

Mapping Pentahelix Collaboration for Human Resource Development of Micro, Small, and Medium Enterprises: A Bibliometric Analysis

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ABSTRACT

This article examines the role of pentahelix collaboration in promoting human resource development (HRD) for micro, small, and medium enterprises (MSMEs) using a bibliometric approach. Using 180 Scopus-indexed publications from 2016 to 2025, data were processed with VOSviewer to examine publication trends, co-authorship networks, keyword clustering, and thematic development. The findings indicate that Indonesia contributes the largest number of studies, reflecting its central role in the pentahelix-based development discourse. Five thematic clusters were identified, covering institutional collaboration, digitalization, education, cultural values, village empowerment, and collaborative governance. The results show a gradual shift from conceptual discussions to practical applications, particularly in digital transformation and inclusive governance for MSMEs. Emerging themes such as sustainability, women's empowerment, and ecosystem-based innovation are gaining significant attention. This study contributes theoretically by refining the conceptual framework of pentahelix collaboration in relation to HRD, while practically providing direction for policymakers, educators, and practitioners to strengthen MSME competitiveness through inclusive and adaptive strategies. By mapping the research landscape, this study highlights the importance of multi-stakeholder collaboration as a foundation for building resilient and innovation-driven MSME ecosystems.

ARTICLE INFORMATION

Keywords:

bibliometric analysis; human resource development; MSME pentahelix collaboration; stakeholder

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INTRODUCTION

Pentahelix collaboration involves five key sectors—academia, business, community, government, and media—working synergistically to address complex societal challenges. This model is particularly relevant in contexts that demand interdisciplinary approaches and active stakeholder engagement, such as regional development planning and public health promotion (Sjögren et al., 2021). Pentahelix collaborations, while promising for addressing complex social and economic challenges, face several inherent obstacles. One significant challenge is the persistence of hierarchical structures within traditional institutions, which can hinder inclusive participation and marginalize input from community stakeholders (Crosby et al., 2017; Sjögren et al., 2021). Communication barriers—especially in geographically dispersed or infrastructure-limited contexts—along with the challenges of fostering mutual trust and sustained commitment among diverse actors, often hinder effective coordination in multi-sectoral partnerships (Bjørn, 2016; Leibinger & Toland, 2023). Lastly, limited access to essential resources—whether financial, human, or technical—can significantly hinder the effectiveness and sustainability of collaborative efforts (Lozano et al., 2021; Nwokolo et al., 2023).

Research on pentahelix collaboration is essential because it enables more effective problem-solving by integrating diverse perspectives and expertise to address complex “wicked problems” such as climate change, digital transformation, and sustainable development (Ansell & Gash, 2018; Elia et al., 2020). This collaborative framework mobilizes the capacities of government, academia, business, civil society, and the media, producing synergistic solutions that are more adaptive and inclusive than those generated by single-actor initiatives (Cai et al., 2020; Etzkowitz & Zhou, 2017). Furthermore, pentahelix models foster innovation and knowledge exchange, which are recognized as critical drivers of scientific progress, entrepreneurial growth, and technological advancement in the 21st century (González-Martínez et al., 2025; Halibas et al., 2017; Iqbal et al., 2022; Uddin et al., 2019; Zakaria et al., 2024). By engaging diverse actors, these collaborations also enhance institutional capacity, build social trust, and strengthen communities’ ability to actively shape development pathways, especially in contexts of rapid societal change (Carmen et al., 2022; Kazanskaia, 2025). Importantly, the integration of non-academic stakeholders ensures that research outputs are not confined to theoretical discourses but are translated into practical, context-responsive applications that generate tangible societal value (Etzkowitz & Zhou, 2017; Koskinen, 2023). Collectively, these findings reinforce the importance of multi-stakeholder collaboration for long-term resilience, sustainability, and inclusive growth.

Although previous studies have explored the pentahelix model in various contexts, no bibliometric analysis has specifically examined its relationship with the human resource development of micro, small, and medium enterprises (MSMEs). Existing research has primarily focused on conceptual and applied perspectives, such as the use of the pentahelix model for innovation and governance (González-Martínez et al., 2025; Hasna & Yuadi, 2024; Zakaria et al., 2024), poverty alleviation (Tadung, 2023), combating sexual harassment (Wulandari et al., 2025), tourism development (Afandi et al., 2024), and conservation efforts (Hak et al., 2025). However, the absence of a bibliometric review in this area highlights a critical research gap, as such an approach is necessary to systematically map scientific contributions, identify thematic trends, and provide evidence-based insights for strengthening MSME human resource development through multi-stakeholder collaboration.

Although pentahelix collaboration is increasingly recognized as a promising approach to solving complex societal challenges, significant gaps remain in guiding its effective implementation and sustainability. One major limitation is the absence of comprehensive frameworks or models that can systematically support the planning, execution, and evaluation of pentahelix initiatives (Meißner et al., 2022; Uddin et al., 2019). Without such structured guidance, many collaborative efforts risk becoming fragmented or short-lived. Additionally, there is a notable scarcity of empirical evidence examining the specific factors that contribute to the success or failure of pentahelix collaborations. Studies investigating how various contextual variables—such as cultural dynamics, governance structures, or resource availability—impact collaboration outcomes remain limited (Iglič et al., 2017; Mwantimwa & Kassim, 2023; Sjögren et al., 2021). As a result, it becomes challenging to replicate or adapt successful practices to different regional or thematic contexts. Finally, long-term impact assessments of pentahelix partnerships are still underdeveloped. Research rarely addresses how these collaborations influence broader societal outcomes over time or what mechanisms are most effective in maintaining stakeholder engagement and partnership resilience (Koskinen, 2023; Sjögren et al., 2021). Understanding these aspects is crucial for designing sustainable and scalable models that can drive lasting change.

To address this gap, the present study conducts a bibliometric review of publications indexed in Scopus and Google Scholar (2016–2025) to map the scientific landscape of pentahelix collaboration and its relevance to MSME human resource development. This approach offers two key contributions.

Theoretically, it advances the conceptual scope of pentahelix by identifying knowledge clusters and gaps within the literature. Practically, it provides evidence-based recommendations for enhancing the effectiveness and sustainability of multi-stakeholder collaboration in supporting the human capital of MSMEs. This novelty highlights the significance of the study as the first bibliometric attempt to connect the pentahelix model with MSME development systematically.

METHOD

This study employed a bibliometric research design to systematically investigate the dynamics of pentahelix collaboration in relation to human resource development within micro, small, and medium-sized enterprises (MSMEs) as presented in Figure 1. The primary objectives were to map the scientific landscape, identify key themes and emerging trends, and develop a comprehensive conceptual framework that could inform both theoretical advancement and policy recommendations. By employing bibliometric analysis, the study ensured an evidence-based approach that integrates quantitative publication data with qualitative interpretation, thereby strengthening the validity of findings and their relevance for multi-stakeholder collaboration.

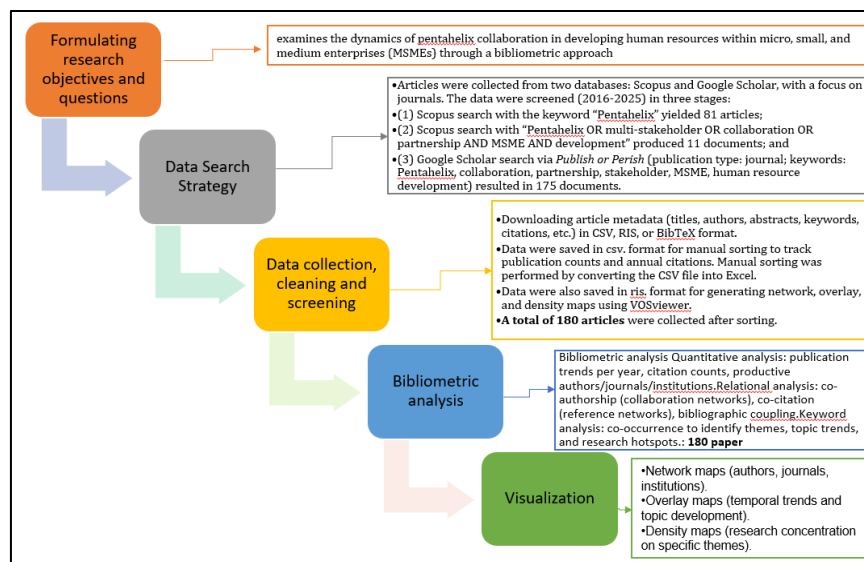


Figure 1. Research Steps

The dataset for this research was derived from publications indexed in the Scopus database, which is widely recognized as one of the largest and most reliable repositories of peer-reviewed scientific literature. To enhance comprehensiveness, additional data were also collected from Google Scholar using the *Publish or Perish* reference management software. Data retrieval was conducted in July 2025 with a structured search strategy focused on journal publications from the period 2016–2025 to capture the most recent decade of scholarly contributions. Three search stages were implemented: 1) Scopus search using the keyword "Pentahelix" yielded 81 articles; 2) Scopus search with the broader terms "Pentahelix OR multi-stakeholder OR collaboration OR partnership AND MSME AND development" produced 11 documents; and 3) Google Scholar search via *Publish or Perish* with the keywords *Pentahelix, collaboration, partnership, stakeholder, MSME, human resource development* resulted in 175 documents. After multiple rounds of screening, cleaning, and removing duplicates, a total of 180 articles were retained as the final dataset for bibliometric analysis.

The research workflow followed four structured steps (Al-Husaeni & Nandiyanto, 2021; Oktiawanti et al., 2024a). First, bibliographic records were retrieved and exported in both CSV and RIS

formats. Second, the data were organized and manually cleaned using Microsoft Excel to eliminate duplicates, incomplete entries, and irrelevant items, ensuring the dataset's validity. Third, bibliometric mapping was conducted using VOSviewer, a widely applied software for scientific visualization. Finally, the bibliometric outputs were systematically interpreted to derive thematic insights that reflect the dynamics of pentahelix collaboration in MSME human resource development. The combination of quantitative publication data and qualitative interpretation strengthened the validity and relevance of the findings for both theory and practice.

VOSviewer was employed to generate three types of bibliometric visualizations: network maps, overlay maps, and density maps. These visualizations were constructed based on co-citation and keyword co-occurrence patterns, offering insights into publication networks, thematic evolution, and research density. To ensure analytical rigor, a minimum threshold of five keyword occurrences was applied, resulting in 49 valid terms after excluding less relevant items. This procedure enabled a comprehensive analysis of the thematic structures, research hotspots, and emerging trends in multi-stakeholder partnerships for empowering MSME human resources. Ultimately, this methodological approach not only facilitated the identification of evolving knowledge clusters but also highlighted the novelty of bibliometric inquiry into the pentahelix model, which has not been systematically explored in previous research.

RESULTS AND DISCUSSION

This section presents the main findings and discussion of a bibliometric study that explores the development of scholarly literature on pentahelix collaboration, particularly in relation to human resource development within the micro, small, and medium enterprise (MSME) sector. It begins by tracing the trajectory of publication activity and citation impact over time (Figure 2), followed by an overview of the most influential works in the field (Table 1).

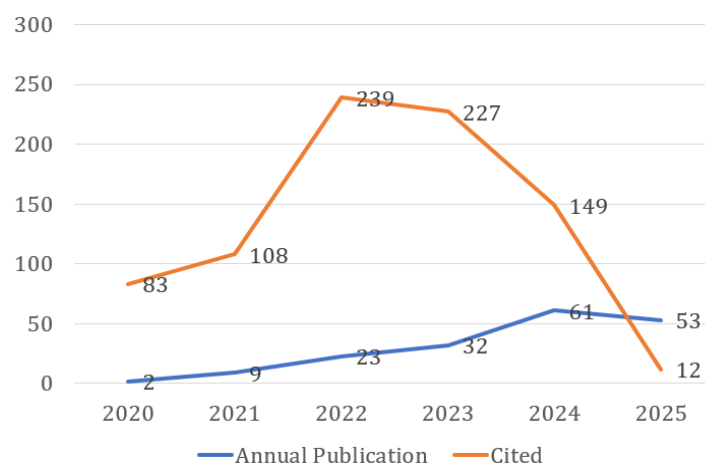


Figure 2. Comparison of Annual Article Counts And Citations

Figure 2 illustrates a comparison between annual publications (blue line) and citations (orange line) from 2020 to 2025, providing insights into the dynamics of research productivity and impact over time. Between 2020 and 2022, the number of annual publications increased steadily, from 2 articles in 2020 to 23 articles in 2022. During the same period, citations rose sharply, from 83 in 2020 to a peak of 239 in 2022, indicating that research outputs during this phase were not only growing in number but also gaining substantial scholarly recognition. In 2023, the number of publications continued to rise, reaching 32, while the number of citations slightly decreased to 227. This suggests a lag effect, where newer publications had yet to accumulate the same level of citations as earlier

works, despite the overall visibility of the research field remaining high. By 2024, publications experienced significant growth, peaking at 61 articles, reflecting a heightened scholarly interest in the topic. However, citations dropped considerably to 149, possibly due to citation saturation of earlier key works or the influx of newer publications that had not yet been widely referenced.

In 2025, publications slightly declined to 53, but the most dramatic change occurred in citations, which fell drastically to 12. This steep decline may reflect the time-dependent nature of citation accumulation, as articles published in the most recent year typically require longer to be cited extensively. Overall, the comparison highlights a temporal gap between publication output and citation impact: while research productivity continued to expand through 2024, the citation trend peaked earlier in 2022 and has since declined. This pattern indicates that the field experienced a rapid surge in both output and influence around 2021–2022, followed by stabilization in productivity and delayed recognition for newer studies. This divergence suggests that, while research output has increased, the impact of these publications varies significantly, possibly due to differences in topical relevance, publication quality, or visibility within the academic community.

Table 1. Top 10 Most Cited Articles

Cite s	Title	Year	Source	Publisher
82	Green entrepreneurship and digitalization enabling the circular economy through sustainable waste management - An exploratory study of emerging economy (Mondal et al., 2023)	2023	Journal of Cleaner Production	Elsevier Ltd
72	Penta-Helix and Quintuple-Helix in the management of tourism villages in Yogyakarta City (Sumarto et al., 2020)	2020	Australasian Accounting, Business and Finance Journal	academia.edu
65	Penta helix communication model through community-based tourism (CBT) for tourism village development in Koto Sentajo, Riau, Indonesia (Yasir et al., 2021)	2021	Geo Journal of Tourism and Geosites	gtg.webhost.uoradea.ro
50	The recovery of the tourism industry in Bali province through the penta-helix collaboration strategy in the new normal era (Budhi et al., 2022)	2022	Geo Journal of Tourism and Geosites	gtg.webhost.uoradea.ro
39	Stakeholder Interaction in the Development of Oxygen Ecotourism on Gili Iyang Island, Indonesia (Musleh et al., 2023)	2023	Journal of Government and Civil Society	jurnal.umt.ac.id
26	Creative tourism economic development strategy with the Penta Helix Collaboration of Batu City (Hidayatullah et al., 2022)	2022	International Journal of Research in Engineering, Science and Management	eprints.unmer.ac.id

20	SOAR-based msme competitiveness in purworejo regency (Purwanggono & Pratiwi, 2022)	2022	Enrichment: Journal of Management,	enrichment.iocspublisher.org
18	How does government policy support sustainable tourism in dealing with COVID-19 pandemic (Purnomo et al., 2022)	2022	Journal of Sustainability Science and Management	researchgate.net
17	Pentahelix based entrepreneurship management at PKBM asholahiyah (Hoerniasih et al., 2022)	2022	International Journal of Professional Business Review: Int. J. Prof.Bus. Rev.	dialnet.unirioja.es
17	Pentahelix Model for the Development of Ecotourism Karang Ginger Beach Punjulharjo Village, Rembang Regency (Suroija et al., 2022)	2022	International Journal of Education, Business and Economics Research (IJEBER)	ijeber.com

The citation analysis in Table 1 reveals that the most influential works on pentahelix collaboration are concentrated in sustainability and tourism development, with Mondal et al. (2023) leading at 82 citations for linking green entrepreneurship, digitalization, and the circular economy, followed by Sumarto et al. (2020) with 72 citations and Yasir et al. (2021) with 65 citations, both emphasizing the role of pentahelix in tourism village and community-based tourism management. Substantial contributions from Indonesia are evident, such as Budhi et al. (2022) on Bali's post-pandemic tourism recovery and Musleh et al. (2023) on ecotourism stakeholder interaction, while other works extend applications into creative tourism (Hidayatullah et al., 2022), MSME competitiveness (Purwanggono & Pratiwi, 2022), community learning centers (Hoerniasih et al., 2022), and local ecotourism (Suroija et al., 2022). Collectively, these studies demonstrate that while highly cited research is predominantly clustered around tourism and sustainability, there is a clear expansion into MSMEs, education, and community empowerment, highlighting the adaptability and growing scholarly relevance of the pentahelix model across diverse sectors. The analysis then expands to a global and institutional scale, identifying the leading countries and affiliations contributing to this domain (Figure 3).

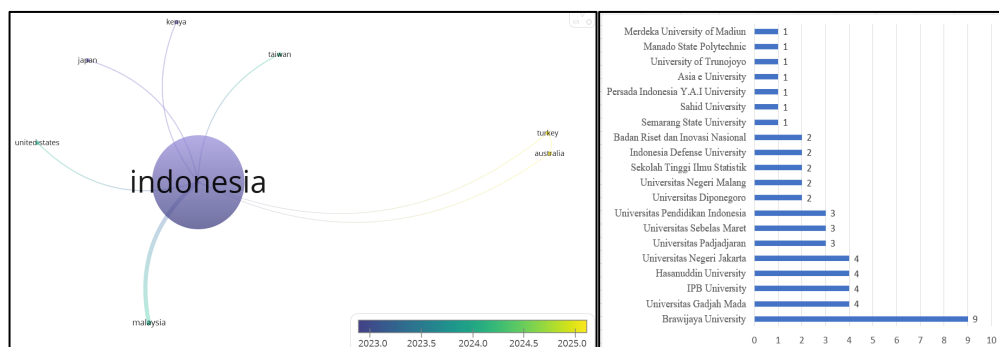


Figure 3. Countries (A) and Affiliations (B) That Published Articles on Pentahelix Collaboration

The visualizations illustrate (Figure 3a) the global and institutional landscape of scholarly publications on pentahelix collaboration, revealing Indonesia as the dominant contributor among 21 countries, with 75 publications—significantly ahead of Malaysia (4), the United Kingdom (2), and others like Australia, Japan, and the United States, which each contributed one. Network visualizations highlight Indonesia's central role in international collaborations, demonstrating active co-authorship with countries such as Malaysia, the U.S., Japan, Taiwan, Kenya, Turkey, and Australia, with new partnerships emerging in 2024–2025. This international presence is matched by strong domestic institutional engagement (Figure 3b). Out of 106 total affiliations, Universitas Brawijaya leads with nine publications, followed by Universitas Gadjah Mada, Institut Pertanian Bogor, Universitas Hasanuddin, and Universitas Negeri Jakarta, each with four. Universities such as Universitas Padjadjaran, Universitas Sebelas Maret, and Universitas Pendidikan Indonesia also show notable contributions, while institutions like Badan Riset dan Inovasi Nasional and Universitas Diponegoro contributed at least two. The rest provided one publication each, reflecting a broad but uneven engagement across the national research landscape. Altogether, these findings highlight Indonesia's growing academic leadership in advancing pentahelix collaboration, both globally and through its leading academic institutions. A disciplinary breakdown is provided through subject areas (Figure 4).

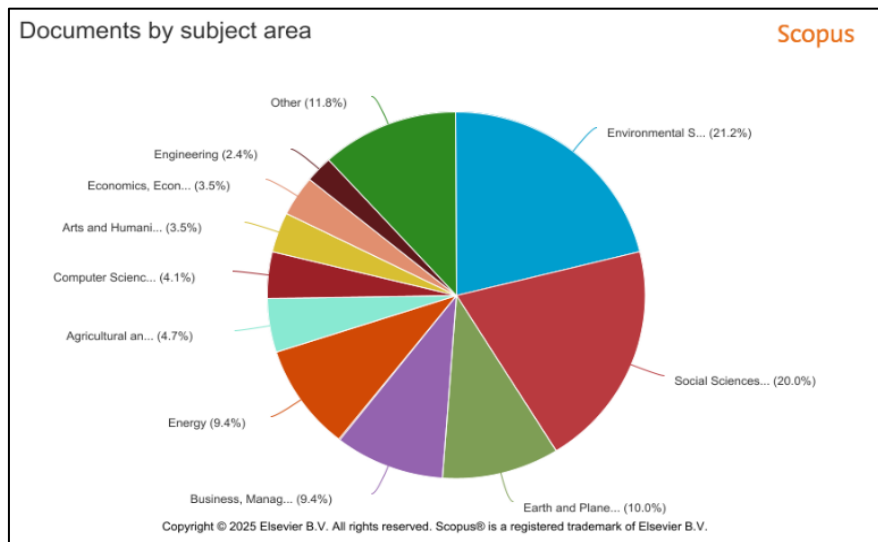


Figure 4. Publications on Pentahelix Collaboration by Subject Area

The documents related to the pentahelix collaboration span a wide range of subject areas, with the most significant contributions coming from Environmental Science (21.2%) and Social Sciences (20.0%). Other significant fields include Earth and Planetary Sciences (10.0%), Business and Management (9.4%), and Energy (9.4%). Additional contributions come from Agricultural and Biological Sciences (4.7%), Computer Science (4.1%), Arts and Humanities (3.5%), Economics (3.5%), and Engineering (2.4%), while 11.8% fall under miscellaneous categories. Author productivity is mapped to reveal key contributors and the distribution of research efforts (Figure 5).

Figure 5 reveals that, of 180 authors, only one publication was contributed, indicating that research in this field remains scattered and exploratory. However, a few authors—such as Sumartono with three articles, and Suryadi, Rozikin, Purwanto, Nalikan, and Kurniawan with two each—emerge as key contributors, suggesting the beginnings of a core group advancing the discourse. This distribution highlights the interdisciplinary appeal of the pentahelix model, which spans education, public policy, tourism, and community development. The findings highlight the need for stronger academic collaboration to consolidate efforts and enhance the impact of this promising framework.

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The bibliometric keyword clustering (Figure 6) reveals five distinct thematic groupings related to pentahelix collaboration in developing human resources within micro, small, and medium-sized enterprises. The keyword co-occurrence network reveals that research on pentahelix collaboration has evolved into five distinct yet interconnected thematic clusters, each highlighting different dimensions of multi-stakeholder engagement in MSME development. Cluster 1 (digitalization, economy, innovation, SMEs, sustainability, and policy) reflects the structural foundation of MSME competitiveness, where technological adoption and government policies play pivotal roles in enhancing performance and ensuring sustainability. This aligns with studies that emphasize the centrality of digital transformation and local policy support in strengthening MSME resilience, particularly in the post-pandemic context.

Cluster 2 (academic, business, government, community, partnership, management, and tourism village) illustrates the operationalization of the pentahelix framework, showing how cross-sectoral involvement contributes to local economic development. Tourism villages emerge as a focal arena where collaboration between academia, business, government, and community actors is most visible, underscoring the importance of context-specific partnerships. Cluster 3 (collaboration, stakeholder role, human resource development, training, and tourism development) complements this by emphasizing the capacity-building dimension, suggesting that training and skill enhancement are essential mechanisms for sustaining stakeholder collaboration.

Cluster 4 (stakeholders, cooperation, collaboration, creative economy, and tourism) highlights the cultural and economic value of collaboration, where creative industries and tourism are positioned as key drivers of collaborative innovation. Finally, Cluster 5 (collaborative governance), though represented by a single node, reflects a theoretical backbone that integrates the other clusters. It suggests that governance frameworks are not merely institutional but are also collaborative, enabling sustained partnerships across sectors. Collectively, these clusters reinforce the argument that the pentahelix model is not only a framework for stakeholder engagement but also a dynamic system that facilitates innovation, strengthens MSME competitiveness, and promotes sustainable local development.

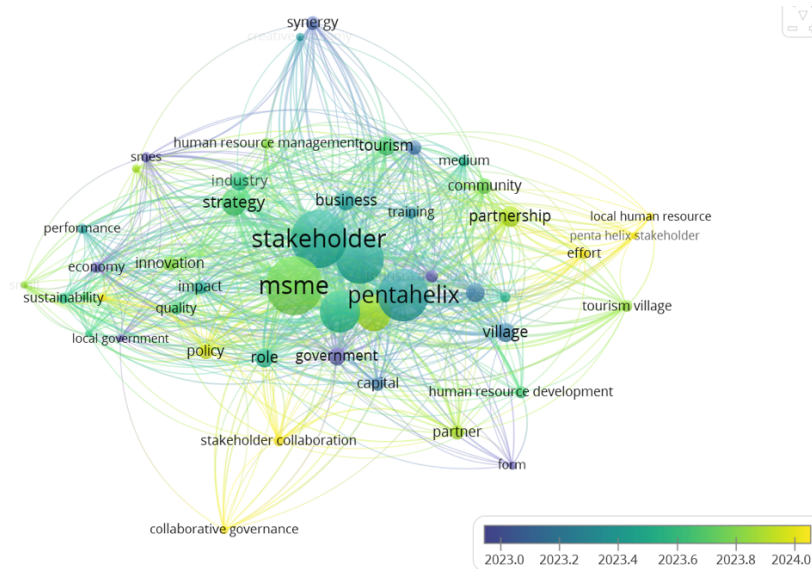


Figure 7. Overlay Visualization on Pentahelix Collaboration in Developing MSME Human Resources

The overlay visualization (Figure 7) illustrates the temporal evolution of research themes on pentahelix collaboration in developing human resources within micro, small, and medium enterprises

(MSMEs). The color gradient, ranging from blue (earlier studies) to yellow (more recent studies), captures the shifts in scholarly attention between 2023 and 2024. At the core of the map, high-frequency terms such as stakeholder, MSME, and pentahelix dominate the discourse, signifying their central role in anchoring the broader thematic landscape. These terms function as integrative nodes, linking diverse sub-topics that reflect both theoretical and practical dimensions of collaboration.

In the earlier stages (depicted in blue and green tones), research tended to emphasize foundational aspects such as collaboration, role, government, policy, and stakeholder collaboration. These terms highlight the initial focus on governance structures, institutional roles, and the conceptual framing of pentahelix partnerships. Concurrently, themes such as strategy, performance, sustainability, and innovation emerged, pointing to the growing interest in MSME competitiveness and the broader economic impact of collaborative models.

More recent studies (shown in yellow) reveal a shift toward context-specific and applied domains, particularly in relation to tourism, community, partnership, village, and local human resources. This suggests that current scholarship is increasingly situating pentahelix collaboration within localized development settings, such as tourism villages, where community engagement and human resource capacity-building are crucial. The presence of a creative economy and collaboration further indicates the integration of cultural and economic perspectives into MSME development strategies. Overall, the overlay visualization demonstrates a clear trajectory, from the conceptual foundations of governance and collaboration toward practical applications in tourism, the creative industries, and local human resource empowerment, underscoring the evolving relevance of the pentahelix model in sustainable MSME development.

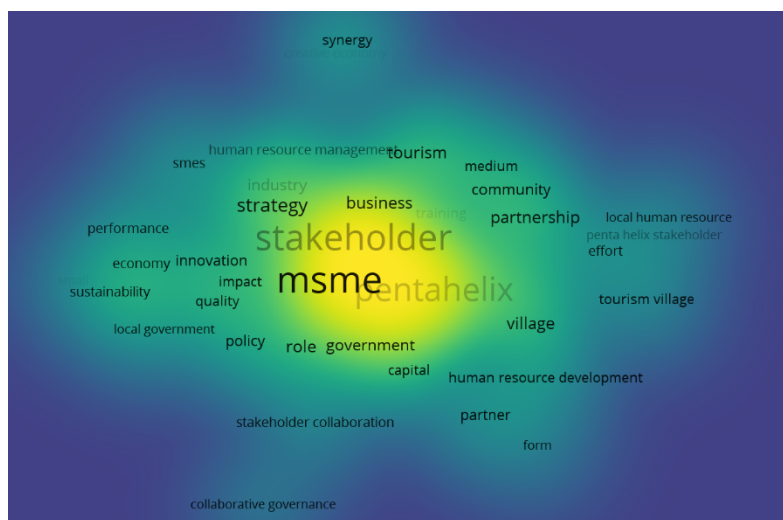


Figure 8. Density Visualization on Pentahelix Collaboration in Developing MSME Human Resources

The density visualization (Figure 8) illustrates the concentration of key terms in publications on pentahelix collaboration and human resource development within MSMEs during the period from 2016 to 2025. The yellow areas indicate high-frequency terms, while the green and blue areas represent lower densities. At the core of the map, the terms “MSME”, “stakeholder”, and “pentahelix” stand out as the most prominent, signaling that these themes are the dominant focus in the literature. These central concepts serve as the primary hubs connecting a diverse range of related topics. Surrounding the core, terms such as government, policy, role, strategy, business, innovation, and sustainability appear with considerable density. This reflects the significant scholarly attention devoted to governance, collaborative strategies, and sustainability issues in the development of

MSMEs. Meanwhile, terms like partnership, community, village, local human resource, tourism village, and human resource development highlight a more contextualized focus, particularly on community-based initiatives, tourism development, and strengthening local human resource capacities. In the outer, less dense areas (shown in blue), terms such as collaboration, creative economy, collaborative governance, and stakeholder collaboration emerge. Although less frequent, these terms are important because they represent new and evolving research directions that link the pentahelix model to the creative economy, cross-sector collaboration, and collaborative governance. Overall, this visualization confirms that research on pentahelix in the MSME context has evolved from foundational themes of roles and policies toward practical implementations in tourism, community development, and human resource empowerment, with recent tendencies emphasizing innovation, the creative economy, and synergistic collaboration. While the pentahelix model is applied in various contexts globally, Indonesia's unique (Table 2) approach integrates local cultural practices, emphasizes regional readiness, and highlights the need for inclusive stakeholder involvement across different sectors.

Table 2. Unique Aspects of Indonesia's Pentahelix Model

Country/Region	Application	Unique Aspects
Philippines, South Africa, Netherlands	Water Resource Management	Participatory mechanisms, stringent regulations (Natalis et al., 2025)
Bali, Indonesia	Sport Tourism	Digital technology, comprehensive event management (Lagarensen et al., 2018)
Aceh, Indonesia	Disaster Management	Collaboration in natural and non-natural disaster management (Yulianto et al., 2021)
Malang Raya, Indonesia	Digital Startup Ecosystem	Institutional alignment, stakeholder collaboration, cultural practices (Pratiwi et al., 2025a, 2025b)
Indonesia (General)	Counter-Terrorism	Need for an inclusive approach involving business and media (Subagyo, 2021)
Serang City, Banten Province, Indonesia	Economic Resilience (COVID-19)	Mixed impact of pentahelix elements on MSME performance (Mardiatmi et al., 2023)

The implementation of pentahelix collaboration in Indonesia is powerfully shaped by cultural dynamics, where local wisdom such as *Subak* in Bali remains underutilized, causing marginalization and ecological degradation (Natalis et al., 2025), while values like *gotong royong* provide crucial communal support in sectors such as healthcare (Cipta et al., 2024). However, cultural challenges, including nepotism and moral hazard, affect governance and organizational behavior, undermining accountability (Rahmania et al., 2024). In contrast, countries such as the Netherlands, South Africa, and the Philippines have strengthened pentahelix governance through participatory mechanisms, public trust doctrines, and green constitutions, thereby reducing conflicts and enhancing socio-ecological justice (Natalis et al., 2025). Indonesian cases, such as Malang, demonstrate that striking a balance between formal institutions and informal social networks is crucial for effective collaboration (Pratiwi et al., 2025a, 2025b). However, challenges, including bureaucracy, weak trust in REDD+ initiatives, and corruption, persist (Enrici & Hubacek, 2019), highlighting the need for capacity building, recognition of traditional systems, and stringent regulations, such as the polluter pays principle, to enhance pentahelix effectiveness (Natalis et al., 2025).

The implementation of the pentahelix collaboration model in Indonesia demonstrates a novel contribution to MSME development by directly linking human resource development (HRD) with digital transformation and financial inclusion, two domains that earlier studies have often addressed

separately. While prior research has highlighted digital literacy gaps or financing barriers in isolation, our findings reveal that these challenges are interconnected and best resolved through multi-actor collaboration. In particular, joint initiatives between government, academia, and the private sector have been shown to effectively enhance digital competencies and expand access to technological infrastructure, thereby accelerating MSMEs' readiness for Industry 4.0 (Oktiawanti et al., 2024b; Saepulrohman et al., 2023; Said & Soi, 2025; Wijatmoko et al., 2025). Furthermore, difficulties in accessing finance remain a structural impediment, underscoring the importance of coordinated efforts between financial institutions and community organizations to promote inclusive growth (Semil et al., 2020; Wijatmoko et al., 2025). The novelty of this study lies in demonstrating how the pentahelix framework can simultaneously address both human capital and financial barriers through synergistic partnerships. This integrative approach differs from previous fragmented interventions by offering a systemic solution tailored to local MSME ecosystems. Beyond practical outcomes, the findings advance scientific discourse by showing that the pentahelix model is not merely a governance framework but also an adaptive capacity-building mechanism that strengthens institutional ecosystems and improves MSMEs' resilience in volatile economic environments (Hamjen et al., 2022; Heliawati et al., 2025; Said & Soi, 2025; Wijatmoko et al., 2025). Thus, the study contributes to both theory and practice: theoretically, by refining the conceptual scope of the pentahelix as a dynamic tool for HRD and financial inclusion; and practically, by providing evidence-based guidance for policymakers and practitioners in designing more inclusive, innovation-driven MSME policies.

CONCLUSION

This bibliometric study demonstrates that research on pentahelix collaboration, particularly in strengthening human resource development (HRD) within micro, small, and medium enterprises (MSMEs), has grown into a multidimensional and interdisciplinary field. The findings reveal thematic shifts over time, with Indonesia emerging as a leading contributor and showcasing the strategic importance of multi-stakeholder collaboration in areas such as tourism, education, innovation, and policy. The study contributes theoretically by refining the conceptual scope of the pentahelix framework and practically by providing evidence-based insights for policymakers, academics, and practitioners to design inclusive, innovation-driven, and sustainable MSME development strategies. Importantly, it underscores the novelty of applying bibliometric analysis to this field, addressing a critical research gap. However, the analysis is limited to journal articles indexed in Scopus and Google Scholar, excluding literature from other databases, conference proceedings, policy reports, and books, suggesting the need for future research to expand data sources for a more comprehensive understanding of pentahelix collaboration and its role in MSME development.

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