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Digital Innovation Ecosystems and Sustainable Economic Development

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ABSTRACT

The rapid expansion of digital technologies has accelerated the development of digital innovation ecosystems that increasingly influence sustainable economic transformation within contemporary digital economies. Digital innovation ecosystems facilitate collaborative innovation, ecosystem integration, technological coordination, and knowledge exchange among interconnected actors operating within digitally mediated environments. The findings indicate that digital innovation ecosystems contribute positively to sustainable economic development by strengthening innovation capability, collaborative integration, digital competitiveness, and ecosystem resilience. In addition, ecosystem-based innovation supports sustainable entrepreneurship, technological modernization, and long-term economic transformation through coordinated innovation systems and collaborative value creation. However, the review also identifies significant governance and ecosystem challenges affecting innovation sustainability, including weak coordination mechanisms, unequal digital capability, fragmented institutional integration, and ecosystem readiness disparities.

Keywords: *Collaborative Innovation, Digital Innovation Ecosystems, Ecosystem Governance, Sustainable Development, Technological Capability.*

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1. | INTRODUCTION

The expansion of digital technologies has accelerated the emergence of innovation ecosystems that increasingly shape contemporary economic development and technological modernization within digital economies. Digital innovation ecosystems consist of interconnected networks involving firms, governments, institutions, technology providers, and collaborative actors that collectively generate innovation, technological integration, and economic value creation. Wang (2021) emphasizes that digital innovation ecosystems should be understood as integrated information ecologies in which technological interactions, knowledge exchange, and ecosystem coordination continuously influence innovation outcomes. Similarly, Chae (2019) argues that digital innovation ecosystems evolve through interconnected technological systems and collaborative innovation processes that support digital economic transformation. These developments indicate that economic modernization is increasingly driven by ecosystem-based innovation structures rather than isolated organizational activities. Consequently, digital innovation ecosystems have become central components of sustainable economic development within contemporary digital economies.

The growing importance of digital innovation ecosystems has also intensified discussions regarding their role in promoting sustainable economic development and long-term societal transformation. Innovation ecosystems facilitate technological collaboration, knowledge sharing, and coordinated innovation activities that contribute to productivity improvement, digital competitiveness, and sustainable development initiatives. Nylund et al. (2021) emphasize that innovation ecosystems play an important role in achieving sustainable development goals through collaborative innovation and ecosystem integration. Similarly, George et al. (2021) highlight that digital innovation increasingly contributes to sustainable entrepreneurship and broader socio-economic development through technology-driven solutions and digital sustainability initiatives. In addition, Xu et al. (2022) identify digital capability and innovation orientation as important drivers of social and environmental value creation within digital economies. These findings demonstrate that digital innovation ecosystems influence not only economic performance but also sustainability-oriented transformation processes. As a result, ecosystem-based innovation has become increasingly associated with sustainable economic modernization and long-term developmental resilience.

The literature further demonstrates that collaborative innovation and ecosystem integration are essential components supporting the effectiveness of digital innovation ecosystems. Open innovation systems enable organizations and institutions to exchange knowledge, coordinate technological development, and co-create value within interconnected digital environments. Costa and Matias (2020) argue that open innovation enhances sustainable innovation ecosystems by strengthening collaboration and technological integration across multiple actors. Similarly, Suseno et al. (2018) emphasize that value creation within digital innovation ecosystems depends heavily on

collaborative interaction and ecosystem coordination mechanisms. In addition, Abbate et al. (2022) highlight that digital platforms and open innovation systems increasingly support capability development and value co-creation within knowledge ecosystems. These findings indicate that innovation capability within digital economies is increasingly generated through collaborative ecosystem structures rather than isolated innovation activities. Consequently, ecosystem collaboration has become a major factor influencing innovation sustainability and economic development outcomes.

Despite the opportunities associated with digital innovation ecosystems, recent literature also identifies significant governance and coordination challenges affecting ecosystem sustainability and effectiveness. Digital innovation ecosystems involve complex interactions among diverse actors with different institutional objectives, technological capabilities, and strategic interests. Schreieck et al. (2022) emphasize that ecosystem transformation requires governance mechanisms capable of coordinating institutional adaptation and ecosystem integration within evolving digital environments. Similarly, Hoffmann et al. (2022) argue that governance capability significantly influences the effectiveness of innovation ecosystem coordination and collaborative innovation processes. In addition, Gill and Germann (2022) highlight the increasing importance of governance frameworks capable of supporting ethical and sustainable digital ecosystems within global development contexts. These findings indicate that governance coordination plays a critical role in determining ecosystem sustainability and innovation effectiveness. Therefore, governance capability becomes increasingly important within digital innovation ecosystem development.

Another important issue identified in recent literature concerns the unequal distribution of digital capability and ecosystem readiness across regions, institutions, and economic actors. Innovation ecosystems with stronger technological infrastructure, knowledge capability, and institutional coordination are generally more capable of generating sustainable innovation outcomes than ecosystems characterized by limited digital capability and weak collaborative structures. Mahmood and Miah (2022) emphasize that strategic technology adoption significantly influences innovation-driven economic growth within digital economies. Similarly, Sturgeon (2021) argues that upgrading strategies and capability development strongly affect participation within digitally driven economic systems. In many contexts, unequal ecosystem readiness creates disparities in innovation performance, technological participation, and sustainable economic development outcomes. These findings demonstrate that digital innovation ecosystems may simultaneously accelerate economic modernization while reinforcing unequal development patterns across digital economies. Consequently, ecosystem capability and innovation readiness become important determinants of sustainable digital economic transformation.

Although research on digital innovation ecosystems has expanded rapidly in recent years, existing studies often examine innovation capability, ecosystem governance, sustainability, or collaborative innovation separately rather than synthesizing these

dimensions within a broader sustainable development perspective. Many studies focus on technological innovation and ecosystem growth while giving less attention to the interconnected relationship between governance coordination, collaborative capability, ecosystem inequality, and sustainable economic outcomes. This creates fragmented understanding regarding how digital innovation ecosystems simultaneously generate opportunities for economic modernization while producing governance and capability challenges within digital economies. Consequently, there remains a need for a more integrated synthesis of the literature examining the relationship between innovation ecosystems, governance coordination, collaborative innovation, and sustainable economic development. Addressing this gap is important for understanding how ecosystem-based innovation shapes long-term digital economic transformation within contemporary economies.

Based on these considerations, this study aims to systematically review the literature on digital innovation ecosystems and sustainable economic development using a qualitative Systematic Literature Review (SLR) approach. The study focuses on analyzing how digital innovation ecosystems influence technological collaboration, ecosystem capability, innovation performance, and sustainable economic transformation within digital economies. In addition, the review examines governance and ecosystem challenges associated with collaborative innovation systems, including ecosystem coordination, unequal capability, institutional readiness, and sustainability-oriented governance adaptation. Snyder (2019) emphasizes that systematic literature reviews enable researchers to identify conceptual relationships and broader research trends within complex academic domains. Furthermore, Page et al. (2021) highlight that PRISMA-based methodologies improve transparency and rigor in evidence synthesis. Through thematic synthesis, this study seeks to provide a more comprehensive understanding of how digital innovation ecosystems contribute to sustainable economic development within the contemporary digital era.

2. | LITERATURE REVIEW

Digital Innovation Ecosystems

Digital innovation ecosystems have emerged as an important framework for understanding how interconnected actors collectively generate technological innovation and economic value within digital economies. Innovation ecosystems involve dynamic interactions among organizations, institutions, governments, technology providers, and collaborative networks that contribute to technological development and ecosystem sustainability. Wang (2021) emphasizes that digital innovation ecosystems function as integrated information ecologies in which technological coordination, knowledge exchange, and ecosystem relationships shape innovation capability and development outcomes. Similarly, Chae (2019) argues that digital innovation ecosystems evolve through interconnected technological systems and adaptive innovation processes capable of supporting economic transformation within digital environments. These findings demonstrate that innovation increasingly occurs

within collaborative ecosystem structures rather than isolated organizational systems. Consequently, digital innovation ecosystems have become increasingly influential within contemporary economic modernization processes.

The literature further demonstrates that digital innovation ecosystems contribute to economic transformation by facilitating ecosystem integration, digital connectivity, and technological collaboration across multiple sectors and institutional actors. Karpunina et al. (2019) emphasize that digital economies increasingly operate through ecosystem-oriented structures that integrate technological systems, innovation capability, and collaborative coordination mechanisms. Similarly, Mahmood and Miah (2022) highlight that data-driven innovation ecosystems support economic growth by accelerating strategic technology adoption and innovation capability development. These developments indicate that ecosystem-based innovation contributes significantly to economic modernization and digital competitiveness within contemporary economies. However, the literature also suggests that ecosystem effectiveness depends heavily on institutional coordination, technological capability, and collaborative readiness across ecosystem participants. Therefore, digital innovation ecosystems should be understood as capability-dependent systems requiring coordinated ecosystem integration and governance support.

Open Innovation and Collaborative Ecosystems

The effectiveness of digital innovation ecosystems is strongly associated with collaborative innovation and open innovation systems that facilitate knowledge sharing, technological integration, and ecosystem coordination. Open innovation approaches allow organizations and institutions to collaborate across traditional boundaries in order to accelerate innovation development and value creation within digital economies. Costa and Matias (2020) emphasize that open innovation strengthens sustainable innovation ecosystems by improving technological collaboration and ecosystem integration among multiple actors. Similarly, Fasnacht (2018) argues that open innovation ecosystems create new value constellations through collaborative interaction and coordinated innovation capability. These findings indicate that innovation sustainability increasingly depends on collaborative ecosystem structures rather than isolated innovation activities. As a result, ecosystem collaboration has become a critical factor influencing innovation effectiveness within digitally mediated economies.

The literature further demonstrates that collaborative innovation contributes to ecosystem sustainability through value co-creation and knowledge integration across interconnected actors. Suseno et al. (2018) highlight that value creation within digital innovation ecosystems is shaped by collaborative interactions and coordinated innovation processes within digital environments. Similarly, Abbate et al. (2022) emphasize that digital platforms and knowledge ecosystems increasingly support capability development and collaborative value co-creation through open innovation systems. In addition, Nebojša (2021) identifies collaborative innovation as an important mechanism supporting innovation capability development within emerging innovation

systems. These findings suggest that innovation ecosystems depend heavily on knowledge exchange, ecosystem learning, and collaborative capability development. Consequently, open innovation systems play a central role in supporting sustainable innovation ecosystems within digital economies.

Sustainable Development and Digital Sustainability

Digital innovation ecosystems increasingly influence sustainable economic development through technological modernization, innovation capability enhancement, and sustainability-oriented transformation initiatives. Innovation ecosystems contribute to sustainable development by supporting economic resilience, environmental innovation, and socially oriented technological solutions within digital economies. Nylund et al. (2021) emphasize that innovation ecosystems support sustainable development goals through collaborative technological integration and ecosystem-level innovation capability. Similarly, George et al. (2021) highlight that digital innovation contributes to sustainable entrepreneurship and climate-related solutions through technology-driven sustainability initiatives. These findings indicate that digital innovation ecosystems influence broader socio-economic transformation processes beyond economic productivity and technological efficiency alone. Consequently, sustainability has become an increasingly important dimension of digital innovation ecosystem development.

The literature also demonstrates that digital capability and innovation orientation significantly influence sustainability outcomes within digital ecosystems. Xu et al. (2022) argue that digital sustainable entrepreneurship depends heavily on digital capability and innovation orientation capable of generating social and environmental value creation. Similarly, Yousaf et al. (2021) identify the importance of sustainable digital innovation for SMEs operating within developing digital economies and resource-constrained environments. In addition, Xiao et al. (2022) emphasize that innovation-driven strategies contribute positively to high-quality economic development and long-term economic modernization. These findings suggest that sustainable digital transformation requires integrated approaches combining innovation capability, ecosystem coordination, and sustainability-oriented development strategies. Therefore, digital sustainability increasingly depends on ecosystem-level capability development and coordinated innovation systems.

Ecosystem Governance and Coordination

Governance coordination represents one of the most important determinants of digital innovation ecosystem sustainability and effectiveness. Innovation ecosystems involve complex relationships among multiple actors with different institutional roles, technological capabilities, and strategic objectives. Schreieck et al. (2022) emphasize that ecosystem transformation requires governance mechanisms capable of coordinating institutional adaptation and ecosystem integration within digital environments. Similarly, Hoffmann et al. (2022) argue that governance structures

significantly influence collaborative innovation processes and ecosystem sustainability within innovation systems. These findings demonstrate that ecosystem governance extends beyond organizational management and involves broader coordination mechanisms supporting innovation integration and ecosystem resilience. Consequently, governance capability has become increasingly important within digital innovation ecosystems.

The literature further highlights the growing importance of governance adaptation in supporting sustainable and ethically coordinated digital ecosystems. Gill and Germann (2022) emphasize that governance frameworks play a major role in supporting digital ecosystems aligned with sustainable development objectives and ethical technological practices. Similarly, Linde et al. (2021) identify ecosystem orchestration capability as an essential factor influencing innovation coordination and ecosystem performance within smart innovation initiatives. These findings suggest that governance coordination supports ecosystem adaptability, technological integration, and long-term sustainability within collaborative innovation systems. However, governance challenges frequently emerge because ecosystem participants possess different institutional capacities, technological resources, and strategic interests. Therefore, effective governance coordination becomes necessary for maintaining sustainable ecosystem integration and collaborative innovation effectiveness within digital economies.

Ecosystem Challenges and Unequal Capability

Despite the opportunities associated with digital innovation ecosystems, the literature consistently identifies significant ecosystem capability disparities and unequal development challenges within digital economies. Innovation ecosystems with stronger technological infrastructure, institutional coordination, and knowledge capability are generally more capable of generating sustainable innovation outcomes than ecosystems characterized by limited capability and weak collaborative integration. Sturgeon (2021) argues that upgrading strategies and capability development strongly influence participation within digitally driven economic systems. Similarly, Mahmood and Miah (2022) emphasize that strategic technology adoption significantly affects innovation-driven economic growth and ecosystem competitiveness. These findings indicate that innovation capability disparities influence economic modernization and sustainable development outcomes across digital economies.

Another important issue identified in the literature concerns the uneven distribution of ecosystem readiness and collaborative innovation capability across regions and institutional environments. Nefedov et al. (2018) emphasize that knowledge representation and technological integration increasingly shape participation within digital economies and innovation ecosystems. In many contexts, ecosystems with limited technological infrastructure and weak institutional coordination experience difficulties in achieving sustainable innovation capability and ecosystem resilience.

These conditions may reinforce unequal development patterns and innovation disparities within digitally mediated economic systems. Consequently, ecosystem sustainability depends heavily on governance coordination, collaborative capability, and equitable access to technological resources and innovation opportunities. Therefore, understanding ecosystem capability disparities remains essential for analyzing sustainable digital economic development within contemporary innovation ecosystems.

3. | RESEARCH METHOD

This study employs a qualitative Systematic Literature Review (SLR) approach to examine the relationship between digital innovation ecosystems and sustainable economic development within contemporary digital economies. A systematic literature review enables researchers to synthesize existing academic literature in a structured and transparent manner while identifying conceptual relationships, theoretical developments, and broader research trends across complex interdisciplinary domains. Snyder (2019) emphasizes that literature reviews play an important role in generating conceptual understanding and identifying research gaps within emerging academic fields. Similarly, Linnenluecke et al. (2020) highlight that systematic review methodologies improve analytical rigor and reliability through transparent synthesis procedures and structured evidence evaluation. Through this approach, the study seeks to provide a comprehensive understanding of how digital innovation ecosystems influence technological collaboration, ecosystem capability, governance coordination, and sustainable economic transformation within digital economies. Consequently, the review focuses not only on innovation opportunities but also on the governance and ecosystem challenges affecting sustainable development outcomes.

The literature review process follows the PRISMA 2020 framework to ensure transparency, consistency, and methodological rigor throughout the identification and selection of academic sources. Page et al. (2021) emphasize that PRISMA guidelines improve systematic review quality through structured procedures involving identification, screening, eligibility assessment, and inclusion stages. Academic literature was collected from major scholarly databases, including Scopus, Google Scholar, ScienceDirect, Springer, Emerald, and Taylor & Francis. The search process utilized combinations of keywords related to digital innovation ecosystems, open innovation, ecosystem governance, collaborative innovation, digital sustainability, innovation capability, and sustainable economic development. Inclusion criteria focused on peer-reviewed journal articles, scholarly books, conference papers, and institutional publications published between 2018 and 2024 that directly addressed digital innovation ecosystems and sustainability-oriented economic transformation. Studies focusing exclusively on highly technical engineering systems without broader ecosystem or development relevance were excluded from the analysis. This process

ensured that the selected literature remained aligned with the objectives and analytical direction of the study.

Following the literature selection process, the identified studies were analyzed using a qualitative thematic synthesis approach to identify recurring themes, conceptual patterns, and broader relationships within digital innovation ecosystem research. Thematic synthesis enables researchers to compare findings across studies while generating broader analytical interpretations regarding complex socio-economic and innovation phenomena. The selected literature was categorized into several thematic areas, including digital innovation ecosystems, collaborative innovation, ecosystem governance, digital sustainability, innovation capability, ecosystem coordination, and unequal ecosystem readiness. This classification process enabled the study to examine how ecosystem-based innovation influences sustainable economic development within digitally mediated economic systems. In addition, thematic synthesis facilitated the identification of recurring governance and capability challenges associated with innovation ecosystems, including coordination complexity, institutional capability gaps, unequal technological access, and ecosystem sustainability barriers. Consequently, the study provides an integrated conceptual synthesis rather than isolated summaries of individual studies.

The analytical process further emphasizes the relationship between ecosystem capability, collaborative innovation, and governance coordination within sustainable digital economic development. The reviewed studies were examined not only for their discussion of technological innovation and ecosystem growth but also for their analysis of institutional adaptation, collaborative capability, and sustainable innovation coordination. This approach enabled the study to analyze both the opportunities and structural limitations associated with ecosystem-based innovation systems. Furthermore, the analysis focused on how ecosystem integration and collaborative innovation contribute to economic modernization, innovation resilience, and sustainability-oriented development within digital economies. By integrating these dimensions, the study seeks to provide a balanced understanding of how digital innovation ecosystems simultaneously generate opportunities for sustainable development while producing governance and capability challenges. Therefore, the qualitative SLR approach enables the study to generate broader insights regarding the ecosystem-dependent and governance-oriented nature of sustainable digital economic transformation within contemporary digital economies.

4. | RESULTS

The reviewed literature demonstrates that digital innovation ecosystems have become increasingly important in supporting sustainable economic development within contemporary digital economies. Innovation ecosystems facilitate interconnected technological collaboration among organizations, governments, institutions, and digital actors through integrated innovation networks and ecosystem coordination mechanisms. These collaborative structures accelerate technological modernization by

improving innovation capability, knowledge exchange, and digital connectivity across economic sectors. The literature consistently identifies ecosystem-based innovation as a major contributor to economic transformation and digital competitiveness within evolving economic environments. In addition, innovation ecosystems support the development of adaptive and sustainability-oriented economic systems capable of responding to technological disruption and changing market conditions. Consequently, digital innovation ecosystems increasingly function as strategic infrastructures supporting long-term economic modernization and sustainable development.

The findings further indicate that collaborative innovation plays a central role in determining the effectiveness and sustainability of digital innovation ecosystems. Open innovation systems and ecosystem integration mechanisms enable organizations and institutions to exchange knowledge, coordinate technological development, and co-create innovation value within digitally mediated environments. The reviewed studies demonstrate that ecosystem collaboration strengthens innovation capability by combining technological resources, institutional expertise, and coordinated innovation activities across multiple actors. In addition, collaborative ecosystems improve the capacity of innovation systems to generate sustainable technological solutions and adaptive economic strategies within digital economies. These findings suggest that innovation sustainability increasingly depends on ecosystem-level collaboration rather than isolated innovation activities conducted independently by individual organizations. As a result, ecosystem integration and collaborative innovation become major determinants of innovation effectiveness within digital economic systems.

The literature also demonstrates that digital innovation ecosystems contribute positively to sustainable economic development by supporting innovation-driven growth, resilience, and long-term competitiveness. Ecosystem-based innovation systems facilitate technological modernization through coordinated innovation capability and digital sustainability initiatives capable of generating economic and social value simultaneously. In many contexts, digital innovation ecosystems contribute to sustainable entrepreneurship, technological upgrading, and innovation-oriented economic transformation. Furthermore, ecosystem integration enables economies to strengthen resilience by improving adaptive capability and supporting continuous innovation within dynamic technological environments. These findings indicate that innovation ecosystems influence not only economic productivity but also broader sustainability-oriented transformation processes within digital economies. Consequently, sustainable development increasingly depends on the ability of innovation ecosystems to maintain coordinated technological adaptation and collaborative capability over time.

Despite these opportunities, the reviewed studies consistently identify governance coordination as a major challenge affecting innovation ecosystem sustainability and effectiveness. Innovation ecosystems involve complex relationships among diverse actors with different institutional objectives, technological capacities, and strategic

interests. In many cases, ecosystem participants require governance mechanisms capable of coordinating technological integration, collaborative innovation, and ecosystem adaptation within rapidly evolving digital environments. The literature further demonstrates that weak governance coordination frequently limits ecosystem integration, reduces collaborative effectiveness, and creates difficulties in sustaining long-term innovation capability. In addition, governance complexity increases as innovation ecosystems expand across sectors, institutional environments, and technological systems. These findings indicate that ecosystem sustainability depends heavily on governance capability and coordinated institutional adaptation within digital economies.

Another important finding identified in the literature concerns the unequal distribution of digital capability and ecosystem readiness across economic environments and institutional systems. Innovation ecosystems characterized by stronger technological infrastructure, digital capability, and collaborative coordination are generally more capable of generating sustainable innovation outcomes than ecosystems with limited capability and weak institutional integration. These disparities significantly influence innovation performance, economic modernization, and long-term sustainability within digital economies. In addition, unequal ecosystem readiness may widen developmental gaps between technologically advanced regions and ecosystems with limited innovation capability. The literature further suggests that ecosystem inequality can reduce participation opportunities and limit the inclusiveness of innovation-driven economic transformation. Consequently, digital innovation ecosystems may simultaneously accelerate economic modernization while reinforcing unequal development patterns within digitally mediated economies.

5. | DISCUSSION

Overall, the reviewed literature demonstrates that digital innovation ecosystems should be understood as collaborative and governance-dependent systems that significantly influence sustainable economic development within digital economies. While ecosystem-based innovation creates substantial opportunities for technological modernization, innovation capability, and sustainability-oriented growth, successful ecosystem outcomes depend heavily on governance coordination, collaborative integration, and ecosystem readiness. The findings indicate that sustainable digital economic transformation requires integrated ecosystem strategies capable of balancing innovation capability, governance adaptation, institutional coordination, and equitable technological participation. In addition, ecosystem resilience increasingly depends on the ability of innovation systems to maintain collaborative capability and adaptive coordination within rapidly evolving technological environments. These findings suggest that sustainable development within digital economies is increasingly determined by ecosystem-level capability and coordinated innovation structures rather than isolated technological adoption alone. Therefore, digital innovation ecosystems

represent both a strategic opportunity and a governance challenge within contemporary digital economic transformation.

6. | CONCLUSION

This study concludes that digital innovation ecosystems have become increasingly important in supporting sustainable economic development within contemporary digital economies. The reviewed literature consistently demonstrates that ecosystem-based innovation contributes to economic modernization through technological collaboration, innovation capability enhancement, ecosystem integration, and coordinated digital transformation processes. Digital innovation ecosystems facilitate knowledge exchange, collaborative innovation, and value co-creation among interconnected actors operating within digitally mediated environments. In addition, ecosystem-based innovation supports long-term competitiveness, adaptive resilience, and sustainability-oriented economic transformation through integrated innovation systems and technological coordination mechanisms. These developments indicate that sustainable economic growth within digital economies increasingly depends on ecosystem-level collaboration and innovation capability rather than isolated technological adoption alone. However, the findings also demonstrate that successful ecosystem outcomes depend heavily on governance coordination, institutional capability, and collaborative readiness across ecosystem participants.

The findings further reveal that governance coordination and ecosystem capability remain major determinants of innovation ecosystem sustainability and effectiveness. Many innovation ecosystems continue to experience significant challenges related to weak institutional coordination, unequal technological capability, fragmented collaboration systems, and limited ecosystem readiness. In addition, disparities in digital infrastructure, innovation resources, and governance capability create uneven participation and unequal development outcomes across digital economies. Ecosystems characterized by stronger collaborative integration and governance adaptation are generally more capable of generating sustainable innovation outcomes than ecosystems with limited coordination capability and weak institutional support. These findings indicate that digital innovation ecosystems may simultaneously accelerate economic modernization while reinforcing unequal innovation capability and development disparities. Consequently, sustainable ecosystem development requires integrated governance approaches capable of balancing innovation expansion, collaborative coordination, and equitable ecosystem participation.

Finally, this study emphasizes that sustainable digital economic transformation requires governance systems and collaborative innovation structures capable of supporting long-term ecosystem resilience and adaptive capability within rapidly evolving digital environments. Policymakers, institutions, and ecosystem actors should prioritize ecosystem coordination, digital capability development, innovation collaboration, and sustainability-oriented governance mechanisms to strengthen inclusive and resilient digital innovation ecosystems. In addition, ecosystem

governance strategies should integrate technological modernization with broader sustainability objectives, institutional adaptability, and equitable participation opportunities within digital economies. Future research may further explore comparative ecosystem governance models, regional innovation disparities, and the long-term socio-economic implications of ecosystem-based innovation systems within emerging digital economies. By synthesizing existing literature, this study contributes to a broader understanding of how digital innovation ecosystems influence sustainable economic development, ecosystem resilience, and collaborative innovation capability within the contemporary digital era.

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Declaration of Conflicting Interests

The authors declare that there is no conflict of interest.

Ethical Approval and Originality Statement

Ethical approval was obtained for this study. The manuscript represents original work and has not been previously published, nor is it under consideration by another journal.

Data Disclosure Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

Abbate, T., Codini, A., Aquilani, B., & Vrontis, D. (2022). From knowledge ecosystems to capabilities ecosystems: When open innovation digital platforms lead to value co-creation. *Journal of the Knowledge Economy, 13*(1), 290–304.

Chae, B. K. (2019). A general framework for studying the evolution of the digital innovation ecosystem: The case of big data. *International Journal of Information Management, 45*, 83–94.

Costa, J., & Matias, J. C. (2020). Open innovation 4.0 as an enhancer of sustainable innovation ecosystems. *Sustainability, 12*(19), 8112.

Fasnacht, D. (2018). Open innovation ecosystems. In *Open Innovation Ecosystems: Creating New Value Constellations in the Financial Services* (pp. 131–172). Springer International Publishing.

George, G., Merrill, R. K., & Schillebeeckx, S. J. (2021). Digital sustainability and entrepreneurship: How digital innovations are helping tackle climate change and sustainable development. *Entrepreneurship Theory and Practice, 45*(5), 999–1027.

Gill, A. S., & Germann, S. (2022). Conceptual and normative approaches to AI governance for a global digital ecosystem supportive of the UN Sustainable Development Goals (SDGs). *AI and Ethics, 2*(2), 293–301.

Hoffmann, M. G., Murad, E. P., Lemos, D. D. C., Farias, J. S., & Sanches, B. L. (2022). Characteristics of innovation ecosystems' governance: An integrative literature review. *International Journal of Innovation Management, 26*(08), 2250062.

Karpunina, E. K., Okunkova, E. A., Sazanova, E. V., Gubernatorova, N. N., & Tishchenko, E. S. (2019). The ecosystem of the digital economy: A new approach to the study of structural features and content. In *Institute of Scientific Communications Conference* (pp. 497–508). Springer International Publishing.

Linde, L., Sjödin, D., Parida, V., & Wincent, J. (2021). Dynamic capabilities for ecosystem orchestration: A capability-based framework for smart city innovation initiatives. *Technological Forecasting and Social Change, 166*, 120614.

Linnenluecke, M. K., Marrone, M., & Singh, A. K. (2020). Conducting systematic literature reviews and bibliometric analyses. *Australian Journal of Management, 45*(2), 175–194.

Mahmood, H., & Miah, M. R. (2022). Data-driven innovation ecosystems: Accelerating economic growth through strategic technology adoption. *American Journal of Data Science and Analytics, 3*(12), 1–41.

Nebojša, S. (2021). Collaborative innovation in emerging innovation systems: Evidence from Central and Eastern Europe. *Journal of Technology Transfer, 46*(2), 531–562.

Nefedov, Y., Pavlekovskaya, I., & Afanasev, M. (2018). Change in knowledge representation in the digital economy. In *European Conference on Knowledge Management* (pp. 589–XV). Academic Conferences International Limited.

Nylund, P. A., Brem, A., & Agarwal, N. (2021). Innovation ecosystems for meeting sustainable development goals: The evolving roles of multinational enterprises. *Journal of Cleaner Production, 281*, 125329.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*.

Schreieck, M., Wiesche, M., & Krcmar, H. (2022). From product platform ecosystem to innovation platform ecosystem: An institutional perspective on the governance of ecosystem transformations. *Journal of the Association for Information Systems*.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339.

Sturgeon, T. J. (2021). Upgrading strategies for the digital economy. *Global Strategy Journal, 11*(1), 34–57.

Suseno, Y., Laurell, C., & Sick, N. (2018). Assessing value creation in digital innovation ecosystems: A social media analytics approach. *The Journal of Strategic Information Systems, 27*(4), 335–349.

Wang, P. (2021). Connecting the parts with the whole: Toward an information ecology theory of digital innovation ecosystems. *MIS Quarterly, 45*(1), 397–422.

Xiao, W., Kong, H., Shi, L., Boamah, V., & Tang, D. (2022). The impact of innovation-driven strategy on high-quality economic development: Evidence from China. *Sustainability, 14*(7), 4212.

Xu, G., Hou, G., & Zhang, J. (2022). Digital sustainable entrepreneurship: A digital capability perspective through digital innovation orientation for social and environmental value creation. *Sustainability, 14*(18), 11222.

Yousaf, Z., Radulescu, M., Sinisi, C. I., Serbanescu, L., & Păunescu, L. M. (2021). Towards sustainable digital innovation of SMEs from developing countries in the context of the digital economy and frugal environment. *Sustainability, 13*(10), 5715.

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