

Framing ecosystems and innovation hubs through culture: Bibliometric analysis



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Abstract The purpose of this study is to map and analyze the evolution of scientific knowledge on the relationship between innovation hubs and culture, with particular emphasis on their role as sociocultural systems within innovation ecosystems. To this end, a systematic literature review was conducted following the PRISMA 2020 protocol, using Scopus as the primary data source. From an initial corpus of 391 records, a rigorous screening and eligibility process resulted in a final sample of 64 peer-reviewed journal articles. These documents were examined through bibliometric techniques, including performance analysis, keyword co occurrence networks, and thematic mapping, supported by VOSviewer and Bibliometrix R. The findings reveal a recent consolidation of the field, with more than seventy percent of the publications concentrated between 2019 and 2025, alongside a pronounced geographical asymmetry in knowledge production dominated by the United States, China, and the United Kingdom. Beyond publication trends, the analysis identifies the progressive articulation of four core cultural forms: innovation culture, organizational culture, entrepreneurial culture, and creative culture that mediate collaboration, learning, and technological transformation within innovation hubs. The thematic map positions innovation culture and innovation ecosystems as motor themes, while creativity and cultural industries emerge as less developed but potentially relevant research lines. Despite the growing theoretical maturity of the field, significant empirical and conceptual gaps persist. These include the limited integration of multiple cultural forms within a single analytical framework and the underrepresentation of Latin American and Global South contexts. The study concludes that understanding innovation hubs solely as technical or infrastructural arrangements is insufficient. Their effectiveness depends on the cultural configurations that legitimize experimentation, cooperation, and public purpose. This research contributes an integrative perspective that repositions culture as a structuring principle of innovation ecosystems, and provides insights for future comparative research and culturally sensitive innovation policy design.

Keywords: organizational culture, creative culture, sociocultural systems, knowledge dynamics, cultural dimensions

1. Introduction

Innovation hubs (IHs) have emerged as strategic nodes within contemporary knowledge and entrepreneurship ecosystems, as they articulate physical and virtual networks that foster value cocreation and collaborative experimentation. From the perspective of the quintuple helix innovation system, these spaces connect universities, firms, the government, civil society and the natural sphere to promote intelligent, sustainable, and inclusive solutions (Carayannis et al., 2022). Their development also responds to the need to bridge the gap between research and market outcomes by configuring environments that combine entrepreneurial and institutional logics (Jucevicius et al., 2016) and to the search for dynamic organizational frameworks that stimulate continuous ecosystem evolution (Rabelo et al., 2024). In practice, the incorporation of Industry 4.0 technologies within these hubs requires organizational cultures that learn and adjust rapidly to contemporary competitive challenges (Wiese et al., 2024; Ciampi et al., 2022).

Digitalization has amplified the reach of the IH, triggering cultural transformation processes grounded in advanced analytics and ongoing organizational learning (Reisberger et al., 2024). Recent studies emphasize that digital culture, understood as the convergence of data, technological capabilities, and agile mindsets, is a decisive factor for transformation initiatives to translate into competitive advantage (Ghafoori et al., 2024; Butt et al., 2024). This cultural orientation aligns with sustainability and creative economy agendas, where servitization and the adoption of novel practices open pathways to new business models (Sundbo et al., 2022; Quandt and Klapproth, 2025; Gezici and Kerimoglu, 2010). As a result, IHs operate as sociotechnical laboratories that convene diverse actors and shape territorial identities in processes of socioeconomic renewal.

Empirical evidence indicates that culture plays a central role in innovation performance across business environments. Values such as openness, proactivity, and collective learning enhance open innovation and business outcomes (Scaliza et al., 2022; Krupskyi and Kuzmytska, 2020). Research in Asian conglomerates shows that cultural alignment with innovation goals



increases corporate agility and technological adoption (Loasakul et al., 2025), whereas studies of startups in technology ecosystems highlight that an innovative culture is essential to scale digital business models (Alabau-Tejada et al., 2024). In the university sphere, academic leadership and technology transfer offices are critical in reshaping organizational culture (Pohlmann et al., 2024; Kaniak et al., 2025). Similarly, engineering education with an entrepreneurial focus and management approaches rooted in business ecosystems broadens the innovative capabilities of participating actors (Ten Caten et al., 2019; Jiang et al., 2019). Global meta-analyses further show that organizations with consolidated innovation cultures are up to sixty percent more likely to lead their industries (Manly et al., 2025).

Even so, the literature still presents gaps that call for comparative studies (Da Silva et al., 2023), particularly those capable of integrating digital strategies with adaptive organizational cultures (Suryani and Dwiputra, 2025; Shah et al., 2024), and examining how culture significantly moderates the relationship between work autonomy and innovative behavior (Lee, 2025; Velyako and Musa, 2024). There remains a pressing need for empirical research across multiple levels of analysis that deepens the understanding of the cultural mechanisms that enable or constrain the effectiveness of these collaborative environments.

2. Materials and Methods

This literature review adopted the 2020 version of the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement as the methodological frame of reference (Page et al., 2021). The protocol comprises three phases: identification, screening, and inclusion. The search was conducted in the Scopus database via the following query: (TITLE ABS KEY("Innovation hub") OR TITLE ABS KEY("Innovation center") OR TITLE ABS KEY("Creative hub") OR TITLE ABS KEY("Innovation ecosystem") OR TITLE ABS KEY("Innovation lab") AND TITLE ABS KEY(Culture)). No temporal restrictions were applied to obtain a broad overview of available publications on the constructs under study. This initial stage resulted in the identification of 391 documents as of August 2025. During the screening phase, duplicate records were removed, and book chapters, conference proceedings, reviews and editorials were intentionally excluded to ensure comparability among empirical and conceptual studies published as journal articles. Titles and abstracts were then reviewed to discard documents not aligned with the topic. After the full-text assessment of potentially eligible papers, a total of sixty-four articles relevant to the research focus were included (Table 1). These form the analytical corpus that supports the discussion of findings and provides insight into current empirical trends concerning innovation hubs and their cultural linkages (Figure 1).

Table 1 Elements of the search strategy.

Database consulted	Scopus
Keywords and descriptors	"Innovation hub", "Innovation center", "Creative hub", "Innovation ecosystem", "Innovation lab", Culture
Combinations of terms with Boolean operators	(TITLE ABS KEY("Innovation hub") OR TITLE ABS KEY("Innovation center") OR TITLE ABS KEY("Creative hub") OR TITLE ABS KEY("Innovation ecosystem") OR TITLE ABS KEY("Innovation lab") AND TITLE ABS KEY(Culture))
Publication period considered in the search	1999-2025 (August)
Inclusion criteria	Articles
Exclusion criteria	Duplicate studies, Non-scientific publications, Off-topic studies
Number of studies found	391
Number of studies included	64

The initial set of articles was subjected to bibliometric analysis via VOSviewer and Bibliometrix R software, which enabled the identification of keyword co-occurrence networks, publication years, author and country rankings, and thematic clusters. In parallel, a discussion was conducted with the final sample of documents to interpret key themes and contributions. This approach made it possible to identify patterns, research gaps, and emerging lines of inquiry within the literature.

3. Results

3.1. Temporal evolution of publications

Figure 2 illustrates the trajectory of scientific output over time. Academic attention to the topic first emerged in 1999, marking the initial stage in its conceptual development as a research subject. This was followed by an embryonic phase in which scholarly contributions remained limited. Beginning in 2010, production gained visibility, signaling an early stage of legitimation characterized by a gradual increase during the first two years. A notable shift occurred from 2019 onward, when scholarly activity experienced a marked acceleration, reaching its highest point in 2025, with thirty-six publications. Seventy-one percent of the total documents were published in the last seven years (2019--2025), which supports the interpretation of this period as one of consolidation and maturity, driven by the contemporary relevance of the theme.

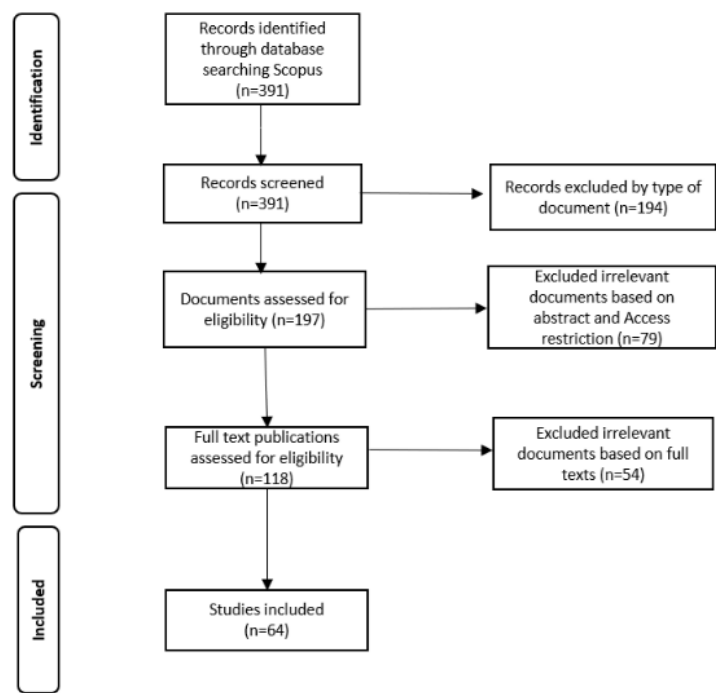


Figure 1 PRISMA Graphic. *Source:* Scopus Database.

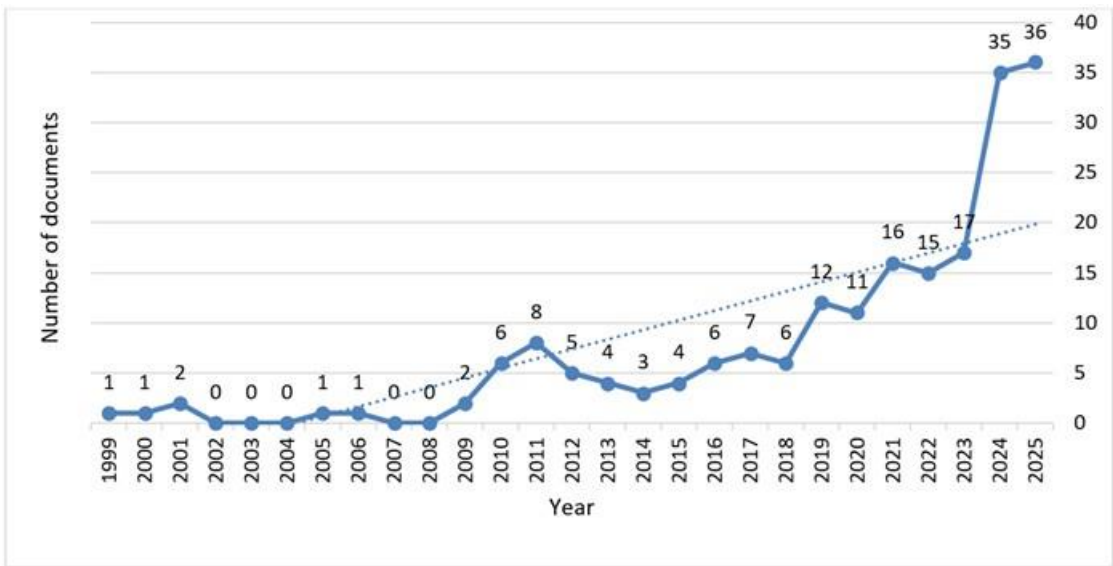


Figure 2 Articles published per year (1999-2025). *Source:* Scopus Database.

3.2. Geographic distribution

Table 2 presents the ranking of publications by country. The United States leads the field with ninety-three documents, demonstrating a significant dominance in the production and dissemination of research on the subject. China follows with thirty-six publications, reflecting its growing interest in innovation centers as drivers of cultural and technological development. The United Kingdom, with twenty-six contributions, continues to serve as a reference in studies on creative industries and innovation ecosystems. An intermediate group formed by Germany (seventeen), Brazil (seventeen), Australia (sixteen), Finland (fifteen), India (fifteen) and Spain (fifteen) comprises countries with consolidated trajectories in this area. In Latin America, participation remains emerging and uneven. Although Brazil stands out with seventeen publications, other countries in the region, including Colombia, Mexico, Chile, and Peru, are less represented in the international landscape. The data show that the literature is largely concentrated in nations with established academic structures and strong research systems, whereas countries in the Global South contribute in a more fragmented and peripheral manner. This scenario underscores the opportunity to strengthen regional research efforts and mitigate asymmetries in knowledge generation.



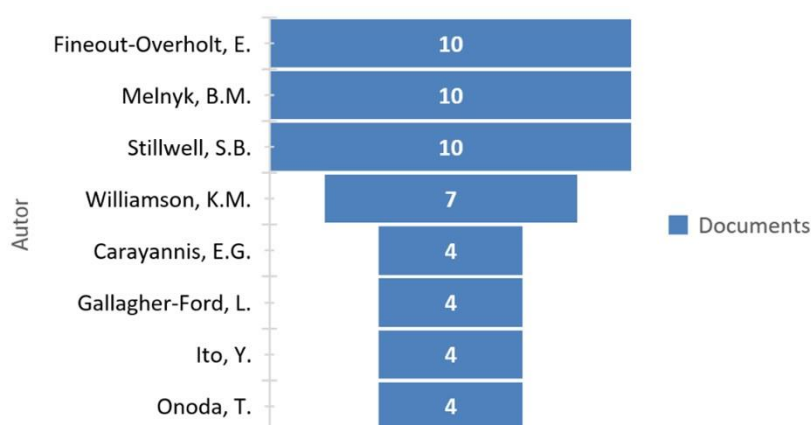
Table 2 Number of documents by country (top positions).

Country	Documents
United States	93
China	36
United Kingdom	26
Italy	20
Germany	19
Brazil	17
Australia	16
Finland	15
India	15
Spain	15

3.3. Relevant authors

Figure 3 shows the concentration of academic production among a small group of scholars who have contributed consistently to the study of innovation hubs, creative ecosystems, and innovation laboratories in relation to culture. Three authors stand out with the highest number of publications, each with ten documents: Fineout-Overholt, E., Melnyk, B. M., and Stillwell, S. B. Their sustained presence suggests consolidated research agendas and likely involvement in collaborative networks or institutional initiatives focused on innovation and organizational culture.

At the second level, Williamson, K. M. has seven publications, reflecting a relevant but less predominant contribution. Additionally, scholars such as Carayannis, E. G., Gallagher-Ford, L., Ito, Y., and Onoda, T., each with four documents, have made continuous contributions associated with approaches to innovation ecosystems in areas such as business management and health.

**Figure 3** Number of documents by author (top positions). *Source:* Scopus Database.

3.4. Keyword co-occurrence network

Figure 4 reveals a complex structure in which two central nodes and interconnected thematic clusters stand out. The term innovation appears as the main organizing axis, with strong linkages to concepts such as open innovation, innovation culture, and innovation management. This pattern confirms that innovation operates as a cross-cutting category that informs both theoretical approaches and practical applications in cultural and organizational settings.

Similarly, the concept of an innovation ecosystem emerges as an independent yet closely connected node, forming a cluster linked to terms such as technology transfer, entrepreneurship, regional planning and knowledge management. This cluster reflects an orientation toward the systemic and territorial dimension of innovation, suggesting that hubs function not only as creative spaces but also as structures that connect economic, academic and social actors in regional development processes.

The node culture, positioned within the green axis of the network, is associated with terms such as ecosystem, science, technology and cultural anthropology. This underscores the interdependence between cultural dynamics and technological advances, where values, identities and cultural processes shape innovation outcomes. The presence of nodes such as sustainable development, education and leadership nodes indicates an intersection between social transformation goals and educational priorities. This pattern suggests that scholarship on innovation hubs is shifting from a primarily economic focus toward a more comprehensive perspective aligned with sustainability.

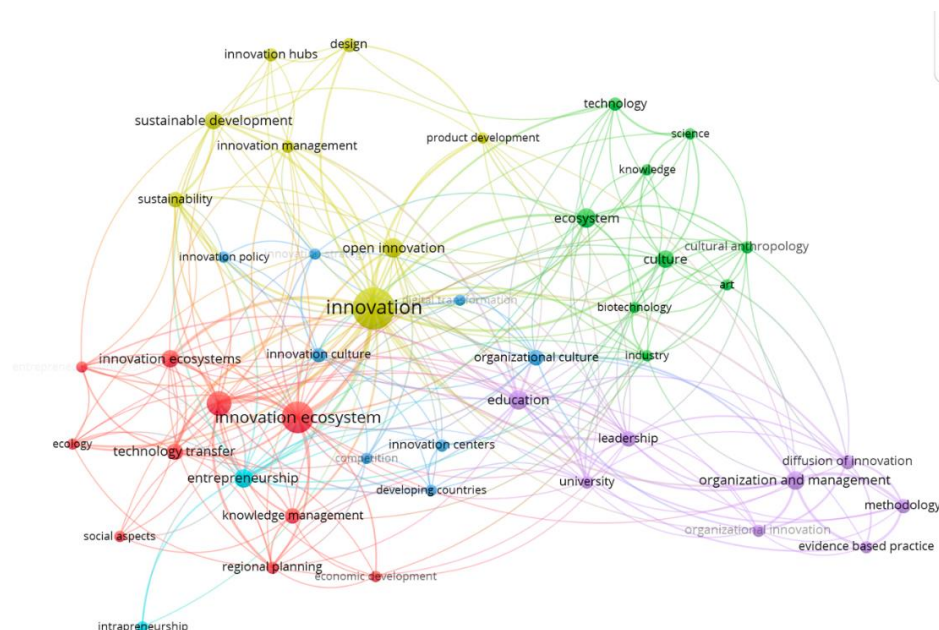


Figure 4 Keyword co-occurrence map (innovation hub). *Source:* VOSviewer.

Overall, the map illustrates the complexity of the field and highlights thematic convergence around innovation culture, digitalization and interactions among universities, industry and society as central elements for understanding the contemporary ecosystems of innovation hubs. Each cluster represents a thematic domain that reflects shared conceptual foundations within the innovation ecosystem literature (Table 3).

Table 3 Clusters.

Cluster 1: Innovation Ecosystem and Organizational Culture	Cluster 2: University Entrepreneurship and Technology Transfer	Cluster 3: Innovation Culture and Leadership	Cluster 4: Digital Transformation and Sustainability	Cluster 5: Education and Intrapreneursh ip	Cluster 6: Art, Design, and Regional Development
innovation ecosystem	ecosystem	organizational culture	innovation	education	entrepreneurship
ecosystems	culture	innovation culture	open innovation	organization and management	intrapreneurship
technology transfer	technology	innovation centers	sustainable development	leadership	
knowledge management	art	competition	sustainability	diffusion of innovation	
regional planning	biotechnology	developing countries	design	methodology	
economic development	industry	digital transformation	innovation hubs	evidence- based practice	
entrepreneurial university	knowledge	innovation policy	innovation management	organizational innovation	
social aspects	science	innovation strategy	product development	university	

3.5. Thematic clusters

The thematic map in Figure 5 provides a visual representation of emerging conceptual clusters within the academic literature. The distribution of themes is organized according to two key dimensions, degree of development (density) and central relevance (centrality), allowing concepts to be classified into four quadrants. In the upper right quadrant, which includes motor themes that are both highly developed and central to the field, notions such as the quadruple helix, entrepreneurial university and academic firm, alongside references to China, the circular economy and innovation hubs, appear. This

configuration indicates a growing emphasis on the coordination of diverse actors and sustainability strategies within innovation environments.

In the lower right quadrant, which contains basic themes, concepts such as the innovation ecosystem, open innovation, organizational culture, and entrepreneurship are included. Although foundational, these themes would benefit from further theoretical refinement. The upper left quadrant comprises niche themes such as design, collaboration and national innovation ecosystems. These topics display strong internal development but remain less connected to the broader body of research. Finally, in the lower left quadrant, which is associated with emerging or declining themes, creativity and creative industries, which are still in early stages or have a more limited presence within the research network, appear.

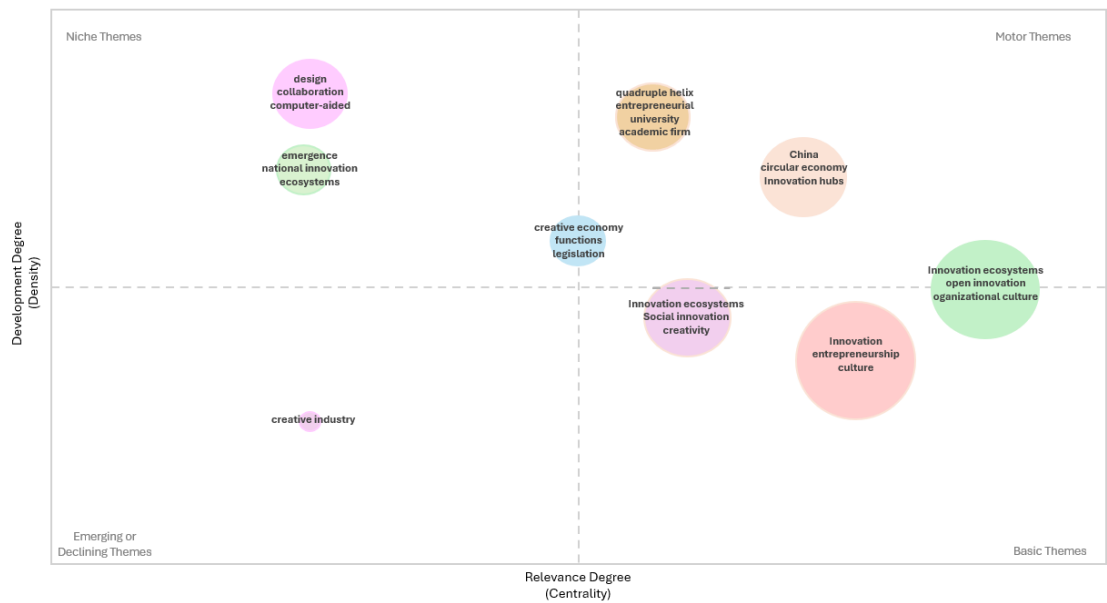


Figure 5 Thematic Map Keyword. *Source:* Bibliometrix R software.

3.6. Recent research trends

Table 4 presents the set of literature reviews published between 2020 and 2025. While some studies employ diverse approaches, systematic reviews remain predominant. Culture is examined as a mechanism that can accelerate or impede open innovation, cocreation, and knowledge exchange. In the Chinese academic context, for example, hierarchy and relational norms shape open innovation toward external search centered on performance outcomes, with less emphasis on users and platforms and with strong institutional translation mediated by public policy. Effective innovation ecosystems require orchestration and alignment. It is not sufficient to collaborate; it is necessary to diagnose and manage gaps among actors in terms of values, goals, and methods, for example, between universities and small- and medium-sized research-intensive firms, because such discrepancies undermine cooperation. Actors to actor matrices assist in anticipating conflicts and designing cultural bridges. In addition, ecosystem resilience is not limited to resource redundancy; it is grounded in adaptive governance, dense networks and sociotechnical diversity and demands mixed metrics and methods to capture its dynamic nature.

Across studies on digital transformation and university management, learning-oriented climates, openness and psychological safety, alongside absorptive capacity, emerge as cultural pivots that allow hubs and laboratories to operate as platforms of shared meaning in terms of norms, common language and expectations rather than solely physical infrastructure. Territorial cases such as San Diego illustrate that the combination of human capital, funding and multiactor governance sustains innovation trajectories oriented to sustainability, offering lessons that may inform tourism destinations seeking to connect creative culture with innovative culture.

Table 4 Literature reviews on the subjects of study.

	Title	Authors	Discipline	Objective	Methodology	Contribution
1	Comprehensive Framework of Influential Factors on Innovation Ecosystem Resilience: Using Meta-Synthesis and	Abdi et al. (2024)	Innovation policy and management	Identify the factors that affect the resilience of the innovation ecosystem	Literature meta-synthesis	The resilience of innovation ecosystems depends on eight interrelated factors: adaptability, innovation management, recovery capacity, culture, resources, robustness,

Structural Equation Modeling						strategic planning and vulnerability. Vulnerability and adaptability are the most decisive variables for strengthening the ecosystem's ability to withstand crises or environmental change, whereas a culture of resilience and recovery capacity exerts a comparatively smaller influence.
2	Innovation within international entrepreneurship: A review and research agenda	Velez-Ocampo et al. (2025)	International entrepreneurship	Organize and discuss the nuances of existing research on innovation in industrial engineering and outline avenues for future inquiry in this area	Systematic review	The study finds that innovation in environmental engineering within international contexts depends on the interaction among organizational culture, collaborative networks and dynamic capabilities, highlighting cocreation and intercultural learning as key drivers.
3	The rise of open innovation in Chinese academia: a systematic review of the literature	Cricchio and Di Minin (2025)	Innovation management	Develop the concept of open innovation within a specific academic community operating in a defined institutional context	Systematic literature review and content analysis	Open innovation in the Chinese academic context is expressed as a search for external knowledge oriented toward firm performance. Traditional hierarchical culture can hinder the generation and acquisition of ideas, and the institutional environment along with public policy strongly shapes open innovation practices.
4	Twenty years, twenty studies: what can we learn from San Diego's innovation ecosystem?	Majava and Rinkinen (2024)	Regional development	Provide a comprehensive overview of San Diego's evolution as a leading global innovation ecosystem, focusing on the ecosystem's key actors and success factors	Systematic review	Regional innovation is driven by multi actor governance, human capital and funding, with an emphasis on sustainable growth and science, technology, engineering and mathematics (STEM).
5	The Linkage Between Digital Transformation and Organizational Culture: Novel Machine Learning	Reisberger et al. (2024)	Knowledge economy and management	Identify the dominant themes, their temporal evolution, and recent developments in	Automated bibliometric review supported by machine learning	The study shows that digital transformation and organizational culture have shifted toward management and knowledge based

	Literature Review Based on Latent Dirichlet Allocation			research on organizational culture linked to digital transformation, using a bibliometric approach supported by machine learning (ML)		innovation. It identifies eight thematic clusters and highlights the centrality of digital culture, technological competence, and workforce transformation.
6	Bibliometric review on technology management in universities: trends, challenges, and opportunities	Bolaño-García and Solano (2023)	Technology management and higher education	Identify trends, challenges, and opportunities in technology management at universities	Bibliometric review	Technology management enhances both the quality of education and the efficiency of academic and administrative operations, saving on financial resources. Effective implementation involves collaboration with industry and other institutions, the formation of expert teams, meticulous planning, and the active engagement of key stakeholders.
7	Role of Agile in Digital Public Health Transformation	Kokol et al. (2022)	Public health and management	Evaluate the role of agile approaches in the digital transformation of public health, analyzing innovation through software development to improve health and organizational management	Bibliometric mapping	Agile approaches remain underutilized in the development and management of health solutions, despite their potential to enhance collaboration, flexibility, and innovation. Health systems must adopt an agile culture grounded in collaboration, adaptive decision making, and co- creation as a key condition for accelerating digital transformation and generating greater clinical and public value.
8	Culture and innovation in the international context: a literature overview	Tian et al. (2020)	Business management	Examine how cultural factors influence innovation in the very nature of international business, and propose the concept of an innovation ecosystem at the global level	Systematic review	The study identifies three interrelated dimensions of innovation: drivers (motivation, investment, international R&D, and multicultural teams), outcomes (products, knowledge, and technology), and commercialization (international adoption and diffusion). It concludes that culture, both national and organizational, permeates

						all stages of the innovation ecosystem.
9	Firm's Innovation Ecosystem: Barriers, Key Success Factors and Strategies	Minh (2021)	Technology management	Explore the innovation ecosystem through literature to deepen understanding of the concept and stimulate future research	Systematic review	Innovation through an ecosystem enables firms to generate value that would not be attainable independently. All ecosystem members benefit from shared resources and complementary technological capabilities, which enhance sustainable innovation performance.

4. Discussion

Recent research on innovation hubs, innovation laboratories and innovation ecosystems shows that culture functions as a cross-cutting element that structures collaboration, learning and technological transformation dynamics. The studies reviewed converge on the idea that innovation cannot be reduced to a technical or economic process; it must be understood as a social construction grounded in shared values, norms and meanings (Paikowsky et al., 2025; Koutsobinas and Michalopoulou, 2023). Innovation hubs are, at their core, cultural devices that institutionalize creativity, enable knowledge circulation and cultivate collaboration among public, private and community actors under a shared language of experimentation and openness (Yang and Chang, 2025; Zvereva et al., 2023). Innovation ecosystems thus draw from multiple cultural expressions, including innovative, entrepreneurial, organizational and creative cultures, which interact with and reinforce each other, shaping both the symbolic and structural dimensions of change.

Innovative culture emerges as the most influential dimension within innovation ecosystems. It represents a system of values, beliefs and behaviors that legitimizes experimentation, tolerates error and promotes cooperation. Innovation hubs, particularly those linked to universities, have demonstrated their capacity to institutionalize such a culture by providing learning environments where students acquire not only technical capabilities but also a mindset oriented toward risk taking and openness (Lathigara et al., 2025).

Jimeno-Morenilla et al. (2025) argue that these structures operate as microecosystems where scientific knowledge is translated into applied projects with social impact. Their value lies less in tangible outputs than in the consolidation of a culture of learning, collaboration and public purpose in knowledge creation. Universities emerge as the environments where an innovation culture can be reproduced most deeply. Marty et al. (2020) reported that faculty act as cultural mediators by promoting autonomy, critical thinking and interdisciplinarity. In university-based hubs, innovation is conceived as a reflective practice that involves learning by doing, embracing error, reconfiguring knowledge and attributing ethical and social meaning to technology.

Innovative culture operates as a structuring force. Rabelo et al. (2024) view it as a symbolic core that sustains the ecosystem by shaping human and social capital and transforming tangible resources, such as technology and funding, into sustainable outcomes. This approach suggests that innovation emerges not only from infrastructure or investment but also from symbolic articulation that gives meaning to collective action. Culture therefore mediates between the technical and the social, between knowledge and its legitimacy. Silicon Valley stands as a paradigmatic example illustrating the centrality of culture. Quandt and Klapproth (2025) describe it as a symbolic ecosystem defined by intellectual freedom, labor mobility and acceptance of failure, which form a shared imaginary of success and reinvention. In this setting, social relations and symbolic capital become as consequential as financial capital, explaining its capacity for constant renewal, supported by values of openness, trust and cooperation. In contrast, in environments characterized by hierarchical or closed business cultures, innovation becomes fragmented, knowledge transfer weakens, and adaptability deteriorates (Xiao et al., 2024).

From this perspective, Mandiello et al. (2025) contend that national culture shapes the maturity of innovation ecosystems by influencing governance, actor interactions and the pace at which innovative practices diffuse. Their study highlights how collective orientation, uncertainty avoidance and power distance generate distinct cultural trajectories. Innovation hubs, understood as sociocultural systems, must therefore adapt their strategies to local contexts rather than replicating universal models, integrating cultural diversity as a prerequisite for ecosystem resilience and sustainability.

In urban settings, the intersection between culture and social innovation ecosystems becomes particularly evident. Kadyrova (2021) shows that social innovation ecosystems are deeply embedded in urban cultural contexts. Here, culture refers not to artistic production but to systems of values, norms and historical memory that shape relations among public, private and community actors. In cities characterized by trust, cooperation and openness, social innovation unfolds through horizontal

cocreation networks; in contrast, where distrust in institutions prevails, innovators tend to retreat into closed networks or depend on international support. Social capital thus emerges as a decisive cultural component: the density and cohesion of collaborative networks reflect the degree of civic culture and collective learning orientation (Lin et al., 2025; Besednjak and Džajić, 2024).

Other studies emphasize cultural differences across economic sectors. Bauwens et al. (2024) reported that while traditional industries such as construction reproduce conservative and hierarchical cultures, sectors such as tourism and food display more open and socially engaged cultural patterns that favor collaborative innovation. These differences confirm that innovation does not occur in isolation but within cultural frameworks that shape production, consumption and learning practices. Similarly, Costa et al. (2025) noted that innovation effectiveness depends on balancing internal knowledge with external collaboration. Robust ecosystems maintain a strong internal research base that operates as a cultural and cognitive anchor. When external knowledge dominates without internal mediation, innovation becomes dependent and less adaptive. In this view, culture is the integrating principle between autonomy and cooperation.

Liu et al. (2025) further argued that digital laboratories fail to generate meaningful innovation without collaborative cultures that encourage creativity and risk tolerance. Technologies remain ineffective catalysts when not embedded in cultural environments that legitimize experimentation and knowledge exchange. This finding reinforces the idea that technological infrastructure cannot substitute for the cultural dimension of innovation; rather, it relies on culture to create value.

In the public sector, innovation laboratories represent cultural disruption within traditionally rigid bureaucracies. Lindquist and Buttazzoni (2021) characterize these units, described as adhocracies, as experimental spaces that foster iterative and participatory governance. Their main contribution is cultural rather than technical: they introduce flexibility, creativity and a learning orientation into historically closed systems. Scaliza et al. (2022) show that adhocracy culture, grounded in flexibility, creativity and risk taking, drives open innovation by facilitating exploration and knowledge sharing inside and outside organizations, whereas hierarchical cultures constrain collaboration and idea flow. Their findings emphasize that ecosystem effectiveness depends on an open and collaborative culture capable of integrating external knowledge and generating collective value.

Some studies show that culture also shapes innovation indirectly through institutional norms. Riyanto et al. (2024) demonstrate that legal culture, defined as a set of institutional values and practices, conditions the effectiveness of innovation policies even when not the primary focus of analysis. Legal frameworks may fail not because of technical limitations but because they misalign with cultural dispositions influencing trust, participation and risk interpretation. This normative dimension highlights the entanglement of culture, governance and innovation policy.

In sustainability research, Shkarupeta et al. (2024) explored the notion of sustainable culture as the sociocultural environment enabling eco-innovation. Innovation in this context entails transforming collective values and behaviors rather than simply adopting green technologies. Sustainability emerges through intersectoral learning networks where academia, industry and society construct shared meanings around environmental responsibility.

Corporate innovation culture operates through six interdependent components, values, behaviors, climate, resources, processes and success, which align to create conditions conducive to experimentation and adaptation. Suseno and Standing (2017) noted that this culture enhances openness to knowledge, strengthens absorptive capacity and stimulates coevolution among firms, universities, the government and society. Under this view, innovation culture is not ancillary; it is the organizing principle that structures ecosystems, shapes interactions and guides sustainability. Without a cultural foundation rooted in trust, learning and cooperation, no innovation system can consolidate or produce enduring transformation.

From an organizational perspective, culture has become decisive in understanding how innovation hubs articulate institutional change and digital transformation. In higher education, institutions have shifted from traditional models to innovative organizational cultures driven by policies that promote technology transfer and academic engagement through conferences, events and training programs (Kaniak et al., 2025). García et al. (2025) expand this view by showing that coproduction processes between governments and innovation labs generate deep cultural transformation in public organizations. Their study identifies three key dynamics: change management through continuous training that fosters a learning mindset; consolidation of a digital culture grounded in agile methods and user-centered approaches; and reinforcement of organizational agility through interdisciplinary teams and horizontal structures. These transformations support the transition from bureaucratic cultures to innovation-oriented cultures, where public value becomes the organizing principle. Innovation labs thus act as cultural mediators that link technology, public management and social value.

In the private sector, innovation hubs support organizational redesign and exploration of new business models. In Asia and Latin America, both large firms and SMEs turn to these hubs to combine the exploitation of existing capabilities with the exploration of digital opportunities (Loasakul et al., 2025; Trevisanuto et al., 2024). The literature highlights that the connection between digital strategy and organizational culture directly shapes business resilience and performance (Abdi et al., 2024), since digital innovation only succeeds when culture supports adoption and continuous learning (Lingling et al., 2023; Jonsson et al., 2025). Innovation ecosystems consolidate when organizational culture is rooted in openness, collaboration and creativity, empowering human capital as the engine of transformation (Rizomyliotis et al., 2025).

The findings of Loasakul et al. (2025) are particularly illustrative in showing how Thai organizations built innovative cultures despite contexts characterized by high power distance and strong uncertainty avoidance. Culture consolidation depends on three factors: transformational leadership, long-term corporate strategies and strategic resource allocation. These factors help overcome rigid hierarchies and frame innovation as preparation for the future, demonstrating that hubs must adapt to local norms and values. Similarly, Shen et al. (2024) show that regional investments in digital infrastructure, such as Big Data Comprehensive Pilot Zones in China, strengthen sustainable competitiveness by linking organizational culture, talent mobility and institutional consolidation. Innovation thus depends less on technology itself than on the cultural capacity of territories to absorb it.

Burtscher et al. (2025) confirmed that corporate culture is the primary enabler of twin transformation, the simultaneous integration of digitalization and sustainability, especially in European SMEs. Their research revealed that innovation hubs function not only as providers of infrastructure or funding but also as collaborative governance arenas that reshape organizational cultures, connect public and private actors and foster shared learning. Organizational culture, in turn, is central for start-ups, which must cultivate internal values and collaborative practices to operate as agents of change. A culture that embraces risk strategically strengthens innovation by motivating exploratory thinking, reinforcing intrinsic motivation and enhancing employees' creative self-efficacy. It also supports the interplay between visionary leadership and organizational learning, turning experimentation and flexibility into institutional assets (Nguyen et al., 2024). In summary, innovation hubs are sociocultural systems where organizational culture sustains effectiveness, resilience and the capacity to orient innovation toward collective benefit.

Entrepreneurial culture also expands within educational institutions, encouraging creativity, academic performance and employability, confirming its pedagogical relevance for training graduates capable of innovating and leading change in real contexts (Lathigara et al., 2025). In this context, Mebratie et al. (2025) highlight the need to implement innovation laboratories in Ethiopian universities, since despite adequate institutional performance, an innovation culture among students remains nascent. Strengthening a culture of technology transfer in university ecosystems depends on the capacity of institutions to align internal structures and build researcher competencies to assume active roles in knowledge management, intellectual property protection and interaction with industry, thereby consolidating an organizational culture oriented toward innovation (Suseno and Standing, 2017).

Fotopoulos and Qian (2025) add that innovation cannot be understood solely through tangible resources or public policies; it must be analyzed through the values, norms and social practices that shape entrepreneurial behavior. Their research shows that innovation flourishes where regional culture supports collective learning and cooperation, strengthening governance and the resilience of innovation ecosystems. The key contribution of this perspective is to show that entrepreneurial culture activates innovation from the bottom up by promoting autonomy, calculated risk and applied creativity. However, research still needs to advance toward intercultural models that recognize how entrepreneurship is redefined by local values.

Creative culture represents another relevant dimension, as it broadens the innovation concept by incorporating symbolic, artistic and community production as sources of social and economic value. Recent studies underline that cultural ecosystems are also social innovation ecosystems where collective creativity catalyzes urban and sustainable transformations. Isa and Shan (2024) show that creative placemaking projects build community cohesion, urban revitalization and citizen wellbeing. Artistic participation in public spaces reduces insecurity, reinforces belonging and stimulates local economies. In contemporary cities, cultural and artistic production functions as a process of innovation that generates cohesion and reimagines public space. These practices extend innovation beyond efficiency and competitiveness, centering it in collective identity formation and shared urban imaginaries. Culture thus becomes an intangible infrastructure connecting actors, reinterpreting space and reshaping the symbolic economy of cities (Koutsobinas and Michalopoulou, 2023).

The situated nature of social innovation demonstrates that culture is not merely context but also a driver of action. Citizen practices such as urban agriculture, sustainable food systems or community laboratories stem from local values, norms and knowledge that structure organization and expansion possibilities. However, the cultural embeddedness that gives meaning to these practices also limits their transferability across territories, emphasizing the need for cocreation and intercultural learning. Innovation in this view requires the translation of knowledge, the negotiation of meanings and the construction of shared languages. Design culture plays a mediating role by enabling communication among diverse actors through participatory methods that foster collective learning and symbolic adaptation, turning innovation into a relational process oriented toward sustainability (Marradi and Mulder, 2022).

Maker culture adds to this discussion by showing how creativity can be institutionalized without losing its community-oriented essence. In contexts such as China, interaction between state policies and civic practices has generated hybrid ecosystems where experimentation and self-directed learning coexist with governmental planning. These communities, although peripheral to formal economic systems, produce meaningful transformations in urban culture, introducing alternative modes of entrepreneurship, cooperation and technological appropriation (Bolli, 2020).

Moreover, the state-led instrumentalization of art and culture in urban projects demonstrates how innovation may also serve as a mechanism for control and legitimization. The conversion of rural and peri-urban areas into artistic clusters through

placemaking and urban rebranding strategies exposes tensions among creativity, sustainability and governance. The creative culture in innovation hubs therefore acts not only as a driver of change but also as a symbolic instrument in territorial transformation processes (Yang and Chang, 2025). Finally, the study by Zvereva and Tikhotskaya (2023) on creative industries in Japan confirms that culture can function as a national innovation infrastructure. The Cool Japan strategy transforms local traditions into global assets, consolidating a model of cultural glocalization that combines art, technology and public policy.

Taken together, the studies reviewed converge on a central finding. Innovation hubs must be understood not only as infrastructures for technological development but also as sociocultural systems that shape values, norms and practices oriented toward organizational and regional transformation (Carayannis et al., 2022; Jucevicius et al., 2016). Multiple contributions to innovation hubs demonstrate that cultural orchestration is decisive for knowledge creation and value cocreation (Da Silva and Emmendoerfer, 2023). When these spaces adopt an adhocratic logic grounded in flexibility, autonomy and creativity, innovation accelerates; conversely, hierarchical structures and excessive control constrain it (Scaliza et al., 2022; Lindquist and Buttazzoni, 2021). Recent studies emphasize that digital transformation and sustainability take place only in hubs where the organizational culture prioritizes openness, interorganizational cooperation and continuous learning as strategic pillars (Reisberger et al., 2024). Evidence from manufacturing and services confirms that culture not only precedes data-driven initiatives but also determines the capacity to build sustainable competitive advantage (Ghafoori et al., 2024; Velyako and Musa, 2024).

Previous reviews on hubs, labs, and innovation ecosystems have concentrated on developing theoretical frameworks to explain success factors, resilience or governance, often with a focus on knowledge management and economic perspectives (Abdi et al., 2024; Reisberger et al., 2024; Minh, 2021). These works highlight the interdependence between organizational culture, interinstitutional collaboration and adaptive capacity; however, they tend to treat culture as an instrumental or moderating variable. In contrast, the present analysis positions culture as a structuring principle rather than a supporting element, as it articulates meanings, norms and values that legitimize experimentation, risk and cooperation.

5. Final Considerations

While previous systematic reviews have emphasized technical or institutional components such as infrastructure, funding, and policy or knowledge management (Majava and Rinkinen, 2024; Bolaño-García and Solano, 2023), this content analysis indicates that robust ecosystems emerge from symbolic processes that integrate innovative, organizational, entrepreneurial and creative cultures. Culture therefore does not merely facilitate innovation; it produces it by transforming technical knowledge into collective value and social cohesion. Moreover, while the international literature frequently focuses on national and corporate determinants (Tian et al., 2020; Velez-Ocampo et al., 2025), the empirical findings of this study show that universities and public hubs act as cultural catalysts that reshape relations among the government, academia and society. The discussion underscores a shift from bureaucratic culture toward adhocratic culture, where flexibility, openness and ongoing learning operate as new institutional norms.

A key divergence is that prior scholarship has privileged digital culture and agility as preconditions for technological change (Reisberger et al., 2024; Kokol et al., 2022). The results here show that without an ethical and symbolic foundation of cooperation and public purpose, such transformations lack long-term viability. Innovation culture thus emerges as a mediator between technology and society, translating technical efficiency into social and environmental responsibility.

The literature points to three epistemic gaps that constrain a deeper understanding of the field. First, there is a tendency to reduce culture to an organizational attribute, such as climate or risk orientation, without addressing its structural and relational dimension. Second, the absence of an integrative framework that connects different cultural expressions, innovative, entrepreneurial, organizational and creative, as interdependent parts of a single ecosystem. Third, cultural and territorial asymmetries, particularly in the Global South, where hubs and labs operate under institutional conditions distinct from those of Anglo American models, are limited. Most research has focused on high-innovation countries such as Singapore, Australia and the United States, whereas emerging economies such as Brazil or Mexico are only beginning to receive systematic attention.

Similarly, a theory explaining how different cultural forms interact within the same ecosystem remains underdeveloped. Their coexistence is acknowledged, yet their mutual hierarchies or transformations are not clearly examined. In addition, prior studies tend to privilege success cases, overlooking tensions and exclusions that innovative culture may reproduce, including digital divides or precarious creative labor.

Future research should therefore address cultural frictions, North South asymmetries in innovation governance and localized forms of collective creativity still absent from global hub models. Comparative studies between urban and rural hubs and across creative, educational and public sectors are warranted. Similarly, new instruments are needed to measure cultural change, linking culture, technological adoption and organizational agility, while examining psychosocial factors that shape the implementation of agile methods to better understand success and failure conditions.

The studies reviewed affirm that innovation hubs are cultural spaces before they are technological spaces. Their effectiveness depends not only on financial capital or infrastructure but also on the type of culture they cultivate. An innovative culture gives meaning to change, an entrepreneurial culture materializes it, an organizational culture institutionalizes it and a

creative culture socializes it. The most significant theoretical contribution of the field has been shifting the focus from innovation as an outcome to innovation as a relational and symbolic process. The primary contribution of this study is to offer an integrated perspective of innovation hubs and ecosystems across educational, organizational, urban, sociotechnical and sustainability lenses, showing how diverse cultures sustain entrepreneurship, creativity, management and collective learning. This cultural reinterpretation expands existing explanations and opens an analytical agenda aimed at understanding how local values and practices determine the sustainability of innovation in academic, business and urban settings.

6. Declarations

6.1. Ethical considerations

Not applicable.

6.2. Use of artificial intelligence (AI)

The authors declare that the generative artificial intelligence (AI) tool ChatGpt was used exclusively for language editing and/or grammatical improvement. The use of AI did not influence the scientific content, study design, data analysis, data interpretation, results, or conclusions of the manuscript. Full responsibility for the content remains with the authors.

6.3. Conflict of interest

The authors declare that they have no conflicts of interest.

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