INTELLECTUAL CAPITAL IN SMES: A BIBLIOMETRIC STUDY AND DIRECTIONS FOR FUTURE RESEARCH

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Abstract:

Background: Intellectual capital (IC) has been recognized as a key driver of business performance and sustainability, particularly for small and medium enterprises (SMEs). IC, which comprises human capital, structural capital, and relational capital, plays a crucial role in fostering innovation, improving knowledge management, and enhancing competitive advantage. However, the comprehensive evolution of IC research in SMEs remains underexplored.
Purpose: This research seeks to examine the evolution of intellectual capital (IC) studies in small and medium-sized enterprises (SMEs) over the last ten years, pinpoint major contributors, investigate prevailing themes, and uncover emerging directions in the field.
Design/Methodology/Approach: This study uses bibliometric analysis with a database sourced from Scopus and uses VOSviewer for visualization. The study applied various bibliometric techniques, including citation analysis, co-word analysis, and bibliographic coupling, to map the intellectual landscape of IC research in SMEs.
Findings/Results: The analysis reveals that IC research in SMEs has grown significantly, with an increasing focus on human, structural, and relational capital. Key research themes include innovation, knowledge management, financial performance, and sustainability. The study also identifies Indonesia, Pakistan, Poland, and Portugal as leading contributors to IC research, reflecting the global recognition of knowledge-based economic growth. The study also observes a significant shift toward IC integration with digital transformation and artificial intelligence.
Conclusion: This research offers beneficial perspectives for academics, policymakers, and business practitioners by emphasizing the strategic role of IC in SMEs' sustainability. The findings suggest that future research should further explore the intersection of IC with digital transformation and AI-driven business models.
Originality/Value (State of the Art): This study is among the first to provide a comprehensive bibliometric analysis of IC research in SMEs, mapping its chronological development and identifying future research directions.

Keywords: bibliometric analysis; competitive advantage; digital transformation; intellectual capital; small and medium enterprises (SMEs)

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INTRODUCTION

Intellectual Capital (IC), which encompasses human, structural, and relational capital, plays a crucial role in driving innovation and sustaining long-term competitive advantage (Todericiu & Şerban, 2021). However, within the context of small and medium-sized enterprises (SMEs), the conceptualization and practical utilization of IC remain suboptimal. This is particularly concerning as SMEs are strategic actors in economic development, especially in developing countries such as Indonesia, where they contribute significantly to GDP and employment (Gloria, 2020). SMEs often face persistent challenges such as limited financial resources, weak managerial capacity, and inadequate access to information, which are further exacerbated by the volatile, uncertain, complex, and ambiguous (VUCA) nature of today's business environment. These conditions necessitate knowledge-based approaches and the strengthening of IC as strategic enablers for sustainable business growth (Igielski, 2018). This study addresses these issues by formulating a central research problem: how the development and application of IC in SMEs can be systematically mapped and analyzed to support innovation and business sustainability in the era of the knowledge-based economy.

One of the most pressing challenges facing SMEs is the underdevelopment and ineffective utilization of IC. A lack of structured mechanisms to manage and leverage IC hinders SMEs' capacity to innovate, adopt new technologies, and expand market reach (Seleim, Ashour, & Bontis, 2004). Although existing studies acknowledge that IC contributes significantly to sustainability by enhancing efficiency, fostering innovation, and improving competitiveness (Rachmawati, 2017), many SMEs continue to struggle in converting these intangible assets into measurable business outcomes (Zuliyati, Budiman, & Delima, 2017). Most prior research has focused on financial, regulatory, and operational factors affecting SMEs performance (Urata, 2000), with relatively little emphasis on the strategic management of IC within the broader entrepreneurial ecosystem. Additionally, while studies such as Meihami and Meihami (2014) have explored knowledge management as a driver of competitiveness, they often overlook the interconnected dynamics of human, structural, and relational capital as integrated resources for strategic decision-making and sustainable growth.

This study addresses this research gap by offering a comprehensive bibliometric analysis that maps the intellectual structure, thematic evolution, and emerging trends in IC research specific to SMEs. Unlike previous research that typically centers on single dimensions of IC or specific industry contexts, this study adopts a holistic and longitudinal approach to examine how IC has been conceptualized and utilized across diverse SMEs settings over the past decade. By doing so, it reveals underexplored areas and provides a foundation for future research that integrates IC with digital transformation, sustainability strategies, and entrepreneurial ecosystem development, domains that remain insufficiently investigated in current literature.

To fill this research gap, the study employs an extensive bibliometric methodology to explore the progression and patterns of IC research in the context of SMEs. Various bibliometric tools including citation analysis, co-word analysis, and bibliographic coupling are applied to reveal the field's intellectual landscape, highlight key authors, and identify prevailing themes along with emerging scholarly directions.This technique helps identify research trends, scientific impact, and relationships between topics, authors, and institutions within a particular field of study (Aria & Cuccurullo, 2017). Drawing on data sourced from the Scopus database and utilizing visualization software like VOSviewer, this research conducts a quantitative and network-based examination of intellectual capital literature within the SME domain.

This research is driven by the following central research questions (RQ):
RQ1: What is the trajectory of intellectual capital research in the SME sector over the past decade?
RQ2: Which researchers and institutions have played the most influential roles in shaping IC research in SMEs?
RQ3: What key thematic areas have defined IC research in SMEs, and how have they developed throughout the years?
RQ4: What are the emerging directions in intellectual capital research, especially in relation to the business performance of SMEs?
RQ5: How is the direction of future research on IC?

Through addressing these questions, this study aims to provide a structured assessment of the progression of IC research in SMEs, spotlight influential scholars, and trace thematic developments along with potential future research avenues.

The novelty of this research lies in its integrative approach to IC from an entrepreneurial perspective, offering a holistic understanding of how SMEs can leverage intangible assets for sustainable and competitive growth. The findings have practical implications for policymakers, business practitioners, and academic researchers, as they underscore the strategic importance of fostering an enabling environment in which SMEs can optimize their IC and contribute meaningfully to economic development.

METHODS

The data utilized in this study are secondary in nature, derived from bibliographic records of scientific publications. The primary data source is the Scopus database, which is recognized as one of the most comprehensive repositories of peer-reviewed academic literature. This ensures broad coverage and high-quality data for bibliometric analysis on the topic of IC in SMEs.

To maintain a structured and targeted analysis, this research utilized data retrieved from the Scopus database, recognized for its broad index of peer-reviewed scholarly publications. The data employed in this study were obtained through institutional access provided by IPB University, Indonesia. The following advanced search query was utilized to retrieve the data: (TITLE-ABS-KEY (“Intellectual Capital”) AND TITLE-ABS-KEY (“Small and Medium Enterprises”)) AND PUBYEAR > 2015 AND PUBYEAR < 2025) AND (LIMIT-TO (DOCTYPE. “ar”) AND (LIMIT-TO (LANGUAGE,”English”)). To ensure relevance, the search was restricted to records containing “Intellectual Capital’ and ‘Small and Medium Enterprises” in the title, abstract, or keyword fields. A full summary of the inclusion criteria is provided in Table 1

The initial structured search yielded a total of 129 records, including journal articles, book chapters, and conference proceedings. To narrow down the dataset, a systematic screening process was conducted using predefined inclusion and exclusion criteria to ensure the studies were relevant to the research focus on IC implementation in SMEs, particularly concerning business performance. The applied criteria used for this refinement are detailed in Table 2.

Following title and abstract screening, a full-text review was conducted to ensure relevance. After applying these filters, the final database comprised 25 documents all of which are journal articles. A dominant focus is on the role of IC in innovation and SMEs, emphasizing how intangible assets contribute to the growth, performance and sustainability of SMEs. The data were exported in CSV (Comma-Separated Values) format, which facilitates seamless integration with bibliometric tools namely VOSviewer. The chosen export format is also compatible with analytical tools, facilitating effective handling and visualization of the data to support deeper investigation into research trends and thematic evolution in IC studies related to SMEs.

Table 1. The inclusion criteria

Criteria	Description
Database	Scopus
Search Query	TITLE-ABS-KEY(“Intellectual Capital”) AND TITLE-ABS-KEY (“Small and Medium Enterprises”))
Publication Period	2015-2025
Document Types	Articles
Language	English

Table 2. Inclusion and exlucion criteria

Criteria	Inclusion	Exclusion
Document Types	Articles	Book chapters, conference papers
Relevance	Research focused on the application of IC in the context of SMEs	Studies focused on IC implementation outside SMEs
Publication Period	2015-2025	Studies published before 2015
Language	English	Non-English studies
Availability	Documents with full-text access to enable detailed analysis	Studies without full-text access or insufficient methodological details

The dataset was examined through descriptive statistics and science mapping techniques, utilizing VOSviewer software version 1.6.20 to support the analysis. VOSviewer, software created by Van Eck & Waltman (2010), provides a powerful means to visually describe and analyze relationships in bibliographic data. The software offers three primary visualization methods to illustrate keyword relationships within the dataset. Network visualization reveals connections among frequently occurring terms, aiding in the identification of emerging thematic clusters. Overlay visualization captures the chronological progression of keyword usage, highlighting changes in research emphasis over time. Additionally, keyword co-occurrence mapping focuses on terms associated with 'intellectual capital,' uncovering key patterns and thematic trends within the field. By applying methods such as bibliographic coupling, co-citation, co-authorship, and keyword co-occurrence, VOSviewer constructs visual maps that depict the interconnections among various entities, including countries, institutions, journals, researchers, and keywords. This integrative visualization technique supports both descriptive analysis and the illustration of intricate data relationships. As a result, the approach facilitates the extraction of valuable insights, highlights prominent trends, uncovers research gaps, and suggests avenues for future exploration in the domain of IC within SMEs.

Although this is an exploratory bibliometric study that does not rely on a formal hypothesis-testing framework, it is guided by the underlying assumption that: "The literature on IC in SMEs has evolved significantly over the last decade, reflecting an increasing integration of IC with innovation, digital transformation, and sustainability performance." This assumption is grounded in prior empirical and theoretical works suggesting that IC is a key enabler of competitive advantage and long-term business viability in SMEs (Mahmood & Mubarik, 2020; Gross-Gołacka et al. 2020).

The framework of thought in this study follows a five-step bibliometric research procedure (Capobianco-Uriarte et al. 2019), as illustrated in Figure 1. The framework begins with defining the research domain (IC in SMEs), selecting a high-quality academic database (Scopus), establishing document criteria (e.g., publication year, language, type), conducting data processing using VOSviewer, and culminating in analytical interpretation. This systematic flow ensures transparency, replicability, and reliability in the identification of research trends, knowledge gaps, and future directions in the field.

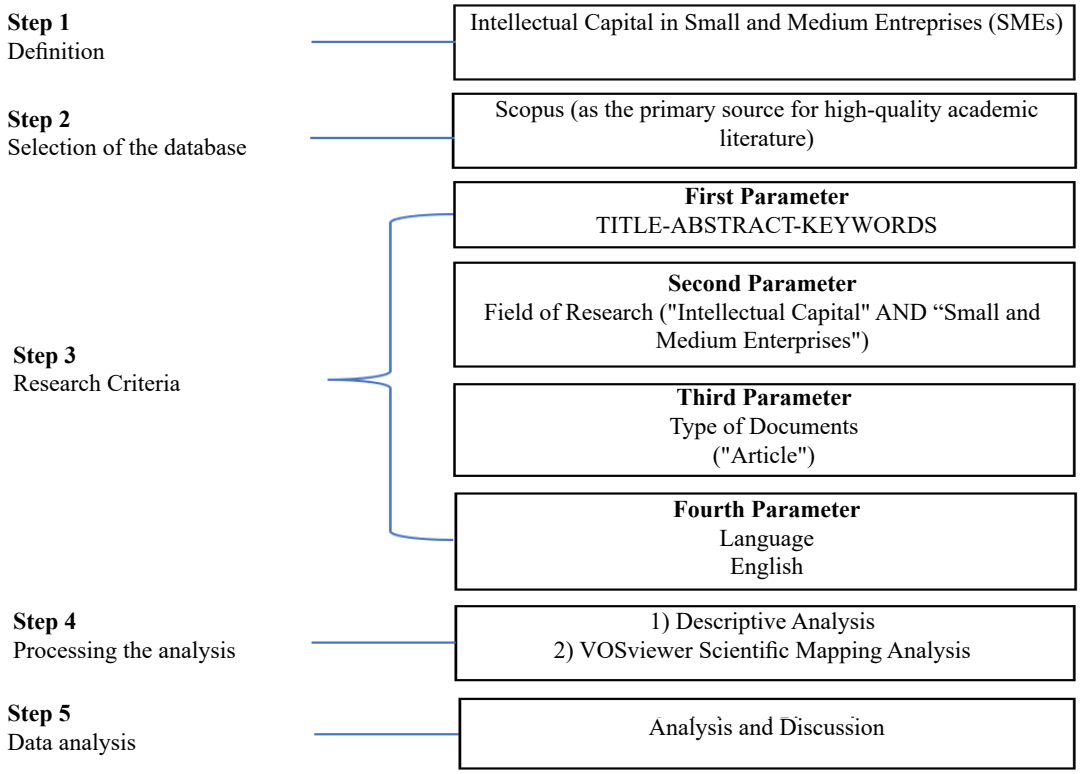

Figure 1. Research methodology framework

RESULTS

The Trajectory Of Intellectual Capital Research In The SME Sector Over The Past Decade

Basic Information about the Data Analyzed

An analysis of the 25 papers in the dataset reveals that a total of 74 unique authors have contributed to these studies, demonstrating a collaborative research effort in the field of IC within SMEs. Furthermore, these papers include 102 distinct keywords, with central themes such as competitive advantage, dynamic capabilities, and innovation performance reflect the broad spectrum of research trajectories within the field. The impact of IC on SMEs is evident in several dimensions, as it enhances business performance, fosters innovation, and strengthens competitive advantage. Research also emphasizes the role of IC in improving financial sustainability, organizational resilience, and knowledge management, which are crucial for SME growth. Additionally, IC plays a critical role in fostering absorptive capacity, allowing SMEs to effectively integrate new knowledge and adapt to market changes, ultimately contributing to long-term business sustainability and economic development.

Annual Publication Trends and Output Based on Bibliographic Databases

The annual output of academic research on IC in SMEs exhibits a fluctuating trend over the years 2015 to 2025, reflecting shifting academic interest and evolving research priorities (Figure 2). While the initial period saw a relatively low but stable output, with minor declines in 2017 and 2021, there was notable growth in 2018, 2020, and a significant peak in 2022. The sharp increase in 2022 suggests a surge in scholarly attention, possibly driven by the increasing recognition of IC's role in digital transformation, sustainability, and post-pandemic economic recovery strategies for SMEs. However, the decline in 2023 indicates a temporary dip, which could be attributed to research diversification into adjacent areas or funding shifts. The subsequent rebound in 2024 highlights a renewed focus, emphasizing the ongoing relevance of IC in enhancing SME competitiveness and resilience in an increasingly knowledge-driven economy. This dynamic pattern underscores the necessity for continuous exploration of IC's impact on SMEs innovation, sustainability, and strategic growth in response to global economic and technological shifts.

Top-Cited Documents and Corresponding Impact Scores

Table 3 presents the key publications that play a central role in advancing studies on IC in SMEs. The most relevant sources for IC research in SMEs, as shown in the table, highlight the key academic journals that contribute significantly to this field. Sustainability (Switzerland) emerges as the leading journal, publishing five articles (20%), indicating a strong focus on the intersection of IC and sustainable business practices. This suggests that researchers are increasingly exploring how SMEs leverage IC for long-term resilience, environmental responsibility, and sustainable competitive advantage. The Journal of the Knowledge Economy follows with two articles (8%), reinforcing the link between IC, knowledge management, and economic growth in SMEs. The remaining journals, including Business: Theory and Practice, Journal of Management and Business Administration. Central Europe, International Journal of Management and Sustainability, and others, each contribute one article (4%), reflecting a diverse academic interest in various dimensions of IC in SMEs. These sources cover a broad spectrum, from economic policy, structural equation modeling, and forecasting, to business administration, indicating that IC is a multidisciplinary topic studied across various business and economic contexts.

The distribution of research output across multiple journals signifies that IC in SMEs is not confined to a single academic domain but spans sustainability, strategic management, knowledge economy, and technological forecasting. The growing presence of IC research in sustainability-oriented journals suggests a shift in scholarly focus toward how SMEs can utilize intellectual assets to navigate the challenges of modern business landscapes, including digitalization, innovation, and long-term viability. Future research may further explore how different components of IC (human, relational, and structural capital) influence SME adaptability in evolving market conditions.

Key Insights and Implications for Future Research

The distribution of research across various journals underscores the multidisciplinary nature of IC research in SMEs. The dominance of Sustainability (Switzerland) as the leading source suggests an increasing emphasis on IC's role in sustainable business practices, highlighting its contribution to

long-term resilience, environmental responsibility, and stroategic growth in SMEs. This indicates a shift in research priorities toward exploring how SMEs utilize intellectual assets to navigate the challenges of sustainability and corporate social responsibility. The presence of the Journal of the Knowledge Economy among the top sources reflects the critical role of knowledge management in SME competitiveness. This suggests that future research should further investigate how SMEs can effectively leverage knowledge-based resources to foster innovation, efficiency, and economic sustainability. Additionally, the inclusion of journals focusing on management, economic policy, and forecasting indicates that IC is studied not only as a strategic business asset but also as a key component in policy-making, economic development, and industry transformation.

From an impact perspective, Table 4 highlights the most frequently cited publications on IC in SMEs reveals key contributions that have significantly shaped this research domain. The highest impact study, authored by Mahmood and Mubarik (2020) in Technological Forecasting and Social Change, has received 222 citations, highlighting its substantial influence on understanding the role of IC in fostering technological advancements and strategic decision-making for SMEs. This suggests that IC is increasingly viewed as a crucial factor in the adaptation and growth of SMEs in dynamic business environments. The second most cited work Ying, Hassan, & Ahmad, (2019) in Sustainability (Switzerland), with 97 citations, underscores the relationship between IC and sustainable business practices, reflecting a growing recognition of how SMEs leverage intangible assets to enhance long-term resilience and environmental responsibility.

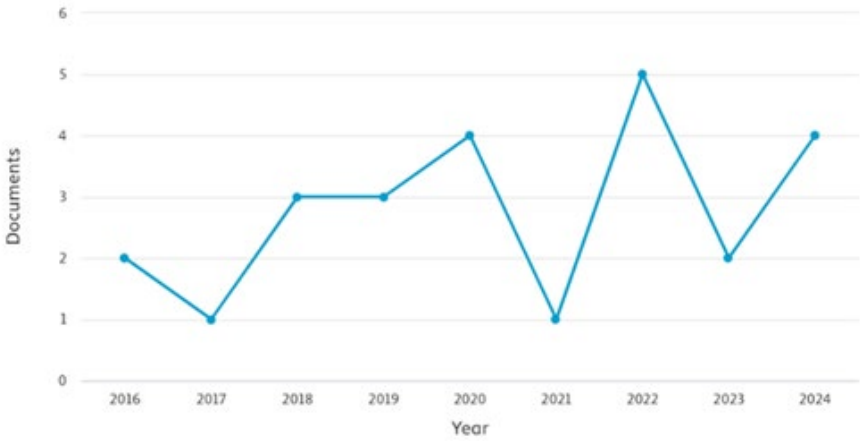

Figure 2. Annual output of academic research

Table 3. Top-contributing journals by number of publications

Source	Articles	Percentage (%)
Sustainability (Switzerland)	5	20
Journal of the Knowledge Economy	2	8
Business: Theory and Practice	1	4
Journal of Management and Business Administration. Central Europe	1	4
International Journal of Management and Sustainability	1	4
International Journal of Energy Economics and Policy	1	4
Economic Research-Ekonomska Istrazivanja	1	4
Technological Forecasting and Social Change	1	4
Journal of Applied Structural Equation Modeling	1	4
British Food Journal	1	4

Table 4. Most Cited Documents According to Scopus Data

Authors	Year	Global Citations
Mahmood and Mubarik (Technological Forecasting and Social Change)	2020	222
Ying et al. (Sustainability (Switzerland))	2019	97
Oliveira et al. (Journal of Intellectual Capital)	2020	76
Gross-Gołacka et al. (Sustainability (Switzerland))	2020	55
Aymen et al. (Polish Journal of Management Studies)	2019	52
Omerzel and Jurdanab (Economic Research-Ekonomska Istrazivanja)	2016	51
Wendra et al. (Business: Theory and Practice)	2019	47
Phonthanukitithaworn et al. (Sustainability (Switzerland)	2023	29
Paoloni et al. (British Food Journal)	2022	29
Jordão (Journal of the Knowledge Economy)	2024	24

Another significant contribution is Oliveira et al. (2020) in the Journal of Intellectual Capital , with 76 citations, which emphasizes theoretical and empirical advances in measuring and applying IC frameworks in SMEs. The dominance of sustainability-oriented journals in this ranking indicates a clear shift in IC research towards sustainable business development and long-term value creation for SMEs. These findings suggest that future researmch should focus on exploring new frameworks to integrate IC into digital business transformation, policy-making, and competitive advantage strategies for SMEs in the global market. Research has shown that while IC enhances innovation performance, its effectiveness is influenced by environmental uncertainty and competitive pressure. Moreover, despite growing interest, SMEs in developing and transition economies often lack formal systems to manage IC effectively, limiting its contribution to long-term performance. This study addresses these gaps by offering a comprehensive bibliometric overview that maps the intellectual evolution, identifies dominant and emerging themes, and highlights areas that remain underexplored particularly the integration of IC with digital transformation and sustainability strategies (Strielkowski et al. 2021).

Researchers and Institutions Have Played the Most Influential Roles in Shaping IC Research in SMEs

A bibliometric approach provides insights into the geographical distribution of research productivity across different nations. Figure 3 highlights the 10 leading countries with the most significant scientific contributions to IC research in SMEs. Indonesia emerges as the leading contributor, producing the highest number of documents. This prominence suggests that IC research is a growing priority in Indonesia, potentially driven by the country's strong reliance on SMEs as a key pillar of economic development. The increasing academic interest in IC within Indonesia indicates that scholars are exploring how knowledge assets, human capital, and innovation-driven strategies can enhance SME competitiveness and sustainability in a rapidly evolving business landscape. Pakistan, Poland, and Portugal follow closely with similar levels of scientific output. The significant representation of these countries suggests that IC research is gaining traction in both developing and developed economies, where SMEs are seen as vital engines of economic progress. The presence of Poland and Portugal among the top contributors implies a strong European academic engagement in SME-related IC research, possibly influenced by policies that emphasize knowledge-based economies, digital transformation, and innovation ecosystems. Meanwhile, Pakistan's active research contributions reflect the increasing recognition of IC's role in entrepreneurial success, technological adaptation, and financial sustainability for SMEs operating in highly dynamic and competitive markets. Brazil and China also make notable contributions, indicating a regional diversification of IC research. The presence of Brazil suggests that Latin American scholars are examining the role of IC in fostering SME growth amid economic fluctuations and global trade challenges. China's participation aligns with its strategic emphasis on technological innovation, knowledge economy, and business modernization, highlighting the intersection between IC, digital transformation, and SME expansion in global markets. Azerbaijan, Chile, Croatia, and the Czech Republic also contribute to the body of research, showcasing a growing academic interest in IC's role in SME resilience and performance across diverse economic environments.

The global representation of the leading ten countries implies that IC related studies in the SMEs context is no longer confined to traditionally dominant economies but is instead expanding across emerging markets and developing regions. The increasing representation from Asia, Europe, and Latin America underscores a global shift toward knowledge-driven SMEs development, where IC is increasingly seen as a strategic enabler of long-term success. The findings indicate that future research directions could focus on comparative studies across different regions, industry-specific applications of IC, and the impact of digitalization on knowledge management practices within SMEs, ensuring that IC continues to serve as a key driver of sustainable business growth worldwide.

Figure 4 illustrates the most prolific authors in IC research, emphasizing leading contributors by publication volume. The analysis of the top 10 most productive authors in IC research within SMEs highlights key scholars shaping this academic field. Bhegawati, D.A.S., Mendra, N.P.Y., and Rustiarini, N.W. emerge as the most prolific contributors, each having published the highest number of documents. Their significant research output suggests a strong academic interest in the strategic role of IC within SMEs, particularly in relation to knowledge management, business performance, and sustainability. Their dominance in the ranking indicates that their studies have likely influenced discussions on how SMEs can leverage IC for competitive advantage, financial stability, and organizational growth in both emerging and developed economies.

Furthermore, the analysis of influential researchers and institutions indicates that Indonesia, Pakistan, Poland, and Portugal are among the leading contributors to IC research in SMEs. The prominence of Indonesia is particularly notable, given the country's strong reliance on SMEs as a key economic driver. This geographic distribution reflects the increasing recognition of IC as a strategic asset for SMEs in both emerging and developed economies.

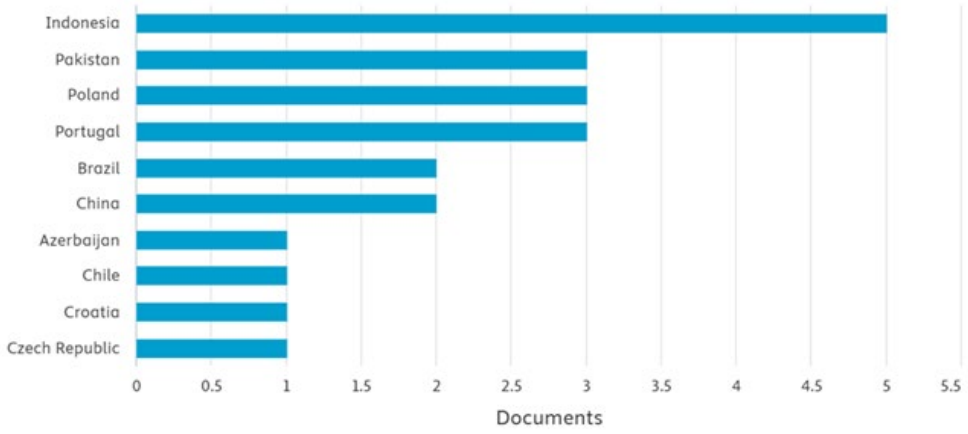

Figure 3. Leading 10 Countries by Research Output on Intellectual Capital in SMEs

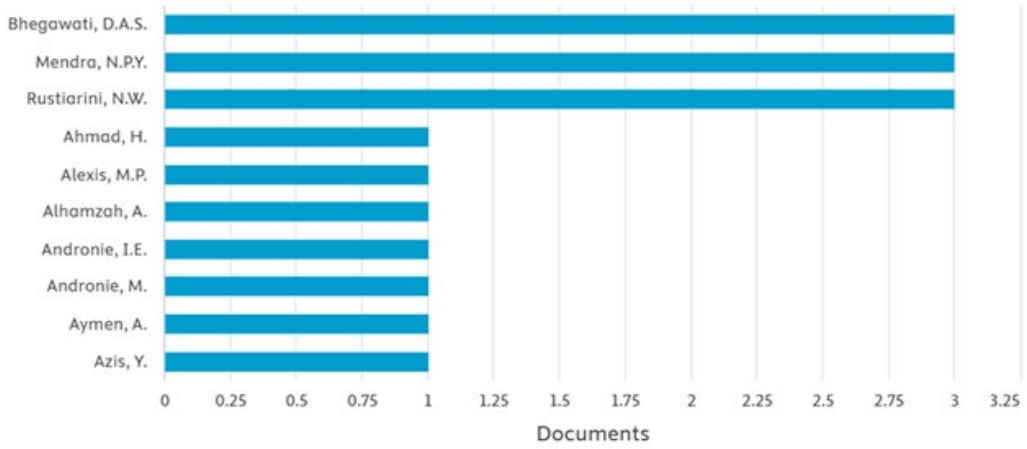

Figure 4. Leading 10 Authors by Publication Output

The Key Thematic Areas Have Defined IC Research in SMEs

Figure 5 depicting the network visualization, illustrates the relationships between key concepts in IC research in SMEs. The network visualization represents the relationships between key concepts in a research domain, centering on "intellectual capital", "innovation", and "sustainability". The most central node is "intellectual capital", as it connects to multiple subtopics across different thematic areas, suggesting that it serves as the foundation for various research discussions. Intellectual capital is linked to "innovation" (green cluster), which further connects to "policy-making", "knowledge management", and "competitive advantage". This highlights that IC is essential in driving innovation, particularly in SMEs. Another major connection is with "sustainability" (red cluster), which branches into themes like "sustainable development", "open innovation", and "human capital", indicating a strong focus on integrating IC into sustainability strategies.

The presence of key terms like "relational capital", "structural capital", "financial performance", and "absorptive capacity" suggests that the research is focused on understanding how knowledge assets contribute to both "organizational performance" and sustainability outcomes. The blue cluster, which includes "financial performance" and sustainability performance, emphasizes the measurement of IC's impact. Meanwhile, the green and red clusters demonstrate its practical application in innovation and sustainability initiatives. The visualization indicates that the research is particularly concerned with how intellectual resources are leveraged for economic and environmental sustainability, aligning with contemporary discussions on sustainable business strategies and corporate responsibility.

Table 5 shows the grouping of concepts related to IC in SMEs based on three main clusters. Cluster 1 includes elements of IC such as human capital, relational capital, and sustainability, emphasizing aspects of human resources and sustainability. Meanwhile, cluster 2 focuses on factors that support innovation and strategic policies, while cluster 3 is more related to organizational performance, indicating that IC plays a direct role in increasing absorptive capacity, financial performance, and business sustainability.

The results also highlight that IC research in SMEs is predominantly focused on three core components: human capital, structural capital, and relational capital. Human capital, including knowledge, skills, and expertise, has been extensively studied in relation to innovation and competitiveness (Ying, Hassan, & Ahmad, 2019). Structural capital, which refers to organizational processes, intellectual property, and technological infrastructure, has been recognized as a key driver of efficiency and scalability in SMEs (Oliveira et al. 2020). Meanwhile, relational capital, encompassing business networks and stakeholder relationships, has been increasingly associated with market expansion and knowledge-sharing mechanisms (Gross-Gołacka, Kusterka-Jefmanska, & Jefmanski, 2020). Another key insight from the bibliometric analysis is the interdisciplinary nature of IC research. Studies published in high-impact journals span across business management, sustainability, and knowledge economy domains, underscoring the multifaceted implications of IC in SMEs.

Table 5. Classification of Concepts in Intellectual Capital in SMEs

Cluster 1	Cluster 2	Cluster 3
Human capital	Competitive advantage	Absoptive capacity
Open innovvation	Innovation	Financial performance
Relational capital	Knowledge management	Intellectual capital
Structural capital	Policy making	Organizational performance
Sustainability	Small and medium enterprises	Sustainability performance
Sustainability development		

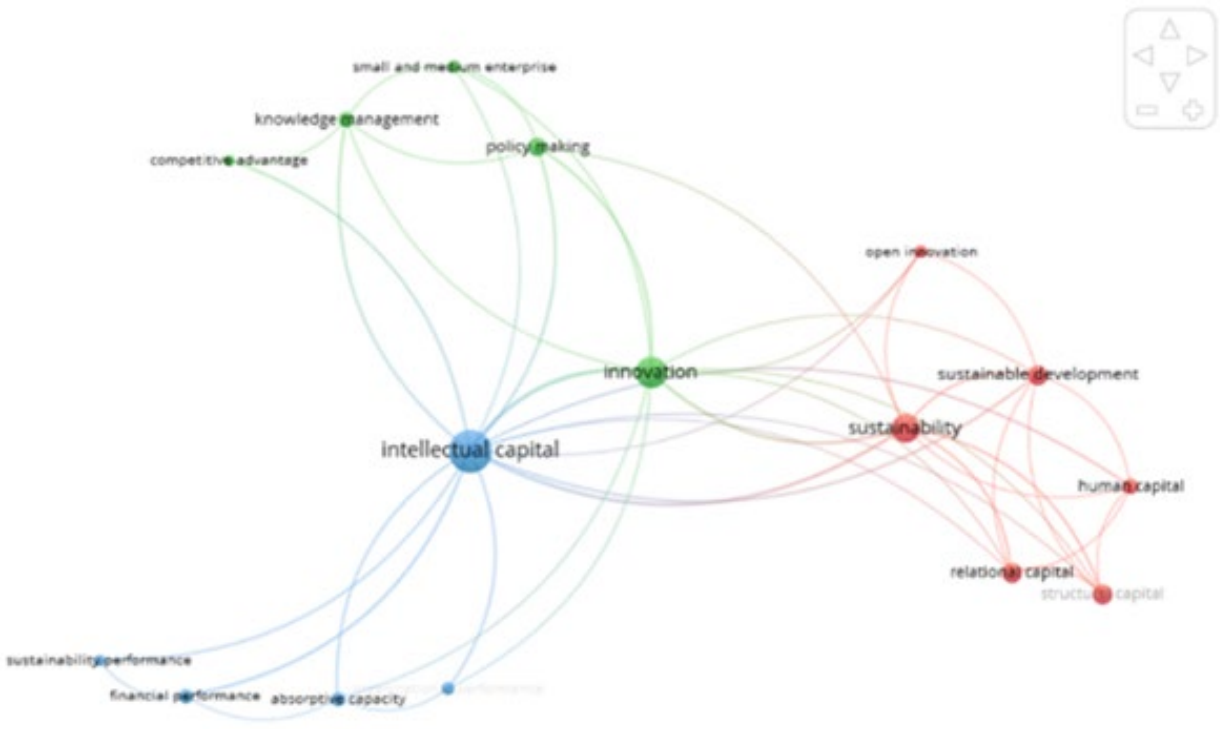

Figure 5. Network visualization of 16 item with 3 clusters

The Emerging Directions in IC Research Related to Business Performance of SMEs

The overlay visualization (Figure 6) showing the development of IC research in SMEs from 2019 to 2022, it can be seen that the focus of research has experienced a significant thematic shift over time. In the 2019-2020 period, research focused more on the basic concepts of IC such as knowledge management, competitive advantage, and policy making. The purple and blue colors in the visualization indicate that at this early stage, research tends to emphasize more on how IC can be utilized to increase competitiveness and innovation in SMEs, especially through knowledge management and the formulation of relevant policies. Topics such as absorptive capacity and financial performance are also starting to be considered, indicating the beginning of exploration of the impact of IC on business performance.

In the 2020-2021 period, research began to shift towards the relationship between intellectual capital and innovation, as shown by the increasing relationship between the concept of innovation and various other aspects. The light green color in this visualization indicates that studies in this phase began to emphasize more on how intellectual capital can be used to accelerate innovation in SMEs, with stronger links to factors such as knowledge management, SMEs, and policy making. In the period 2021-2022, research is increasingly focused on the integration of intellectual capital with sustainability and sustainable development, as seen from the dominance of the color yellow indicating the latest studies. Concepts such as human capital, relational capital, and structural capital are increasingly being studied in the context of sustainability, indicating that academic attention is shifting from innovation alone to utilizing intellectual capital to achieve sustainability goals.

Overlay visualization of IC research in SMEs shows the thematic evolution of research from 2019 to 2022. At the beginning of the period (2019-2020), research focused more on fundamental concepts such as knowledge management, competitive advantage, and policy making, which are closely related to how intellectual capital can improve a company's competitiveness. Over time, in the 2020-2021 period, there was a shift towards innovation as the core of IC utilization in SMEs, with increasingly close connections between innovation and various other elements such as absorptive capacity and SMEs. Entering the 2021-2022 period, research began to focus on sustainability, with sustainable development and sustainability becoming dominant topics that show how IC can contribute to long-term business sustainability. The link between

sustainability performance and financial performance became more prominent, indicating a shift from mere innovation to a real impact on organizational and financial sustainability. The trends identified in this figure show that IC research in SMEs has evolved from a competitive advantage-based approach to utilizing IC in innovation, and finally focusing on sustainability aspects.

The density visualization (Figure 7) illustrates the distribution of research density related to IC in SMEs. Lighter colors indicate areas with higher research density, while darker colors indicate areas with less academic exploration. Intellectual capital, innovation, and sustainability are the three main concepts with the highest intensity, indicating that research in this domain focuses on how intellectual capital can drive innovation and contribute to business sustainability. In addition, the relationship between these concepts shows a close relationship between intellectual capital as a foundation, innovation as a driver of change, and sustainability as the ultimate goal in SME development. In addition to the three main concepts, there are several areas with medium density that reflect research subtopics that support the main discussion.

Another trend that can be identified from this visualization is the emergence of lower density in areas related to business performance such as financial performance, absorptive capacity, and sustainability performance. This shows that although research has focused a lot on how intellectual capital contributes to innovation and sustainability, studies that directly link intellectual capital to financial performance and knowledge absorption in organizations are still not as many as other domains. The co-citation and keyword analysis reveal that emerging research themes include the intersection of IC with open innovation, absorptive capacity, and digitalization. These trends suggest that scholars are recognizing the necessity of integrating IC with advanced technologies to maintain SME resilience in a dynamic business environment (Aymen, Alhamzah, & Bilal, 2019). The analysis of IC research within SMEs through bibliometric study reveals significant trends in the evolution of the field, key contributors, and thematic developments. Findings highlight a rising interest in the impact of IC on promoting innovation, boosting SME performance, and achieving sustainable growth.

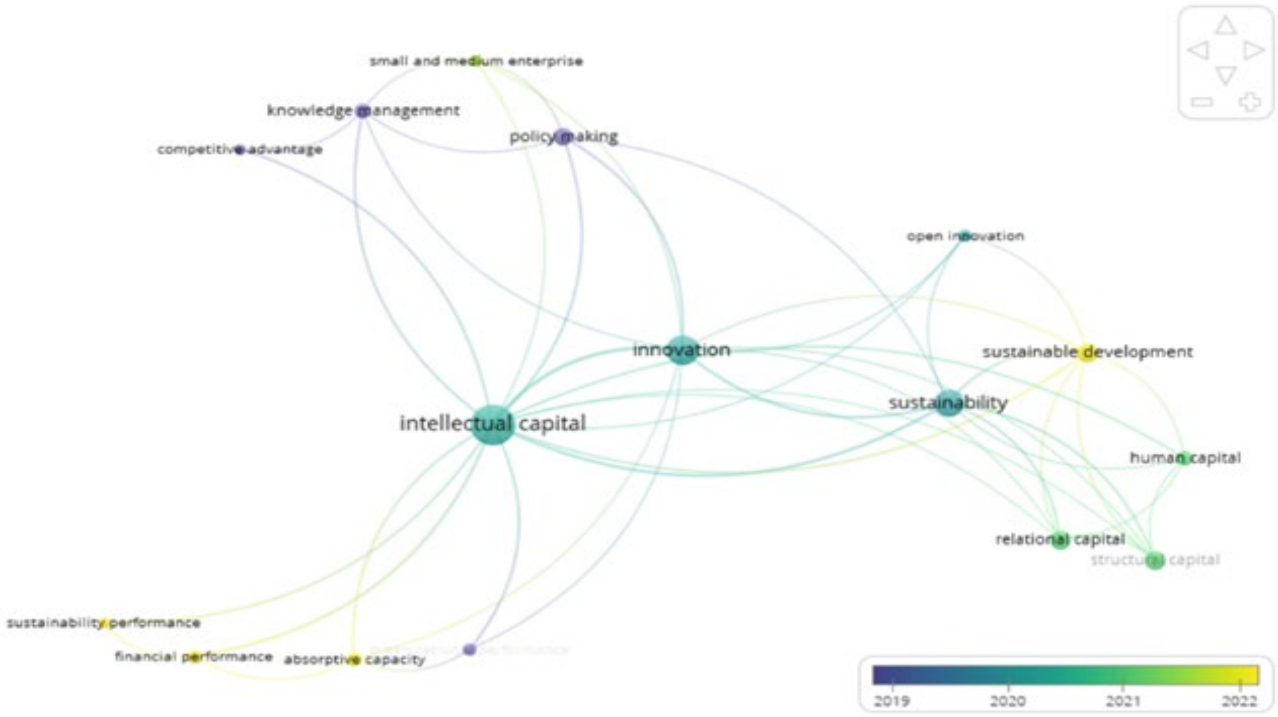

Figure 6. Overlay visualization of 16 item with 3 clusters

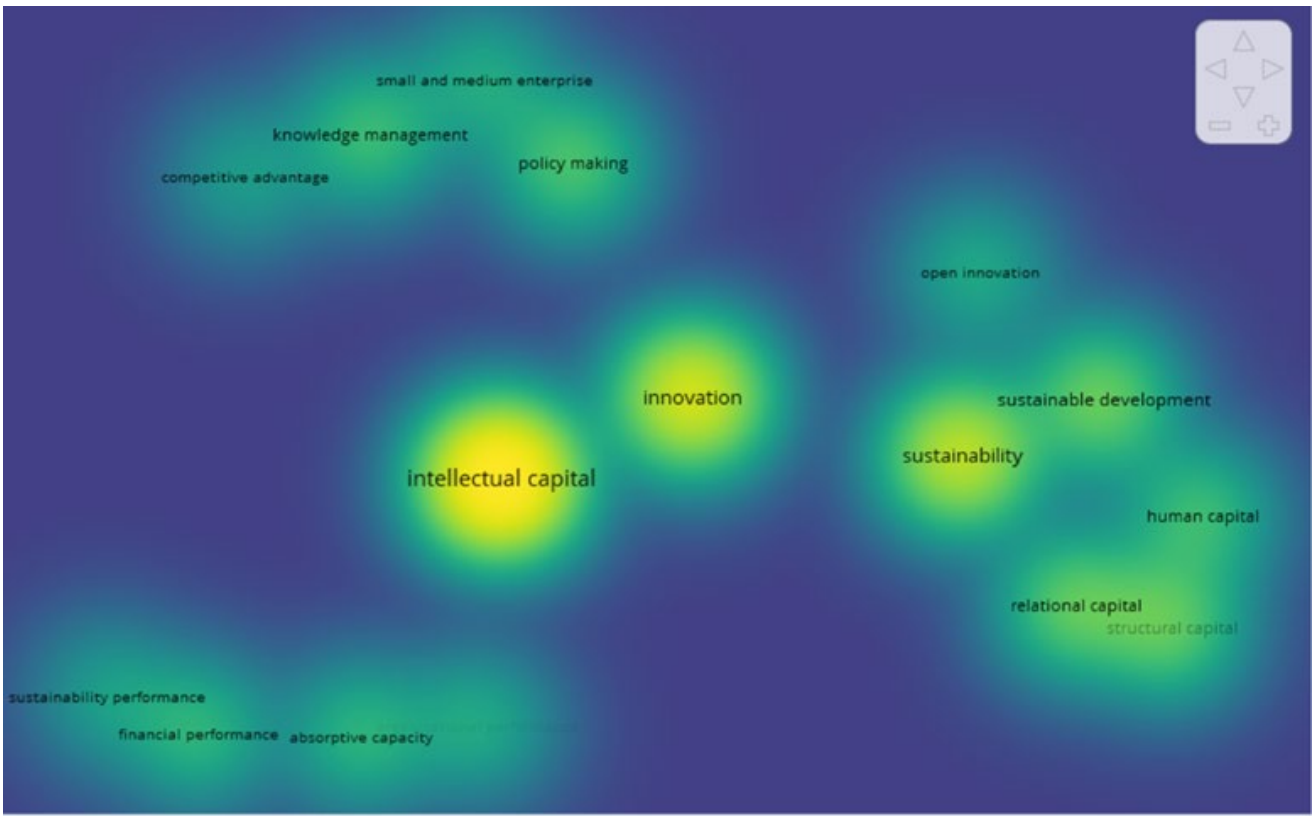

Figure 7. Density visualization of 16 item with 3 clusters

Managerial Implications

The insights derived from this bibliometric analysis carry important implications for SME practitioners, policymakers, and researchers. One of the most critical takeaways is the need for SMEs to systematically manage their intellectual assets to drive innovation and sustainability. Given that IC has been linked to enhanced business performance, SME owners and managers should focus on investing in human capital development, fostering collaborative networks, and leveraging technological infrastructure to optimize knowledge flows and operational efficiency (Mahmood & Mubarik, 2020). The findings also suggest that SMEs must adopt a more structured approach to knowledge management. Studies indicate that many SMEs lack formal mechanisms for capturing, sharing, and utilizing knowledge resources, which limits their ability to innovate and remain competitive (Ying, Hassan, & Ahmad, 2019). Policymakers can support SMEs by developing initiatives that facilitate access to knowledge-sharing platforms, capacity-building programs, and strategic partnerships with research institutions. Additionally, the increasing research focus on sustainability and digital transformation suggests that SMEs must embrace digital tools to enhance their competitive advantage. The integration of IC with emerging technologies such as artificial intelligence, big data analytics, and cloud computing presents opportunities for SMEs to streamline operations, improve decision-making, and expand market reach (Oliveira et al. 2020). Policymakers can facilitate this transition by providing SMEs with the necessary digital infrastructure, regulatory frameworks, and financial incentives to adopt technology-driven business models. For academic researchers, the bibliometric trends highlight key areas that warrant further exploration. The growing body of research linking IC to financial performance indicates the necessity for additional empirical research exploring the direct impact of IC on profitability, revenue growth, and investment efficiency in SMEs. Moreover, the underrepresentation of studies on IC in specific industry contexts (e.g., manufacturing, services, and creative industries) indicates a research gap that needs to be addressed. Future research should explore how IC strategies differ across industries and business models to generate tailored recommendations for SME development (Gross-Gołacka, Kusterka-Jefmanska, & Jefmanski, 2020).

CONCLUSION AND RECOMMENDATION

Conclusions

This study answers the five research questions by providing a comprehensive bibliometric analysis of intellectual capital (IC) research in SMEs over the past decade. In response to RQ1, the analysis shows a clear chronological progression, with early studies focusing on knowledge management and competitiveness, followed by a shift toward innovation, and more recently, an emphasis on sustainability and digital transformation. Addressing RQ2, the findings identify Indonesia, Pakistan, Poland, and Portugal as leading contributors, with influential scholars such as Bhegawati, Mendra, and Rustiarini shaping the academic discourse on IC in SMEs. Regarding RQ3, the dominant themes identified include human capital, structural capital, and relational capital, which have evolved to incorporate digitalization, sustainability, and open innovation. For RQ4, emerging trends point to growing interest in IC's role in digital transformation, absorptive capacity, and AI integration, particularly in enhancing SME business performance. In relation to RQ5, the study highlights the practical implications of IC research, emphasizing the need for SMEs to strategically manage intangible assets to boost innovation, adaptability, and resilience in the face of digital disruption and post-pandemic challenges. In addressing the research gap, this study offered novel insights by visualizing the intellectual structure of IC discourse in SMEs and identifying underexplored areas for future investigation. As a key contribution, it demonstrated how bibliometric mapping can uncover strategic directions to better integrate IC into SME development in a knowledge-driven economy.

Recommendations

The findings of this study have important implications for policymakers, SMEs practitioners, and researchers. Policymakers are encouraged to develop targeted initiatives such as capacity-building programs, regional IC resource hubs, and fiscal incentives to support SMEs in adopting and managing IC effectively, while addressing practical barriers such as limited managerial capacity and digital infrastructure. SME owners and managers should view IC as a strategic asset by implementing internal audits, fostering knowledge-sharing practices, and aligning IC development with long-term business goals. For researchers, future studies should address identified gaps by exploring sector-specific applications of IC, conducting cross-regional comparisons, and empirically linking IC components with measurable outcomes like innovation, market expansion, and sustainability performance. Moreover, the integration of IC with emerging technologies such as AI, big data, and digital ecosystems offers a promising avenue for investigation, particularly in understanding how SMEs can build resilience and adaptability in a rapidly evolving knowledge-based economy.

Future Research Directions

The findings of this study suggest several promising directions for future research in IC and SMEs. One key area that requires further investigation is the relationship between IC and digital transformation. While existing studies highlight the role of IC in fostering digital innovation, there is a need to explore how SMEs can effectively integrate IC with digital tools to enhance their competitiveness in an increasingly digital economy (Aymen, Alhamzah, & Bilal, 2019). Research that examines best practices for digital IC management can provide actionable insights for SME owners and policymakers. Another important avenue for future research is the role of IC in sustainable business practices. The bibliometric analysis indicates a growing scholarly interest in the link between IC and sustainability performance, yet there remains a lack of comprehensive studies that examine how SMEs can leverage IC to achieve long-term environmental and social sustainability (Oliveira et al. 2020).

Additionally, the geographic distribution of IC research suggests that future studies should focus on regional and cross-cultural comparisons. Examining how SMEs in different countries leverage IC for growth and resilience can contribute to a more nuanced understanding of best practices in intellectual capital management (Gross-Gołacka, Kusterka-Jefmanska, & Jefmanski, 2020). Finally, there is a need for research that explores the evolving role of IC in the post-pandemic business landscape. Future research should investigate how SMEs have adjusted their IC strategies in response to these shifts and identify long-term trends in knowledge management and innovation-driven growth (Mahmood & Mubarik, 2020). This study contributes to the ongoing discourse on IC in SMEs by mapping the intellectual landscape of this field, identifying key research trends, and proposing future directions.

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