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The Role of Sustainability in Innovation Networks to Enhance SME Competitiveness: An Integrative Framework Based on PRISMA and Bibliometric Mapping

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The April 2026 issue of ***Spektrum Industri (Vol. 24 No. 1)*** highlights the theme Quality and Reliability Management, presenting a curated collection of studies that emphasize the advancement of efficient, sustainable, and human-centered industrial systems. This edition is distinguished by its international collaboration, featuring contributions from researchers across five countries: Indonesia, Malaysia, United States, Japan, and Saudi Arabia, thereby enriching the academic discourse through diverse perspectives and reinforcing the journal's commitment to global knowledge exchange.

The published articles cover a broad spectrum of topics, including Six Sigma-based quality improvement for MSMEs, ergonomic and work system design, sustainability-driven innovation and business strategies, as well as logistics and supply chain management, particularly in halal and food security contexts. Additionally, this issue addresses contemporary challenges in manufacturing systems, such as green manufacturing barriers and renewable energy optimization. Collectively, these contributions offer valuable insights for advancing industrial engineering practices and strengthening the role of research in addressing real-world industrial challenges.

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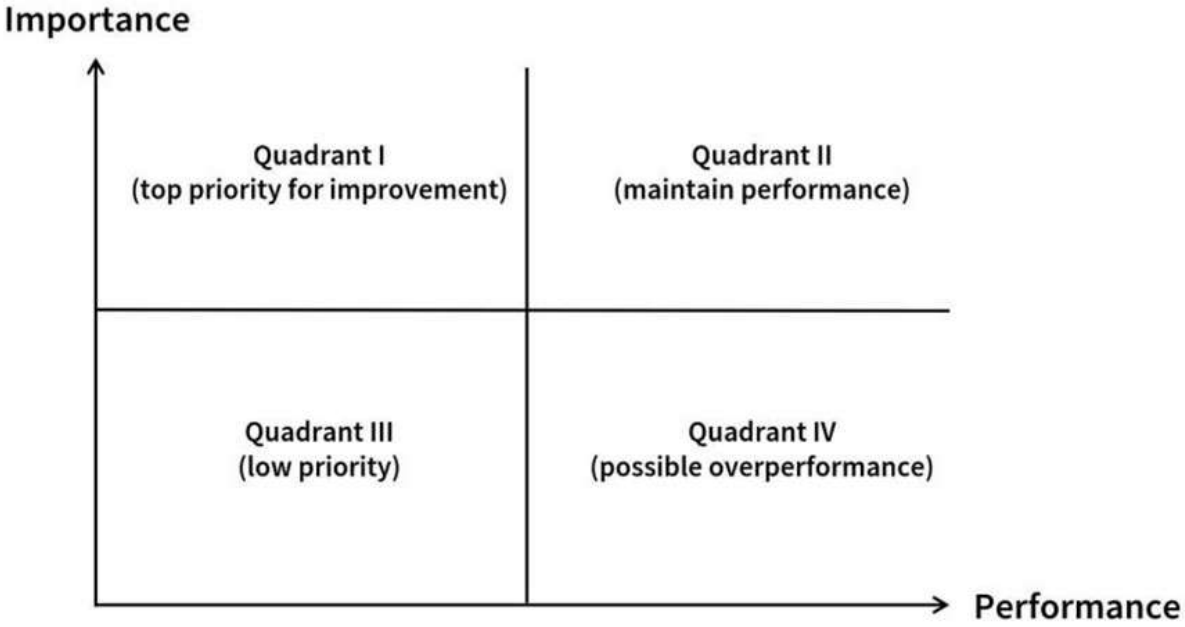
Quality and Reliability Management



- **Six Sigma-Based Quality Management Strategy to Enhance the Competitiveness of Food Souvenir MSMEs in East Kalimantan**

  Alex Kisanjani[(1)]★, **Marulan Andivas**[(2)], **Hirwandi Hirwandi**[(3)]

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  - Alex Kisanjani [PDF]

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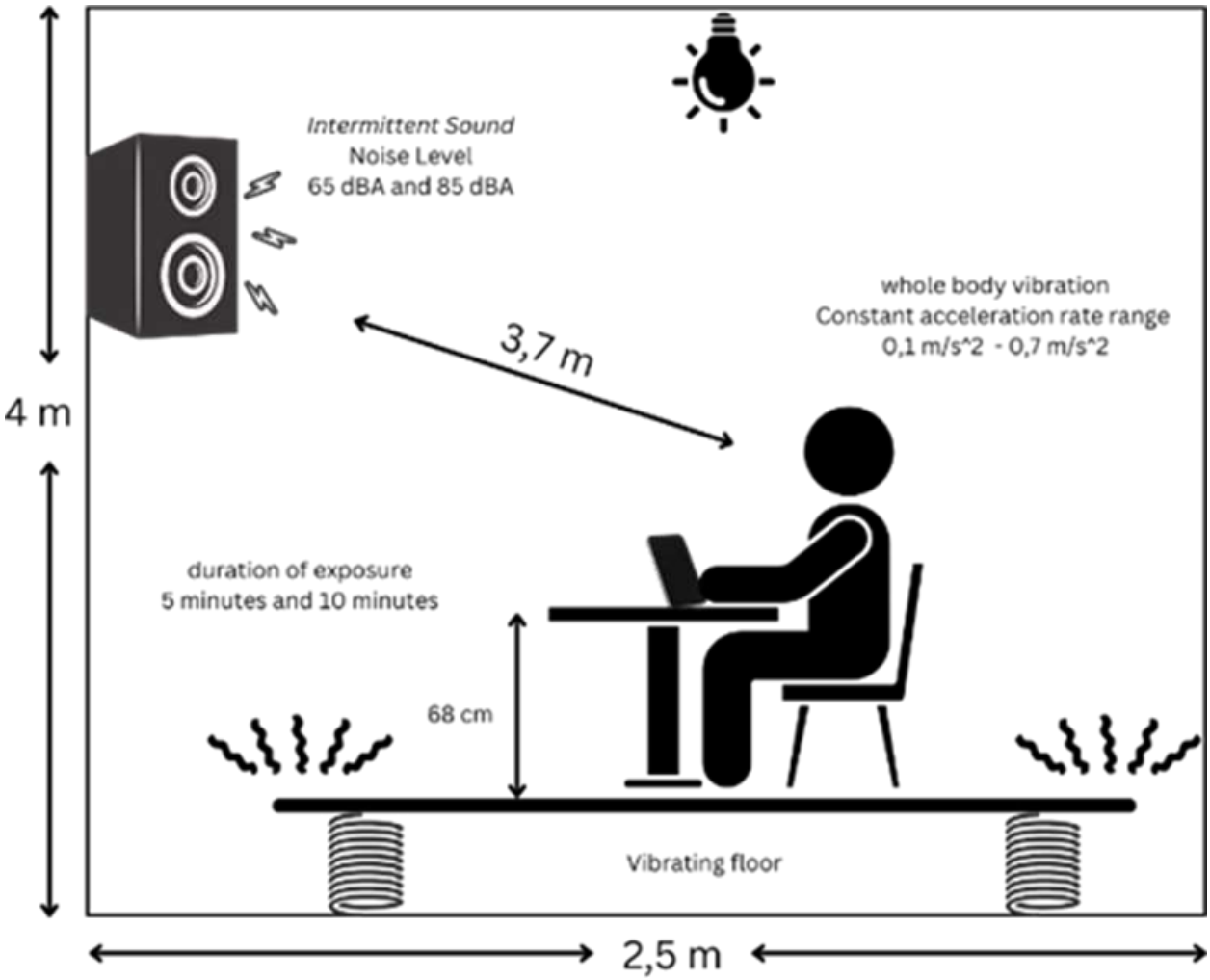

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  - Rahmaniyah Dwi Astuti [PDF]

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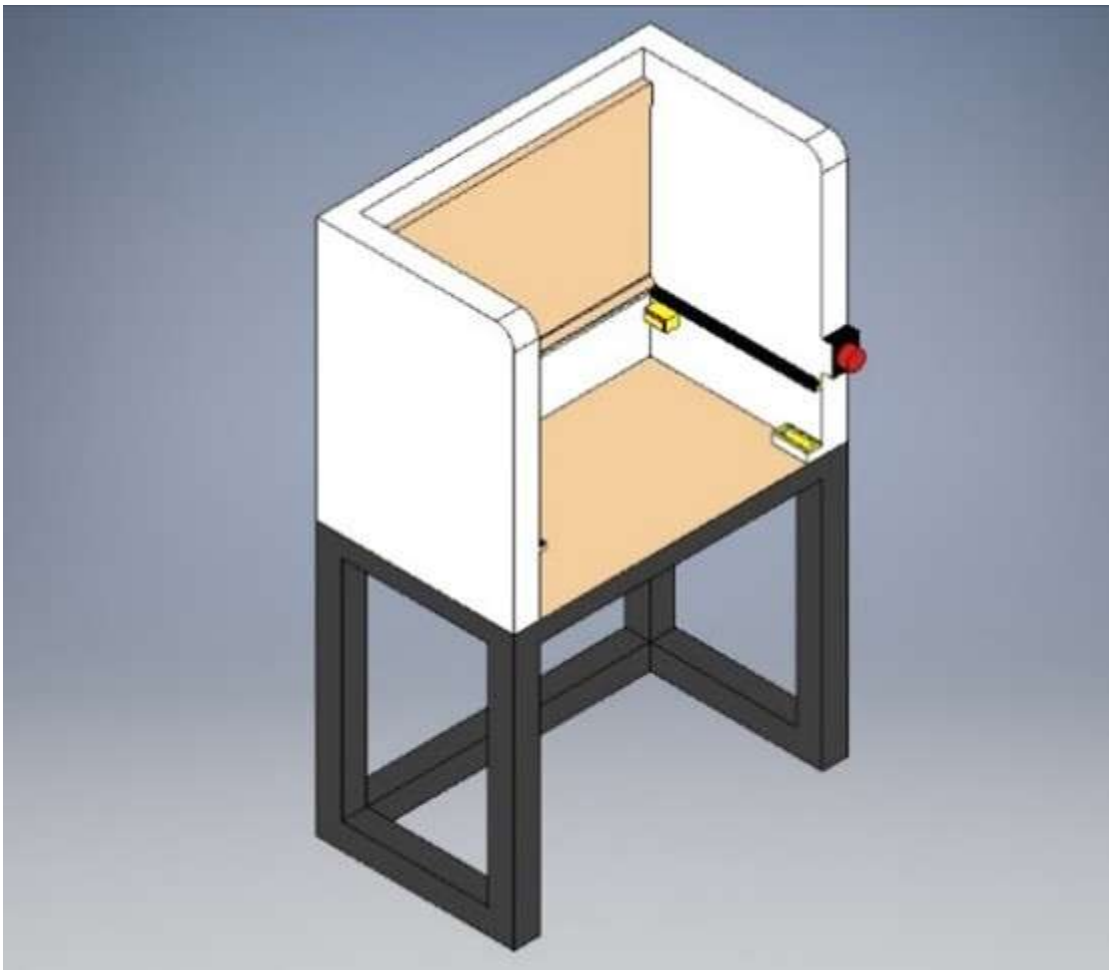

- **Designing Accessible Election Voting Booths: An Integrated Approach Using Universal Design, Design Thinking, and Ergonomics**

Akh Sokhibi[(1)]★, **Budi Cahyo Wibowo** [(2)], **Putri Rachmawati**[(3)], **Salman Alfarisi**[(4)]

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  Heri Setiawan(1)★, **Tri Budiyanto**(2)

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  (2) Industrial Engineering Study Program, Universitas Ahmad Dahlan, Yogyakarta, 55191, Indonesia

  - Heri Setiawan [PDF]

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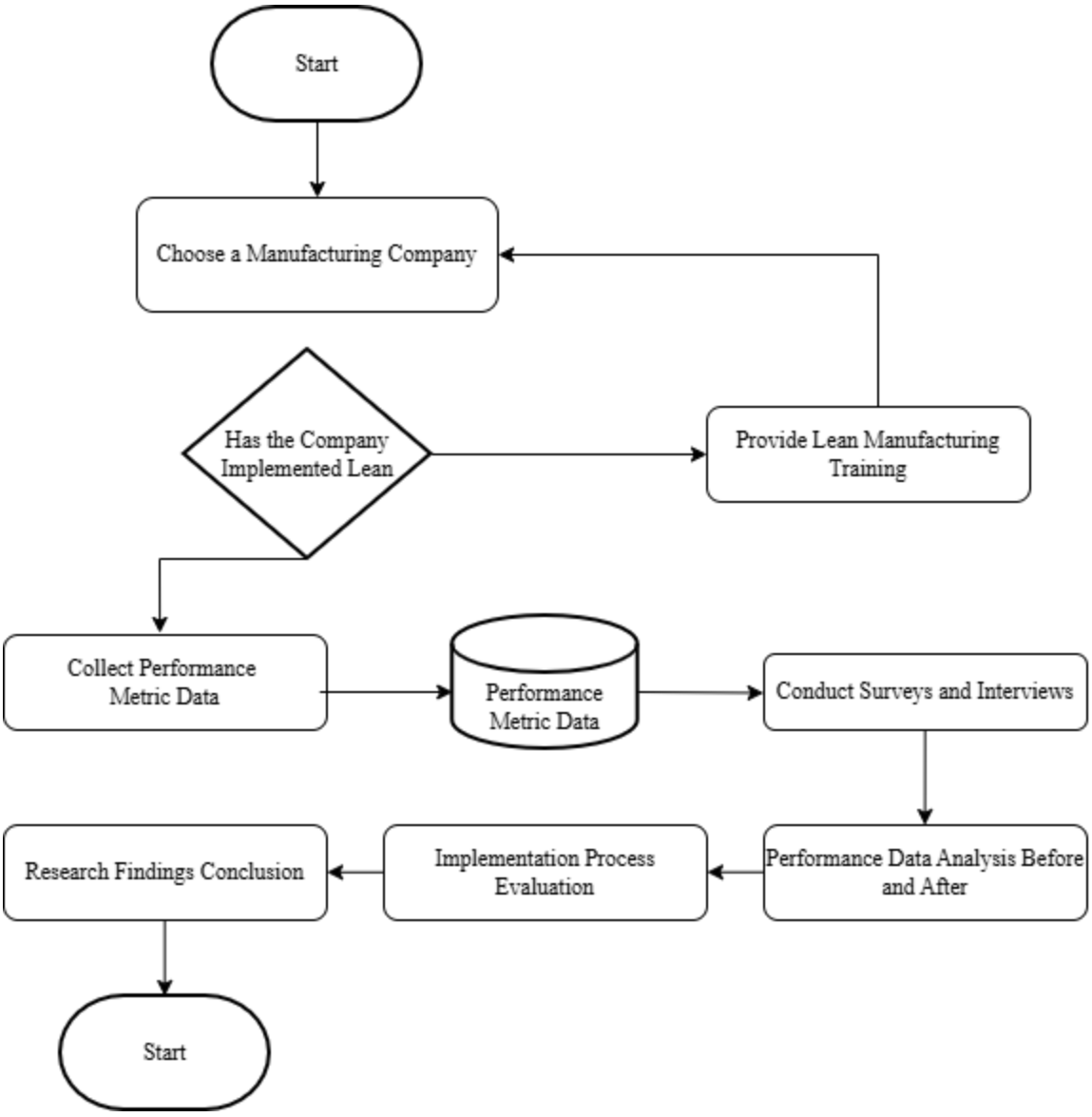

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- Zain Amarta [PDF]

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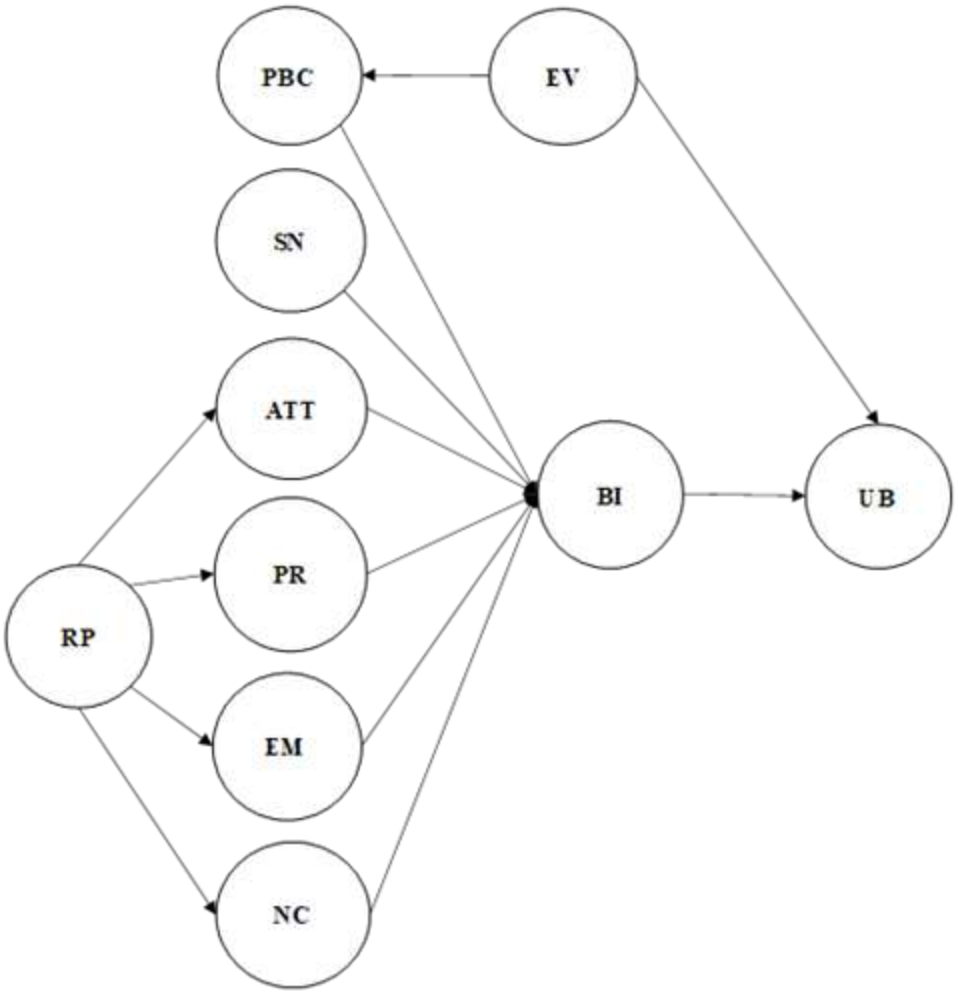

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Desrina Yusi Irawati[(1)]★, **Nyoman Sri Widari**[(2)], **Armadeo Ruben Canariesa**[(3)]

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  - Desrina Yusi Irawati [PDF]

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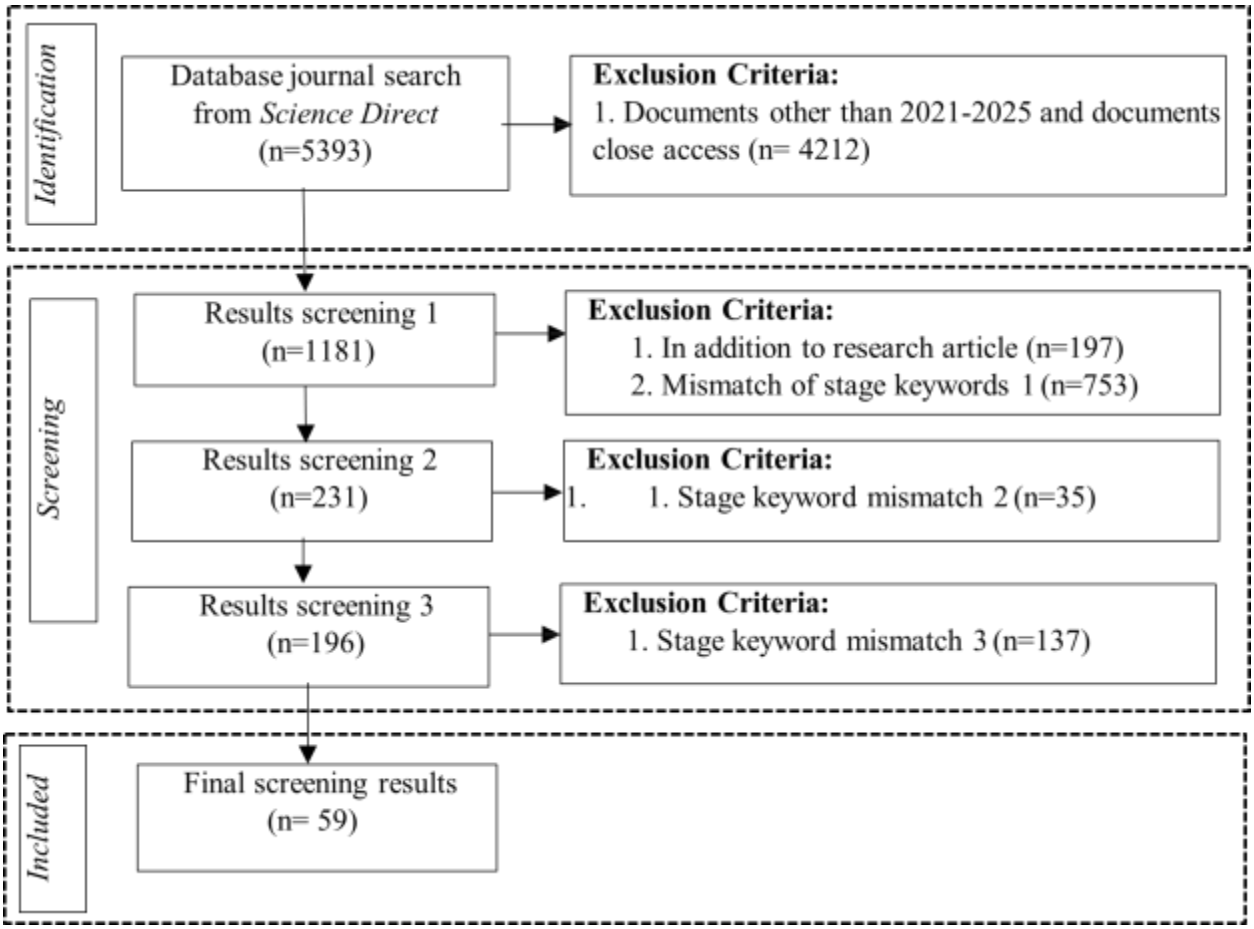

- **The Role of Sustainability in Innovation Networks to Enhance SME Competitiveness: An Integrative Framework Based on PRISMA and Bibliometric Mapping**

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  - Ragil Pardiyono [PDF]

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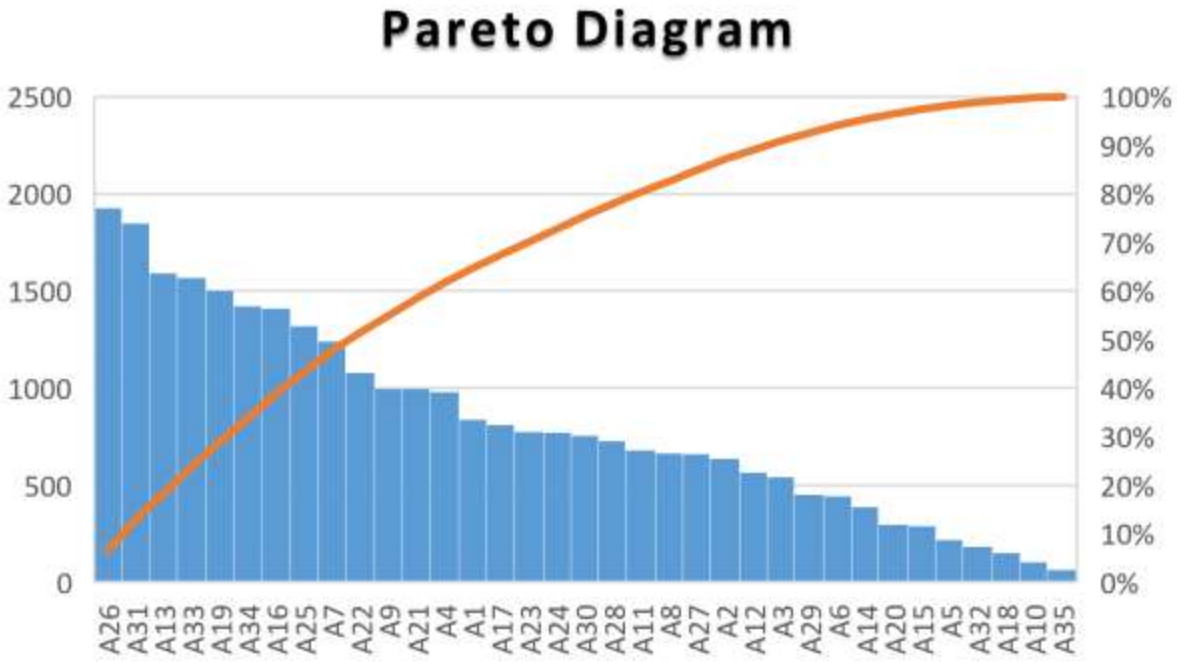

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Nisrina Faiza Mufid[(1)], **Agus Mansur**[(2)]★, **Rajiv Noor Said**[(3)], **Norhidaya Binti Paozi** [(4)]

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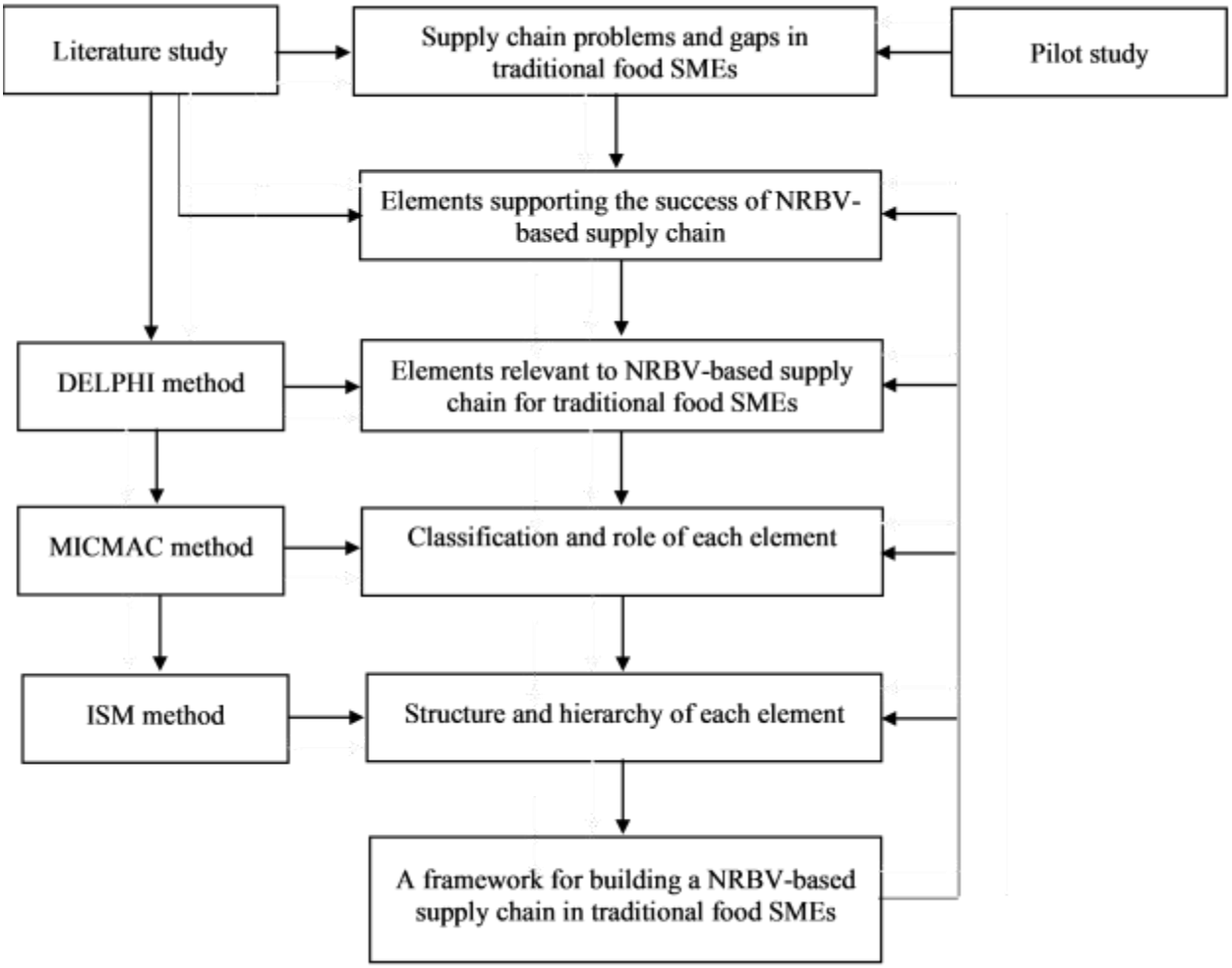

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- Lukman Achmad [PDF]

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Process SCOR	Actor
Plan	Farmer/Farmer Group
Source	Forage farmer
	Distributor of concentrates and vitamins
Production	feed mill operator
Distribution	Feed storage farmer
Return	Farmers, distributors

Sustainability Risk Analysis of the Halal Feed Supply Chain for Ruminant Commodities Through the Integration of the SCOR-FMEA Method

Hana Catur Wahyuni[(1)]★, **Lusia Permata Sari Hartanti**[(2)], **Inggit Marodiyah**[(3)], **Muhammad Wahyu Setya Kurniawan**[(4)], **Norhidayah binti Pauzi**[(5)]

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- Hana Catur Wahyuni [PDF]

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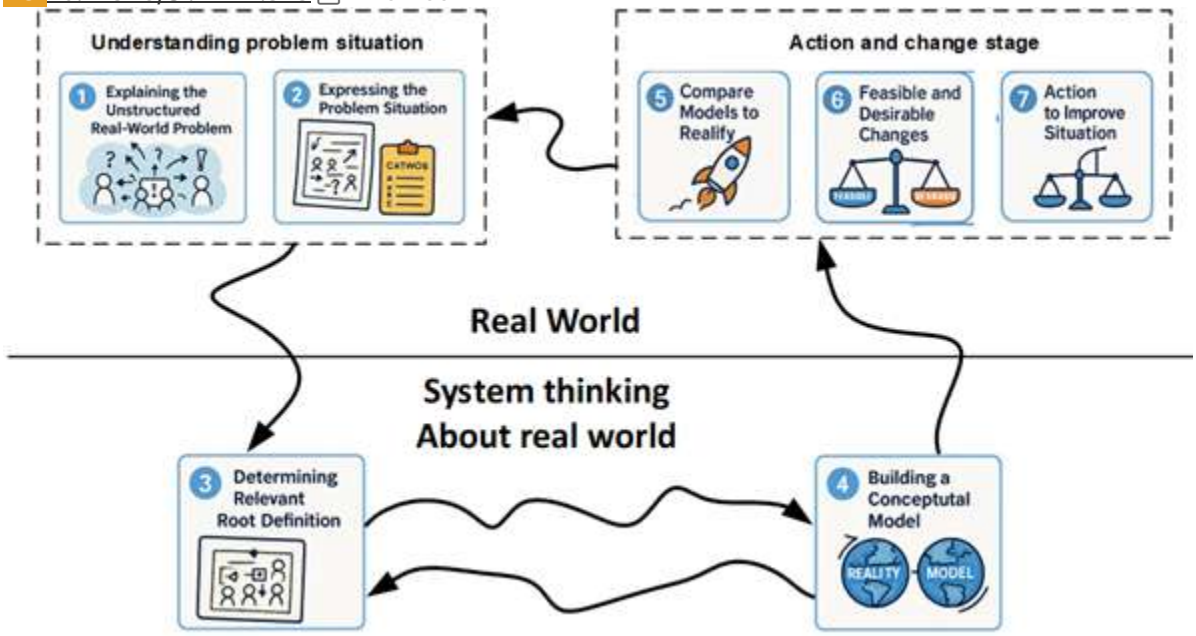

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- Tombak Gapura Bhagya [PDF]

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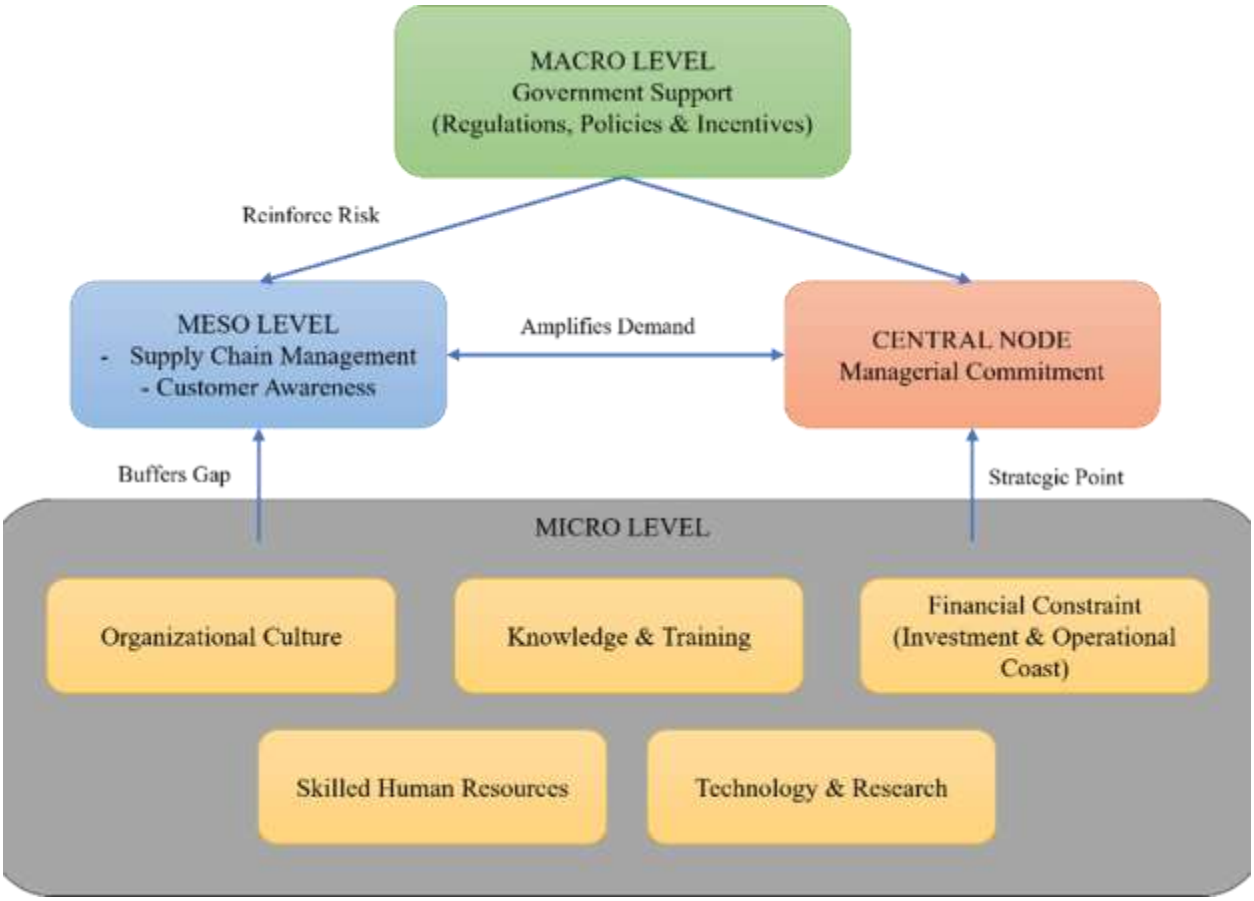

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  - Ajib Haryanto [PDF]

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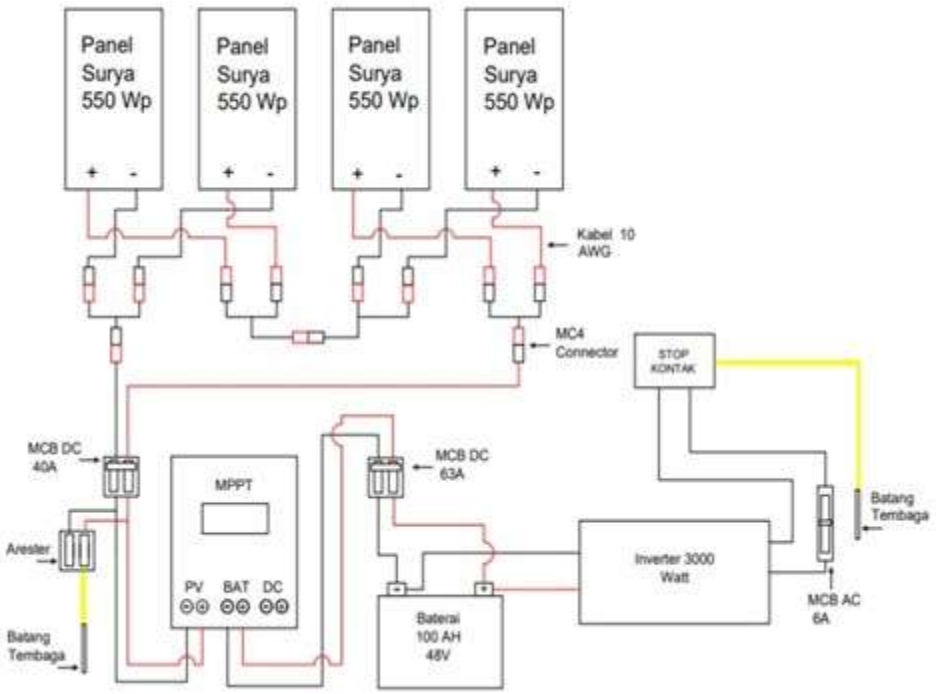

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The Role of Sustainability in Innovation Networks to Enhance SME Competitiveness: An Integrative Framework Based on PRISMA and Bibliometric Mapping

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ABSTRACT

Small and medium-sized enterprises (SMEs) play a critical role in economic development; however, their competitiveness remains constrained by fragmented integration of sustainability and innovation practices. Previous studies examine direct relationships between sustainability and competitiveness, without sufficiently explaining how innovation networks and policy environments interact within this relationship. This study addresses this gap by developing an integrative understanding of the role of sustainability in innovation networks to enhance SME competitiveness. This research employs a Systematic Literature Review (SLR) based on PRISMA 2020 guidelines, combined with bibliometric analysis using VOS viewer. The literature search initially identified 5,393 articles from the ScienceDirect database, of which 59 met the inclusion criteria for final analysis. The results reveal four main thematic clusters: (1) sustainability-oriented innovation, (2) internal firm capabilities, (3) innovation networks and national innovation systems, and (4) policy and digital transformation. The findings indicate that SME competitiveness emerges from the interaction between internal capabilities, collaborative networks, and institutional support, with sustainability acting as both a driver and outcome of innovation processes. This study contributes theoretically by proposing an integrative framework that extends prior literature by incorporating innovation networks as mediating factors and policy digital environments as enabling mechanisms. Methodologically, it demonstrates the value of combining PRISMA-based SLR with bibliometric mapping to systematically identify research patterns and gaps. Practically, the findings suggest that strengthening sustainability-oriented innovation and innovation networks, supported by appropriate policy and digital infrastructure, may enhance SME competitiveness in the evolving green and digital economy.

1. Introduction

Small and Medium Enterprises (SMEs) play a crucial role in the economic structure of many countries, particularly in developing countries (Bayraktar & Algan, 2019). SMEs employ a significant workforce, contribute to domestic income, and serve as the backbone of local economic development

(Omowole et al., 2024). Currently, SMEs in Indonesia account for 99% of all business units (Prodjo, 2024). Their role is significant in Indonesia's economic growth. Their contribution to Gross Domestic Product reaches 60.5%, and their employment accounts for 96.9% of the total national workforce (Limanseto, 2022).

While the role of SMEs in the national economy is undeniable, this contribution does not necessarily guarantee their ability to survive in increasingly open and dynamic competition (Wang & Shi, 2011). The main challenge currently faced is not only maintaining its role as a driver of the people's economy, but also increasing competitiveness to adapt to the global market (Lopez-Torres, 2023). But according to research Amelia et al., (2023) currently the competitiveness of MSMEs in Indonesia continues to decline.

According to the IMD World Competitiveness Centerer (WCR 2025) report, Indonesia's competitiveness ranking dropped by 13 places to 40th in 2025 (Aris, 2025). The World Competitiveness Centerer is a subsidiary of the International Institute for Management Development (IMD) in Switzerland. This institution publishes various annual reports, such as the IMD World Competitiveness Yearbook, which assesses and ranks the economic competitiveness of countries worldwide, based on various performance factors and weaknesses. The European Commission, in its "Annual Report on European SMEs 2024/2025," noted that the real value added of SMEs in Europe declined by -0.2% in 2024. This indicates that although SMEs are important to the European economy, they are facing a contraction in productivity performance (Schulze, 2025).

KfW-ifo Research, in its report “SMEs see growing risks to their international competitiveness” (October 2024), shows that export expectations of SMEs in Germany were 16.5 balance points below the long-term average in September 2024. While this is not a direct measure of overall SME competitiveness, it does indicate declining confidence and export potential in SMEs, which are an aspect of competitiveness (Abel-Koch, 2024). SME Competitiveness in Francophone Africa 2024 states that only 14% of companies in Francophone African countries export, an indicator of challenges to competitiveness and integration into global markets (International, 2024). SME Policy Index: Latin America and the Caribbean 2024 presents an analysis of SME policies in Latin America and the Caribbean, although this report focuses more on policy frameworks than on explicit figures on competitiveness decline (OECD, 2024).

The data above presents information on the declining competitiveness of SMEs in Indonesia by 2024. This decline in competitiveness also occurred in SMEs in Europe, Germany, Africa, and Latin America by 2024. SME competitiveness is key to success in the global market (Dvouletý & Blažková, 2021). In this context, competitiveness is determined not only by production efficiency and financial capability, but also by innovation capacity, collaboration within business networks, and the application of sustainability principles. The role of SMEs as job providers and drivers of the local economy needs to be strengthened through continuous innovation so they can actively compete in the global market (Vrontis et al., 2022).

To increase competitiveness amidst the pressures of globalization, SMEs cannot rely solely on internal capabilities. Limited resources, capital, and access to knowledge require SMEs to build innovation networks as an effective collaborative strategy (Prasanna et al., 2019). Through innovation networks, SMEs can connect with various actor such as research institutions, universities, governments, industry associations, and other business partners to share knowledge, technology, and best practices. This collaboration plays a crucial role in accelerating the diffusion of innovation, expanding market access, and strengthening adaptive capacity to the dynamic business environment (Mata et al., 2024). Thus, innovation networks are a key element bridging SMEs' internal potential and external opportunities.

SMEs can develop innovations that are not only competitive but also sustainable (Prasanna et al., 2019). Innovations that ignore sustainability aspects are prone to negative externalities and reduce business legitimacy in the long term (Prasanna et al., 2019). On the other hand, innovations that consider sustainability can create differential added value and strengthen competitive positions in an increasingly environmentally conscious market. In their literature review Hermundsdottir & Aspelun

(2021) found that sustainable innovation generally has a positive effect on company competitiveness. Implementing sustainable innovation in the SME context still faces unique barriers, such as limited resources, technological capacity, and market access (Kannan & Gambetta, 2025).

A systematic review by Lopez-Torres et al. (2022) on the relationship between sustainability and competitiveness indicates that there are important moderating variables that influence the direction and magnitude of these effects. Furthermore, a meta-analysis by Oduro & Haylemariam (2025) confirmed that sustainability aspects have a positive effect on the competitiveness of SMEs. Several early studies have linked innovation networks and sustainability practices, including in Sarango-Lalangui et al. (2023), which examined the influence of environmental sustainability on open innovation and found that companies that integrate environmental aspects are more active in innovation networks. Furthermore Dory (2023) reviewed key factors in sustainability-oriented innovation in SMEs, stating that the success of sustainable innovation depends on the integration of social and environmental aspects, organizational structure, and stakeholder involvement in the innovation network.

The Indonesian government has demonstrated a strong commitment to building and strengthening innovation networks through national policies such as the establishment of the National Research and Innovation Agency, established under Presidential Regulation No. 33 of 2021, the 2017–2045 National Research Master Plan, and Presidential Regulation No. 38 of 2018 concerning the National Innovation System Master Plan. These policies seek to synergize research activities from various institutions, encourage cross-sector collaboration, and create a productive national innovation ecosystem (Suwarno, 2022). An example of a concrete policy is the Kedaireka Matching Fund program from the Ministry of Education, Culture, Research, and Technology, which encourages collaboration between lecturers and industry players. This program serves as a good example of how innovation networks can facilitate the intersection of academic research and industry needs (Pradana et al., 2021). Although the concept of innovation networks has been introduced and utilized, its implementation has not yet fully improved the competitiveness of SMEs in the global market.

Globalization has led to tightening sustainability standards in trade, from the European Union's climate policy to the expansion of governance through voluntary sustainability standards, so that environmental and social issues are now integrated into cross-border trade rules (Marx et al., 2024). Developed countries have adopted regulations that directly impact market access, for example, the European Union's EU Deforestation Regulation (EUDR), the United States' Uyghur Forced Labor Prevention Act (UFLPA), Australia's Modern Slavery Act 2018, and Japan's Clean Wood Act, which are included in the global timber legality regime (Apeti & N'Doua, 2023; D. Kim & Gang, 2024; Ru, 2024; Sinclair & Nolan, 2020). These regulations require evidence of due diligence to ensure imported products are deforestation-free, respect workers' rights, and traceability of raw materials (Kim et al., 2024). Consequently, SMEs in developing countries face compliance burdens and the risk of being "marginalized" from global supply chains if mentoring support on voluntary sustainability standards is not strengthened (Muradian et al., 2025).

Despite the growing body of literature on sustainability, innovation networks, and SME competitiveness, existing studies remain fragmented and largely examine these dimensions in isolation. First, there is a lack of integrated analysis that simultaneously links sustainability practices, innovation networks, and competitiveness within a unified conceptual framework. Most prior studies focus on direct relationships, such as sustainability performance or innovation–competitiveness, without explaining how these elements interact across multiple levels.

There is limited use of bibliometric mapping approaches to systematically identify research patterns, thematic structures, and knowledge gaps in this field. As a result, the intellectual landscape of sustainability-driven innovation in SMEs has not been comprehensively mapped. The existing literature shows a limited focus on developing country contexts, where SMEs face distinct structural challenges, including resource constraints, institutional gaps, and limited access to innovation networks. This creates a gap in understanding how sustainability-oriented innovation operates under different economic and institutional conditions.

Therefore, this study is academically necessary as it provides a systematic and integrative synthesis of the literature by combining PRISMA-based SLR with bibliometric analysis. This approach enables the identification of key research themes, the development of an integrative conceptual framework, and the clarification of how sustainability, innovation networks, and competitiveness are interconnected in the context of SMEs. This also study aims to address gaps by conducting a Systematic Literature Review to develop an integrative understanding of the role of sustainability in innovation networks in enhancing SME competitiveness. Specifically, this study seeks to answer the following research questions: (1) What are the main research themes linking sustainability and innovation networks in SMEs? (2) How do innovation networks contribute to SME competitiveness through sustainability? (3) What research gaps and future research directions can be identified in this field?

2. Method

This study used a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize research findings relevant to the topics of sustainability, innovation networks, and SME competitiveness. The SLR approach was chosen because it provides a comprehensive overview of existing empirical evidence while systematically identifying research gaps (Azarian et al., 2023; Cabrera et al., 2023). According to Snyder (2019), an SLR is a structured and transparent scientific methodology for reviewing literature, enabling replication and minimizing researcher bias. This SLR was implemented following the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) developed by Page et al. (2021). PRISMA was used to ensure transparency and traceability at every stage of the review, from literature identification to presentation of results. The procedure consists of four main stages: identification, screening, eligibility assessment, and final inclusion. All processes are reported using a PRISMA flow diagram to show the number of articles retrieved, screened, and selected through the final stage of analysis.

The literature search was conducted online using the reputable scientific database ScienceDirect, as it offers extensive coverage of innovation and sustainability topics. The ScienceDirect database was chosen as the sole source for the Systematic Literature Review (SLR) because it provides a collection of highly reputable scientific journals with a rigorous peer-review process and broad multidisciplinary coverage, thus ensuring the quality, consistency, and credibility of the analysed literature (Snyder, 2019). The publication year range was limited to 2021 and 2025, considering that the last five years have shown a significant increase in literature linking sustainability and innovation in SMEs (Hermundsdottir & Aspelund, 2021; Lopez-Torres et al., 2022). All search results were downloaded in bibliographic reference format and then cleaned to remove duplications before proceeding to the selection stage.

The screening stage consisted of two stages: reviewing titles and abstracts to ensure topic relevance and reading in full to ensure alignment with the research objectives. Inclusion criteria included: (1) peer-reviewed scientific articles, (2) focusing on SMEs and sustainable innovation, (3) discussing the relationship between sustainability, innovation networks, and competitiveness, and (4) published in English or Indonesian. Articles that were conceptual in nature without empirical data support, irrelevant to the SME context, or unavailable in full text were excluded from the analysis. All inclusion and exclusion decisions were documented to maintain transparency in the selection process (Snyder, 2019).

To ensure the rigor and reliability of the selected studies, a quality assessment was conducted. Each article was evaluated based on several criteria, including: (1) clarity of the research objectives, (2) relevance to the topics of sustainability, innovation networks, and SME competitiveness, and (3) contribution to the field. The assessment was conducted systematically to ensure that only studies meeting academic standards were included in the final analysis. This process helped minimize bias and increase the validity of the synthesized findings.

3. Results and Discussion

A Systematic Literature Review (SLR) is used to systematically determine the research's position. Several methods were used to compile the SLR, including a search on the website www.sciencedirect.com from 2021 to 2025, including open access. The search results using keywords to identify scientific articles used in the literature review are shown in Table 1.

Table 1. Systematic literature review

No	Keywords	Total Article
1	"innovation networks"	1181
2	"innovation networks" "SMEs"	231
3	"innovation networks" "SMEs" "Sustainability"	196
4	"innovation networks" "SMEs" "Sustainability" "competitiveness"	59

The paper screening process was conducted in three stages: publication year between 2021 and 2025, and screening access type: open access and archive. The process of identifying the number of scientific articles eligible for use in the SLR process used a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram based on the keywords used. The results of the identification of eligible papers using the Prism diagram are shown in Fig. 1.

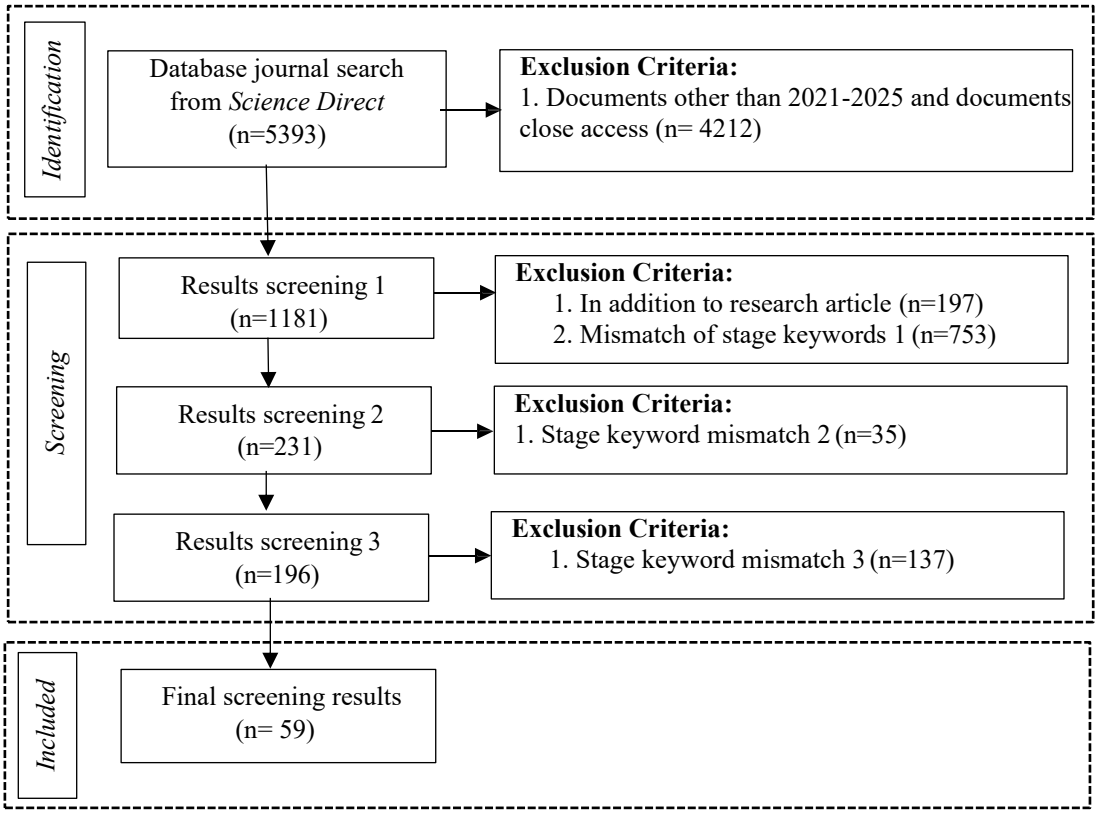

Fig. 1. Results of Prism Analysis to Determine Selected Paper

Based on Fig. 1, the results of paper identification using the PRISMA diagram, the first stage of the search for scientific articles using Science Direct yielded 5,393 scientific articles. In the first stage of screening, which used criteria other than 2020-2025 and closed access documents, there were 4,212. In the second stage of screening, which used criteria other than research articles, there were 197 scientific articles, and 753 articles that did not meet the criteria for keywords in the first stage. Stage 3 screening with stage 2 keyword mismatch criteria contained 35 and stage 4 screening with stage 3 keyword mismatch criteria contained 137. So, from the screening results that will be used in the literature study, 59 relevant scientific articles were obtained for a literature review to determine gaps in the research.

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Next, to determine the research position, VOSviewer was used. VOSviewer is software that functions to analyze and visualize bibliometric data interactively and easily. This software is used to map the relationships between elements in scientific literature, such as keywords, authors, institutions, or documents. VOSviewer is able to identify subtopics or themes within a research field, making it very useful in systematic literature studies to uncover research trends, find influential studies, and identify research gaps. Fig. 2 presents the results of VOSviewer.

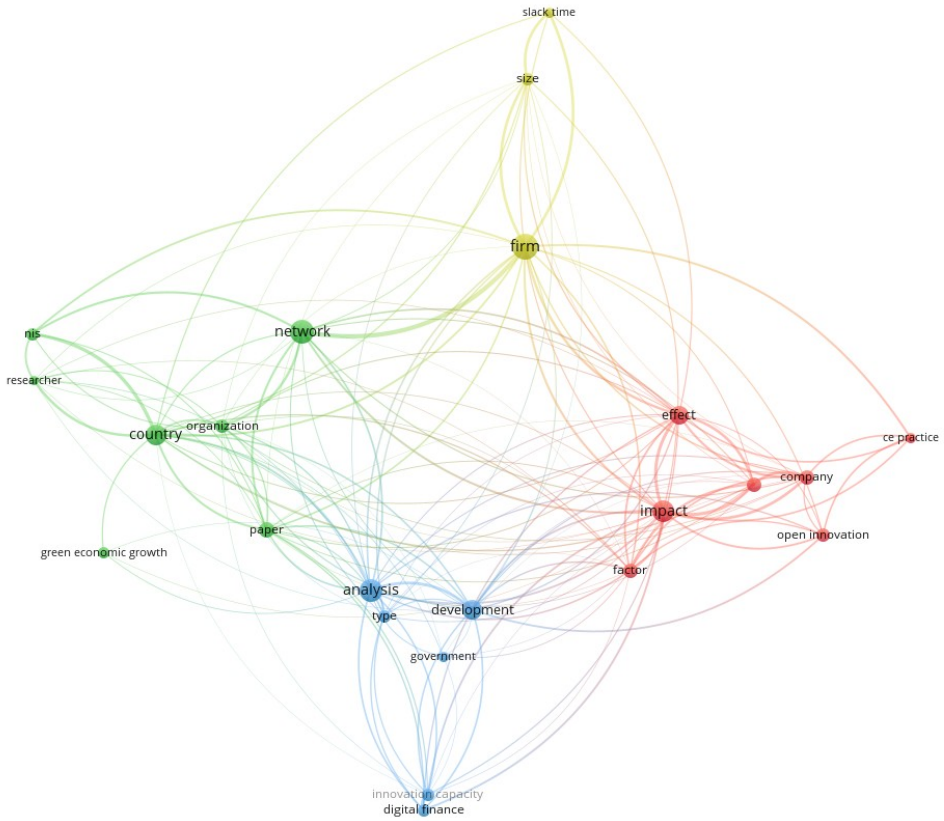

Fig. 2. Vosviewer results

This visualization, generated by the VOSviewer software, shows a co-occurrence map of keywords in the analyzed literature. Each node on the graph represents a keyword that frequently appears in the document collection, and the connecting lines (edges) indicate the degree of correlation between these keywords. The size of the circles reflects the frequency of keyword occurrences in the documents, while different colors indicate thematic clusters or groups formed automatically based on the clustering algorithm.

The VOSviewer visualization results show that research in the field of innovation and the green economy has developed within several relatively separate thematic clusters. One key gap identified is the lack of integration between government innovation policies and circular economy practices at the company level. While numerous studies have addressed open innovation and the circular economy and their impact on company performance, the direct link between public policy and circular economy implementation in the industrial world remains largely unexplored. This presents an opportunity to examine the extent to which national policies can encourage or hinder the adoption of sustainable innovation in the manufacturing sector.

Furthermore, there appears to be limited research linking research collaboration networks between countries and institutions to corporate innovation performance. Nodes such as network, organization, and country in the green cluster demonstrate a focus on global research networks, but few studies have quantitatively assessed their impact on micro-level performance, such as corporate

innovation capability or green economic value creation. Therefore, studies are needed that link the intensity and quality of research collaboration with tangible outcomes at the firm level, particularly in the context of a sustainable economy.

Another gap is the limited number of studies examining the role of digital financial technology in supporting innovation in the industrial sector, particularly in small and medium-sized enterprises. The keyword "digital finance" appears in the blue cluster, which discusses policy aspects and innovation capacity, but does not show a strong relationship with nodes such as firm or company. This suggests that the adoption of financial technology as a catalyst for innovation remains under-researched, despite its significant potential to facilitate capital access and managerial efficiency.

A critical comparison of the clusters shows distinct but complementary roles. The yellow cluster represents the internal capacity of firms, including organizational slack, firm size, and resource flexibility, which form the foundation for innovation (Bayon & Aguilera, 2021; Kannan & Gambetta, 2025). In contrast, the green cluster captures the external relational dimension, where innovation networks facilitate knowledge exchange and collaboration across organizations and countries (Novillo-Villegas et al., 2025). While the yellow cluster is internally oriented, the green cluster extends SMEs' capabilities beyond organizational boundaries (Fioravanti et al., 2023; Rodrigues & Franco, 2023).

The blue cluster differs by functioning as an enabling environment rather than a direct capability (Faiz et al., 2024; Gao & Ren, 2023). It reflects policy support, digital finance, and institutional infrastructure that shape how effectively SMEs can access and utilize innovation networks. Compared to the green cluster, which focuses on relationships, the blue cluster determines the conditions under which these relationships can be formed and sustained. The red cluster represents the outcome dimension, where innovation activities translate into measurable impacts such as sustainability performance and competitiveness (Hermundsdottir & Aspelund, 2021; Sarango-Lalangui et al., 2023). Unlike the other clusters, which focus on inputs and processes, this cluster captures the final value created through innovation.

From a causal perspective, the visualization suggests a directional relationship. Internal firm capabilities (yellow cluster) influence the ability of SMEs to engage in innovation networks (green cluster). These interactions are strengthened or constrained by policy and digital support systems (blue cluster). Together, these factors drive sustainable innovation outcomes (red cluster), which ultimately enhance SME competitiveness. Based on this synthesis, an integrative framework is proposed in which SME competitiveness is the result of a dynamic interaction between internal capacity, network collaboration, policy support, and sustainability-oriented innovation outcomes. This framework extends prior studies by explicitly linking micro-level capabilities, meso-level networks, and macro-level policy environments into a unified analytical model.

This research uses the SLR framework to map the literature on innovation networks, sustainability, and SME competitiveness over the 2021–2025 timeframe, resulting in four main clusters that illustrate current research directions. First, the red cluster emphasizes how open innovation and circular economy practices are key drivers of sustainable impact for SMEs, consistent with findings that green innovation and circular economy practices are significantly related to organizational performance (Oduro & Haylemariam, 2025; Rahmat et al., 2024). Second, the yellow cluster demonstrates that internal factors such as firm size, organizational slack, and resource flexibility play a crucial role in a firm's adaptive capacity. Recent results suggest that organizational slack enables more effective technology and market search (Bo et al., 2024; Zhao & Yan, 2023). Third, the green cluster highlights the systemic level and inter-organizational networks, where innovation networks and national innovation systems have been shown to strengthen technological capabilities and knowledge transfer between countries and industry actors (Li et al., 2023; Petraite et al., 2022). Finally, the blue cluster emphasizes that public policy, digital transformation, and digital finance are important enablers of SME innovation; for example, government technology support and digital finance development significantly improve firms' innovation performance (Abu et al., 2025; Liu & Xia, 2025; Pardiyono et al., 2025).

Research has shifted from an exclusively internal (firm capacity) or external (network) focus to an integration of all three domains, as evidenced by a comparison with the literature over the last five years. This calls for a comprehensive understanding of the synergies between innovation, sustainability, networks, and policies. There are still gaps, though. For instance, there aren't many quantitative empirical studies that concurrently relate the sustainability outcomes of SMEs, especially in developing nations, to the intensity of their innovation networks, internal capacity, and policy support. By combining micro, and macro dimensions into a single integrative conceptual framework, this study strategically aims to close this gap.

3.1. Development of an Integrative Conceptual Model

The development of an integrative conceptual model in this study demonstrates that MSME competitiveness is not determined by a single dimension, but rather is the result of a dynamic interaction between three main levels: micro (internal company capabilities), meso (innovation networks), and macro (policy support and digital transformation). The findings of four clusters (red, yellow, green, and blue) demonstrate that sustainable innovation acts as a primary outcome mediated by innovation networks and facilitated by public policy. Thus, the resulting conceptual model integrates the causal relationship from internal capability, innovation network, policy support, sustainable innovation, competitiveness. This model expands previous understanding by demonstrating that sustainability is not only an outcome but also a connecting mechanism between dimensions in the MSME innovation system.

3.2. Identification of Theoretical Advances Compared to Previous Literature

This study provides theoretical advancements by integrating three main perspectives: innovation theory, network theory, and sustainability theory, which previously tended to be studied separately. Previous studies such as Hermundsdottir & Aspelund (2021); Lopez-Torres et al. (2022) generally emphasize the direct relationship between sustainability and competitiveness, without considering the mediating role of innovation networks and enabling factors from policies. This article goes beyond this approach by demonstrating that the relationship is multi-level and non-linear, but rather influenced by the interaction between internal capabilities, network structure, and institutional support. Thus, the main theoretical contribution of this study is to provide an integrative framework that unites various previously fragmented streams of literature.

3.3. Implications for Future Research Based on Quantitative Gaps

The bibliometric analysis in this study identified important gaps, particularly the lack of quantitative empirical studies that simultaneously examine the relationship between internal capabilities, innovation networks, policy support, and sustainability outcomes in MSMEs. Most existing studies are partial or qualitative, thereby failing to explain causal relationships comprehensively. Therefore, future research is recommended to develop quantitative models based on multi-level analysis or structural equation modelling (SEM) to test the proposed conceptual framework. In addition, longitudinal research is needed to understand the dynamics of sustainable innovation, as well as contextual studies in developing countries to capture the unique institutional and structural factors that enhance the competitiveness of MSMEs.

These findings are interpreted through three main theoretical perspectives. From innovation theory, sustainability-oriented innovations (e.g., green innovation and the circular economy) have been shown to enhance SME competitiveness by creating long-term value. From network theory, innovation networks enable SMEs to overcome resource constraints through knowledge sharing and collaboration, suggesting that relational capabilities shape competitiveness. From sustainability theory, sustainability is not merely a compliance requirement but also a strategic driver of competitive advantage, supported by policies and the institutional environment.

These perspectives suggest that SME competitiveness emerges from the interaction between internal capabilities, innovation networks, and policy support, with sustainability acting as both a driver and an outcome of innovation. The findings of this study suggest that SMEs may enhance their competitiveness by integrating sustainability-oriented innovation strategies into their business processes. Approaches such as circular-economy practices and environmentally friendly process

innovations are associated with improved resource efficiency and increased value creation. The literature indicates that firms adopting such strategies tend to strengthen their market positioning, particularly in markets that increasingly prioritize environmentally responsible products and practices.

From a policy perspective, the results highlight the importance of fostering collaborative innovation ecosystems that connect SMEs with academic institutions, research organizations, and financial actors. Evidence from the reviewed studies suggests that access to digital finance, applied research support, and sustainability-oriented incentives can facilitate innovation activities within SMEs. In this context, policy instruments such as green financing schemes and innovation support programs are associated with increased adoption of sustainable technologies and practices. Furthermore, the findings indicate that intermediary institutions, including financial institutions and industry associations, may play a significant role in fostering innovation networks. The availability of digital collaboration platforms and financial technologies is linked to improved access to resources and knowledge, which in turn can support the implementation of sustainable innovation initiatives. Strengthening connectivity among actors within innovation networks is therefore associated with enhanced adaptive capacity and competitiveness of SMEs in the evolving green and digital economy.

4. Conclusion

This study provides an integrative synthesis of the literature on sustainability, innovation networks, and SME competitiveness by identifying four interrelated thematic dimensions: internal firm capabilities, innovation networks, policy and digital support, and sustainability-oriented innovation outcomes. The findings demonstrate that SME competitiveness emerges from the interaction among these dimensions rather than from any single factor. From a theoretical perspective, this study contributes by proposing an integrative framework that connects innovation, network, and sustainability theories into a unified model. Unlike prior studies that predominantly examine the direct relationship between sustainability and competitiveness, this study highlights the mediating role of innovation networks and the enabling role of policy and digital transformation, thereby offering a multi-level explanation spanning micro, meso, and macro dimensions.

From a methodological perspective, this study contributes by combining a PRISMA-based systematic literature review with bibliometric mapping using VOSviewer, enabling a structured and transparent identification of research clusters and gaps. This approach enhances the rigor and replicability of literature synthesis in the field of SME innovation and sustainability. Despite these contributions, several limitations should be acknowledged. First, the study relies on selected databases and a defined publication period (2021–2025), which may limit the comprehensiveness of the literature coverage. Second, differences in terminology and conceptual definitions across studies may influence the consistency of thematic classification. These limitations suggest caution in generalizing the findings. Based on the identified gaps, several directions for future research are proposed. Future studies are encouraged to develop and empirically test the proposed integrative framework using quantitative methods such as structural equation modeling or multilevel analysis. Additionally, more research is needed in developing countries to capture institutional and structural variations. Longitudinal and mixed-method studies may also provide deeper insights into the dynamic evolution of sustainability-driven innovation in SMEs.

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The Role of Sustainability in Innovation Networks to Enhance SME Competitiveness: An Integrative Framework Based on PRISMA and Bibliometric Mapping

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ABSTRACT

Small and medium-sized enterprises (SMEs) play a critical role in economic development; however, their competitiveness remains constrained by fragmented integration of sustainability and innovation practices. Previous studies examine direct relationships between sustainability and competitiveness, without sufficiently explaining how innovation networks and policy environments interact within this relationship. This study addresses this gap by developing an integrative understanding of the role of sustainability in innovation networks to enhance SME competitiveness. This research employs a Systematic Literature Review (SLR) based on PRISMA 2020 guidelines, combined with bibliometric analysis using VOS viewer. The literature search initially identified 5,393 articles from the ScienceDirect database, of which 59 met the inclusion criteria for final analysis. The results reveal four main thematic clusters: (1) sustainability-oriented innovation, (2) internal firm capabilities, (3) innovation networks and national innovation systems, and (4) policy and digital transformation. The findings indicate that SME competitiveness emerges from the interaction between internal capabilities, collaborative networks, and institutional support, with sustainability acting as both a driver and outcome of innovation processes. This study contributes theoretically by proposing an integrative framework that extends prior literature by incorporating innovation networks as mediating factors and policy digital environments as enabling mechanisms. Methodologically, it demonstrates the value of combining PRISMA-based SLR with bibliometric mapping to systematically identify research patterns and gaps. Practically, the findings suggest that strengthening sustainability-oriented innovation and innovation networks, supported by appropriate policy and digital infrastructure, may enhance SME competitiveness in the evolving green and digital economy.

1. Introduction

Small and Medium Enterprises (SMEs) play a crucial role in the economic structure of many countries, particularly in developing countries (Bayraktar & Algan, 2019). SMEs employ a significant workforce, contribute to domestic income, and serve as the backbone of local economic development

(Omowole et al., 2024). Currently, SMEs in Indonesia account for 99% of all business units (Prodjo, 2024). Their role is significant in Indonesia's economic growth. Their contribution to Gross Domestic Product reaches 60.5%, and their employment accounts for 96.9% of the total national workforce (Limanseto, 2022).

While the role of SMEs in the national economy is undeniable, this contribution does not necessarily guarantee their ability to survive in increasingly open and dynamic competition (Wang & Shi, 2011). The main challenge currently faced is not only maintaining its role as a driver of the people's economy, but also increasing competitiveness to adapt to the global market (Lopez-Torres, 2023). But according to research Amelia et al., (2023) currently the competitiveness of MSMEs in Indonesia continues to decline.

According to the IMD World Competitiveness Centerer (WCR 2025) report, Indonesia's competitiveness ranking dropped by 7 places to 40th in 2025 (Aris, 2025). The World Competitiveness Centerer is a subsidiary of the International Institute for Management Development (IMD) in Switzerland. This institution publishes various annual reports, such as the IMD World Competitiveness Yearbook, which assesses and ranks the economic competitiveness of countries worldwide, based on various performance factors and weaknesses. The European Commission, in its "Annual Report on European SMEs 2024/2025," noted that the real value added of SMEs in Europe declined by -0.2% in 2024. This indicates that although SMEs are important to the European economy, they are facing a contraction in productivity performance (Schulze, 2025).

KfW-ifo Research, in its report “SMEs see growing risks to their international competitiveness” (October 2024), shows that export expectations of SMEs in Germany were 16.5 balance points below the long-term average in September 2024. While this is not a direct measure of overall SME competitiveness, it does indicate declining confidence and export potential in SMEs, which are an aspect of competitiveness (Abel-Koch, 2024). SME Competitiveness in Francophone Africa 2024 states that only 14% of companies in Francophone African countries export, an indicator of challenges to competitiveness and integration into global markets (International, 2024). SME Policy Index: Latin America and the Caribbean 2024 presents an analysis of SME policies in Latin America and the Caribbean, although this report focuses more on policy frameworks than on explicit figures on competitiveness decline (OECD, 2024).

The data above presents information on the declining competitiveness of SMEs in Indonesia by 2024. This decline in competitiveness also occurred in SMEs in Europe, Germany, Africa, and Latin America by 2024. SME competitiveness is key to success in the global market (Dvouletý & Blažková, 2021). In this context, competitiveness is determined not only by production efficiency and financial capability, but also by innovation capacity, collaboration within business networks, and the application of sustainability principles. The role of SMEs as job providers and drivers of the local economy needs to be strengthened through continuous innovation so they can actively compete in the global market (Vrontis et al., 2022).

To increase competitiveness amidst the pressures of globalization, SMEs cannot rely solely on internal capabilities. Limited resources, capital, and access to knowledge require SMEs to build innovation networks as an effective collaborative strategy (Prasanna et al., 2019). Through innovation networks, SMEs can connect with various actor such as research institutions, universities, governments, industry associations, and other business partners to share knowledge, technology, and best practices. This collaboration plays a crucial role in accelerating the diffusion of innovation, expanding market access, and strengthening adaptive capacity to the dynamic business environment (Mata et al., 2024). Thus, innovation networks are a key element bridging SMEs' internal potential and external opportunities.

SMEs can develop innovations that are not only competitive but also sustainable (Prasanna et al., 2019). Innovations that ignore sustainability aspects are prone to negative externalities and reduce business legitimacy in the long term (Prasanna et al., 2019). On the other hand, innovations that consider sustainability can create differential added value and strengthen competitive positions in an increasingly environmentally conscious market. In their literature review Hermundsdottir & Aspelun

(2021) found that sustainable innovation generally has a positive effect on company competitiveness. Implementing sustainable innovation in the SME context still faces unique barriers, such as limited resources, technological capacity, and market access (Kannan & Gambetta, 2025).

A systematic review by Lopez-Torres et al. (2022) on the relationship between sustainability and competitiveness indicates that there are important moderating variables that influence the direction and magnitude of these effects. Furthermore, a meta-analysis by Oduro & Haylemariam (2025) confirmed that sustainability aspects have a positive effect on the competitiveness of SMEs. Several early studies have linked innovation networks and sustainability practices, including in Sarango-Lalangui et al. (2023), which examined the influence of environmental sustainability on open innovation and found that companies that integrate environmental aspects are more active in innovation networks. Furthermore Dory (2023) reviewed key factors in sustainability-oriented innovation in SMEs, stating that the success of sustainable innovation depends on the integration of social and environmental aspects, organizational structure, and stakeholder involvement in the innovation network.

The Indonesian government has demonstrated a strong commitment to building and strengthening innovation networks through national policies such as the establishment of the National Research and Innovation Agency, established under Presidential Regulation No. 33 of 2021, the 2017–2045 National Research Master Plan, and Presidential Regulation No. 38 of 2018 concerning the National Innovation System Master Plan. These policies seek to synergize research activities from various institutions, encourage cross-sector collaboration, and create a productive national innovation ecosystem (Suwarno, 2022). An example of a concrete policy is the Kedaireka Matching Fund program from the Ministry of Education, Culture, Research, and Technology, which encourages collaboration between lecturers and industry players. This program serves as a good example of how innovation networks can facilitate the intersection of academic research and industry needs (Pradana et al., 2021). Although the concept of innovation networks has been introduced and utilized, its implementation has not yet fully improved the competitiveness of SMEs in the global market.

Globalization has led to tightening sustainability standards in trade, from the European Union's climate policy to the expansion of governance through voluntary sustainability standards, so that environmental and social issues are now integrated into cross-border trade rules (Marx et al., 2024). Developed countries have adopted regulations that directly impact market access, for example, the European Union's EU Deforestation Regulation (EUDR), the United States' Uyghur Forced Labor Prevention Act (UFLPA), Australia's Modern Slavery Act 2018, and Japan's Clean Wood Act, which are included in the global timber legality regime (Apeti & N'Doua, 2023; D. Kim & Gang, 2024; Ru, 2024; Sinclair & Nolan, 2020). These regulations require evidence of due diligence to ensure imported products are deforestation-free, respect workers' rights, and traceability of raw materials (Kim et al., 2024). Consequently, SMEs in developing countries face compliance burdens and the risk of being "marginalized" from global supply chains if mentoring support on voluntary sustainability standards is not strengthened (Muradian et al., 2025).

Despite the growing body of literature on sustainability, innovation networks, and SME competitiveness, existing studies remain fragmented and largely examine these dimensions in isolation. First, there is a lack of integrated analysis that simultaneously links sustainability practices, innovation networks, and competitiveness within a unified conceptual framework. Most prior studies focus on direct relationships, such as sustainability performance or innovation–competitiveness, without explaining how these elements interact across multiple levels.

There is limited use of bibliometric mapping approaches to systematically identify research patterns, thematic structures, and knowledge gaps in this field. As a result, the intellectual landscape of sustainability-driven innovation in SMEs has not been comprehensively mapped. The existing literature shows a limited focus on developing country contexts, where SMEs face distinct structural challenges, including resource constraints, institutional gaps, and limited access to innovation networks. This creates a gap in understanding how sustainability-oriented innovation operates under different economic and institutional conditions.

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Therefore, this study is academically necessary as it provides a systematic and integrative synthesis of the literature by combining PRISMA-based SLR with bibliometric analysis. This approach enables the identification of key research themes, the development of an integrative conceptual framework, and the clarification of how sustainability, innovation networks, and competitiveness are interconnected in the context of SMEs. This also study aims to address gaps by conducting a Systematic Literature Review to develop an integrative understanding of the role of sustainability in innovation networks in enhancing SME competitiveness. Specifically, this study seeks to answer the following research questions: (1) What are the main research themes linking sustainability and innovation networks in SMEs? (2) How do innovation networks contribute to SME competitiveness through sustainability? (3) What research gaps and future research directions can be identified in this field?

2. Method

This study used a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize research findings relevant to the topics of sustainability, innovation networks, and SME competitiveness. The SLR approach was chosen because it provides a comprehensive overview of existing empirical evidence while systematically identifying research gaps (Azarian et al., 2023; Cabrera et al., 2023). According to Snyder (2019), an SLR is a structured and transparent scientific methodology for reviewing literature, enabling replication and minimizing researcher bias. This SLR was implemented following the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) developed by Page et al. (2021). PRISMA was used to ensure transparency and traceability at every stage of the review, from literature identification to presentation of results. The procedure consists of four main stages: identification, screening, eligibility assessment, and final inclusion. All processes are reported using a PRISMA flow diagram to show the number of articles retrieved, screened, and selected through the final stage of analysis.

The literature search was conducted online using the reputable scientific database ScienceDirect, as it offers extensive coverage of innovation and sustainability topics. The ScienceDirect database was chosen as the sole source for the Systematic Literature Review (SLR) because it provides a collection of highly reputable scientific journals with a rigorous peer-review process and broad multidisciplinary coverage, thus ensuring the quality, consistency, and credibility of the analysed literature (Snyder, 2019). The publication year range was limited to 2021 and 2025, considering that the last five years have shown a significant increase in literature linking sustainability and innovation in SMEs (Hermundsdottir & Aspelund, 2021; Lopez-Torres et al., 2022). All search results were downloaded in bibliographic reference format and then cleaned to remove duplications before proceeding to the selection stage.

The screening stage consisted of two stages: reviewing titles and abstracts to ensure topic relevance and reading in full to ensure alignment with the research objectives. Inclusion criteria included: (1) peer-reviewed scientific articles, (2) focusing on SMEs and sustainable innovation, (3) discussing the relationship between sustainability, innovation networks, and competitiveness, and (4) published in English or Indonesian. Articles that were conceptual in nature without empirical data support, irrelevant to the SME context, or unavailable in full text were excluded from the analysis. All inclusion and exclusion decisions were documented to maintain transparency in the selection process (Snyder, 2019).

To ensure the rigor and reliability of the selected studies, a quality assessment was conducted. Each article was evaluated based on several criteria, including: (1) clarity of the research objectives, (2) relevance to the topics of sustainability, innovation networks, and SME competitiveness, and (3) contribution to the field. The assessment was conducted systematically to ensure that only studies meeting academic standards were included in the final analysis. This process helped minimize bias and increase the validity of the synthesized findings.

3. Results and Discussion

A Systematic Literature Review (SLR) is used to systematically determine the research's position. Several methods were used to compile the SLR, including a search on the website www.sciencedirect.com from 2021 to 2025, including open access. The search results using keywords to identify scientific articles used in the literature review are shown in Table 1.

Table 1. Systematic literature review

No	Keywords	Total Article
1	"innovation networks"	1181
2	"innovation networks" "SMEs"	231
3	"innovation networks" "SMEs" "Sustainability"	196
4	"innovation networks" "SMEs" "Sustainability" "competitiveness"	59

The paper screening process was conducted in three stages: publication year between 2021 and 2025, and screening access type: open access and archive. The process of identifying the number of scientific articles eligible for use in the SLR process used a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram based on the keywords used. The results of the identification of eligible papers using the Prism diagram are shown in Fig. 1.

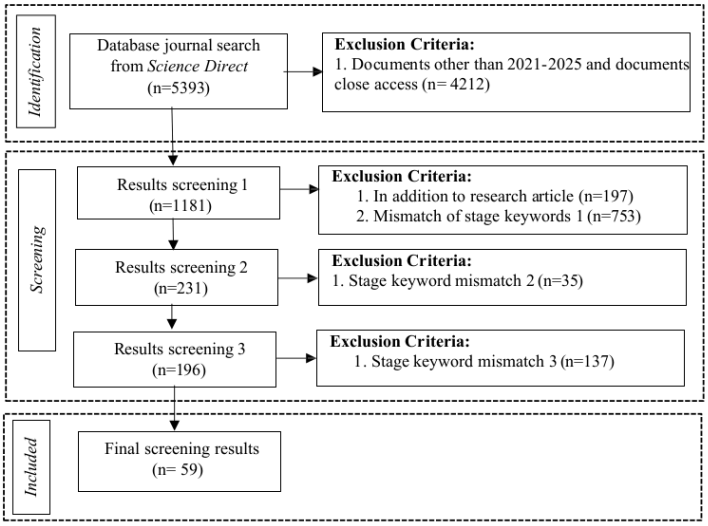

Fig. 1. Results of Prism Analysis to Determine Selected Paper

Based on Fig. 1, the results of paper identification using the PRISMA diagram, the first stage of the search for scientific articles using Science Direct yielded 5,393 scientific articles. In the first stage of screening, which used criteria other than 2020-2025 and closed access documents, there were 4,212. In the second stage of screening, which used criteria other than research articles, there were 197 scientific articles, and 753 articles that did not meet the criteria for keywords in the first stage. Stage 3 screening with stage 2 keyword mismatch criteria contained 35 and stage 4 screening with stage 3 keyword mismatch criteria contained 137. So, from the screening results that will be used in the literature study, 59 relevant scientific articles were obtained for a literature review to determine gaps in the research.

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Next, to determine the research position, VOSviewer was used. VOSviewer is software that functions to analyze and visualize bibliometric data interactively and easily. This software is used to map the relationships between elements in scientific literature, such as keywords, authors, institutions, or documents. VOSviewer is able to identify subtopics or themes within a research field, making it very useful in systematic literature studies to uncover research trends, find influential studies, and identify research gaps. Fig. 2 presents the results of VOSviewer.

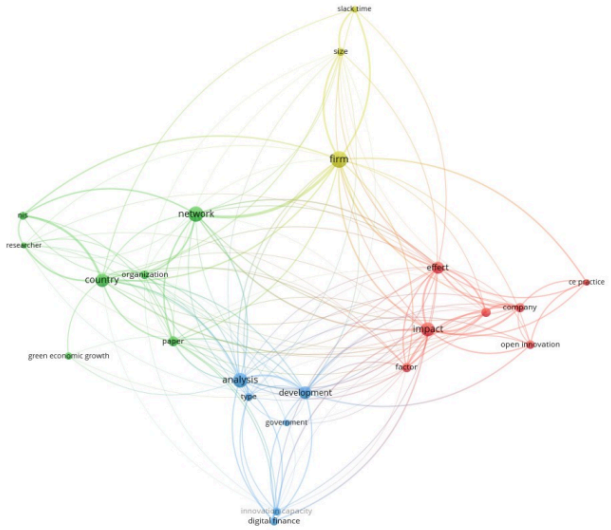

Fig. 2. Vosviewer results

This visualization, generated by the VOSviewer software, shows a co-occurrence map of keywords in the analyzed literature. Each node on the graph represents a keyword that frequently appears in the document collection, and the connecting lines (edges) indicate the degree of correlation between these keywords. The size of the circles reflects the frequency of keyword occurrences in the documents, while different colors indicate thematic clusters or groups formed automatically based on the clustering algorithm.

The VOSviewer visualization results show that research in the field of innovation and the green economy has developed within several relatively separate thematic clusters. One key gap identified is the lack of integration between government innovation policies and circular economy practices at the company level. While numerous studies have addressed open innovation and the circular economy and their impact on company performance, the direct link between public policy and circular economy implementation in the industrial world remains largely unexplored. This presents an opportunity to examine the extent to which national policies can encourage or hinder the adoption of sustainable innovation in the manufacturing sector.

Furthermore, there appears to be limited research linking research collaboration networks between countries and institutions to corporate innovation performance. Nodes such as network, organization, and country in the green cluster demonstrate a focus on global research networks, but few studies have quantitatively assessed their impact on micro-level performance, such as corporate

innovation capability or green economic value creation. Therefore, studies are needed that link the intensity and quality of research collaboration with tangible outcomes at the firm level, particularly in the context of a sustainable economy.

Another gap is the limited number of studies examining the role of digital financial technology in supporting innovation in the industrial sector, particularly in small and medium-sized enterprises. The keyword "digital finance" appears in the blue cluster, which discusses policy aspects and innovation capacity, but does not show a strong relationship with nodes such as firm or company. This suggests that the adoption of financial technology as a catalyst for innovation remains under-researched, despite its significant potential to facilitate capital access and managerial efficiency.

A critical comparison of the clusters shows distinct but complementary roles. The yellow cluster represents the internal capacity of firms, including organizational slack, firm size, and resource flexibility, which form the foundation for innovation (Bayon & Aguilera, 2021; Kannan & Gambetta, 2025). In contrast, the green cluster captures the external relational dimension, where innovation networks facilitate knowledge exchange and collaboration across organizations and countries (Novillo-Villegas et al., 2025). While the yellow cluster is internally oriented, the green cluster extends SMEs' capabilities beyond organizational boundaries (Fioravanti et al., 2023; Rodrigues & Franco, 2023).

The blue cluster differs by functioning as an enabling environment rather than a direct capability (Faiz et al., 2024; Gao & Ren, 2023). It reflects policy support, digital finance, and institutional infrastructure that shape how effectively SMEs can access and utilize innovation networks. Compared to the green cluster, which focuses on relationships, the blue cluster determines the conditions under which these relationships can be formed and sustained. The red cluster represents the outcome dimension, where innovation activities translate into measurable impacts such as sustainability performance and competitiveness (Hermundsdottir & Aspelund, 2021; Sarango-Lalangui et al., 2023). Unlike the other clusters, which focus on inputs and processes, this cluster captures the final value created through innovation.

From a causal perspective, the visualization suggests a directional relationship. Internal firm capabilities (yellow cluster) influence the ability of SMEs to engage in innovation networks (green cluster). These interactions are strengthened or constrained by policy and digital support systems (blue cluster). Together, these factors drive sustainable innovation outcomes (red cluster), which ultimately enhance SME competitiveness. Based on this synthesis, an integrative framework is proposed in which SME competitiveness is the result of a dynamic interaction between internal capacity, network collaboration, policy support, and sustainability-oriented innovation outcomes. This framework extends prior studies by explicitly linking micro-level capabilities, meso-level networks, and macro-level policy environments into a unified analytical model.

This research uses the SLR framework to map the literature on innovation networks, sustainability, and SME competitiveness over the 2021–2025 timeframe, resulting in four main clusters that illustrate current research directions. First, the red cluster emphasizes how open innovation and circular economy practices as key drivers of sustainable impact for SMEs, consistent with findings that green innovation and circular economy practices are significantly related to organizational performance (Oduro & Haylemariam, 2025; Rahmat et al., 2024). Second, the yellow cluster demonstrates that internal factors such as firm size, organizational slack, and resource flexibility play a crucial role in a firm's adaptive capacity. Recent results suggest that organizational slack enables more effective technology and market search (Bo et al., 2024; Zhao & Yan, 2023). Third, the green cluster highlights the systemic level and inter-organizational networks, where innovation networks and national innovation systems have been shown to strengthen technological capabilities and knowledge transfer between countries and industry actors (Li et al., 2023; Petraite et al., 2022). Finally, the blue cluster emphasizes that public policy, digital transformation, and digital finance are important enablers of SME innovation; for example, government technology support and digital finance development significantly improve firms' innovation performance (Abu et al., 2025; Liu & Xia, 2025; Pardiyono et al., 2025).

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Research has shifted from an exclusively internal (firm capacity) or external (network) focus to an integration of all three domains, as evidenced by a comparison with the literature over the last five years. This calls for a comprehensive understanding of the synergies between innovation, sustainability, networks, and policies. There are still gaps, though. For instance, there aren't many quantitative empirical studies that concurrently relate the sustainability outcomes of SMEs, especially in developing nations, to the intensity of their innovation networks, internal capacity, and policy support. By combining micro, and macro dimensions into a single integrative conceptual framework, this study strategically aims to close this gap.

3.1. Development of an Integrative Conceptual Model

The development of an integrative conceptual model in this study demonstrates that MSME competitiveness is not determined by a single dimension, but rather is the result of a dynamic interaction between three main levels: micro (internal company capabilities), meso (innovation networks), and macro (policy support and digital transformation). The findings of four clusters (red, yellow, green, and blue) demonstrate that sustainable innovation acts as a primary outcome mediated by innovation networks and facilitated by public policy. Thus, the resulting conceptual model integrates the causal relationship from internal capability, innovation network, policy support, sustainable innovation, competitiveness. This model expands previous understanding by demonstrating that sustainability is not only an outcome but also a connecting mechanism between dimensions in the MSME innovation system.

3.2. Identification of Theoretical Advances Compared to Previous Literature

This study provides theoretical advancements by integrating three main perspectives: innovation theory, network theory, and sustainability theory, which previously tended to be studied separately. Previous studies such as Hermundsdottir & Aspelund (2021); Lopez-Torres et al. (2022) generally emphasize the direct relationship between sustainability and competitiveness, without considering the mediating role of innovation networks and enabling factors from policies. This article goes beyond this approach by demonstrating that the relationship is multi-level and non-linear, but rather influenced by the interaction between internal capabilities, network structure, and institutional support. Thus, the main theoretical contribution of this study is to provide an integrative framework that unites various previously fragmented streams of literature.

3.3. Implications for Future Research Based on Quantitative Gaps

The bibliometric analysis in this study identified important gaps, particularly the lack of quantitative empirical studies that simultaneously examine the relationship between internal capabilities, innovation networks, policy support, and sustainability outcomes in MSMEs. Most existing studies are partial or qualitative, thereby failing to explain causal relationships comprehensively. Therefore, future research is recommended to develop quantitative models based on multi-level analysis or structural equation modelling (SEM) to test the proposed conceptual framework. In addition, longitudinal research is needed to understand the dynamics of sustainable innovation, as well as contextual studies in developing countries to capture the unique institutional and structural factors that enhance the competitiveness of MSMEs.

These findings are interpreted through three main theoretical perspectives. From innovation theory, sustainability-oriented innovations (e.g., green innovation and the circular economy) have been shown to enhance SME competitiveness by creating long-term value. From network theory, innovation networks enable SMEs to overcome resource constraints through knowledge sharing and collaboration, suggesting that relational capabilities shape competitiveness. From sustainability theory, sustainability is not merely a compliance requirement but also a strategic driver of competitive advantage, supported by policies and the institutional environment.

These perspectives suggest that SME competitiveness emerges from the interaction between internal capabilities, innovation networks, and policy support, with sustainability acting as both a driver and an outcome of innovation. The findings of this study suggest that SMEs may enhance their competitiveness by integrating sustainability-oriented innovation strategies into their business processes. Approaches such as circular-economy practices and environmentally friendly process

innovations are associated with improved resource efficiency and increased value creation. The literature indicates that firms adopting such strategies tend to strengthen their market positioning, particularly in markets that increasingly prioritize environmentally responsible products and practices.

From a policy perspective, the results highlight the importance of fostering collaborative innovation ecosystems that connect SMEs with academic institutions, research organizations, and financial actors. Evidence from the reviewed studies suggests that access to digital finance, applied research support, and sustainability-oriented incentives can facilitate innovation activities within SMEs. In this context, policy instruments such as green financing schemes and innovation support programs are associated with increased adoption of sustainable technologies and practices. Furthermore, the findings indicate that intermediary institutions, including financial institutions and industry associations, may play a significant role in fostering innovation networks. The availability of digital collaboration platforms and financial technologies is linked to improved access to resources and knowledge, which in turn can support the implementation of sustainable innovation initiatives. Strengthening connectivity among actors within innovation networks is therefore associated with enhanced adaptive capacity and competitiveness of SMEs in the evolving green and digital economy.

4. Conclusion

This study provides an integrative synthesis of the literature on sustainability, innovation networks, and SME competitiveness by identifying four interrelated thematic dimensions: internal firm capabilities, innovation networks, policy and digital support, and sustainability-oriented innovation outcomes. The findings demonstrate that SME competitiveness emerges from the interaction among these dimensions rather than from any single factor. From a theoretical perspective, this study contributes by proposing an integrative framework that connects innovation, network, and sustainability theories into a unified model. Unlike prior studies that predominantly examine the direct relationship between sustainability and competitiveness, this study highlights the mediating role of innovation networks and the enabling role of policy and digital transformation, thereby offering a multi-level explanation spanning micro, meso, and macro dimensions.

From a methodological perspective, this study contributes by combining a PRISMA-based systematic literature review with bibliometric mapping using VOSviewer, enabling a structured and transparent identification of research clusters and gaps. This approach enhances the rigor and replicability of literature synthesis in the field of SME innovation and sustainability. Despite these contributions, several limitations should be acknowledged. First, the study relies on selected databases and a defined publication period (2021–2025), which may limit the comprehensiveness of the literature coverage. Second, differences in terminology and conceptual definitions across studies may influence the consistency of thematic classification. These limitations suggest caution in generalizing the findings. Based on the identified gaps, several directions for future research are proposed. Future studies are encouraged to develop and empirically test the proposed integrative framework using quantitative methods such as structural equation modeling or multilevel analysis. Additionally, more research is needed in developing countries to capture institutional and structural variations. Longitudinal and mixed-method studies may also provide deeper insights into the dynamic evolution of sustainability-driven innovation in SMEs.

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GENERAL COMMENTS

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ragil pardiyono:

We have reached a decision regarding your submission to Spektrum Industri, "The Role of Sustainability in Innovation Networks to Enhance SME Competitiveness: A Systematic Literature Review (SLR)".

Our decision is: **Revisions Required**

The reviewers have indicated that the manuscript needs to be improved according to the recommendations before publication. Please carefully address the issues raised in the comments (please see below), and submit your revised version by **March 30, 2026.**

Please, also provide a separate "response to the reviews" letter, in which you outline each change made (point by point, in red colour) as raised in the reviewer comments, and provide a suitable rebuttal to each reviewer comment, which is not addressed in the revised version of your manuscript.

Please modify your manuscript and save as (with changes made in manuscript marked in red color) and send back to us.

Reviewer A:
Recommendation: Revisions Required

Originality

Enough

Relevancy

Good

Quality of writing

Enough

Clarity of presentations

Good

Contribution

Enough

Depth of research

Enough

Abstract

Please ensure that the abstract explicitly includes:
Research gap
Objectives
Methodological approach
Main findings
Theoretical contributions
Practical implications

Introduction

The introduction presents a strong argument, demonstrating the importance of SMEs to the global and national economies. The use of empirical data from various international reports enhances the article's credibility.

However, there are several major weaknesses:
Unclear and Uncritical Research Gap
The introduction tends to be descriptive, rather than critical. The article cites numerous previous studies, but does not clearly indicate:
What is not yet known
What has not been analyzed
Why is this SLR academically necessary
The author needs to state the gap, for example explicitly:
Lack of integrated analysis linking sustainability, innovation networks, and competitiveness
Lack of bibliometric mapping in this field
Lack of focus on developing countries

The article does not explicitly present the research question or research objective in the form of structured research questions or research objectives.

Example of improvement:
This study aims to answer the following research questions:
What are the main research themes linking sustainability and innovation networks in SMEs?
How do innovation networks contribute to SME competitiveness through sustainability?
What research gaps exist in this field?

Method

The methodology section is quite good, using PRISMA and SLR. However, there are several serious weaknesses:
Use of only one database (ScienceDirect).
This is a significant methodological weakness.
International journals typically use:

Scopus
Web of Science
or a combination of databases.

Using only ScienceDirect can introduce bias into the literature.
Authors should provide a strong academic justification or include other databases.

No quality assessment
International SLRs typically conduct a quality assessment of selected articles.

Add research ethics at the end of your research methods.

Result and Discussion

The use of VOSviewer is a strength of this article. The identification of four clusters is a good contribution.
However, the main weakness is that the analysis remains descriptive rather than critical.
The author only describes the clusters, but does not:
Compare the clusters critically
Explain causal relationships
Offer a new conceptual model
The author needs to add a conceptual synthesis.

The discussion is not yet sufficiently theoretical. The article does not link the findings to key theories such as:
Innovation theory
Network theory
Sustainability theory
The discussion is still a summary of the literature, not a theoretical interpretation.

Conclusion

The conclusion is quite good, but it remains a summary rather than a theoretical synthesis.

The conclusion should answer the research question and emphasize the novelty of the findings.

General comments

This article addresses a highly relevant and important topic, namely the relationship between sustainability, innovation networks, and competitiveness in SMEs through a Systematic Literature Review (SLR) approach. This theme has significant theoretical and practical contributions, particularly in the context of green and digital economic transformation. The use of the PRISMA method and bibliometric analysis with VOSviewer demonstrates a systematic effort in mapping the literature. However, this article still requires substantial improvements in the preparation of the introduction, the sharpness of theoretical arguments, methodological consistency, depth of critical analysis, and academic structure, in order to meet the standards of a reputable international journal in accordance with the Industrial Spectrum Journal.

Reviewer B:
Recommendation: Revisions Required

Originality

Enough

Relevancy

Good

Quality of writing

Good

Clarity of presentations

Good

Contribution

Enough

Depth of research

Enough

Abstract

The abstract's structure reflects the main components of the research, but several weaknesses remain. First, there is inconsistent numerical analysis during the article identification process (N=5,393), which is grammatically inaccurate. Second, the theoretical and practical contributions are presented in general terms and do not specifically explain their novelty relative to previous studies, such as those by Hermundsdottir & Aspelund or Lopez-Torres. The abstract needs to clarify the research gaps and the concrete implications arising from integrating the four thematic clusters.

Introduction

The introduction is rich in data and demonstrates the urgency of the research, supported by global reports. However, the argumentation is still too long and tends toward descriptive narrative without an explicit sharpening of the problem statement. As a reviewer, I suggest that the opening paragraph focus on the main contradiction: the high contribution of SMEs to the economy, but declining global

competitiveness. After that, the research gap should be explicitly formulated as a research question. Currently, the gap is more implied than stated directly.
Additionally, some policy references and media reports (e.g., online news) need to be evaluated for academic credibility. International journals generally prioritize scholarly sources over popular news articles. Spelling consistency, such as "European commission," also needs to be revised to "European Commission."

Method

In the Methods section, the use of the PRISMA 2020 guidelines is appropriate and in accordance with international standards. However, there are logical inconsistencies in the article selection process. The authors state that they only used the ScienceDirect database, which methodologically significantly limits the scope of the literature and potentially introduces selection bias. For international journal standards, a minimum of two to three major databases (e.g., Scopus or Web of Science) is required. If a single database is used, a strong methodological justification must be provided.

Result and Discussion

In the Results and Discussion section, the use of VOSviewer software is an added value because it provides a bibliometric dimension to the SLR. However, the resulting cluster analysis is still descriptive and insufficiently analytical. The authors should deepen the interpretation of the relationships between the clusters and explain how the four clusters form an integrative conceptual framework. Currently, each cluster is discussed separately without a strong conceptual synthesis.

Section 3.5, the Discussion, offers a significant opportunity to demonstrate theoretical contributions. However, the discussion is still a recapitulation of the previous cluster results. Therefore, I suggest adding sections to this section: (1) development of an integrative conceptual model, (2) identification of theoretical advancements compared to previous literature, and (3) implications for future research based on the quantitative gaps identified.

Conclusion

The Conclusion section summarizes the main findings well, but is somewhat repetitive in the discussion. To improve academic quality, the conclusion should explicitly state the theoretical and methodological contributions and the future research agenda. Furthermore, the study's limitations are only briefly mentioned in the methods section and not expanded upon in the conclusion.

General comments

Please ensure the text in the image is clearly visible. If it is unclear, please submit an HD version in a separate Word file. This will allow for revisions. The quality of your article’s content will be much better visually.

Overall, this article has good publication potential due to its relevant topic and use of SLR and bibliometric approaches. However, to meet the standards of a reputable international journal or the intended journal, the author needs to: clarify research gaps and novelty; strengthen methodological justification, especially regarding the use of a single database; deepen the conceptual synthesis analysis; streamline the PRISMA structure; pay attention to good academic grammar; and eliminate less credible non-scientific reference sources.

--

Yours sincerely,

Agung Kristanto, Ph.D.

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