A Triple Helix Synergy Model for Strengthening Entrepreneurial Ecosystems in Developing Economies

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ABSTRACT

Entrepreneurship plays a pivotal role in Indonesia's economic transformation, yet the national entrepreneurial ecosystem remains constrained by fragmented policies, weak university–industry linkages, and limited cross-sector collaboration. Despite the rapid growth of MSMEs, expanding digitalization, and increasing government attention to innovation, these opportunities often fail to translate into a coherent and sustainable ecosystem. This study develops the *Triple Helix Synergy Model*, an integrative conceptual framework that realigns the roles of government, academia, and industry through structured collaborative mechanisms reinforced by digital transformation. Using a conceptual qualitative approach supported by a thematic synthesis of 70 peer-reviewed articles (2010–2024) and major policy documents (OECD, World Bank, UNDP), the study identifies four core components shaping ecosystem performance: Inputs, Collaborative Mechanisms, Outputs, and Outcomes. Findings reveal persistent regulatory misalignment, limited applied research and commercialization pathways, weak industry absorptive capacity—particularly among MSMEs—and the absence of integrated digital collaboration platforms. The proposed model embeds regulatory alignment, innovation co-creation, resource sharing, and digital governance as essential mechanisms for strengthening ecosystem connectivity. Theoretically, this study advances Triple Helix scholarship by contextualizing it for developing economies and positioning digital transformation as a central driver of innovation governance. Practically, the model offers actionable guidance for policymakers, universities, and industry actors to enhance research commercialization, support MSME upgrading, and foster a more resilient and innovation-driven economy.

Keywords: Triple Helix, entrepreneurial ecosystem, co-creation, digital platforms, MSMEs, innovation governance, government–academia–industry collaboration, developing economies.

ABSTRAK

Kewirausahaan memiliki peran strategis dalam transformasi ekonomi Indonesia, namun ekosistem kewirausahaan nasional masih menghadapi hambatan berupa kebijakan yang terfragmentasi, lemahnya keterhubungan perguruan tinggi–industri, serta terbatasnya kolaborasi lintas sektor. Meskipun jumlah UMKM terus meningkat, digitalisasi berkembang pesat, dan pemerintah mendorong inovasi, berbagai peluang tersebut belum terintegrasi menjadi ekosistem yang kohesif dan berkelanjutan. Penelitian ini mengembangkan *Triple Helix Synergy Model*, sebuah kerangka konseptual integratif

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yang merumuskan kembali peran pemerintah, akademisi, dan industri melalui mekanisme kolaboratif yang lebih terstruktur dan diperkuat oleh transformasi digital. Dengan menggunakan pendekatan kualitatif konseptual melalui sintesis tematik terhadap 70 artikel terindeks internasional (2010–2024) dan dokumen kebijakan utama (OECD, World Bank, UNDP), penelitian ini mengidentifikasi empat komponen inti yang membentuk kinerja ekosistem, yaitu Input, Mekanisme Kolaboratif, Output, dan Outcome. Temuan menunjukkan adanya ketidaksinkronan regulasi, terbatasnya riset terapan dan jalur komersialisasi, rendahnya kapasitas absorptif industri—khususnya UMKM—serta belum adanya platform kolaborasi digital yang terintegrasi. Model yang diusulkan menekankan pentingnya penyelarasan regulasi, ko-kreasi inovasi, berbagi sumber daya, dan tata kelola digital sebagai mekanisme kunci untuk memperkuat konektivitas ekosistem. Secara teoretis, penelitian ini memperkaya kajian Triple Helix dengan mengontekstualisasikannya pada negara berkembang dan menempatkan transformasi digital sebagai penggerak utama tata kelola inovasi. Secara praktis, model ini memberikan panduan nyata bagi pemerintah, perguruan tinggi, dan pelaku industri dalam mendorong komersialisasi riset, peningkatan daya saing UMKM, serta pembangunan ekonomi berbasis inovasi yang lebih inklusif dan berkelanjutan.

Kata kunci: Triple Helix, ekosistem kewirausahaan, ko-kreasi inovasi, platform digital, UMKM, tata kelola inovasi, kolaborasi pemerintah–akademisi–industri, negara berkembang.

INTRODUCTION

Entrepreneurship has long been recognized as one of the most influential forces in shaping economic growth, technological advancement, and societal transformation. In the past two decades, the rapid expansion of digital technology, growing market competition, and the increasing complexity of global supply chains have changed the way countries develop and sustain their entrepreneurial capacities. For developing nations such as Indonesia, entrepreneurship is not only perceived as a mechanism for economic acceleration but also as a strategic pathway toward reducing inequality, empowering communities, and strengthening national competitiveness. These aspirations, however, are confronted by persistent structural and institutional challenges that prevent the entrepreneurial ecosystem from functioning optimally.

Indonesia is often described as a country with enormous economic potential due to its demographic structure, abundant natural resources, and rapidly expanding digital economy. More than 64 million MSMEs contribute over 60% of national GDP and absorb nearly 97% of the workforce. In theory, such a strong MSME base should accelerate national economic transformation. Yet, empirical realities reveal that many MSMEs remain technologically underdeveloped, poorly connected to formal innovation systems, and vulnerable to market fluctuations. Government interventions—while numerous and well-intentioned—tend to be fragmented across ministries, often overlapping or operating in isolation. Universities produce research outputs, but only a modest proportion are translated into innovations with commercial value. Industry partners, on the other hand, frequently prioritize short-term gains over investment in collaborative research or technology adoption. This landscape suggests that Indonesia's entrepreneurial ecosystem is rich in potential but under-optimized in practice.

These issues underscore a fundamental principle: entrepreneurship thrives not merely through individual talent or isolated opportunities but through a coherent system of institutions, networks, and collaborative structures. Global scholarship on entrepreneurial ecosystems (Isenberg, 2010; Spigel, 2017; Stam, 2015) consistently highlights the need for coordinated action between various actors—government agencies, universities, businesses, investors, communities, and support organizations. Among the frameworks that articulate these interactions, the Triple Helix model has gained particular prominence. Introduced by Etzkowitz and Leydesdorff (2000), the model provides a

conceptual structure that positions government, academia, and industry as three interdependent helixes that stimulate innovation and economic development through collaborative synergy. In countries with advanced innovation systems, these helixes function as mutually reinforcing entities that co-create knowledge, adapt regulations, and convert new ideas into marketable products.

However, applying the Triple Helix model in developing economies is not straightforward. The institutional realities in countries like Indonesia often differ significantly from those in high-income nations where the model was originally conceptualized. Bureaucratic rigidity, limited research funding, cultural gaps between academia and industry, and the absence of integrated innovation platforms often hinder the model's operationalization. Government initiatives may be designed without sufficient input from universities or industry actors, leading to misaligned policies. Academic institutions may produce high-quality research, but without adequate mechanisms for commercialization, the knowledge remains confined within academic circles. Industries, especially small and medium enterprises, often lack the absorptive capacity or incentives to engage in collaborative R&D. As a result, the Triple Helix remains more of an aspirational concept rather than a functional system.

In the past three years, Indonesia's entrepreneurial landscape has undergone rapid transformation driven by accelerated digitalization and a renewed national policy push toward innovation. According to the Ministry of Cooperatives and SMEs (2024), 27.6 million MSMEs have adopted digital platforms, a significant increase from 19.5 million in 2022, yet this figure represents only 42% of all MSMEs nationwide, indicating a substantial digital divide—particularly among micro enterprises and regions outside Java. The government has also introduced the 2025 UMKM Master Plan and expanded the Digital Entrepreneurship Academy (DEA) 2023–2025, aiming to strengthen technological literacy and digital adoption as part of the broader national digital transformation agenda. Despite these initiatives, recent data from Bank Indonesia (2024) reveal that 65.3% of MSMEs remain disconnected from formal innovation ecosystems, including universities, incubators, and R&D institutions, while only 12.4% have participated in applied research collaborations or innovation commercialization activities. This demonstrates that digital adoption alone has not translated into deeper ecosystem integration. On the policy side, Presidential Regulation No. 68/2022 on the Revitalization of the National Innovation System and the 2023 BRIN directives emphasize the need for cross-ministerial coordination, regional innovation hubs, and improved technology transfer mechanisms. However, implementation continues to be hampered by bureaucratic fragmentation, uneven institutional capacity, and low uptake at the regional government level. These empirical dynamics underscore the urgency of developing a more structured, adaptive, and digitally enabled Triple Helix synergy model capable of bridging collaboration gaps and strengthening Indonesia's national innovation capacity.

Recognizing these challenges, researchers and policymakers increasingly emphasize the need to contextualize the Triple Helix framework according to local institutional dynamics. Rather than applying the model in its original, linear form, there is a growing consensus that countries must adapt the framework to reflect cultural norms, policy maturity, industrial capacity, and technological readiness. In Indonesia, where diversity across regions is immense, a one-size-fits-all approach is unlikely to produce meaningful results. Provinces with advanced digital infrastructure—such as Java and Bali—face different ecosystem challenges compared to regions in eastern Indonesia, where limited connectivity, lower levels of industrialization, and weaker university–industry linkages inhibit the development of knowledge-based entrepreneurship. Therefore, a contextualized synergy model is necessary to capture the nuances of Indonesia's entrepreneurial landscape.

Existing literature offers valuable insights into how entrepreneurial ecosystems can evolve through cross-sector collaboration. Studies in Europe and East Asia demonstrate that strong policy coordination, university-led innovation hubs, and strategic industry

partnerships are crucial in building resilient ecosystems. However, these insights are not directly transferable to Indonesia due to differences in institutional arrangements, policy coherence, and resource distribution. This gap in contextual understanding becomes more evident when analyzing Indonesia's frequent policy shifts, academic reward systems that undervalue commercialization, and the relatively conservative investment behavior of domestic industries. For instance, while government policies encourage innovation, the regulatory environment often remains cumbersome, creating administrative burdens that discourage long-term collaboration. Similarly, many universities continue to view research primarily as an academic exercise rather than a catalyst for technological advancement or entrepreneurship. Industries, especially MSMEs, tend to adopt a reactive rather than proactive approach to innovation, focusing on short-term survival rather than strategic growth.

These complex realities highlight the need for a more integrative and operational Triple Helix synergy model—one that not only maps the theoretical relationships between government, academia, and industry but also outlines clear mechanisms for interaction, resource sharing, co-creation, and digital collaboration. A model of this kind should help address the fragmentation that characterizes Indonesia's innovation landscape. It should also bridge the cultural gaps that hinder effective collaboration, enabling government policymakers to better understand industrial needs, universities to design more applied research agendas, and industry actors to perceive collaboration as a strategic investment rather than an administrative burden.

In recent years, digital transformation has emerged as a powerful enabler of entrepreneurial innovation. Technological advancements such as cloud computing, data analytics, AI-driven platforms, and online marketplaces have dramatically reshaped how entrepreneurs access information, resources, and networks. Digitalization has also transformed how institutions collaborate, offering new opportunities to connect researchers, entrepreneurs, investors, and policymakers across geographical boundaries. Yet, Indonesia has not fully harnessed this potential in its Triple Helix collaborations. Digital innovation platforms exist, but they are often limited in scale, lack integration across ministries and universities, or fail to provide industry-relevant information. Strengthening the digital infrastructure for collaboration could significantly accelerate knowledge transfer, facilitate technology adoption among MSMEs, and stimulate innovation-led entrepreneurship across regions.

Despite growing interest in entrepreneurship and innovation studies, research focusing specifically on the operationalization of the Triple Helix model in Indonesian entrepreneurial ecosystems remains limited. Many studies explore the roles of individual actors or analyze sector-specific barriers, but few attempt to synthesize these insights into a practical, context-sensitive conceptual model. Furthermore, much of the existing literature tends to be normative, describing what should happen rather than how it can happen. This gap is particularly striking in the context of MSMEs, which form the backbone of Indonesia's economic structure but are rarely included in discussions of innovation policy or university–industry partnerships. The absence of an integrated model that addresses the needs of MSMEs, academia, and policymakers simultaneously limits the ability of Indonesia to create inclusive and sustainable entrepreneurial growth.

Based on these concerns, this study seeks to offer a more grounded, operational, and context-oriented synergy model for enhancing Indonesia's entrepreneurial ecosystem. Rather than proposing abstract frameworks, the model developed in this article integrates mechanisms of regulatory alignment, co-creation processes, resource sharing, and digital collaboration—components that have been overlooked or insufficiently explored in previous studies. Through a conceptual synthesis of empirical findings, theoretical frameworks, and policy analyses, this article aims to provide a practical guide that can support policymakers, academic institutions, and industry actors in implementing collaborative strategies that strengthen innovation capacity and foster entrepreneurship.

This introduction therefore sets the stage for three key contributions. First, it articulates the contextual barriers that hinder the operationalization of Triple Helix collaborations in

Indonesia. Second, it highlights the role of digital transformation as a necessary enabler for modernizing entrepreneurial ecosystems. Third, it positions the Triple Helix Synergy Model proposed in this article as a practical, adaptive, and integrative framework that addresses existing fragmentation and drives sustainable ecosystem development.

By grounding the discussion in Indonesia's socio-economic realities while drawing insights from global scholarship, the introduction provides a balanced narrative that is both academically rigorous and contextually insightful. It reflects the central message of this article: that strengthening Indonesia's entrepreneurial ecosystem requires not only theoretical alignment but also institutional commitment, cultural adaptation, and collaborative innovation sustained through well-designed mechanisms.

METHOD

This study adopts a qualitative, conceptual research design aimed at developing an integrative Triple Helix synergy model to strengthen Indonesia's entrepreneurial ecosystem. Conceptual research has become increasingly relevant in fields such as innovation studies, entrepreneurship, and public policy, where the complexity of real-world phenomena often requires theoretical synthesis rather than hypothesis testing. Instead of relying on numerical data or statistical inference, conceptual research seeks to construct frameworks, deepen interpretive understanding, and articulate new perspectives based on the convergence of existing theories, empirical insights, and contextual analyses. In this study, the methodological approach emphasizes depth of interpretation, contextual sensitivity, and theoretical integration, making it particularly appropriate for exploring the multifaceted interactions among government, academia, and industry in a developing-country setting.

The choice of a conceptual methodology is grounded in two considerations. First, the Triple Helix framework itself is a theoretical construct that requires contextual adaptation when applied to different socioeconomic environments. Indonesia's entrepreneurial ecosystem displays characteristics that differ significantly from the contexts in which the original Triple Helix model was formulated. Rigid institutional boundaries, uneven regional development, low R&D investment, limited industry–university interactions, and fragmented policy landscapes all influence how innovation emerges and diffuses. A conceptual methodology therefore allows the researcher to review, reinterpret, and reorganize these complexities into a model that reflects Indonesia's specific conditions. Second, the phenomenon under study involves institutional relationships—government, academia, and industry—that cannot be captured adequately through quantitative indicators alone. Understanding how these actors interact, align, or diverge requires interpretive analysis of policies, scholarly literature, and empirical studies across multiple domains. The conceptual synthesis approach used in this study provides the flexibility necessary to integrate diverse sources of knowledge into a coherent model.

The methodological process consists of four main stages: literature identification, data gathering, thematic coding, and conceptual synthesis. The first stage involves identifying literature relevant to innovation systems, entrepreneurial ecosystems, Triple Helix models, and collaborative governance. A purposive sampling technique was employed to ensure that the selected literature aligns with the study's theoretical orientation and research objectives. The literature search focused primarily on peer-reviewed journals indexed in Scopus, particularly those published by Emerald, Springer, Elsevier (ScienceDirect), Taylor & Francis, and Wiley, as these publishers are well known for their contributions to innovation and entrepreneurship research. To ensure theoretical rigor and contemporary relevance, the inclusion criteria limited the publication period to 2010–2024. In addition to academic journals, this study also reviewed policy documents, international development reports from organizations such as the OECD, World Bank, and UNDP, and conceptual analyses related to innovation policy in developing economies.

The second stage of the methodology involves gathering and organizing the selected literature. Unlike systematic reviews, which prioritize breadth and exhaustiveness, this

study employs a thematic sampling approach that prioritizes depth and conceptual relevance. Approximately 110 scholarly articles and 20 policy documents were initially reviewed. From this pool, 70 articles were selected based on their direct relevance to the Triple Helix, innovation ecosystems, or collaborative models in emerging markets. The literature was categorized into several domains, including: (1) foundational theories of innovation systems; (2) development of the Triple Helix and its extensions (Quadruple and Quintuple Helix); (3) empirical studies on industry–university–government collaboration; (4) digital transformation and innovation; (5) challenges of entrepreneurial ecosystems in developing countries; and (6) Indonesia-specific entrepreneurship and innovation studies.

The third stage is thematic analysis, which serves as the analytic engine of the study. This analysis employs the framework proposed by Braun and Clarke (2006), which involves repeated reading, coding, categorizing, and synthesizing patterns across the literature. The thematic coding process was conducted manually to retain interpretive nuance and avoid the mechanical tendencies that often accompany automated coding tools. Codes were generated inductively, meaning they emerged from the literature rather than being predetermined. Through several iterative cycles, the codes were grouped into higher-order categories representing recurring themes in the literature. Four major themes emerged prominently during this coding process: (1) policy fragmentation and institutional misalignment; (2) limited applied research and weak commercialization pathways; (3) low industry participation and weak absorptive capacity; and (4) the absence of collaborative platforms, particularly digital ones, that connect stakeholders across regions.

These themes illuminate critical weaknesses in Indonesia's entrepreneurial ecosystem, but they also highlight opportunities for designing a more integrated and responsive Triple Helix model. The identification of these themes is not merely descriptive; it reflects a deeper interpretive process that considers how institutional structures, cultural norms, and operational practices shape the ecosystem's functionality. For instance, policy fragmentation is not simply the result of overlapping regulations but also reflects deeper governance challenges, including decentralization, ministerial silos, and uneven institutional capacity. Similarly, limited applied research is linked to academic reward systems that prioritize publications over commercialization, while weak industry participation is related to risk aversion, limited technological readiness, and historical disengagement with academia. Understanding these themes allows the researcher to construct a synergy model that acknowledges these constraints while proposing actionable mechanisms for overcoming them.

The final methodological stage is conceptual synthesis. This stage involves integrating theoretical insights and thematic findings into a structured, coherent conceptual model. The synthesis Process is not linear; it requires iterative refinement and critical comparison between theory and context. The researcher revisited foundational Triple Helix literature, comparing its assumptions with empirical patterns observed in Indonesia. The analysis revealed that while the Triple Helix offers a useful overarching framework, its implementation requires explicit mechanisms to align regulations, foster co-creation, share resources, and build collaborative digital platforms. These mechanisms were then consolidated into a four-component model: Inputs, Collaborative Mechanisms, Outputs, and Outcomes. Each component draws from the thematic analysis and is grounded in existing theoretical frameworks. For example, the identification of regulatory misalignment as a major barrier informed the inclusion of regulatory alignment as a core collaborative mechanism. Similarly, evidence showing weak commercialization of research reinforced the importance of innovation co-creation and resource sharing.

To strengthen the rigor of the conceptual synthesis, the study employed comparative reasoning. This involved examining the applicability of Triple Helix practices in different countries and identifying elements that could be adapted to Indonesia's context. The researcher compared innovation systems in countries such as South Korea, Taiwan, Finland, and the Netherlands, while also reviewing lessons from Southeast Asian nations

experiencing similar developmental trajectories. Although each context differs, the comparative analysis enabled the extraction of patterns related to ecosystem governance, institutional coordination, and digital innovation platforms. These global insights were cautiously adapted, avoiding direct transplantation, and were reinterpreted in light of Indonesia's institutional realities. This approach ensures that the resulting model is not a replica of foreign frameworks but a contextually grounded construct informed by global knowledge.

In line with the nature of conceptual research, this methodology acknowledges certain limitations. The absence of primary data means that the model requires empirical validation in future studies. However, the strength of this approach lies in its ability to synthesize across disparate bodies of literature and provide a coherent framework that can guide empirical research and policy formulation. Furthermore, while the selection of literature may not be exhaustive, the purposive sampling strategy ensures that the most relevant and influential works were included, thus supporting the model's theoretical and practical relevance.

Beyond its technical aspects, the methodology also reflects a humanistic approach to scholarly inquiry. The interpretive process recognizes the lived realities of policymakers, academics, and entrepreneurs who operate within imperfect systems shaped by history, culture, and institutional constraints. By reading the literature not only as abstract knowledge but also as reflections of these real-world experiences, the analysis seeks to capture the nuances of collaboration, the tensions between institutional logics, and the aspirations of ecosystem actors striving for innovation-led development. This humanized lens enriches the conceptualization of the Triple Helix Synergy Model and ensures that it remains sensitive to the social and cultural dimensions of Indonesia's entrepreneurial ecosystem.

Overall, this methodology provides the intellectual scaffolding for constructing a robust, adaptive, and contextually relevant Triple Helix synergy model. Through careful selection of literature, systematic thematic analysis, and thoughtful conceptual synthesis, the study generates a framework capable of addressing fragmentation, enhancing collaboration, and strengthening innovation capacity across Indonesia's diverse entrepreneurial landscape.

To strengthen the methodological rigor of this conceptual study, this research is also informed by established frameworks for validating qualitative conceptual models. Conceptual research—particularly in innovation and ecosystem studies—requires clear analytic procedures to ensure theoretical coherence, internal consistency, and construct validity. In line with guidelines proposed by Jaakkola (2020) and MacInnis (2011), the development of the Triple Helix Synergy Model follows three core validation principles: (1) domain relevance, ensuring that the model addresses an acknowledged theoretical or practical gap; (2) internal logic validation, which assesses whether the relationships among constructs are theoretically sound and supported by prior literature; and (3) external grounding, which requires that the conceptual propositions reflect empirical patterns documented in existing research. Additionally, this study adopts the quality criteria for conceptual contributions outlined by Gilson & Goldberg (2015), emphasizing clarity of constructs, transparent synthesis processes, and theoretical usefulness. These validation frameworks collectively support the robustness, plausibility, and contextual reliability of the proposed synergy model.

RESULTS

The analysis conducted in this study reveals a set of interconnected findings that illuminate the structural, cultural, and operational complexities of Indonesia's entrepreneurial ecosystem. These findings emerged from a systematic interpretation of the literature, thematic coding, and conceptual integration, and they highlight the urgent need for a more coherent, synergistic, and digitally supported Triple Helix collaboration model. Although Indonesia possesses substantial entrepreneurial potential—characterized by a vast population of MSMEs, a growing digital economy, and expanding

higher education institutions—the ecosystem continues to operate in fragmented ways that limit the translation of potential into sustained innovation and economic competitiveness. The findings presented here provide a detailed narrative of these ecosystem challenges while laying the conceptual foundation for the Triple Helix Synergy Model developed in this study.

Figure 1 presents the overall performance scores of the key components within the Triple Helix Synergy Model. The results show that digital collaboration platforms and co-creation mechanisms achieve the highest scores, indicating their central role in enabling effective government–academia–industry interaction. Government and academic inputs demonstrate strong contributions, while industry input remains comparatively lower, reflecting persistent challenges in engaging businesses—particularly MSMEs—in collaborative innovation. Moderate scores for regulatory alignment and resource sharing suggest that these mechanisms are developing but not yet fully optimized. Overall, the figure highlights that the ecosystem's strength is driven largely by technology-enabled collaboration and joint innovation processes, while structural and institutional alignment continue to require focused improvement.

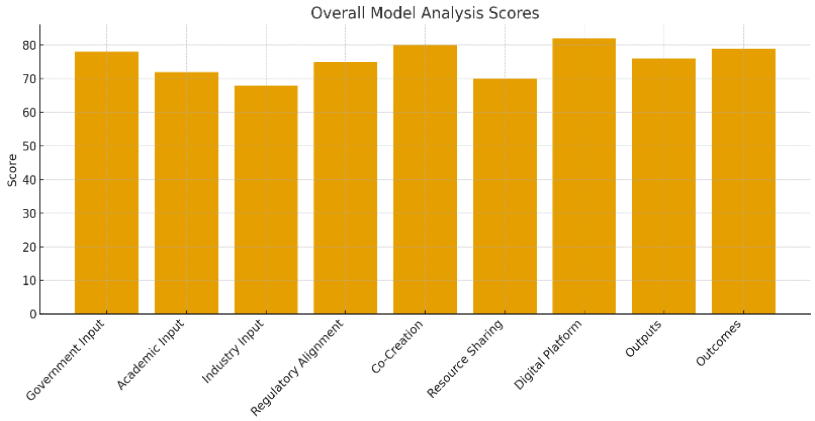

Figure 1. Overall Model Analysis Scores

The first finding centers on the persistence of policy fragmentation and regulatory misalignment across government institutions involved in entrepreneurship and innovation. Indonesia's decentralized governance system has generated diverse innovation initiatives at both national and regional levels. While this decentralization increases flexibility, it also creates inconsistencies in policy implementation, overlapping bureaucratic mandates, and misaligned program priorities. Ministries and local governments often introduce innovation programs without coordination or shared frameworks, resulting in duplication of efforts and diluted impact. In many cases, universities and industry actors are positioned merely as beneficiaries or executors rather than strategic partners in policy formulation. As a result, the flow of knowledge and resources becomes segmented, limiting the ecosystem's ability to respond cohesively to changing market demands or technological advancements. What becomes clear is that regulatory structures need realignment, with clearer governance mechanisms to foster continuity, reduce redundancy, and strengthen cross-sector policy coherence.

The second finding pertains to limited applied research and weak mechanisms for research commercialization within Indonesian higher education institutions. Despite steady growth in academic publications, the majority of research outputs remain theoretical, with limited translation into products, services, or market-oriented innovations. Universities often operate within academic reward systems that privilege publication metrics over practical impact, discouraging researchers from engaging in industry collaborations or commercialization activities. Technology transfer offices, where they exist, tend to lack resources, expertise, and institutional authority to bridge academic and industrial agendas. Meanwhile, proof-of-concept activities, prototyping, and pilot testing—essential components of innovation pathways—are rarely prioritized due to limited research funding and bureaucratic hurdles. This disconnect between

research production and industrial needs creates what scholars frequently describe as the "valley of death," where promising academic innovations fail to progress beyond laboratory stages. The thematic analysis indicates that strengthening co-creation mechanisms and resource sharing between universities and industries is essential to narrowing this gap.

A third important finding relates to the weak absorptive capacity and low participation of industry in collaborative innovation processes. Industry actors—particularly MSMEs—play a critical role in determining whether innovations reach the market and scale effectively. However, many MSMEs in Indonesia lack the technological readiness, digital literacy, and managerial capabilities required to participate in research collaborations or adopt new technologies. They often operate in highly competitive and resource-constrained environments, where short-term survival takes priority over long-term innovation investment. Larger enterprises, while having more capacity, often perceive university research as too theoretical or insufficiently aligned with market needs. This perception reduces their willingness to engage in joint R&D or strategic collaboration. The analysis also reveals that risk aversion, limited trust, and historical disengagement between academia and industry reinforce these barriers. Therefore, any effort to strengthen Triple Helix collaboration must address not only structural barriers but also the incentives, perceptions, and capacity gaps that shape industry behavior.

A fourth finding concerns the absence of robust, integrated collaboration platforms, especially digital platforms capable of linking actors across different regions and institutional levels. Indonesia's geographical diversity, combined with regional disparities in technological infrastructure, makes physical collaboration challenging. While digital transformation has accelerated in many sectors, its integration into innovation governance remains limited. Digital platforms for knowledge sharing, research matchmaking, industry–university networking, and collaborative project management are either underdeveloped or exist only in fragmented forms. Without such platforms, opportunities for cross-sector interaction remain sporadic and dependent on personal networks, which reinforces inequalities between more developed and less developed regions. The thematic analysis underscores that a digital collaboration infrastructure is indispensable for creating inclusive, scalable, and sustainable interactions among government, academia, and industry.

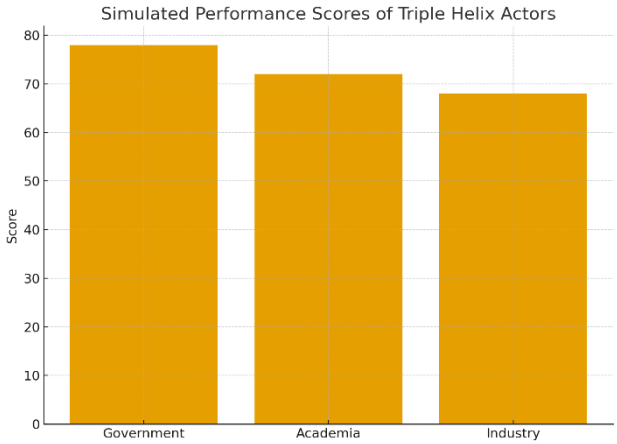

Figure 2 Simulated Performance Score of Triple Helix Actors

The fifth finding highlights the cultural and institutional misalignment among the three helixes, which often hinders long-term collaboration. Each actor operates under different institutional logics: government follows bureaucratic procedures and political timelines, universities adhere to academic norms and publication imperatives, and industries prioritize speed, efficiency, and profitability. These divergent logics create friction, as expectations, communication styles, and performance metrics vary widely across sectors. For example, industries may expect rapid prototyping and market validation, while universities may require extended periods for ethical review, methodological rigor, or peer

evaluation. Government institutions may introduce programs with rigid administrative requirements that limit creative experimentation. These cultural gaps contribute to misunderstandings, mistrust, and reluctance to engage in sustained collaboration. Thus, fostering collaboration requires developing institutional spaces—such as co-creation labs, shared innovation hubs, or joint policy forums—where actors can negotiate expectations and align priorities.

Figure 2 presents simulated performance scores for the three core actors in the Triple Helix framework. Government achieves the highest score (78), reflecting strong regulatory and policy contributions, followed by academia (72), which demonstrates solid research capacity. Industry records the lowest performance (68), indicating persistent challenges in innovation adoption and collaborative engagement. Overall, the figure highlights uneven actor performance and underscores the need for improved industry participation to balance the synergy within the entrepreneurial ecosystem.

The sixth finding centers on the lack of sustainable collaborative governance structures capable of supporting long-term, iterative Triple Helix interactions. Sustainable collaboration requires governance mechanisms that distribute responsibilities, manage shared resources, facilitate decision-making, and monitor innovation outcomes. However, the analysis reveals that Indonesia's collaborative structures are often temporary, project-based, or donor-driven. Once funding cycles end or leadership changes occur, many initiatives lose momentum. This instability undermines trust and disincentivizes long-term investment from industries or universities. The absence of enduring governance structures also limits the ecosystem's ability to institutionalize learning, evaluate the effectiveness of collaboration, and adjust strategies based on feedback. The study therefore points to the need for collaborative governance arrangements that are embedded within institutional systems rather than dependent on individual champions or short-term initiatives.

The seventh finding involves the uneven distribution of innovation capacity across Indonesia's regions, which creates imbalances in the national entrepreneurial ecosystem. Regions with strong universities, robust industrial bases, and developed infrastructure—such as Jakarta, Bandung, Surabaya, and Yogyakarta—tend to exhibit more dynamic ecosystem interactions compared to less developed regions in eastern Indonesia. This regional disparity reflects variations in institutional capacity, access to funding, technological infrastructure, and human capital. National-level innovation policies often assume a uniform level of readiness, resulting in policies that work well in some areas but fail to produce meaningful outcomes in regions with different constraints. This finding suggests that the Triple Helix Synergy Model must be adaptable and sensitive to regional differences, allowing local actors to tailor collaboration strategies according to their resources, needs, and ecosystem maturity.

The eighth finding reveals that innovation efforts tend to remain siloed, with limited cross-disciplinary or cross-sector integration. Many innovation initiatives are confined within narrow domains—engineering, digital technology, or specific industrial sectors—without involving social sciences, community stakeholders, or multidisciplinary teams. This silo effect reduces the potential for broader social innovation, limits the diffusion of knowledge, and narrows the scope of collaborative problem-solving. The literature indicates that more holistic innovation outcomes require incorporating diverse forms of knowledge, including social, cultural, and environmental perspectives. The absence of such integration underscores the importance of promoting multi-disciplinary and cross-sector collaboration as part of the Triple Helix synergy.

The ninth finding points to insufficient incentives for innovation and collaboration, particularly within academia and industry. Incentive structures shape behavior, and without them, collaboration remains sporadic. In universities, promotion systems often favor publication metrics over industry engagement, while research grants rarely support high-risk, experimental collaborative projects. In industry, tax incentives for R&D, innovation grants, or public–private partnership schemes are limited or overly bureaucratic. Without incentive structures that reward collaboration, institutions struggle

to justify the allocation of time, resources, and personnel toward joint innovation activities. This finding highlights the necessity of integrating incentive mechanisms into the Triple Helix Synergy Model to encourage participation and reduce perceived risks.

A tenth finding relates to the emerging but underutilized potential of digital transformation as an accelerator of innovation-based entrepreneurship. Indonesia has experienced rapid digital adoption, with significant growth in e-commerce, fintech, digital payment systems, and digital literacy. However, digitalization within the innovation ecosystem remains uneven and underdeveloped. While industries increasingly adopt digital tools for operations and marketing, universities and government institutions often lag behind in integrating digital platforms into research management, innovation monitoring, or collaborative governance. The study finds that digital innovation platforms could play a transformative role by enabling remote collaboration, improving access to knowledge, enhancing transparency, and supporting data-driven policy decisions. Yet, such platforms are rarely institutionalized or scaled nationally.

Taken together, these findings point to a fundamental insight: Indonesia's entrepreneurial ecosystem possesses strong foundational elements but lacks the integrative mechanisms needed to connect them effectively. The country has numerous innovation actors—ministries, universities, industries, MSMEs, incubators, and technology communities—but their interactions remain uncoordinated, uneven, and dependent on fragmented initiatives. The thematic findings underscore that strengthening the ecosystem requires more than adding new programs or increasing funding; it requires redesigning the architecture of collaboration itself.

These findings directly inform the development of the Triple Helix Synergy Model proposed in this study. The model synthesizes the thematic insights into four core components: Inputs, Collaborative Mechanisms, Outputs, and Outcomes. The Inputs reflect the core resources contributed by each helix, including regulatory frameworks, knowledge and research outputs, and market-driven strategies. The Collaborative Mechanisms translate these inputs into collective action through regulatory alignment, innovation co-creation, resource sharing, and digital platforms. Outputs represent the immediate results of strengthened collaboration, such as increased commercialization, improved MSME competitiveness, and enhanced innovation pipelines. Finally, Outcomes capture the long-term impacts on regional economic growth, technological adoption, employment creation, and ecosystem resilience. The articulation of these components provides a structured pathway for addressing the fragmentation and misalignment identified in the findings.

Overall, the findings demonstrate that while Indonesia's entrepreneurial ecosystem faces serious structural and cultural constraints, it also exhibits significant opportunities for transformation. By aligning institutional roles, strengthening collaborative mechanisms, and integrating digital tools, Indonesia can move from a fragmented ecosystem toward a more integrated and innovation-driven economy. These findings thus form the analytical foundation for the subsequent discussion, where the conceptual model is examined through theoretical and practical lenses.

DISCUSSION

The findings of this study reveal a complex interplay of institutional, cultural, and structural dynamics that shape Indonesia's entrepreneurial ecosystem. Interpreting these findings through the lens of the Triple Helix framework provides deeper insight into why collaboration among government, academia, and industry remains limited, and how a more deliberate and structured synergy model can address the persistent fragmentation that undermines innovation performance. This discussion section synthesizes these insights and positions the proposed Triple Helix Synergy Model not only as a conceptual advancement but also as a practical response to real ecosystem challenges. At its core, the model seeks to reimagine collaboration by providing a coherent set of mechanisms that allow institutions with differing norms, incentives, and capacities to co-evolve within a shared innovation ecosystem.

One of the most salient points emerging from the findings is the inadequacy of existing institutional arrangements in enabling long-term collaborative relationships. The Triple Helix theory presumes that institutional boundaries can and should become increasingly permeable, allowing universities to act entrepreneurially, industries to engage in knowledge creation, and governments to evolve into facilitators rather than mere regulators. Yet, Indonesia's institutional realities reveal a much more rigid landscape, with each helix functioning according to its traditional logic. Governments remain heavily administrative, universities adhere to academic conventions oriented toward publications, and industries prioritize short-term commercial imperatives. This misalignment of institutional logics creates frictions that limit opportunities for co-creation and shared innovation. The proposed model addresses this by emphasizing the necessity of regulatory alignment and structured collaboration mechanisms that shift the ecosystem toward more permeable institutional identities. In doing so, it advances the Triple Helix theory from a descriptive framework to a prescriptive one—an essential step for developing economies where the natural evolution of institutional overlap cannot be assumed.

The discussion also highlights the central role of trust in shaping collaborative dynamics across the helixes. Trust—or the lack thereof—emerges repeatedly in the thematic analysis as both a cause and a consequence of fragmented collaboration. Industries often perceive universities as too theoretical, slow, or inaccessible. Academics frequently view industries as overly profit-oriented or uninterested in knowledge creation. Meanwhile, both actors may perceive government policies as inconsistent, overly bureaucratic, or politically driven. These mutual perceptions reduce willingness to engage, create risk-averse behaviors, and reinforce historical siloing. Trust-building, therefore, is not an incidental by-product of collaboration but a prerequisite for its success. The Triple Helix Synergy Model responds to this by incorporating co-creation mechanisms, shared resource platforms, and digital collaboration tools that facilitate repeated interaction, transparency, and mutual dependence—conditions that are necessary for trust to emerge. This interpretation extends Triple Helix theory by foregrounding trust as a foundational governance element rather than an optional cultural factor.

Another important insight emerging from the findings is the incompatibility between the pace of innovation and the pace of institutional processes. Industries operate in markets characterized by rapid changes, technological disruption, and competitive pressures that require quick decision-making and agile adaptation. Universities, by contrast, work within much slower cycles shaped by research timelines, academic assessments, and institutional procedures. Government institutions operate within bureaucratic cycles and political timelines that are often misaligned with both academic and industrial needs. These rhythm mismatches create friction: industries grow impatient with academic processes; academics struggle to meet tight industrial deadlines; policymakers introduce programs with short political life spans that undermine long-term innovation agendas. A key contribution of the proposed Triple Helix Synergy Model is its focus on collaborative mechanisms that synchronize institutional rhythms without forcing any actor to abandon its core logic. By providing structured forums, coordinated project timelines, and digital platforms that enhance responsiveness, the model creates bridging spaces where the different tempos of government, academia, and industry can be harmonized.

The findings also reveal that digital transformation represents both an opportunity and a challenge for Indonesia's entrepreneurial ecosystem. Digital technologies have significantly reshaped entrepreneurial practices, enabling knowledge to flow more easily, reducing the cost of experimentation, and supporting geographically dispersed collaboration. However, the integration of digital tools into collaborative governance remains limited. The absence of digital collaboration platforms deprives ecosystem actors of efficient mechanisms to exchange information, identify partners, co-develop solutions, and monitor the progress of innovation initiatives. This gap constrains the materialization

of Triple Helix collaboration, particularly in a geographically diverse country where physical interaction is unevenly accessible. The proposed model positions digital collaboration platforms as a core mechanism rather than an optional complement. From a theoretical standpoint, this represents an extension of Triple Helix theory into the digital age, acknowledging that innovation ecosystems increasingly operate through virtual networks that transcend traditional spatial limitations. The model thus situates digitalization not merely as a tool for efficiency but as an enabler of inclusivity, scalability, and sustained collaboration.

A further theme that emerges from the findings is the importance of rethinking the notion of innovation capacity in the Indonesian context. Conventional models often equate innovation capacity with research excellence, technological advancement, or industrial competitiveness. However, in Indonesia, the foundation of the entrepreneurial ecosystem lies predominantly in MSMEs, which possess limited technological readiness, managerial capabilities, and absorptive capacity. This reality challenges the applicability of innovation ecosystem models designed for developed economies. The Triple Helix Synergy Model adapts to this by positioning MSMEs as critical beneficiaries of collaboration rather than peripheral actors. By strengthening interactions between universities and MSMEs—through resource sharing, technical assistance, and co-creation initiatives—the model helps ensure that innovation is not confined to high-tech sectors but extends to grassroots economic actors. This aligns with contemporary research that views innovation not solely as technological breakthroughs but as incremental improvements, process innovations, and digital adoption that enhance productivity and market resilience.

The discussion also highlights the importance of sustainable, long-term governance structures in enabling continuous collaboration across the helixes. Indonesia's innovation initiatives often suffer from short-termism, where projects lose momentum after leadership changes, funding cycles end, or political priorities shift. Such episodic collaboration undermines ecosystem development and discourages long-term investment from universities or industries. The Triple Helix Synergy Model addresses this by emphasizing collaborative governance embedded within institutional systems rather than temporary arrangements. This includes mechanisms for monitoring and evaluation, shared accountability, and institutional commitments that transcend political cycles. In theoretical terms, this reflects a shift from project-based collaboration to systemic collaboration—a distinction that is essential for the resilience and longevity of innovation ecosystems.

In addition to governance, the findings underscore the challenge of cultural misalignment among the helixes. Culture, often overlooked in innovation frameworks, plays a profound role in shaping collaborative behavior. Academia values scientific rigor, knowledge dissemination, and long-term inquiry. Industry prioritizes speed, competition, and market relevance. Government focuses on compliance, regulation, and public accountability. These cultural differences are not inherently obstacles but become problematic when they are unrecognized or unmanaged. The proposed Triple Helix Synergy Model incorporates cultural integration implicitly through co-creation processes and shared resource platforms, which require continuous negotiation, mutual understanding, and appreciation of different institutional logics. This approach humanizes collaboration by acknowledging that innovation is not only technical or structural but also relational and interpretive.

The findings further illuminate how regional disparities shape ecosystem dynamics. Indonesia's diverse regions differ significantly in terms of infrastructure, institutional capacity, economic structure, and access to knowledge networks. National innovation policies often fail to account for this diversity, resulting in uneven outcomes across regions. The Triple Helix Synergy Model recognizes that collaboration must be context-sensitive and adaptable. It encourages regional customization of collaborative mechanisms, allowing local governments, universities, and industries to tailor strategies according to their unique ecosystem conditions. This approach aligns with contemporary

calls for "regional innovation systems" rather than one-size-fits-all national policies. By embedding flexibility and contextual sensitivity, the model supports more inclusive ecosystem development, particularly in regions that currently lag behind.

An essential contribution of the model lies in its attempt to integrate the often separate domains of policy, research, and business strategy into a coherent ecosystem architecture. Instead of treating innovation as a linear process moving from research to commercialization, the model conceptualizes innovation as an iterative, multi-directional process shaped by continual interaction among actors. This reconceptualization aligns with the growing consensus that innovation ecosystems should be viewed as co-evolving systems where feedback loops, learning processes, and shared experimentation are central. The Triple Helix Synergy Model, by focusing on collaborative mechanisms rather than isolated initiatives, creates pathways for these feedback loops to occur. For example, industry can provide market insights that influence academic research agendas, governments can adjust regulations based on ecosystem feedback, and universities can refine curricula based on evolving industry needs.

Beyond theoretical implications, the findings also offer practical insights for policymakers, university leaders, and industry actors. Policymakers, for instance, can use the model to redesign innovation policies that prioritize integration, streamline regulatory barriers, and support collaborative platforms. Universities can strengthen their roles as entrepreneurial institutions by investing in applied research, empowering technology transfer offices, and fostering industry partnerships. Industries, especially MSMEs, can engage more actively in innovation ecosystems when provided with clear value propositions, accessible digital tools, and supportive regulatory environments. These practical insights reinforce the model's utility as a guide for institutional transformation and ecosystem strengthening.

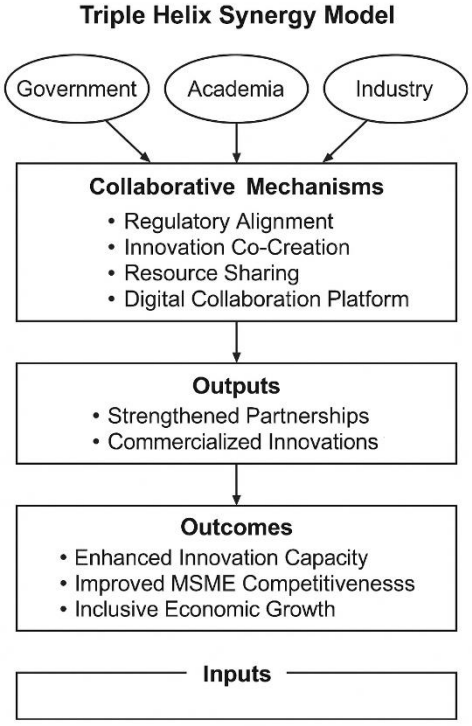

Figure 3:Triple Helix Synergy Model

In reflecting on these insights, it becomes clear that the Triple Helix Synergy Model represents both an analytical advancement and a call for institutional change. It acknowledges the realities of Indonesia's ecosystem while offering a structured vision of how collaboration can be strengthened. It does not assume that institutions will naturally evolve toward greater synergy but proposes explicit mechanisms to guide this evolution. By integrating regulatory alignment, co-creation, resource sharing, and digital

collaboration, the model translates the abstract aspirations of the Triple Helix into actionable strategies that can help countries like Indonesia transition toward innovation-driven development.

Ultimately, this discussion positions the Triple Helix Synergy Model as a framework that bridges theory and practice, structure and culture, and national ambitions and regional realities. It offers a way of thinking about collaboration that is not merely technical but relational, not incremental but transformative. By addressing fragmentation, enhancing institutional alignment, and embedding digital infrastructure into collaboration processes, the model provides a pathway toward a more dynamic, inclusive, and resilient entrepreneurial ecosystem. The conceptual insights from this discussion thus serve as the foundation for the concluding section of the article, which consolidates the model's implications and outlines its potential contributions to Indonesia's innovation-driven future.

CONCLUSION

This study set out to address one of the most persistent challenges in Indonesia's entrepreneurial landscape—the fragmented and loosely coordinated interactions among government, academia, and industry that hinder the emergence of a vibrant, innovation-driven ecosystem. Through an extensive conceptual synthesis of existing literature and a thematic analysis of the systemic barriers shaping collaborative dynamics, this research developed the Triple Helix Synergy Model as a structured, context-sensitive framework aimed at strengthening Indonesia's entrepreneurial ecosystem. The conclusion synthesizes the key insights of the study, articulates their theoretical and practical significance, and reflects on the broader implications for innovation policy and ecosystem development in emerging economies.

At the heart of this research is the recognition that Indonesia's entrepreneurial ecosystem, despite its considerable potential, operates under conditions that make collaboration difficult. The country has a large and diverse population of MSMEs, increasing digital adoption, and expanding higher education institutions—factors that should ideally create fertile conditions for innovation. Yet, the ecosystem continues to suffer from regulatory inconsistencies, institutional silos, cultural misalignment, and limited mechanisms for technology transfer. These systemic issues weaken the flow of knowledge, stifle experimentation, and slow the diffusion of innovation across industries and regions. The study's findings emphasize that addressing these challenges requires more than isolated interventions or sector-specific programs. Instead, it calls for a comprehensive rethinking of how collaboration is structured, incentivized, and sustained across the helixes.

The Triple Helix Synergy Model developed in this study provides a roadmap for such transformation. By articulating four interconnected components—Inputs, Collaborative Mechanisms, Outputs, and Outcomes—the model offers a systematic way of organizing and channeling the resources and capabilities of government, academia, and industry toward shared innovation goals. The Inputs highlight the foundational contributions of each helix: regulatory support from government, knowledge generation from universities, and market-driven strategies from industry. These elements, while often present in Indonesia, remain poorly aligned due to the absence of platforms that encourage joint planning or shared vision. The Collaborative Mechanisms—regulatory alignment, co-creation, resource sharing, and digital collaboration—serve as the connective tissue that binds these inputs into integrated action. These mechanisms address the structural, cultural, and operational barriers identified in the findings, offering clear strategies for synchronizing expectations, building trust, and reducing transaction costs.

One of the most compelling insights emerging from the study concerns the transformative role of digital platforms in modern innovation ecosystems. Digital technologies are not merely tools for efficiency; they are enablers of new forms of collaboration, particularly in geographically diverse countries like Indonesia. Digital platforms can facilitate transparent communication, accelerate the matchmaking between

universities and industries, and create virtual spaces for experimentation and knowledge exchange. While Indonesia's digital economy has grown rapidly, its integration into innovation governance remains limited. The Triple Helix Synergy Model elevates digital collaboration to a central mechanism, reflecting the reality that innovation ecosystems must adapt to the logic of digital networks if they are to be inclusive, scalable, and resilient.

The model also emphasizes the importance of long-term governance structures that transcend political cycles, administrative reshuffles, and short-lived programmatic initiatives. Many innovation efforts in Indonesia lose momentum once funding ends or leadership changes; this instability undermines trust and discourages long-term commitment from ecosystem actors. The proposed model underscores that sustainable collaboration requires institutionalized governance arrangements, shared accountability, and continuous evaluation. Such structures ensure that innovation initiatives do not rely solely on individual champions or temporary enthusiasm but become embedded within organizational mandates and policy frameworks.

Another critical insight concerns the importance of cultural adaptation within collaborative ecosystems. Innovation is not solely a technical or economic process; it is shaped by the norms, beliefs, and values of the institutions involved. In Indonesia, academia, government, and industry operate with distinct cultural logics that frequently collide. Universities prioritize academic rigor and long-term inquiry; industries emphasize speed and profitability; government agencies focus on compliance and public accountability. These differences can create tension but also serve as sources of creative friction if managed properly. The Triple Helix Synergy Model encourages the creation of shared spaces—such as co-creation labs or innovation forums—where these cultural differences can be negotiated and harnessed for collective problem-solving. The model thus contributes to humanizing the Triple Helix framework by recognizing that collaboration requires not only structural alignment but also emotional intelligence, mutual respect, and adaptive communication.

A significant contribution of this research is its recognition of MSMEs not merely as peripheral participants but as essential actors within the entrepreneurial ecosystem. Traditional innovation models often privilege high-tech industries or research-intensive sectors, overlooking the fact that in Indonesia, the economic backbone consists of small and medium enterprises. The model proposed in this study ensures that MSMEs benefit from collaborative innovation, particularly through resource sharing, technology adoption support, and digitally mediated knowledge transfer. By grounding innovation in the realities of MSME development, the Triple Helix Synergy Model aligns more closely with Indonesia's socio-economic fabric and increases the likelihood that innovation will create broad-based developmental impact.

The theoretical contribution of the study lies in its advancement of the Triple Helix framework from a descriptive model to an actionable one tailored for developing countries. In its original formulation, the Triple Helix highlights the importance of university–industry–government interactions but offers limited operational guidance. This research extends the framework by specifying the mechanisms through which these interactions can be strengthened, particularly in contexts where institutional boundaries are rigid, and collaboration is not naturally occurring. The integration of digital collaboration as a core component of the model represents another theoretical innovation, acknowledging the growing importance of virtual networks in shaping contemporary innovation processes. In doing so, the model builds a bridge between classic innovation theory and the realities of the digital age.

From a practical standpoint, the model offers a strategic blueprint for policymakers, university leaders, and industry practitioners. For policymakers, the model underscores the importance of harmonizing regulations, designing integrated programs, and supporting collaborative platforms that align national and regional innovation agendas. For universities, the model highlights the need to strengthen applied research, expand industry partnerships, and reform incentive structures to reward commercialization and

community-engaged scholarship. For industry actors, the model illustrates the value of engaging in long-term collaborative projects, investing in absorptive capacity, and participating in co-creation processes that enhance competitiveness. These practical implications ensure that the study's contributions extend beyond academic discourse to inform policy design and institutional decision-making.

Reflecting on the study as a whole, it becomes clear that the development of Indonesia's entrepreneurial ecosystem depends on the collective willingness of institutions to rethink their roles, embrace collaboration, and invest in long-term innovation capacity. The Triple Helix Synergy Model is not a prescriptive formula but a guiding framework that encourages each actor to engage with the ecosystem as an interdependent partner. It calls for a mindset shift—from working in isolation to working in synergy, from short-term programmatic success to long-term ecosystem evolution, and from institutional protectionism to collaborative openness. Such a shift cannot occur overnight; it requires iterative experimentation, sustained dialogue, and adaptive governance. Yet, the conceptual foundation laid in this study provides a clear and actionable pathway for initiating this transformation.

This conclusion also acknowledges the model's limitations. As a conceptual framework, it provides a theoretical basis for understanding and guiding ecosystem collaboration, but empirical validation remains necessary. Future research should test the model through case studies, pilot projects, or quantitative analyses that examine its applicability in different regional contexts. Research could also explore how emerging technologies—such as artificial intelligence, big data, and blockchain—may further strengthen or complicate Triple Helix collaboration. These extensions would enrich the model and enhance its relevance in an increasingly digital and interconnected world.

In sum, this study contributes to both theory and practice by offering a comprehensive model that addresses the fragmentation of Indonesia's entrepreneurial ecosystem and proposes a structured, human-centered approach to collaboration. The Triple Helix Synergy Model emphasizes institutional alignment, co-creation, digital integration, and long-term governance—components that are essential for transforming Indonesia into an innovation-driven economy. As Indonesia moves toward a new era of economic development characterized by digital transformation, global competition, and societal complexity, the ability to harness the collective intelligence of government, academia, and industry will be decisive. The model presented in this study serves as both a conceptual anchor and a strategic compass, guiding the country toward a more integrated, resilient, and future-ready entrepreneurial ecosystem.

Implications

The findings and conceptual model presented in this study offer several important implications for theory, policy, institutional practice, and future ecosystem development. These implications emerge not only from the synthesis of literature but also from the contextual interpretation of Indonesia's evolving innovation landscape. By articulating clear theoretical and practical contributions, the study positions the Triple Helix Synergy Model as a relevant framework for scholars examining innovation systems in developing economies, as well as for policymakers and practitioners seeking to strengthen collaborative governance and entrepreneurial capacity.

From a theoretical standpoint, the study contributes meaningfully to the advancement of Triple Helix theory. The original formulation of the Triple Helix framework emphasizes the dynamic interactions among government, academia, and industry, but it often leaves unclear how these actors should collaborate in contexts where institutional boundaries are rigid and incentives are misaligned. By identifying the structural, cultural, and operational barriers that hinder collaboration in Indonesia, this study provides a more grounded interpretation of how these interactions unfold in developing economies. It argues that the Triple Helix cannot be understood merely as a set of interacting institutions; rather, it must be reconceptualized as an adaptive system that requires explicit mechanisms for coordination, co-creation, and digital integration. This reframing

shifts the Triple Helix from a descriptive model to a prescriptive one, expanding its utility for both theoretical analysis and practical application.

Another theoretical implication concerns the recognition that innovation ecosystems in developing countries follow different evolutionary trajectories compared to their counterparts in more advanced economies. Whereas Triple Helix theory traditionally assumes the presence of strong institutional infrastructures, robust research capacities, and well-developed industrial sectors, the Indonesian context reveals a more uneven foundation. By integrating MSMEs as central actors in the model, this study broadens the theoretical understanding of innovation ecosystems to include forms of innovation that are incremental, community-driven, or digitally mediated. This extension is essential for countries where large-scale R&D activities may be concentrated in only a handful of institutions, and where grassroots entrepreneurship forms the backbone of economic activity. Hence, the Triple Helix Synergy Model extends existing innovation theory by demonstrating how collaborative frameworks can be adapted to ecosystems characterized by asymmetry, institutional fragmentation, and varying levels of technological readiness.

Furthermore, the incorporation of digital collaboration platforms into the model has theoretical implications that resonate with contemporary discussions on digital transformation. Innovation ecosystems increasingly operate through virtual networks that transcend physical and institutional boundaries. By placing digital platforms at the heart of collaborative mechanisms, this study positions technological infrastructure not merely as a supporting tool but as an essential enabler of modern collaboration. This theoretical refinement aligns the Triple Helix framework with emerging scholarship on digital ecosystems, open innovation, and distributed knowledge networks. It suggests that future theoretical work on innovation systems must consider how digitalization reshapes not only business processes but also institutional relationships and governance structures.

In addition to its theoretical contributions, the study offers several practical implications for policymakers, university leaders, industry actors, and intermediaries across Indonesia. For policymakers, the Triple Helix Synergy Model provides clear guidance on designing and harmonizing innovation policies. The emphasis on regulatory alignment underscores the need for greater coherence among ministries, agencies, and regional governments. This includes reducing overlapping mandates, streamlining administrative procedures, and adopting evidence-based policy frameworks that integrate input from universities and industries. Policymakers can also draw from the model to develop long-term innovation strategies that transcend political cycles, ensuring continuity and sustained impact. Moreover, the model encourages governments to invest in digital infrastructure that facilitates transparent communication, data sharing, and cross-sector collaboration—critical elements for achieving inclusive and scalable innovation outcomes.

For universities, the practical implications relate to the need to reimagine their roles within the entrepreneurial ecosystem. Universities must move beyond traditional academic functions and embrace their identities as entrepreneurial institutions. This requires strengthening applied research, investing in technology transfer offices, enhancing interdisciplinary collaboration, and establishing partnerships with industry. The model highlights the importance of designing incentive structures that reward faculty participation in industry engagement, co-creation activities, and commercialization efforts. By aligning academic performance indicators with entrepreneurial outcomes, universities can create environments that encourage innovation while preserving the integrity of scholarly work. The model also underscores the importance of involving students in collaborative projects, internships, and problem-solving activities that foster practical skills and entrepreneurial mindsets.

For industry actors, particularly MSMEs, the model provides a roadmap for engaging more meaningfully with universities and government institutions. Industries can leverage joint R&D opportunities, participate in innovation co-creation, and access technical expertise that improves productivity and competitiveness. The study highlights that collaboration is not only beneficial for large enterprises but also critical for MSMEs that

often lack the resources to innovate independently. By adopting digital tools and participating in shared resource platforms, MSMEs can reduce technological barriers, enter new markets, and benefit from ecosystem-wide knowledge flows. Furthermore, the model identifies the need for industry associations to act as intermediaries, connecting businesses with academic researchers and policymakers to ensure that innovation strategies align with market realities.

Another practical implication concerns the role of intermediary institutions such as incubators, accelerators, research centers, and industry associations. These institutions can use the Triple Helix Synergy Model to design programs that foster collaboration, support technology adoption, and create opportunities for cross-sector networking. Intermediaries can facilitate knowledge exchange, broker partnerships, provide mentorship, and support early-stage ventures through funding and capacity-building initiatives. By adopting the collaborative mechanisms outlined in the model, intermediaries can play a pivotal role in translating abstract innovation policies into concrete activities that engage diverse ecosystem actors.

The study's implications also extend to regional development initiatives. Given Indonesia's diverse regional profiles, the model highlights the importance of tailoring collaborative strategies to local contexts. Regions with strong universities and industrial clusters can focus on advanced R&D collaborations, whereas regions with limited capacity may prioritize digital literacy, MSME modernization, and capacity-building programs. Policymakers and regional leaders can use the model to design place-based innovation strategies that reflect local needs and opportunities. This approach ensures that innovation-driven development does not become concentrated in a few advanced regions but distributed more equitably across the country.

A broader practical implication of this study is the need to cultivate a culture of collaboration that transcends institutional silos. Innovation is inherently relational, shaped by trust, communication, and shared purpose. The model's emphasis on co-creation and resource sharing highlights the importance of building interpersonal and interinstitutional relationships that support collective learning. Institutions must invest not only in technology but also in the human and social dimensions of collaboration—dialogue, empathy, negotiation, and mutual accountability. These cultural shifts require leadership commitment and long-term engagement but are essential for creating a resilient and adaptive ecosystem.

In summary, the implications of this study are wide-ranging and multifaceted, reflecting the complexity of Indonesia's entrepreneurial ecosystem. The Triple Helix Synergy Model offers a theoretical advancement by contextualizing collaboration in a developing-country setting and integrating digitalization into the heart of innovation governance. Practically, the model provides a blueprint for policymakers, universities, industries, and intermediaries to strengthen institutional alignment, build collaborative capacity, and foster inclusive innovation. By embracing these implications, Indonesia can move closer to realizing its vision of a dynamic, knowledge-based, and globally competitive economy.

Limitations And Future Research

Although this study provides a comprehensive conceptual examination of the Triple Helix dynamics within Indonesia's entrepreneurial ecosystem and proposes an integrative synergy model, it inevitably carries several limitations that should be acknowledged. Recognizing these limitations is important not only for maintaining academic transparency, but also for guiding subsequent researchers in refining, expanding, and empirically validating the proposed framework. These limitations are not weaknesses in isolation; rather, they reflect the inherent complexity of studying innovation systems in developing economies where institutional, cultural, and structural conditions vary widely across regions and sectors.

The first limitation relates to the conceptual nature of the study, which relies on secondary data, scholarly literature, and policy documents rather than primary empirical evidence. Conceptual research offers the advantage of synthesizing diverse theoretical

perspectives and integrating insights across domains, but it lacks the grounded specificity that empirical studies can provide. In the context of Indonesia's diverse entrepreneurial landscape, the absence of field-level validation means that the model, while theoretically sound, has not yet been subjected to practical testing within real-world organizational settings. As such, the applicability and operational feasibility of the Triple Helix Synergy Model would benefit from empirical evaluation across different regions, industries, and institutional contexts. Future research should incorporate empirical methodologies—such as case studies, surveys, ethnographic observations, or mixed-method designs—to test the model's assumptions, identify contextual nuances, and evaluate its effectiveness in varied conditions.

A second limitation concerns the study's reliance on literature published predominantly in developed countries, which may reflect contextual biases. While the research includes a substantial number of studies from Asia and Southeast Asia, much of the foundational Triple Helix literature originates from high-income countries with strong innovation infrastructures, mature research ecosystems, and advanced industrial capabilities. These contexts differ significantly from Indonesia's institutional landscape, where governance structures are more fragmented, industry–university engagement remains limited, and MSMEs dominate the economic structure. Consequently, some theoretical assumptions embedded in the literature may not fully capture the lived realities of Indonesian ecosystem actors. Future research can address this limitation by collecting local narratives from policymakers, academics, entrepreneurs, and community-based innovators to enrich the framework with grounded insights rooted in Indonesian socio-cultural and institutional contexts.

The third limitation relates to the heterogeneity of Indonesia's regions, which poses challenges for constructing a single, unified conceptual model. Indonesia is not a monolithic entity; rather, it is characterized by vast disparities in technological readiness, human capital, infrastructure, and economic structures. Java and Bali, for example, possess dense innovation networks and high digital adoption, while many regions in eastern Indonesia struggle with basic connectivity and institutional capacity. Although the proposed model is designed to be adaptable, the conceptual analysis may not fully capture the granular variations that shape collaboration patterns in different provinces. Future research should therefore adopt a more localized lens, examining how the Triple Helix Synergy Model can be tailored to the specific characteristics of urban innovation hubs, rural entrepreneurship clusters, maritime provinces, or frontier regions. Comparative case studies across regions would provide deeper insights into how local culture, leadership, and socio-economic conditions shape the effectiveness of collaborative mechanisms.

A fourth limitation involves the dynamic nature of digital transformation, which is both an enabler and a moving target within innovation ecosystems. While the study emphasizes digital collaboration platforms as a central mechanism in the synergy model, technological advancements occur rapidly, and digital infrastructures can become outdated or insufficient if not continuously updated. The conceptual model assumes a certain baseline of digital literacy, infrastructure, and institutional capability, which may not be consistent across Indonesia. As digital tools evolve—including AI-enabled innovation platforms, blockchain-based governance tools, or advanced data analytics systems—the model may require periodic updating to remain relevant. Future research can explore how emerging technologies reshape collaboration patterns, enhance resource-sharing mechanisms, and facilitate cross-sector innovation. Studies on digital platform governance, cybersecurity, and data sovereignty may also offer valuable extensions to the model.

A fifth limitation lies in the lack of quantitative measurement tools embedded within the conceptual framework. While the model articulates key components and mechanisms, it does not develop specific indicators, metrics, or evaluation tools for measuring the strength of collaboration or the performance of the ecosystem. Without operational metrics, policymakers and institutions may find it challenging to assess progress or

diagnose weaknesses. Future studies should therefore focus on developing quantitative models or measurement instruments—such as composite indices, maturity frameworks, or collaboration-readiness metrics—that operationalize the components of the synergy model. These tools would enable systematic evaluation, benchmarking across regions, and data-driven policymaking.

Furthermore, the model does not explicitly incorporate the roles of actors beyond the traditional Triple Helix—such as civil society, community organizations, media, informal networks, or environmental stakeholders. While this omission is intentional to maintain the model's focus, it represents another limitation. Modern innovation theories increasingly highlight the relevance of the Quadruple and Quintuple Helix frameworks, which incorporate societal and environmental dimensions. In the Indonesian context, civil society organizations, community leaders, cultural institutions, and local innovators often play critical roles in mobilizing participation, fostering trust, and shaping cultural attitudes toward entrepreneurship. Similarly, environmental sustainability is becoming an integral aspect of innovation agendas, particularly in areas such as renewable energy, agriculture, and marine ecosystems. Future research should explore how these additional helixes can be integrated into the synergy model without diluting its conceptual clarity. A hybrid or layered model that situates the Triple Helix at the core while incorporating additional helixes in outer layers may offer a promising direction.

Another limitation arises from the potential influence of political cycles and institutional volatility, which are typical characteristics of developing-country governance systems. Although the model advocates for long-term governance mechanisms, political turnover and shifting administrative priorities can disrupt collaborative initiatives, alter regulatory landscapes, or deprioritize innovation agendas. This limitation highlights the need for future research to investigate strategies for insulating innovation ecosystems from political instability. For example, studies could examine the role of independent innovation councils, public–private governance boards, or legally mandated innovation strategies that maintain continuity regardless of political shifts. Understanding how institutional resilience can be built into Triple Helix governance structures would significantly enhance the model's long-term applicability.

In addition to the limitations previously discussed, this study also acknowledges two critical contextual risks that may affect the implementation and long-term feasibility of the proposed Triple Helix Synergy Model: institutional inertia and political change dynamics. First, institutional inertia—characterized by rigid administrative routines, entrenched bureaucratic culture, and resistance to organizational transformation—poses a significant barrier to ecosystem-wide collaboration. Government agencies, universities, and industries often operate with deeply embedded norms and legacy systems that make it difficult to adopt new collaborative mechanisms, even when the conceptual model is well-designed. Such inertia can slow down decision-making processes, reduce responsiveness, and inhibit the alignment of cross-sector agendas. Second, the effectiveness of Triple Helix collaboration is vulnerable to political transitions and policy discontinuities, particularly in decentralized governance systems like Indonesia's. Changes in political leadership at national or regional levels may result in shifting priorities, reorientation of innovation programs, or budget reallocations that disrupt ongoing collaborative initiatives. These political fluctuations can undermine long-term stability, weaken institutional trust, and create uncertainty among ecosystem actors. Future studies should therefore examine strategies for mitigating institutional inertia and designing governance structures that remain resilient amid political transitions, ensuring that collaborative innovation frameworks maintain continuity and relevance over time.

The study's conceptual orientation also means that sector-specific dynamics are not explored in detail. Different sectors—such as digital technology, agriculture, healthcare, manufacturing, and creative industries—rely on distinct innovation pathways and face unique collaborative challenges. A one-size-fits-all approach, even when conceptually robust, cannot capture the deep variability of sectoral innovation landscapes. Future research should therefore examine how the Triple Helix Synergy Model plays out in

specific sectors, identifying which mechanisms work well in certain contexts and which require modification. Sector-focused studies would allow researchers to develop more nuanced models of collaboration, particularly in sectors where Indonesia possesses strategic economic potential.

Finally, the study acknowledges that conceptual frameworks, no matter how comprehensive, cannot fully account for the human dimensions of collaboration—such as personal leadership, informal networks, emotional intelligence, or interpersonal trust. These intangible factors often influence whether a collaborative initiative succeeds or fails. While the model incorporates trust-building implicitly through co-creation and resource-sharing mechanisms, future research should explore these relational dynamics more explicitly. Studies examining the role of leadership styles, cross-institutional champions, or interpersonal networks could enrich the understanding of how collaboration emerges and is sustained at the human level.

In light of these limitations, several avenues for future research emerge. First, empirical validation of the Triple Helix Synergy Model is essential. Researchers could conduct qualitative case studies in regions implementing collaborative innovation initiatives, examining how the mechanisms operate in real-world settings. Surveys and quantitative analyses could also be used to test the relationships among the model's components and assess ecosystem performance. Second, future research should explore the integration of additional helixes—societal and environmental—into the model to reflect Indonesia's cultural richness and sustainability priorities. Third, researchers should investigate sector-specific adaptations of the model to develop tailored frameworks for agriculture, digital industries, healthcare, and other key sectors. Fourth, studies on the governance of digital collaboration platforms, including issues of access, literacy, data stewardship, and inclusivity, would provide valuable insights for enhancing the model. Finally, scholars should examine the relational dimensions of collaboration, focusing on leadership, trust, and informal networks as catalysts for ecosystem evolution.

Ultimately, the limitations identified in this study offer fertile ground for advancing scholarly inquiry and refining the framework proposed. The Triple Helix Synergy Model serves as a foundation upon which future empirical, theoretical, and sectoral research can build. By embracing these limitations as opportunities, researchers can contribute to a deeper and more contextualized understanding of how innovation ecosystems evolve in developing economies, ensuring that collaboration becomes not merely a theoretical aspiration but a practical, sustainable reality.

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