRM) and green competitive advantage, indicating that the more effective green knowledge-sharing practices lead to greater competitiveness. Paredes Chacín et al. (2024) also revealed that inter-organizational knowledge transfer positively influences sustainable innovation, where SMEs

that actively exchange information with suppliers, customers, and external partners are better able to integrate economic, social, and environmental aspects into innovation.

Besides direct channels, knowledge-sharing influences green innovation through indirect mechanisms, particularly by enhancing absorptive capacity and innovation capabilities. Riana et al. (2023) and Lustono and Wening (2023) show that knowledge-sharing strengthens an organisation's ability to recognise, assimilate, and utilize external knowledge, including green technology and environmental regulations. As a result, SMEs with strong knowledge-sharing practices are better equipped to adopt green innovation. In line with this research, Lin and Lai (2021) emphasize that knowledge-sharing is a crucial factor in developing technological capabilities, which are essential for implementing green innovation.

Leadership also plays a vital role in facilitating knowledge-sharing. Chowdhury et al. (2022) found that leadership and organizational culture contribute to the success of the circular economy in SMEs, while Dahiya (2024) highlights that humble leadership creates psychological safety that encourages employees to be more open in sharing knowledge. Harel et al. (2021) and Arsawan et al. (2022) added that transformational and entrepreneurial leadership styles support a strong knowledge-sharing, which ultimately drives various forms of green innovation.

Furthermore, external networks expand the role of knowledge-sharing on green innovation. Dogbe et al. (2020) present that network embeddedness strengthens SME innovation performance by providing access to external knowledge, especially when combined with open innovation practices. Crupi et al. (2020) also emphasize the role of digital innovation hubs as knowledge brokers that facilitate interaction among actors, enrich the open innovation process, and support GI development.

In summary, the influence of knowledge-sharing on green innovation in SMEs is through three main channels. First, the direct channel of green knowledge-sharing strengthens the relationship between managerial practices and green competitive advantage. Second, the indirect channel where knowledge-sharing enhances absorptive capacity, technological capabilities, and overall innovation potential. Third, the integrative mechanisms through leadership, organizational culture, and external networks mediate and moderate the relationship between knowledge-sharing and green innovation.

RQ2: How does the knowledge-sharing and green innovation concept in SMEs evolved?

The annual distribution of publications indicates a growing interest related to knowledge-sharing and green innovation in SMEs over the past two decades (see Figure 2). Before 2008, only three relevant articles were published, one in 2006 and two in 2007. This number began to increase significantly in 2020, with six publications, followed by seven in 2021, eight in 2022, and nine in 2023. According to the authors' interpretation in 2020, there was the COVID-19 pandemic, which triggered widespread remote work and compelled organizations to adopt digital tools for internal communication and coordination, such as Google Meet, Zoom, and Discord. These changes accelerated the research agenda on digital transformation, remote knowledge-sharing, and service innovation to be more relevant. SMEs, in particular, were forced to implement digital solutions and knowledge-sharing practices to maintain operational resilience. Additionally, the surge in publications during this period was supported by external drivers, including specific issues in academic journals focusing on the pandemic, digital recovery, green transformation, and funding programs that prioritized digital and green innovation.

However, a decline in publications occurred in 2024, with seven articles, and a further drop in 2025, with only four articles published. Several factors may explain this downturn. First, topic maturity and saturation may have reduced the rate of new contributions. Second, the

researchers may have shifted their focus toward emerging concepts, such as sustainable digital transformation, green digitalization, circular economy, and digital sustainability. Third, the decline may reflect the conclusion of special issue cycles and temporary funding programs that had previously boosted research activity in this area.

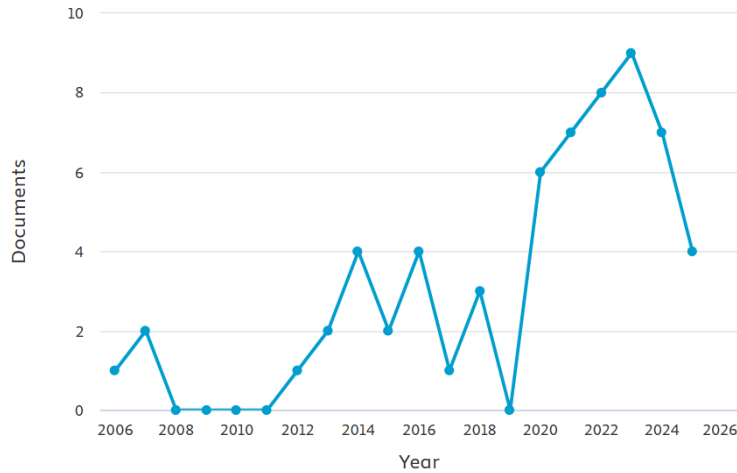


Figure 2. Number of publications related to knowledge-sharing and green innovation in SMEs for the period 2003-2025

Source: Scopus database

On the other hand, the distribution of articles related to knowledge-sharing and green innovation in SMEs based on the top 10 countries, as shown in Figure 3, indicates that the most popular journals among researchers related to knowledge-sharing and green innovation in SMEs originate from the United Kingdom, with 10 articles. China follows with nine articles, Italy with seven articles, France with six articles, and Australia with five articles. Belgium, Germany, Indonesia, Pakistan, and Vietnam each contribute four articles. These findings indicate that the knowledge-sharing and green innovation in SMEs have attracted attention not only in European countries but also in Asia and Australia, with particular relevance in Indonesia. Given its extensive SMEs sector, which play an important role in the national economy, Indonesia holds practical potential to enhance SMEs competitiveness, supporting the sustainable development goals, and encouraging international research collaboration. Nonetheless, the adoption of knowledge-sharing and green innovation still faces several challenges, including technological resource limitations, financing access, and collaborative network development.

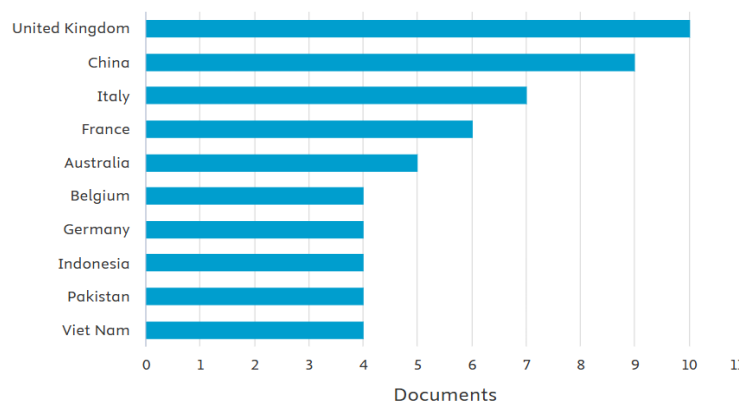


Figure 3. Distribution of articles by country or region (top 10 countries)

Source: Scopus database

RQ3: What are the theoretical and practical implications identified in the existing literature, and what directions do they suggest for future research?

Figure 4 below visualizes the relationship among key themes that emerge in the literature through co-occurrence keyword analysis using VOSviewer. This analysis forms the basis for identifying research clusters, theoretical and practical implications, and research gaps that are relevant to answering RQ3. From a total of 300 keywords with a minimum of two occurrences, 46 keywords met the threshold and were identified in seven clusters through content analysis. These clusters are represented by the colors of red, green, navy, purple, baby blue, as well as yellow and orange. The red cluster includes the keywords, such as knowledge transfer, knowledge management, absorptive capacity, small and medium-sized enterprises, small to medium-sized enterprises, and sustainable innovation. This cluster represents how SMEs successfully innovate and improve their performance through knowledge management and transfer.

The green cluster includes the keywords such as digital transformation, SMEs, digitalization, digital innovation and product innovation, and transformational leadership. This cluster reflects that digitalization is a dynamic capability that stimulates innovation. Digital transformation enables SMEs to change their business models, optimise operations, and produce more sophisticated product innovations. The navy cluster includes keywords such as SMEs, innovation, open innovation, dynamic capabilities, performance, knowledge, and cooperation. This cluster reflects how SMEs, as entities focused on long-term sustainability, must adapt and interact with the external environment to maintain competitiveness.

The purple cluster includes the keywords such as knowledge-sharing, social capital, information technology, and innovation capability. This cluster reflects that networks and social norms are important prerequisites for individuals and groups to share knowledge effectively, both explicit and tacit. The baby blue cluster includes the keywords innovation performance, innovation management, innovation orientation, and organization. This cluster reflects the internal and managerial dimensions of innovation so that its innovation can occur consistently and measurably within a company. Then, the yellow and orange clusters include keywords such as green innovation, Vietnam, China, and Pakistan, indicating a geographic focus in the analyzed research, which may reveal several gaps related to the generalization of theory across different cultures and economies.

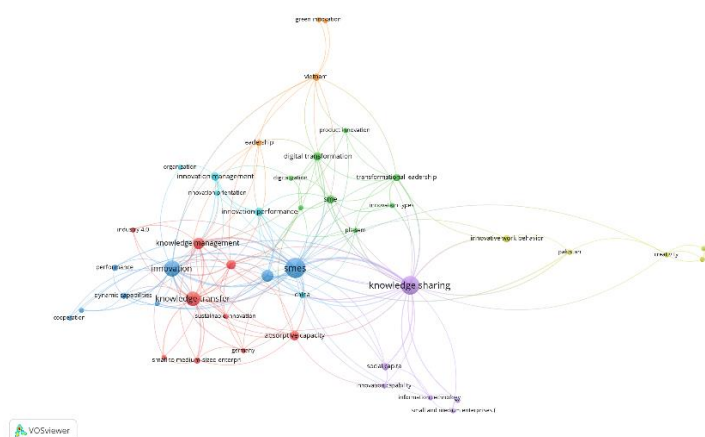


Figure 4. Co-Occurrence Framework and Representation of Key Terms

Source: VOSviewer output

The bibliometric analysis presents several significant theoretical and practical implications while also identifying relevant future research directions. Theoretically, the literature shows

that innovation in SMEs is a complex and multifactorial process. The integration of Knowledge-Based Theory and Diffusion of Innovation Theory is frequently employed to explain how digital adoption fosters dynamic capabilities that mediate the relationship between technology adoption and innovation performance. Practically, the implications of these findings are highly relevant to SME managers and policymakers. Managers are encouraged to cultivate an adaptive digital culture and encourage open collaboration as an innovation strategy, including through social capital-based knowledge-sharing that strengthens green competitiveness. However, most research focuses on specific European and Asian contexts, indicating the need for further research in developing countries, such as Indonesia to enrich our understanding of the dynamics of knowledge-sharing in supporting green innovation (Audretsch et al., 2023; Chowdhury et al., 2022; Crupi et al., 2020; Dahiya, 2024; Dogbe et al., 2020; Esponda Pérez and Galindo, 2025; Harel et al., 2021; Lin and Lai, 2021; Lustono and Wening, 2023; Paredes Chacín et al., 2024; Riana et al., 2023). Therefore, future research agendas should integrate green innovation aspects and adopt non-linear approaches to gain a deeper understanding of the conditions that knowledge-sharing serves either as a catalyst or an obstacle to innovation in SMEs. Expanding empirical studies to countries with diverse socio-economic contexts will further enrich the field.

5. Conclusion

This study presents a comprehensive synthesis of the relationship between knowledge-sharing and green innovation in Small and Medium Enterprises by analyzing 68 articles from the Scopus database. The findings indicate that knowledge-sharing is a key element that influences green innovation through three main channels: First, the direct channel of green knowledge-sharing strengthens the relationship between managerial practices and green competitive advantage. Second, the indirect channel where knowledge-sharing enhances absorptive capacity, technological capabilities, and overall innovation potential. Third, the integrative mechanisms through leadership, organizational culture, and external networks mediate and moderate the relationship between knowledge-sharing and green innovation. The evolution of research in this field shows a process of maturation, marked by a surge in publications during the pandemic and a shift in research focus towards more specific, contextual, and sustainability-oriented issues. This main contribution is that the effectiveness of knowledge-sharing is entirely determined by the configuration of contextual factors, including leadership, organizational culture, and external networks. Thus, contradictory findings in the literature are not anomalies, but rather reflections of the complex, dynamic, and context-dependent nature of the knowledge-sharing-green innovation relationship. The practical implications of this research emphasize that SME managers should not merely promote knowledge-sharing in general, but actively build supportive conditions, such as an adaptive digital culture and open collaboration, making that knowledge flows can be optimally utilised to generate green innovation. Meanwhile, for policymakers, particularly in developing countries such as Indonesia, more contextual interventions are required, tailored to socio-economic characteristics and local challenges, to ensure that knowledge-sharing and green innovation strategies can be implemented effectively and sustainably.

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