


Bibliometric Analysis of Open Innovation Research Trends in the Technology Industry

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Article Info	ABSTRACT
<p>Article history:</p> <p>Received June, 2025 Revised June, 2025 Accepted June, 2025</p> <hr/> <p>Keywords:</p> <p>Open Innovation Technology Industry Bibliometric Analysis VOSviewer</p>	<p>Open innovation has emerged as a critical paradigm in the technology industry, enabling firms to leverage external knowledge and collaborative networks to accelerate innovation and enhance competitiveness. This study conducts a comprehensive bibliometric analysis of open innovation research from 2003 to 2024 using data extracted from the Scopus database. By employing VOSviewer software, the study visualizes keyword co-occurrences, temporal trends, author co-citation networks, and international collaboration patterns. The results reveal that the field has matured significantly, with foundational themes such as knowledge transfer, absorptive capacity, and product development remaining central. Concurrently, emerging topics including artificial intelligence, business models, sustainability, and digital ecosystems reflect the evolving relevance of open innovation in addressing contemporary technological and societal challenges. Influential scholars like Chesbrough, Gassmann, and Bogers have played pivotal roles in shaping the intellectual landscape, while countries such as the United States, Germany, China, and Italy lead in global collaboration. The study highlights the multidimensional and dynamic nature of open innovation research and offers insights for academics and practitioners aiming to navigate the next frontier of innovation management.</p> <p><i>This is an open access article under the CC BY-SA license.</i></p> 

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1. INTRODUCTION

In the era of rapid technological advancement, the ability of firms to sustain innovation and competitiveness increasingly depends on their capacity to integrate external knowledge sources. This phenomenon has given rise to the concept of open innovation, which represents a paradigm shift from the traditional closed model of innovation. Coined by [1], open innovation refers to the

use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand markets for external use of innovation. Particularly in the technology industry, where product life cycles are short and technological obsolescence is high, open innovation offers a strategic framework for leveraging external ideas, partnerships, and collaborations to drive value creation and innovation agility.

The technology sector is uniquely positioned to adopt and benefit from open innovation due to its dynamic nature and the increasing interconnectedness of actors in the innovation ecosystem. From startups to multinational corporations, firms in this sector frequently engage in collaborative arrangements such as co-development, joint ventures, user innovation, and crowdsourcing. Additionally, digital platforms and the proliferation of big data have facilitated more open forms of innovation through networks, online communities, and distributed R&D. This has expanded the innovation landscape beyond organizational boundaries, transforming how firms manage knowledge and develop technologies [2].

Over the past two decades, scholarly interest in open innovation within the technology industry has grown significantly. Numerous studies have explored its antecedents, processes, and impacts on firm performance, innovation capability, and ecosystem development. Research streams have also evolved to examine open innovation across different technological domains—such as ICT, biotech, AI, and green technologies—each with distinctive modes of collaboration and knowledge integration. Despite the growing body of literature, the field remains fragmented, with varying definitions, methodologies, and analytical lenses. Understanding how research in this area has evolved over time can provide insights into emerging trends, gaps, and future directions for theory and practice.

Bibliometric analysis serves as a powerful method to uncover the intellectual structure and development trajectory of a research field. By applying quantitative techniques to a large corpus of publications, bibliometric studies reveal influential works, prominent authors, thematic clusters, and publication patterns across time and space. In the context of open innovation, bibliometric mapping can highlight the evolution of concepts, identify leading journals and institutions, and trace how the field has responded to technological and managerial shifts. Furthermore, such analysis aids in

capturing the diffusion of open innovation research across various subfields in technology and its cross-disciplinary nature [1], [3].

Given the increasing complexity and strategic relevance of open innovation in the technology industry, a comprehensive bibliometric analysis is both timely and necessary. It allows researchers and practitioners to assess the maturity of the field, understand the intellectual roots and emerging hotspots, and align academic inquiry with industrial needs. Moreover, this study is situated in a post-pandemic context, where innovation models have been reshaped by disruptions, digital acceleration, and the urgency of sustainable development. Open innovation has become not only a competitive advantage but also a mechanism for resilience and societal impact, making it essential to understand its evolving research dynamics in the technological domain [4].

Despite the proliferation of literature on open innovation in the technology industry, there is a lack of consolidated knowledge regarding the development and direction of the field. Prior reviews have largely relied on qualitative assessments or focused on narrow aspects of open innovation, overlooking broader publication trends, citation networks, and thematic structures. This fragmented understanding hinders the ability of scholars to build cumulative knowledge and limits the strategic application of research findings by practitioners and policymakers. Therefore, there is a pressing need for a systematic, data-driven analysis to map the trajectory, patterns, and intellectual foundations of open innovation research in the technological context. This study aims to conduct a bibliometric analysis of open innovation research trends within the technology industry.

2. METHODS

This study adopts a bibliometric analysis approach to explore the intellectual landscape, thematic evolution, and research trends in the field of open innovation within

the technology industry. Bibliometric methods are widely used in research evaluation and science mapping to analyze large volumes of scholarly data, allowing for the identification of key contributors, influential publications, and the structural development of a scientific domain [5].

The primary data source for this study is the Scopus database, selected for its extensive coverage of peer-reviewed journals, conference proceedings, and high-impact publications in technology and innovation studies. A comprehensive search query was developed using keywords derived from the literature on open innovation and the technology industry. The search string employed was as follows:

"open innovation" AND ("technology industry" OR "tech sector" OR "high-tech" OR "ICT" OR "information technology")

The search was restricted to titles, abstracts, and keywords to ensure relevance and was limited to publications from 2003 to 2024, aligning with the emergence of open innovation theory introduced by [6]. Only documents published in English and categorized as articles, reviews, and conference papers were included. After applying exclusion criteria and manual screening for relevance, a total of 1,256 publications were selected for analysis.

The raw bibliographic data were exported from Scopus in the BibTeX and CSV formats, which included metadata such as author names, titles, abstracts, keywords, sources, publication years, institutions, citation counts, and references. Data cleaning was conducted to address inconsistencies in author names (e.g., name variants), remove duplicates, and unify institutional affiliations. This process was critical to ensuring accurate co-authorship and institutional network mapping. For disambiguation of terms in keyword co-occurrence analysis, synonyms and spelling variants (e.g., "R&D" vs. "research and development") were consolidated using a controlled vocabulary. The cleaned dataset was analyzed using VOSviewer (version 1.6.20), a well-established software for constructing and visualizing bibliometric networks [7].

3. RESULTS AND DISCUSSION

Keyword Co-Occurrence Network Analysis

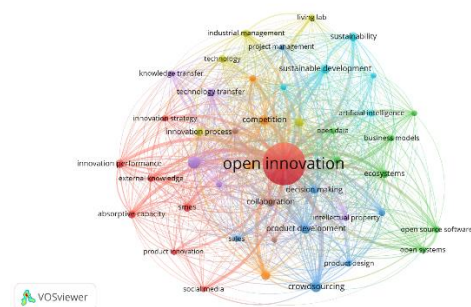


Figure 1. Network Visualization
Source: Data Analysis

Figure 1 above visualizes the conceptual structure of *open innovation* research within the technology industry based on the frequency and strength of keyword relationships across academic publications. At the center of the map, the term "open innovation" dominates as the most central and interconnected keyword, representing the core concept of the research field. It is surrounded by a dense network of associated themes such as *collaboration*, *product development*, *innovation performance*, and *external knowledge*. The size of the node indicates the frequency of keyword usage, while the proximity and thickness of the lines (links) reflect the strength of co-occurrence with other terms.

The red cluster on the left highlights a strong research stream focused on *innovation processes and outcomes*. Keywords like *innovation performance*, *absorptive capacity*, *product innovation*, *SMEs*, and *external knowledge* suggest an emphasis on how open innovation contributes to firm-level outcomes and capabilities. This cluster represents studies exploring the operationalization of open innovation, especially in small and medium-sized enterprises, and the mechanisms through which external knowledge sources enhance performance. The blue and orange clusters in the lower part of the map indicate themes related to *digital and participatory innovation tools*. Terms like *crowdsourcing*, *social media*, *open source*, and *product design* reflect the growing significance of user-driven and platform-enabled

innovation mechanisms. These studies often examine the role of digital platforms and community engagement in fostering collaborative product development and idea generation in tech environments.

To the upper right, the green cluster shows a convergence between open innovation and broader strategic themes such as *ecosystems*, *business models*, *artificial intelligence*, *open data*, and *open source software*. This suggests a growing research interest in the intersection of open innovation with digital transformation, sustainable ecosystems, and technology governance. The green cluster positions open innovation as a key enabler of business model innovation and value co-creation in increasingly complex and interconnected technological landscapes. The yellow and cyan clusters in the upper section introduce perspectives on *sustainability*, *project management*, and *industrial applications*. Keywords like *sustainable development*, *living lab*, *industrial management*, and *technology transfer* point to research that links open innovation to long-term societal goals and real-world implementation. This suggests that open innovation is being framed not only as a business strategy but also as a tool for addressing grand challenges and supporting sustainable technological transitions.

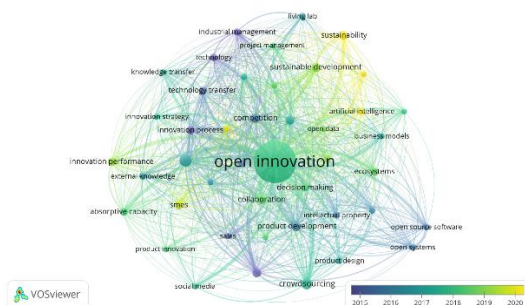


Figure 2. Overlay Visualization

Source: Data Analysis

Figure 2 displays the temporal evolution of research themes related to open innovation in the technology industry, using color gradients to represent the average publication year of keywords. The color bar ranges from dark blue (older terms, ~2015) to bright yellow (newer terms, ~2020). The central term "open innovation", depicted in green, indicates sustained interest throughout the mid-to-late 2010s. Keywords such as

collaboration, product development, and external knowledge also appear in green, suggesting their ongoing relevance in foundational research across the decade.

A clear shift toward emerging topics is visible in the yellow cluster on the upper right, which includes terms such as sustainability, sustainable development, and artificial intelligence. These keywords are associated with more recent studies, reflecting the growing intersection of open innovation with global challenges such as sustainability transitions and digital transformation. Additionally, terms like open data and business models show an upward trend in interest, highlighting new focal areas where open innovation practices are being applied to address complex, systemic issues. In contrast, keywords shown in blue and purple, such as social media, crowdsourcing, open source, and product design, represent earlier research trends, with peak attention around 2015–2017. These themes focused on digital platforms and user participation in innovation, which formed the basis for many open innovation strategies in the technology sector during the early adoption phase.

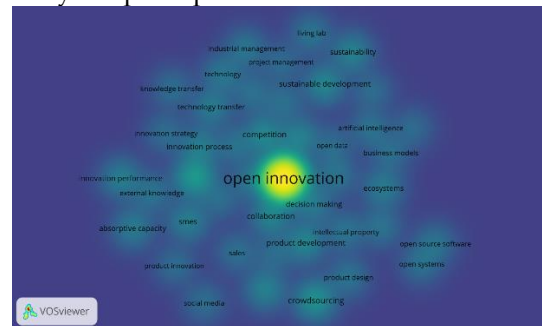


Figure 3. Density Visualization

Source: Data Analysis

Figure 3 above provides a density-based representation of keyword occurrences in open innovation research within the technology industry. The term "open innovation" appears as the most frequently occurring keyword, highlighted in bright yellow at the center, indicating its dominant presence and centrality in the field. Surrounding this core are moderately frequent terms such as collaboration, product development, decision making, and external knowledge, which are shown in green and light blue—signifying high but relatively

lower intensity compared to the central concept. These keywords reflect key mechanisms and processes through which open innovation is implemented and studied across technological domains. Areas shown in darker shades of blue or purple—such as living lab, sales, project management, and social media—represent less frequent but still relevant terms. While these topics contribute to the diversity of the research landscape, their lower intensity suggests that they are either emerging areas or niche themes within the broader open innovation discourse.

Co-Authorship Analysis

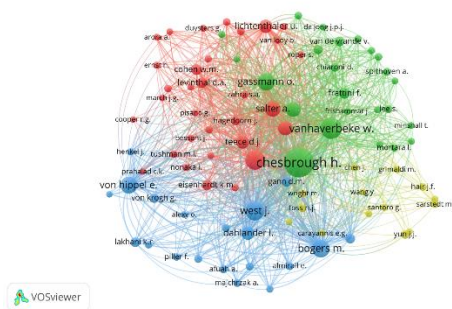


Figure 4. Author Visualization
Source: Data Analysis

Figure 4 above reveals the intellectual structure of open innovation research by mapping the most influential scholars and their collaborative clusters. At the center of the map is Henry Chesbrough, the founder of the open innovation concept, serving as the most prominent and widely connected author—indicating his foundational role in shaping the field. Surrounding him are tightly connected clusters of scholars. The red cluster includes authors like Gassmann, Salter, Teece, and Lichtenthaler, representing early institutional and managerial perspectives on innovation. The green cluster, anchored by Vanhaverbeke, emphasizes applied and ecosystem-oriented research. The blue cluster, featuring Von Hippel, Dahlander, West, and Bogers, is associated with user innovation, digital platforms, and distributed knowledge systems.

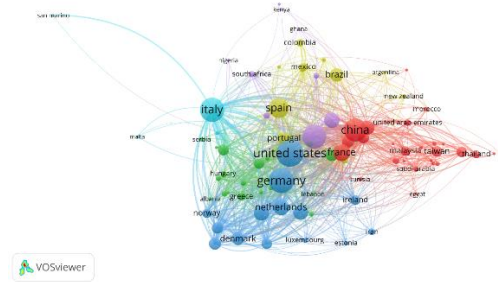


Figure 5. Country Visualization
Source: Data Analysis

The figure 5 illustrates the global distribution and co-authorship patterns in open innovation research. Prominent countries such as the United States, China, Germany, Italy, Netherlands, and United Kingdom (notably France and Spain too) form the central hubs, indicated by their larger node sizes and dense interlinkages—signifying high productivity and frequent international collaboration. The blue cluster groups several European nations, reflecting strong intra-regional cooperation, while the red cluster centered on China links to East and Southeast Asian countries like Malaysia, Taiwan, and Thailand, showing regional research ties. The yellow and green clusters represent emerging contributors from Latin America (e.g., Brazil, Mexico) and Africa (e.g., Nigeria, Kenya), with fewer but growing connections.

DISCUSSION

Conceptual and Thematic Structure

The keyword co-occurrence map provides insight into the core themes driving open innovation research. At the heart of this landscape is the concept of collaboration across firm boundaries, which serves as the central mechanism for innovation in technologically dynamic environments. Closely connected terms such as product development, external knowledge, absorptive capacity, and innovation performance reflect the theoretical underpinning of the knowledge-based view and the resource-based view of the firm [8] [9]. These frameworks posit that the ability to acquire, integrate, and apply external knowledge is vital for maintaining competitive advantage in rapidly changing markets—precisely the scenario facing technology firms today.

In addition, the presence of keywords like product innovation, technology transfer, innovation strategy, and SMEs suggests a growing interest in the operational and strategic dimensions of open innovation. Research in this domain often explores how firms—especially small and medium-sized enterprises—leverage external partners, universities, and ecosystems to overcome resource limitations and accelerate innovation cycles. This confirms previous studies emphasizing that open innovation is not solely the domain of large firms but is increasingly adopted across various organizational scales [10].

Meanwhile, the appearance of terms like artificial intelligence, business models, ecosystems, and open data in newer clusters (as revealed in the overlay map) points to the broadening scope of open innovation toward digital transformation and ecosystem-based innovation. These themes indicate that open innovation is increasingly being contextualized within the platform economy, where technological infrastructures enable distributed knowledge sharing and value co-creation across heterogeneous actors. The integration of AI and big data into innovation processes also reflects a shift toward data-driven innovation models, where external data streams enhance decision-making and market responsiveness.

Temporal Dynamics and Emerging Topics

The overlay visualization, which captures the average publication years of keywords, reveals a chronological evolution of research priorities. Earlier research, marked by terms in blue and purple, focused on topics such as crowdsourcing, open source software, and social media. These studies laid the groundwork by exploring the mechanisms and platforms that enable open participation in innovation. Theoretical contributions during this period largely revolved around delineating the boundaries of openness and comparing closed versus open innovation models [11]. However, more recent studies (marked in green to yellow) have expanded the discourse toward sustainability, artificial intelligence, and business model innovation. The prominence of sustainable development,

open data, and ecosystems reflects a growing recognition that open innovation can also serve societal goals, not just commercial objectives. These shifts are consistent with global megatrends emphasizing the importance of inclusive innovation, green transitions, and responsible technology use in the context of climate change, global pandemics, and digital inequality. This evolution suggests a convergence between technological innovation and grand challenges, positioning open innovation as a tool for systems-level transformation. Researchers are increasingly examining how open innovation can be applied to cross-sectoral domains such as smart cities, health technology, and energy systems—each requiring coordination among diverse actors and knowledge domains. These insights reinforce the importance of adaptive, collaborative, and platform-enabled innovation strategies in future-ready technology firms.

Intellectual Foundations and Key Contributors

The author co-citation network identifies the intellectual foundations of the field and the main contributors shaping its trajectory. Henry Chesbrough, the originator of the open innovation concept, remains the most influential scholar, centrally positioned with strong ties to both theoretical and applied research domains. His early work provided the definitional clarity and strategic frameworks that catalyzed widespread academic inquiry. Other key authors such as Joel West, Wim Vanhaverbeke, Marcel Bogers, and Oliver Gassmann form dense collaboration networks, suggesting a cohesive core of scholars advancing the theory, measurement, and empirical applications of open innovation. The clustering of authors into thematic groups—such as user-centered innovation (e.g., von Hippel), strategic management (e.g., Teece, Zahra), and digital platforms (e.g., Dahlander, Alexy)—demonstrates the field's multidisciplinary nature. This diversity has enriched the discourse, allowing scholars to draw from economics, organization theory, knowledge management, and information systems. It also

underscores the field's capacity for theoretical integration, as researchers adapt the open innovation paradigm to a variety of analytical lenses and empirical contexts. Interestingly, recent contributions from scholars focused on ecosystem management, AI integration, and sustainable innovation indicate that the next frontier of open innovation research lies in managing complex innovation systems rather than isolated firm-level practices. This shift necessitates new methodological tools and conceptual frameworks capable of capturing the interdependencies and emergent dynamics within innovation ecosystems.

Geographical Trends and Global Collaboration

The country collaboration map further reveals the geographical diffusion and internationalization of open innovation research. The United States, Germany, the Netherlands, China, and Italy are among the most productive and collaborative countries, forming dense co-authorship networks. European countries in particular show strong cross-border collaborations, reflecting the role of regional funding bodies such as the European Commission in supporting open innovation projects across national boundaries. China has emerged as a major contributor in recent years, particularly in applying open innovation models to manufacturing, digital platforms, and government-led innovation initiatives. Its integration into the global research network, alongside East Asian countries like Malaysia and Taiwan, reflects the regional expansion of open innovation beyond Western economies. The increasing involvement of Latin American and African nations, although still limited in scale, suggests a broader interest in contextualizing open innovation for local development and institutional settings. These global collaborations are critical for the future of the field. As innovation challenges become increasingly transnational—ranging from pandemic response to climate action—cross-country knowledge flows and joint research become indispensable. The open innovation paradigm itself is inherently global, advocating for permeability, distributed intelligence, and boundary-spanning

interactions. Thus, fostering international partnerships in both research and practice is aligned with the paradigm's fundamental principles.

Implications for Research and Practice

This analysis provides several implications for scholars and practitioners. For researchers, the results call for more integrative and cross-disciplinary frameworks that can accommodate the evolving complexity of innovation ecosystems. Thematic areas such as platform governance, sustainability-oriented innovation, and data-driven decision-making warrant deeper exploration. Moreover, greater attention should be given to the ethical and societal dimensions of openness, including data privacy, equity, and the governance of shared knowledge. For practitioners, particularly those in technology-intensive firms, the findings underscore the importance of dynamic capabilities to manage external collaborations, orchestrate innovation ecosystems, and adapt business models in light of changing environmental and technological conditions. Firms must invest not only in technological infrastructure but also in relational capabilities and absorptive capacity to fully benefit from open innovation strategies.

Limitation and Future Research

While this study offers a systematic overview, it is not without limitations. The reliance on Scopus as the sole database may exclude relevant publications indexed elsewhere, and the keyword-based approach may underrepresent conceptual nuances. Additionally, bibliometric methods capture only the quantitative structure of the field and not the qualitative depth of contributions. Future research could complement these findings with systematic literature reviews, case studies, or meta-analyses to enrich the interpretation of key themes and theories.

4. CONCLUSION

This bibliometric study reveals that open innovation has evolved into a robust and interdisciplinary research field within the technology industry, characterized by diverse

themes ranging from knowledge transfer and product development to emerging topics such as sustainability, artificial intelligence, and digital ecosystems. The intellectual foundation of the field is anchored by influential scholars like Chesbrough, West, and Vanhaverbeke, while collaborative networks among countries such as the United States, Germany, China, and Italy demonstrate the global nature of research in this domain. Temporal analysis indicates a

shift from early explorations of participatory tools like crowdsourcing to more recent engagements with platform-based, ecosystem-driven, and sustainability-oriented innovation strategies. These findings offer valuable guidance for future academic inquiries and practical applications by highlighting both the established pillars and underexplored frontiers of open innovation in an increasingly complex technological landscape.

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