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History and future of business ecosystem: a bibliometric analysis and visualization

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Abstract
The business ecosystem theory has developed rapidly in recent years and has become a hot topic in the field of business and management. However, the use of this concept is controversial. This study systematically reviewed literature published spanning nearly three decades from 1993 to 2022. In this paper, researchers designed an improved traceability method to retrieve literature based on data sources form Web of Science. VOSviewer and CiteSpace are adopted as two scientific atlas tools for information processing and visualization to evaluate the relationship between sub fields of business ecosystem. The findings show that the four branches of business ecosystem, i.e., innovation, platform, entrepreneurship and service, absorb theoretical ideas to varying degrees. Among them, the theoretical inheritance relationship of innovation branch is most clear, and gradually grows into the backbone of ecosystem research. Major contribution of this study is reflected in three aspects: Firstly, the improved traceability method provides a repeatable quantitative description process on the basis of significantly reducing researchers' subjective participation. Secondly, from perspective of bibliometrics, the branch direction and key nodes of theory development are identified. Thirdly, the study helps identify the future development directions of business ecosystem, including innovation, digitalization, entrepreneurship, self-organization and the strategic transformation guided by emerging technologies.

Keywords Business ecosystem · Innovation · Literature visualization, traceability method · Co-citation

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1 Introduction

Open innovation in business models is as impactful as technological innovation (Chesbrough, 2007). At the end of the last century, companies like Apple and Wal-Mart achieved significant success through disruptive innovations based on open platform models. Their achievements have inspired managers and researchers to understand that, in today's business environment, companies must transcend traditional organizational boundaries to tackle innovation challenges. They need to incorporate external supplements into their governance systems to overcome key bottlenecks that might lie outside organizational control (Adner, 2006). In this multi-faceted interaction structure, a system regarded as complex at one level can function as a component in a more extensive system (Christensen & Rosenbloom, 1995). Simple bilateral relations cannot fully explain the intricate value relationships among network members in such nested systems, necessitating a shift from existing linear value theories.

In this context, business ecosystem theory emerged. The term "ecosystem" originally described the interactions between organisms and their physical environment (Tansley, 1935). This concept has since expanded to encompass complex connections and dynamic evolution beyond natural sciences, profoundly influencing social science research. Business ecosystem theory, a product of interdisciplinary linkages, metaphorically bridges natural and social sciences, offering a groundbreaking business perspective: companies should be viewed not as isolated industry members but as part of a cross-industry business ecosystem (Moore, 1993). This theory provides a framework to bridge the gap between reality and theoretical understanding. Surprisingly, it did not gain significant research attention for a long time. Entering the new century, the concept of business ecosystems regained researchers' interest, with the term appearing sporadically in business research fields. Significant milestones were reached a decade later with two influential studies published in Harvard Business Review (Iansiti & Levien, 2004; Adner, 2006), leading researchers to recognize the potential of business ecosystems to develop into a comprehensive theoretical knowledge system.

Business ecosystems are not naturally occurring; they are partially shaped by experimental and engineering design from various perspectives (Jacobides et al., 2018), reflecting the intentions of system designers. In these systems, each member occupies a unique niche, developing capabilities aligned with goals set by designers, collectively creating value for the entire network (Moore, 2016; Iansiti & Levien, 2004). System designers are typically one or more core enterprises, referred to as cornerstone companies or focal actors. They simplify complex connections among network participants by creating service, tool, or technology platforms, leveraging platform leadership to influence the innovation direction within the system (Cusumano & Gawer, 2002). Non-core companies usually do not rely on a single ecosystem; they benefit from cross-ecosystem operations and diversification strategies. Participation in ecosystems extends the operational scope of non-core firms, equipping them with the management capabilities and technical resources essential for innovation (Selander et al., 2013).

Given the diversity of stakeholders, ecosystem structures may represent some of the most extensive network structures in management research (Autio & Thomas, 2014). The broad membership facilitates the integration of ecosystem theory with other theoretical paradigms, evolving various ecological branches tailored to different application scenarios. This trait

aided the dissemination of concepts in the early stages of theory development. However, with the rapid expansion of terminology usage and fine-grained theoretical applications, the notion of business ecosystems has shifted from being a premium to a discount, similar to a diversified entity (Khanna & Yafeh, 2007). Chaotic usage scenarios and blurred theoretical boundaries undermine the theory's core values, threatening its legitimacy. Some scholars have sharply criticized this trend in recent years (Oh et al., 2016; Bogers et al., 2019), suggesting that "ecosystems" function more as a "conceptual umbrella" covering various viewpoints rather than a coherent scientific theory (Spigel, 2017).

The interdisciplinary nature of business ecosystem theory results in research being widely distributed across various disciplines and fields. This distribution leads to significant subjectivity in the literature review process. Consequently, our study reflects on the limitations of mainstream literature retrieval methods and proposes an improved "traceability method" for collecting literature. Our research focuses on the following three issues:

1. What is the main scope of relevant research on business ecosystem theory?
2. What is the logical relationship between the fields of ecological branching?
3. What are the theoretical development trends and future research directions?

The rest of this paper is structured into four parts. Section 2 introduces the research and data acquisition methods used in this study. Section 3 reveals fundamental information about the retrieved literature, such as growth trends and the distribution of disciplines and journals. Section 4 analyzes and interprets data concerning the three questions above using keyword co-occurrence, co-citation analysis, cluster distribution, burst detection, and timeline trends. Section 5 compares the traceability method used in this study with traditional search techniques and conducts cluster analysis for findings ; The final part, Sects. 6 & 7 summarizes the study, discussing future research directions in this field.

2 Methodology and data sources

The reasonable selection and filtration of literature are crucial factors that enable smooth and accurate research analysis. Traditionally, the data collection process in existing research comprises two main components: conditional restrictions (such as databases, core terms, subject areas, journals, ratings, etc.) and manual review. This study adheres to this approach for the initial phase of data collection and identifies two opposing challenges:

1. Subject area restrictions or stringent journal designations can compromise the integrity of research on the periphery.
2. Removing these restrictions risks limiting the scope to the direction of natural ecology.

This issue partly stems from the metaphorical nature of the business ecosystem concept itself.

To address this challenge, conventional methods often rely on a manual screening process, which increases the subjectivity of the investigator. A horizontal comparison of previous data collection methods highlights the prevalence of this issue. Even with the most stringent double restriction method (Tsujimoto et al., 2018), the screening rate for manual

review exceeds 50% (see Table 1 below). Such intensive screening can introduce researchers' personal biases, undermining the credibility of discussions on theoretical boundaries.

2.1 Improved traceability method

To address the challenges in the data collection process, this study developed a literature retrieval method based on concept traceability, using two key literatures as foundational points: (1) Moore's article "Predators and Prey: A New Ecology of Competition" published in 1993, and (2) the monograph "The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems" published in 1996. The former marks the birth of the business ecosystem concept, while the latter provides the first comprehensive explanation of the theory. Given the expanding scope of ecosystem logic, traceability helps distinguish research based on the business ecosystem concept from those that are not. When an article cites these foundational works, it indicates that the author acknowledges a logical connection between their research and the business ecosystem concept, whether positively or critically. The data samples thus obtained form a necessary subset strongly related to business ecosystem theory.

Building on this foundation, researchers employed VOSviewer and CiteSpace for information processing and visualization. Both programs are designed to construct and view bibliometric maps (Eck & Waltman, 2010). VOSviewer excels in speed when handling large-scale maps and balances expressive drawing and functionality, while CiteSpace offers greater operability with a unique timeline view and burst detection function. Bibliometric maps provide a systematic method for researchers to understand the evolution of scientific fields and integrate various information to capture the latest technologies (Chen, 2017). This study combines the advantages of both tools to mine and expand information, ensuring that gaps in the sample are filled to meet the literature combing sufficiency requirements.

In summary, this research identifies the shortcomings of traditional methods in handling literature related to business ecosystems and proposes an improved traceability method to address the challenges of the manual review process in data collection.

2.2 Adopted data sources

This study uses the Web of Science (WOS) database as the primary data source. WOS is the leading platform for scientific citation search and analysis, supporting a wide range of scientific tasks across different knowledge areas and serving as a data set for large-scale, data-intensive research. When comparing different databases, WOS is typically regarded as the most stable (Harzing & Alakangas, 2016; Mongeon & Paul-Hus, 2016; Li et al., 2018). Although WOS lacks coverage of social science books (Waltman, 2016), this does not impact the study's content.

Table 1 Examples of data acquisition methods for business ecosystem review studies

Author	Restricted categories before manual review	BM/AM
Aarikka-Stenroos et al. (2017)	Keywords → journal designation	240/71
Tsujimoto et al. (2018)	Field → Journal Rating → Keywords	187/90
Scaringella and Radziwon (2018)	Domain → Keywords	354/104
Hakala et al. (2020)	Domain → Keywords	622/55

Note: BM: amount of literature before manual screening; AM: amount of literature after manual screening

Using the WOS citation function "Cited References," 1106 items were retrieved that cited the 1993 baseline literature. Standard restrictions were applied to refine the target scope: selecting the "Social Sciences Citation Index (SSCI)" and "Science Citation Index Expanded (SCIE)" qualification levels to enhance literature quality, restricting subject headings to include "ecosystem*" to ensure relevance, and selecting only "article" types, excluding "early access" articles. As of March 1, 2022, a total of 400 papers met these requirements. The 610 works citing the 1996 baseline monograph were similarly screened, resulting in 189 retained articles. The two literature sets were combined and deduplicated, yielding a final sample of 488 articles. Each document in the sample focuses on ecosystems and is influenced by Moore's business ecosystem theory to varying degrees, identifying the sample as research "established on the basis of business ecosystem thinking."

This information query process is general and traceable. For further review, two experts in related fields were invited to examine the samples and list any doubtful literature. If both experts had doubts about the same literature, it was excluded; if they disagreed, consensus was reached through discussion. The results showed that all sample documents successfully passed the review process.

3 Fundamental information of retrieved business ecosystem literatures

This section presents fundamental information about the retrieved literature to outline the contours of the business ecosystem field. It includes the distribution of publications by year, country and region, WOS field, journal, and research institution. Among these indicators, only the distribution ratios for years and journals sum to 1, while other items have cross-connections.

Figure 1 illustrates the growth trend of articles citing Moore's foundational literature in the WOS database. The earliest related article appeared in 2004, confirming a decade-long period of relative silence for the theory. The research field entered an explosive growth phase around 2012, with the number of published papers continuing to rise after a brief fluctuation. Overall, more than half of the total published papers have been produced in the last three years. Currently, the research concept appears to have reached the mature stage of its life cycle, with the publication growth rate stabilizing.

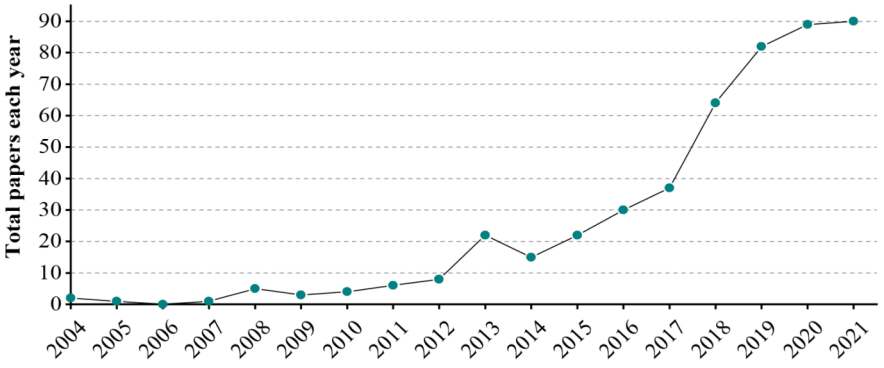

Fig. 1 The growth trend of articles in the field of business ecosystem

Figure 2 illustrates the distribution of documents across different countries and regions, segmented into three time periods represented by different colors. Prior to 2019, the top three countries by the number of articles were the USA, England, and China. In the subsequent two years, China's share of published articles increased significantly, propelling it to the top rank. As of 2022, the top four countries in terms of total published documents are China, England, the USA, and Finland, with a significant gap between these and the following countries and regions.

Figure 3 demonstrates distribution of literature by different subject areas. "Management" and " Business" categories are the main research fields of this theory. At the same time, there are also a large number of research works involving this theory in the fields such as "Regional Urban Planning", "Environmental Studies", "Environmental Sciences" and "Green Sustainable Science Technology". This suggests that ecosystem theory extends beyond stereotypes and builds bridges between multidisciplinary fields. This echoes our concern that "subject area restrictions or more aggressive designated journal restrictions undermine the integrity of the research fringes".

In terms of journal distribution, the 488 articles in the sample are spread across 195 journals. Among these, *Technological Forecasting and Social Change* and *Sustainability* have notable quantitative advantages, with 47 and 37 papers published, respectively, accounting for 9.63% and 7.58% of the total. From the perspective of research institutions, the University of Cambridge and Tsinghua University are tied for the highest number of publications, although the University of Cambridge holds a more central position within the knowledge network.

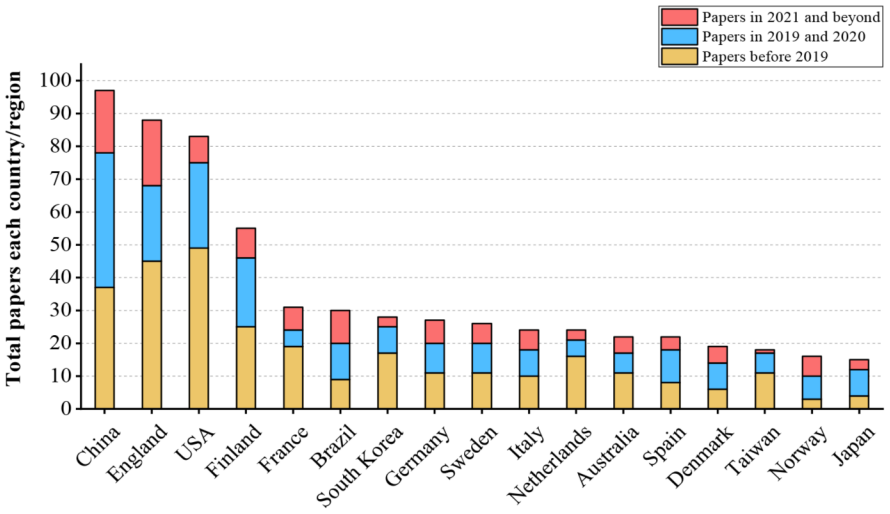

Fig. 2 Distribution of the sample articles in different countries and regions

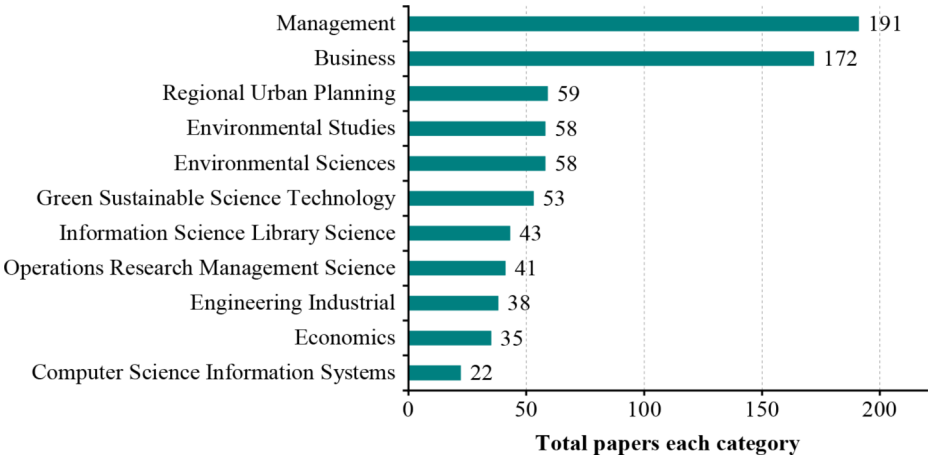

Fig. 3 The top 11 WOS categories by number of articles

4 Main scope of Business Ecosystem Literatures

This section further analyzes the commonalities and connections between the sample literature, describing the main scope of business ecosystem research using the bibliometric indices "co-occurrence" and "co-citation".

4.1 Keywords co-occurrence

The full record information of 488 documents was imported into VOSviewer to analyze the co-occurrence of keywords. According to the bibliometric data, 2251 keywords were involved in the sample. To achieve better visualization, the co-occurrence threshold for keywords was set to 6 times, resulting in a visualization map with 135 items, as shown in Fig. 4 below:

The 135 keywords formed 6 clusters, and the top eleven words sorted by "Total Link Strength" covered all six categories, as shown in Table 2.

Researchers integrated high-order words calculated by frequency and centrality, categorizing them into three groups:

1. Initial Search Terms and Derivatives: This includes terms like ecosystem, business ecosystem, network, and business model. Here, the network is related and similar to the ecosystem, with the former being relationship-based and the latter purpose-based. An interesting distinction is that two companies within the same network structure can have vastly different business ecosystems due to differing value propositions (Adner, 2017).
2. Nominalized Verbs: This category includes words such as innovation, value creation, competition, evolution, and cooperation. These terms are highly expressive, reflecting the core of business ecosystem thought. Innovation is the most prominent word, indicating that all business ecosystem projects revolve around innovation. The concept encompasses both dynamic processes and outcomes compared to traditional ecological studies. Notably, "value creation" appeared 88 times, while terms like value distribution

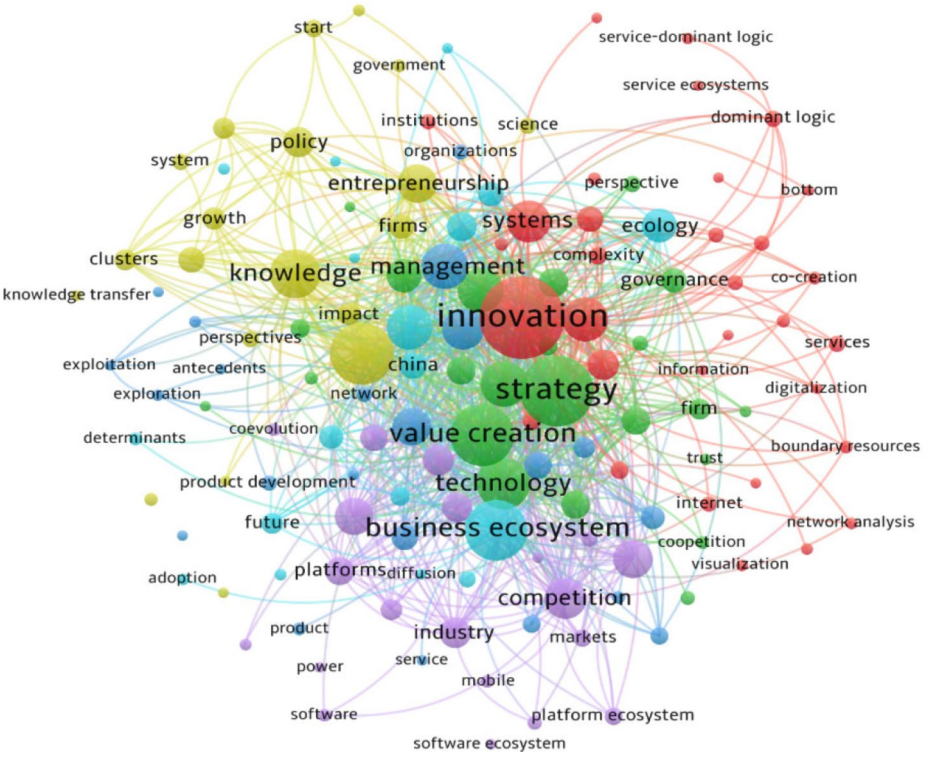

Fig. 4 Co-keyword network visualization on business ecosystem research

Table 2 Top keywords ranked by total link strength

Keywords	Strength	Cluster	Links	Occurrences
innovation	793	1	127	141
strategy	707	2	126	111
performance	583	4	116	90
value creation	577	2	120	88
technology	456	2	113	67
business ecosystem	425	6	102	87
knowledge	409	4	108	62
management	337	3	102	55
networks	337	2	102	53
frameworks	324	1	100	53
competition	315	5	89	46

or value sharing were scarcely used, highlighting a preference and imbalance in theoretical development. The term competition, particularly in the context of Moore's "death of competition," refers to a shift from enterprise to ecosystem competition, often resulting in more intense conflicts between ecosystems.

3. Generic Terms: This includes words like strategy, performance, technology, knowledge, and framework. Strategy here implies a meso-level perspective, often higher than

individual enterprises or industries but below the macro societal level. Performance emphasizes the effective output of ecosystem members, echoing the focus on value creation and reflecting a pursuit of research quantification by scholars.

4.2 Co-citation analysis

A key feature of science mapping is co-citation analysis. When two articles appear together in the bibliography of a third article, they form a co-citation relationship (Chen, 2006). The co-citation function identifies significant works in the study of inheritance relationships, isolating weakly related or unrelated literature. This process expands our focus from the 488 documents to those within their citation networks, allowing researchers to identify key research results that connect knowledge networks. Conclusions drawn from this approach are significant for discussions on boundary and genre divisions in business ecosystem theory.

According to bibliometric data, 9,725 citation sources were involved in the sample. By setting a minimum citation threshold of 20, 221 entries were included in the visual map, shown in Fig. 5. This map highlights journals with significant attention in the field, briefly introduced as follows:

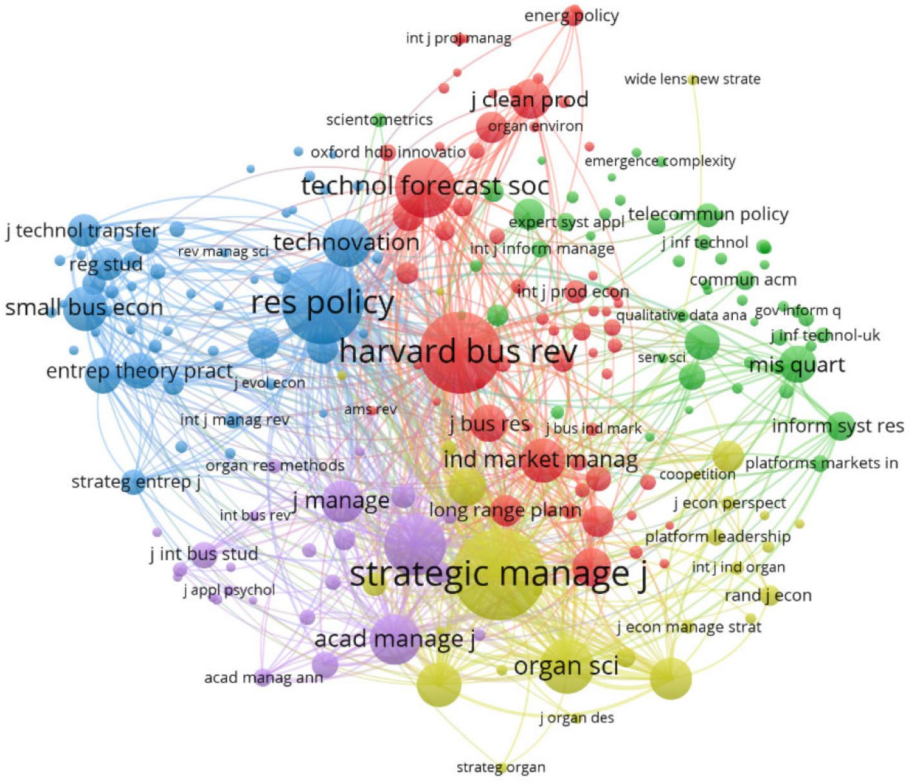

Fig. 5 Co-keyword network visualization on business ecosystem research

4.2.1 Harvard business review

Known for being forward-looking, it is the origin and cradle of business ecosystem theory, publishing significant works by Moore, Iansiti, and early Adner.

4.2.2 Strategic management journal

Known for outstanding works by Adner and Kapoor (2010), Jacobides et al. (2018), and Hannah and Eisenhardt (2018), these works are frequently cited and remain foundational.

4.2.3 Research policy

Notable for the number of articles published on ecosystems, significantly outperforming other journals in this index.

Using CiteSpace, co-citation analysis was conducted on key nodes. Full record information of 488 documents was imported, with the network clipping method set to "Pathfinder." In the co-citation graph, node size represents the frequency of occurrences, and line thickness indicates co-occurrence frequency. Figure 6 shows two visualization perspectives of co-citation analysis:

1. Author Perspective: This map shows the shapers of theoretical foundations, key bottleneck breakthroughs, and continuous investment builders, emphasizing the historical significance of researchers.
2. Literature Perspective: This map observes field connections and sustained influence, emphasizing the importance of recent research results and depicting a more complex relationship structure between literature.

Among the top ten authors with total citations, Moore, Iansiti, Adner, Jacobides, and Autio have been previously mentioned. Gawer and Nambisan will be introduced in clustering information and burst detection later. Porter and Teece, masters in strategic management and competitive strategy, also provide intellectual value for business ecosystem theory. Porter's concept of creating shared value aligns with business ecosystem ideas (Porter & Kramer, 2011), focusing on value shared within the ecosystem. Teece's most co-cited work explores innovative support for the digital platform ecosystem (Teece, 2018). Additionally, Eisenhardt stands out as a prominent node in the citation network, with her work improving the case study method being frequently cited (Eisenhardt, 2007).

This sector explored the scope of business ecosystem literature using co-occurrence and co-citation analyses. The analysis revealed the evolution of business ecosystem research and its integration with strategic management, highlighting the importance of shared value and digital platform ecosystems, and underscoring the historical and ongoing contributions to the field. In the following sector, we will compare the method used in this study with traditional search techniques.

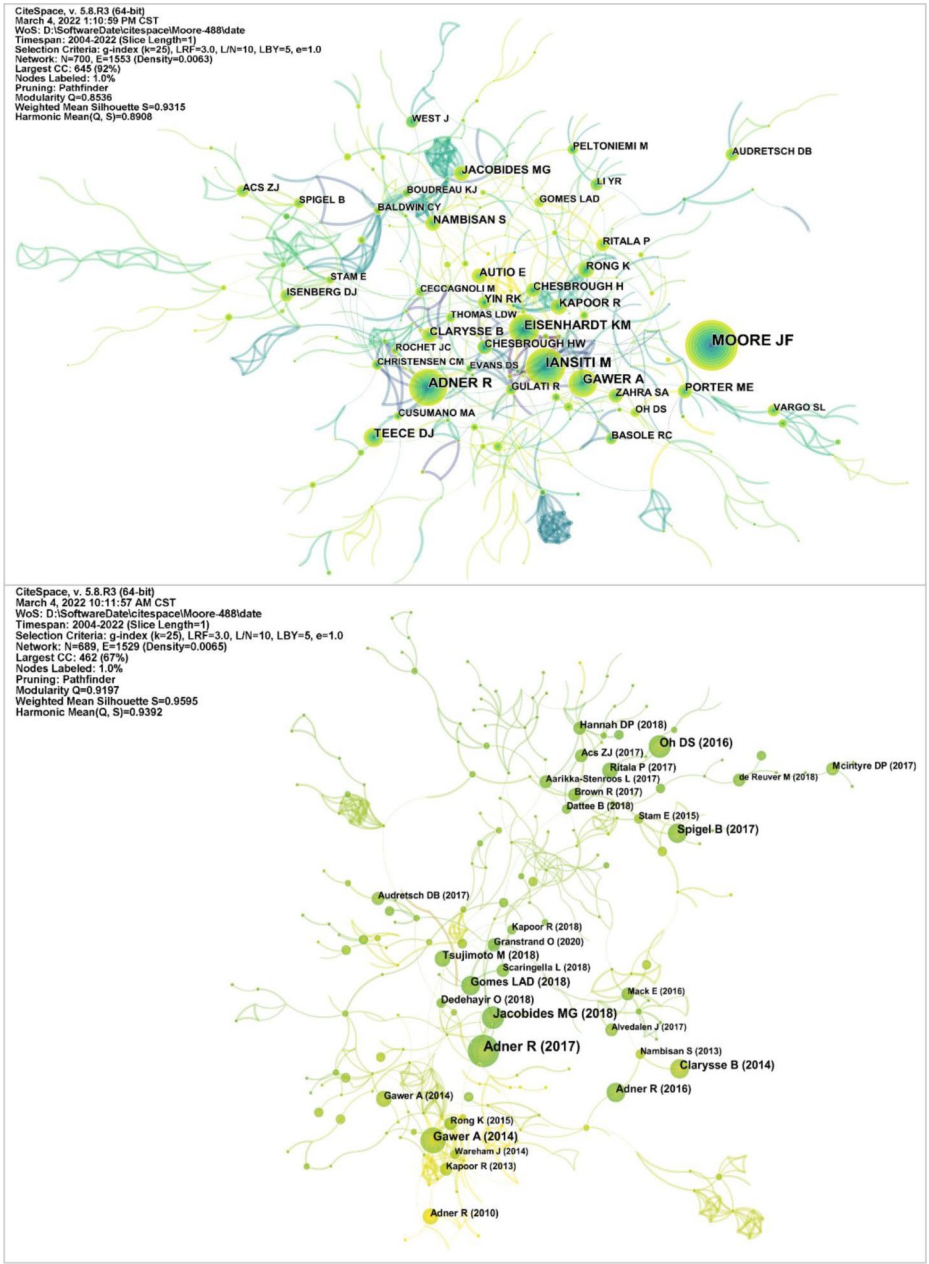

Fig. 6 Co-citation analysis maps from the perspective of author (above) and literature (below)

5 Findings and discussion

5.1 Comparison between new traceability method and traditional search techniques

The traceability method proposed in this study offers significant advantages over traditional search techniques. Firstly, it aligns closely with the trajectory of business ecosystem theory, which has a well-documented origin and a ten-year quiescent period, effectively minimizing interference from multiple sources. Secondly, the literature sourced through this method directly links to the theoretical origin, aiding in excluding: 1) Passive fuzzing usage, where researchers use ecological concepts merely as a backdrop without engaging with the theoretical source; 2) Actively blurred usage, where authors may avoid acknowledging the theory's historical importance for various reasons; 3) Same disciplinary usage, where the concept of 'ecosystem' is used differently within the same field, such as the interaction between businesses and natural ecology, without a significant inheritance relationship.

Thirdly, this method mitigates the impact of subjective biases, providing highly discriminative samples that help address contentious issues more effectively.

Although the proposed traceability method has certain limitations compared to traditional search techs, the study has effectively addressed these limitations. One limitation is that it omits documents without citation information, such as articles in the Harvard Business Review, which cannot be retrieved using citation data. Another limitation is the potential overemphasis on certain authors and their research teams, beyond the method's intended scope. To address the first limitation, this study used bibliometrics to expand the sample and complete the knowledge network. Bibliometric methods employ quantitative approaches to describe, evaluate, and monitor published research, introducing a systematic, transparent, and repeatable review process, thereby enhancing review quality (Zupic & Čater, 2015). The second limitation regarding author prominence was addressed by analyzing work from Google Scholar, showing that most of Moore's ecosystem-related work is independent, with the chosen base points having clear advantages in timelines and citation counts, suggesting that the influence of authorial weight is within acceptable limits.

This study also incorporated a control data set, applying traditional domain constraints like "Management or Business or Economics" and restricting the level to SSCI and SCIE, excluding articles with "early access". The sample was manually reviewed, resulting in 579 out of 952 articles passing the review. Researchers further validated the new method's unique advantages by conducting lexical clustering analysis on co-cited documents and comparing these with samples obtained via traditional searches. The analysis, supported by CiteSpace software, confirmed that clusters with a modularity (Q) value above 0.3 and a silhouette (S) value above 0.7 are considered structurally sound and efficient. The new method achieved Q values of 0.926 and S values of 0.952, surpassing traditional methods in creating more coherent and interconnected clusters. The traditional method resulted in scattered clusters with sparse connections, whereas the traceability method produced tightly integrated clusters, enhancing cross-disciplinary linkages and producing distinct cluster labels, which are illustrated in Figs. 7 and 8.

Comparing the cluster profiles of the two groups of samples, the researchers found significant discrepancy. The clustering modules obtained under the traditional retrieval method are obviously scattered, and the connections between nodes are relatively sparse, while the

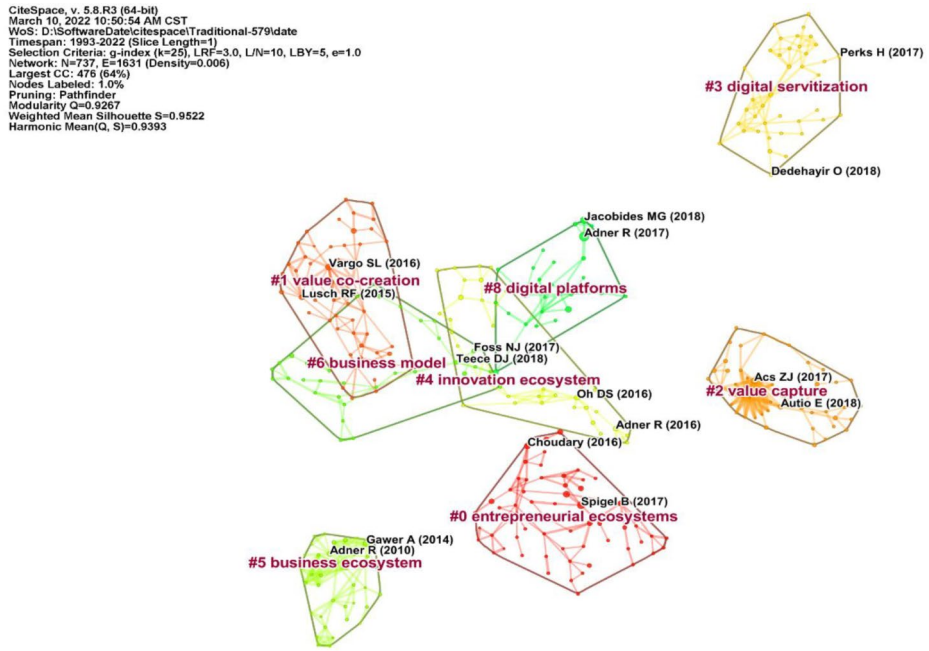

Fig. 7 Clustering comparison of traditional retrieval methods

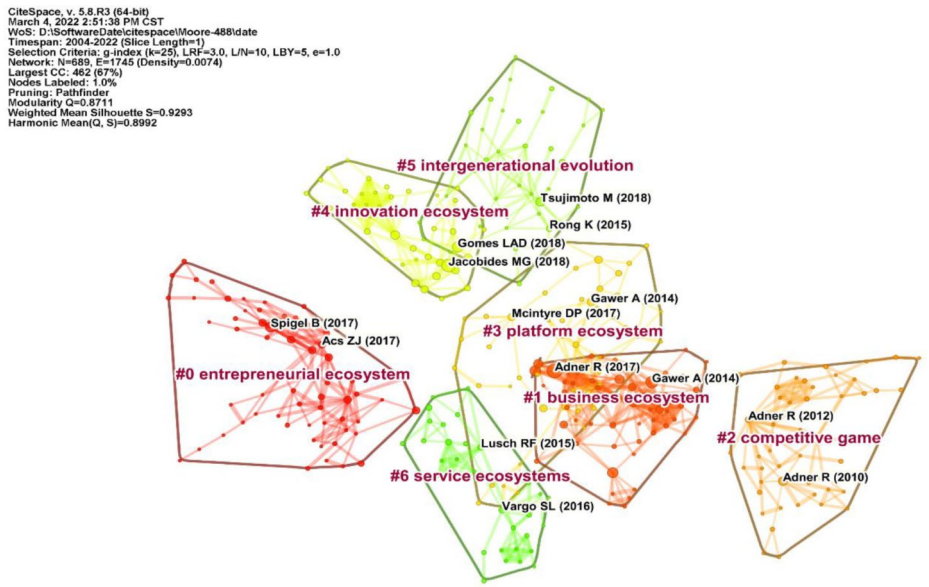

Fig. 8 Clustering comparison of traceability retrieval methods

Table 3 Information of main clusters obtained by traceability retrieval methods

Cluster	M	S	MY	Label (LSI)	Label (LLR)
#0	62	0.956	2016	entrepreneurial ecosystem	entrepreneurial ecosystem
#1	60	0.939	2013	business ecosystem	business ecosystem
#2	49	0.915	2010	competitive game	coopetition
#3	49	0.852	2016	platform ecosystem	two-sided market
#4	42	0.965	2017	innovation ecosystem	innovation ecosystem
#5	41	0.814	2017	intergenerational evolution	strategic transformation
#6	32	0.922	2014	service ecosystems	service ecosystems

Note: M: cluster members; S: Silhouette value; MY: mean year; LSI: Latent Semantic Indexing; LLR: log-likelihood Rate

Table 4 Information of main clusters obtained by traditional retrieval methods

Cluster	M	S	MY	Label (LSI)	Label (LLR)
#0	60	0.925	2014	entrepreneurial ecosystems	entrepreneurial ecosystems
#1	54	0.911	2014	value co-creation	service-dominant logic
#2	49	0.956	2018	value capture	entrepreneurial ecosystems
#3	42	1	2017	digital servitization	servitization
#4	40	0.924	2015	innovation ecosystem	innovation ecosystem
#5	39	0.945	2011	business ecosystem	business ecosystem
#6	34	0.936	2016	business model	internet of things
#8*	26	0.942	2016	digital platforms	platform ecosystems

Note: M: cluster members; S: Silhouette value; MY: mean year; LSI: Latent Semantic Indexing; LLR: log-likelihood Rate

modules are closely combined under the traceability method, covering more node in the intersection area. These articles serve as a key link between different fields. At the same time, the cluster labels extracted by the two methods are quite different. Tables 3 and 4 respectively list the clustering information of both two samples. The serial numbers are arranged according to the number of members in the group, and the correlation depends more on location of the cluster. With 25 members as the boundary, traceability samples form 7 categories above the scale, and this indicator is 8 in traditional samples. LSI and LLR represent two label extraction algorithms, which are carried out after the clustering ends and do not affect the shape of the clusters.

The results indicate that traditional clustering labels cover a broader range and include general terms like business model and digital platform, suggesting a less precise focus on the research field. New technology hotspots, such as digitization and the Internet of Things, have become central concepts in this theory. The traditional retrieval method often extends literature too far into adjacent disciplines. For example, the semantics of "service-dominant logic" overshadow "service ecosystem," making it a key clustering label, while entrepreneurship literature is overrepresented, splitting the concept into "Entrepreneurial Ecosystem" and "Value Capture." Additionally, "digital service" forms a loosely connected category, making it challenging to determine a stable relationship with business ecosystem theory. These issues highlight the negative impact of stringent field restrictions and intensive manual review on the scientific quality of literature samples.

5.2 Relationship between ecological branches and cluster analysis

Despite significant differences, both sample groups agree on basic concepts. They clearly delineate four ecosystem sub-concepts: innovation, platform, entrepreneurship, and service, aligning with mainstream business ecosystem reviews. Business, innovation, and platform clusters hold central positions, while entrepreneurship and service are relatively peripheral. The entrepreneurial ecosystem consistently forms an independent module with a stable member association structure. The following example will analyze the clusters generated according to the traceability method.

Cluster 0 is named as the entrepreneurial ecosystem, and this category has the most group members, and the top three papers with co-citation index are Spigel, 2017; Acs et al., 2017; Audretsch & Belitski, 2017. Entrepreneurial flow is an incomplete ecosystem, which is generally limited by geography, and more consideration is given to analysis and research in conjunction with local cultural backgrounds and social systems. There are also barriers in the exchange of entrepreneurial ecosystems and external resources. Entrepreneurs often do not compete for market share, but sell an expectation to attract capital. Therefore, the entrepreneurial ecosystem is likely to lack a dominant player.

On a larger map scale, entrepreneurial ecosystems are connected to knowledge ecosystems, but their value propositions and relational structures are fundamentally different. The centers of the knowledge ecosystem are universities and public research institutions, and value flows mainly linearly along the value chain; the cornerstone of the business ecosystem is the leading company that provides key resources and business infrastructure, and the value creation process adopts an integrated approach (Clarysse et al., 2014). It can also be seen from the co-citation relationship that the logical connection between the two concepts is estranged and does not form a major clustering structure. It is worth noting that the process of converting knowledge to business value is still included in the field of business ecosystem research.

The label of cluster 1 is the subject word business ecosystem, and the top three documents in the co-citation index are Adner, 2017; Gawer & Cusumano, 2014; Oh et al., 2016. According to Moore's (2016) definition, business ecosystem is an economic community of suppliers, major producers, consumers, competitors, and other stakeholders whose members collectively develop their capabilities and tend to align with the direction set by one or more central companies. Iansiti and Levien (2004) summarized the roles of companies in the business ecosystem as cornerstone, dominant and niche; and constructed three health indicators for evaluating business ecosystems: productivity, robustness and niche creation. As can be seen from the two core literatures of business flow, the school starts from the role of stakeholders, studies the behavior and activities of the participants, and finally boils down to the value proposition of the system. Adner (2017) reads this process in reverse, starting with a value proposition, considering the activities needed to materialize it, and ending with actors that need to be adjusted. A logical deepening develops between the two schools, the former emphasizing roles and structural relationships, the latter emphasizing value propositions and changing processes. From the perspective of operational effects, starting from the value proposition helps to establish connections with potential participants and achieve multilateral interaction.

Cluster 3 is named platform ecosystem or two-sided marketplace. The top three articles in the co-citation index are Gawer, 2014; McIntyre & Srinivasan, 2017; Reuver et al., 2018.

Platform may be the fastest growing of all research streams. Under the trend of the Internet of Everything, any business form can be built on the platform, but only by focusing on platform behavior can it be regarded as a platform genre literature. Gawer (2014) defines an external platform as a product, service or technology, that is the ecological basis for an organization's external innovators to develop their own complementary products, technologies or services. We also noticed that the platform is in a crossover zone, and its S value is only 0.852, which is in a low range. This means that its composition is more complex.

Cluster 4 is named Innovation Ecosystem, with an S-value of 0.965 being the highest in the list. This indicates a high homogeneity of the set. The top three papers in this cluster are Jacobides et al., 2018; Gomes et al., 2018; Hannah & Eisenhardt, 2018. Jacobides et al., (2018) believes that the mainstream of ecological literature includes business flow, innovation flow and platform flow. The above-mentioned schools of business ecosystem theory have inherited the commonalities of ecosystem research. The ecological characteristics that have been agreed upon are modularity, complementarity, multilateral market relationships and common value proposition. This work by Jacobides is also the most recent explosive literature (Fig. 8). What deserves special attention is that the outbreak period of this document has not yet ended, and its second-ranked intensity score still has a large room for improvement.

The label of cluster 6 is service ecosystem, and the top three co-citation literatures are Vargo & Lusch, 2016; Lusch & Nambisan, 2015; Vargo et al., 2015. Compared with the logic deepening of "role" to "structure" in the business school, the service school tends to transform from "product" to "service". In this process, the service-dominant (S-D) logic is the core. Humorously, the research positions of Vargo and Lusch, the founders of S-D logic, may still be slightly different. Moore's work is almost never cited in Vargo's literature, while Lusch describes in detail the process of combining S-D logic and ecosystems: a relatively independent and self-regulating system consisting primarily of loosely coupled social and economic actors linked together by shared institutional logic and exchange of services to create common value (Lusch & Nambisan, 2015).

The top three co-citation literatures of other two clusters are Tsujimoto et al., 2018; Rong et al., 2015; Russell & Smorodinskaya, 2018 (cluster 3); and Adner & Kapoor, 2010, Adner, 2012; Basole & Karla, 2011(cluster 5). Due to space limitations, the introduction will not be carried out. Readers can read and refer to it by themselves. In particular, digitization has been inserted into multiple research streams and has the potential to develop into an independent digital ecosystem school. From the perspective of cohesion, the concept is only lack of landmark literature from the perspective of ecosystem.

6 Development trends and future research directions in business ecosystem

The burst detection function in CiteSpace is used to investigate the phenomenon of sudden increases in the frequency of research topics over a short period, with intensity indicating the level of attention to these hotspots. In the field of business ecosystem research, 43 outbreak literature nodes were initially identified using default parameters. By adjusting the criteria, researchers narrowed this down to the nine most significant pieces of literature.

As shown in Fig. 9, these nine articles play a crucial role in the evolution of research directions. Business ecosystems and innovation ecosystems exhibit contrasting logical structures, forming at the intersection where a role-based perspective transitions to a structural perspective (Adner & Kapoor, 2010; Kapoor, 2018). The independence of the innovative school signifies a shift in ecosystem research from a metaphorical ecological relationship to the fundamental logic of business activities. Another critical aspect is examining the value creation and value capture processes as interconnected components (Ritala et al., 2013), which helps bridge the research gap resulting from an overemphasis on value creation.

Nambisan (2013) discussed the innovation ecosystem and entrepreneurial environment within the context of central platforms. Due to the overlapping meanings of "business ecosystem" and "innovation ecosystem," this article serves as a bridge connecting the four main modules. The mixing of terms is common in platform research. In this context, Moore and Iansiti's work is recognized for their research on platform-based business ecosystem innovation (Gawer & Cusumano, 2014). One of the figures summarizes literature related to the platform ecosystem and compares it with the literature flow of other platforms (Thomas et al., 2014).

Figure 10 illustrates the time axis map of the 13 main research lines. Solid lines indicate that a line has formed an emerging research area, while dotted lines suggest a cooling trend. Analysis shows that the two-sided market route transitioned to the innovation ecosystem route around 2018, with the business ecosystem branch completing this shift earlier. The convergence of these paths has fostered the growth of the innovation branch into a mainstream research line. The service path has developed steadily for a long period, though its popularity has waned in the past two years. The digital technology research series draws from multiple branches, with its influence steadily expanding, making it the route with the most development potential. Generally, the life cycles of Routes 2, 9, 10, 12, and 15 are relatively short and have been out of the spotlight for a long time. Conceptual fields such as

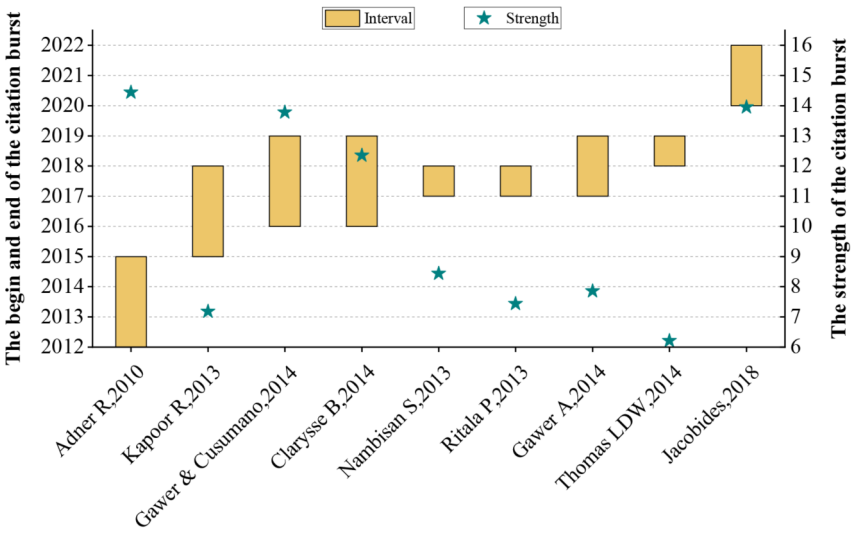

Fig. 9 The top 9 literatures by burst strength

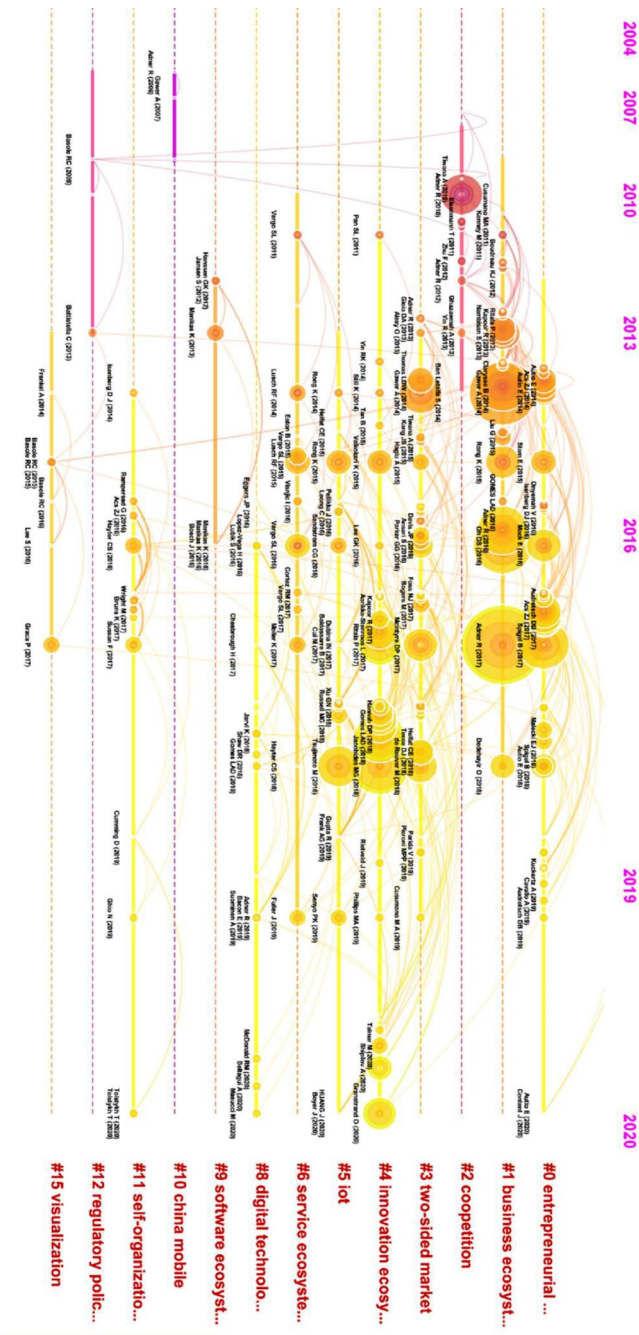

Fig. 10 Timeline map of main research routes

entrepreneurship, innovation, Internet of Things, digitalization, and self-organization continue to release energy, with innovation and digitization leading the way.

The research findings indicate that future development in the ecological domain will predominantly focus on innovation, digitization, entrepreneurship, self-organization, and strategic transformations driven by technologies such as the Internet of Things. Due to extensive digital scene construction and industrial digital transformation, digital ecosystem theory is well-grounded in practice and has the potential to evolve into a distinct research domain. Business ecosystem theory effectively captures the dynamic evolutionary process of value logic through three critical links: value creation, value capture, and value sharing. While there is substantial work on integrating value creation with value capture, research that intricately weaves these with value sharing remains scant.

Following the model proposed in our paper, relevant literature in the field has emerged. Consequently, we have adopted this traceable method to identify and review 17 documents published since March 2022, aiming to examine recent research developments. The key findings from this review are discussed below.

Yoon et al. (2022) examined the connection between business and biological ecosystems, suggesting that a key specie, a leader within a business ecosystem, can enhance its success by strategically managing symbiotic relationships; Shou et al. (2022) deconstructed business ecosystems into four aspects: complementarity, capabilities, co-creation, and co-evolution, noting that many of the world's largest and most valuable companies adopt this ecosystem approach. The lack of a unified understanding of business ecosystem features and characteristics complicates the ability of business leaders to formulate and implement effective strategies; Hoeborn et al. (2022) developed a morphological framework describing all value systems and applied it to business ecosystems, linking its characteristics with ongoing inter-organizational research to aid practitioners in implementing ecosystem concepts; Chandrasekharan and Titov (2022) explored the business models within the ÜlemisteCity ecosystem to understand the conceptualization of business models and the factors influencing their creation or transformation from an ecosystem perspective, developing a conceptual framework to enhance organizational participation and value processes within ecosystems. Cui et al. (2022) explored how key enterprises govern their business ecosystems under conditions of resource abundance and resource scarcity.

Further studies have linked business ecosystems to various industries, exploring structural dimensions and standards for assessing industries. Chang et al. (2022) used fuzzy hierarchical analysis, fuzzy decision-making methods, and experimental laboratory methods to construct five evaluation dimensions and thirty-one evaluation criteria to explore the open data service industry from the perspective of the business ecosystem. Winkler et al. (2023) demonstrated how knowledge misalignment, knowledge gaps, cultural differences, insufficient building codes, frequently changing regulations, and the implementation of highly embedded innovations disrupt ecosystem coordination, by studying the challenges faced by business ecosystem coordination when implementing solar PV systems in the Swedish built environment. Zhao et al. (2022) explored the structure of the business ecosystem required for companies to achieve sustainable performance and investigated the open innovation that can be promoted on this basis. Mann et al. (2022) introduced orchestration as a concept to pursue this research opportunity, using it to observe digital transformation in business ecosystems. Fort (2023) studied productivity and fairness in the U.S. financial market from the perspective of the business ecosystem. Wei and Li (2023) researched the impact of platform

strategies and niche strategies on corporate growth based on the perspective of business ecosystem positioning. Suuronen et al. (2022) revealed the significant impact of digital business ecosystems on the industry through a systematic literature review of the prerequisites, challenges, and benefits of manufacturing DBEs. Yi et al. (2022) examined stakeholder relationships, organizational learning, and business model innovation based on the perspective of business ecosystem research systems. Burström et al. (2022) integrated business and digital ecosystem literature to study the present and future of software ecosystems. Kokkonen et al. (2023) studied digital twin business ecosystems based on qualitative data collected from six case companies in the manufacturing industry. Marques-McEwan et al. (2023) investigated the transition to CE in the chemicals manufacturing industry, revealing the rules for creating circular business ecosystems. Zhu and Du (2023) investigated the impact on the value of existing business ecosystems when new innovations are introduced, through an event study of Google's self-driving car announcement.

Collectively, these insights not only deepen academic understanding of business ecosystems but also guide enterprises in formulating and implementing effective strategies in today's complex business landscape. As digital scene construction and industrial digital transformation continue to solidify the practical foundation for integrating digitalization with ecosystem theory, the direction is poised to evolve into an independent branch of study. However, research methodologies still require further refinement to broaden theoretical applicability. Facing these challenges, coupling business and social ecosystems offers a viable direction. Developing standards and regulatory frameworks to guide sustainable business ecosystem constructions and prevent capital-driven changes in cornerstone enterprises' nature remain critical future research topics.

7 Conclusion

This paper designed an improved traceability method to retrieve literature related to business ecosystem theory in the WOS database, aiming to avoid interference from the stringent field restrictions and intensive manual screening typical of traditional retrieval methods. Co-occurrence, co-citation, and cluster analyses were used to outline the context of knowledge production, with research results visualized using two scientific mapping tools, VOSviewer and CiteSpace.

This study provides several key insights. Firstly, innovation, platform, entrepreneurship, and service, as main ecological branches, inherit business ecosystem theory to varying degrees. The innovation branch has a clear inheritance relationship and has become a new backbone of ecosystem research. The platform branch has a relatively loose association structure with extensive cross-links to other branches. The entrepreneurial branch's unique theoretical application scenarios make it easily distinguishable. The service branch combines S-D logic with business ecosystem theory, but research progress on this branch's ecosystem preference is slow due to S-D logic's prominence. We identified the shapers of theoretical foundations, breakthroughs of key bottlenecks, and builders of continuous investment in each branch, focusing on nine key literatures that bridge different fields and play a significant role in ecosystem research development.

Although the study offers valuable references for scholars as discussed above, some limitations should be noted and addressed in future research. Firstly, the sample data is sourced

from a single database, limiting journal coverage. Secondly, early literature citations are inconsistent, compounded by the impact of journal literature without citations, creating obstacles for vertical logical context and visual analysis. Finally, this article proposes a literature retrieval strategy based on the genealogy of concepts, using James Moore's seminal works as temporal benchmarks, i.e. his1993 article "Predators and Prey: A New Ecology of Competition," marking the inception of the business ecosystem concept; and his 1996 book, 'The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems,' which provided the first comprehensive interpretation of the theory. However, Moore's introduction of the concept in 1993 did not gain academic acceptance until a decade later, with significant studies emerging only in 2022. This highlights the unique aspects of studying this concept. While the traceability method is suitable for historical research of business ecological theory, its application in other research domains may introduce noise, requiring careful judgment by researchers regarding specific circumstances. Therefore, discussing the limitations and applicability of this method to other fields is essential.

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Data availability The data that support the findings of this study are derived from public domain resources, which are available in Web of Science.

Declarations

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

References

Aarikka-Stenroos, L., & Ritala, P. (2017). Network management in the era of ecosystems: Systematic review and management framework. *Industrial Marketing Management*, *67*, 23–36.

Acs, Z. J., Stam, E., Audretsch, D. B., & O'Connor, A. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, *49*(1), 1–10.

Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. *Harvard Business Review*, *84*(4), 98.

Adner, R. (2012). *The wide lens: A new strategy for innovation* (Vol. 34). Penguin Uk. 9.

Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, *43*(1), 39–58.

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, *31*(3), 306–333.

Audretsch, D. B., & Belitski, M. (2017). Entrepreneurial ecosystems in cities: Establishing the framework conditions. *The Journal of Technology Transfer*, *42*(5), 1030–1051.

Autio, E., & Thomas, L. (2014). *Innovation ecosystems* (pp. 204–288). The Oxford handbook of innovation management.

Basole, R. C., & Karla, J. (2011). On the evolution of mobile platform ecosystem structure and strategy. *Business & Information Systems Engineering*, *3*(5), 313–322.

Bogers, M., Sims, J., & West, J. (2019). What is an ecosystem? Incorporating 25 years of ecosystem research.

Burström, T., Lahti, T., Parida, V., Wartiovaara, M., & Wincent, J. (2022). Software ecosystems now and in the future: A definition, systematic literature review, and integration into the business and digital ecosystem literature. *IEEE Transactions on Engineering Management*.

Chandrasekharan, N., & Titov, E. (2022). A Conceptual Framework of Business Model Innovation based on Business Ecosystem – A Case Study of Ulemiste City. *The Proceeding of 12th International Scientific Conference*, 2022.

Chang, Y. T., Chen, M. K., & Kung, Y. C. (2022). *Evaluating a Business Ecosystem of Open Data Services Using the Fuzzy DEMATEL-AHP Approach Sustainability*, 14(13), 7610.

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology*, *57*(3), 359–377.

Chen, C. (2017). Science mapping: a systematic review of the literature. *Journal of data and information science*, *2*(2).

Chesbrough, H. (2007). *Business model innovation: it's not just about technology anymore*. Strategy & leadership.

Christensen, C. M., & Rosenbloom, R. S. (1995). Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network. *Research Policy*, *24*(2), 233–257.

Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, *43*(7), 1164–1176.

Cui, M., Li, W., Cui, L., Jia, Y., & Wu, L. (2022). How do keystones govern their business ecosystems through resource orchestration? *Industrial Management & Data Systems*, *122*(9), 1987–2011.

Cusumano, M. A., & Gawer, A. (2002). The elements of platform leadership. *MIT Sloan Management Review*, *43*(3), 51.

de Gomes, V., Salerno, L. A., Phaal, M. S., R., & Probert, D. R. (2018). How entrepreneurs manage collective uncertainties in innovation ecosystems. *Technological Forecasting and Social Change*, *128*, 164–185.

De Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: A research agenda. *Journal of Information Technology*, *33*(2), 124–135.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, *50*(1), 25–32.

Fort, H. (2023). Productivity vs. evenness in the US Financial Market: A Business Ecosystem. *Perspective Entropy*, *25*(7), 1029.

Gawer, A. (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, *43*(7), 1239–1249.

Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, *31*(3), 417–433.

Hakala, H., O'Shea, G., Farny, S., & Luoto, S. (2020). Re-storying the business, innovation and entrepreneurial ecosystem concepts: The model-narrative review method. *International Journal of Management Reviews*, *22*(1), 10–32.

Hannah, D. P., & Eisenhardt, K. M. (2018). How firms navigate cooperation and competition in nascent ecosystems. *Strategic Management Journal*, *39*(12), 3163–3192.

Harzing, A. W., & Alakangas, S. (2016). Google Scholar, Scopus and the web of Science: A longitudinal and cross-disciplinary comparison. *Scientometrics*, *106*(2), 787–804.

Hoeborn, G., Conrad, R., Götzen, R., Betz, C., & Neudert, P. K. (2022). Understanding business ecosystems using a morphology of Value systems. *Research-Technology Management*, *65*(5), 44–53.

Iansiti, M., & Levien, R. (2004). Strategy as ecology. *Harvard Business Review*, *82*(3), 68–78.

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, *39*(8), 2255–2276.

Kapoor, R. (2018). Ecosystems: Broadening the locus of value creation. *Journal of Organization Design*, *7*(1), 1–16.

Khanna, T., & Yafeh, Y. (2007). Business groups in emerging markets: Paragons or parasites? *Journal of Economic Literature*, *45*(2), 331–372.

Kokkonen, K., Hannola, L., Rantala, T., Ukko, J., Saunila, M., & Rantala, T. (2023). Preconditions and benefits of digital twin-based business ecosystems in manufacturing. *International Journal of Computer Integrated Manufacturing*, *36*(5), 789–806.

Li, K., Rollins, J., & Yan, E. (2018). Web of Science use in published research and review papers 1997–2017: A selective, dynamic, cross-domain, content-based analysis. *Scientometrics*, *115*(1), 1–20.

Lusch, R. F., & Nambisan, S. (2015). Service innovation. *MIS Quarterly*, *39*(1), 155–176.

Mann, G., Karanasios, S., & Breidbach, C. F. (2022). Orchestrating the digital transformation of a business ecosystem. *The Journal of Strategic Information Systems*, *31*(3), 101733.
Marques-McEwan, M., Xu, B., Bititci, U. S., & Jiang, M. (2023). Unveiling the rules for creating circular business ecosystems: A case study in the chemical industry. *Journal of Cleaner Production*, *427*, 139185.
McIntyre, D. P., & Srinivasan, A. (2017). Networks, platforms, and strategy: Emerging views and next steps. *Strategic Management Journal*, *38*(1), 141–160.
Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of web of Science and Scopus: A comparative analysis. *Scientometrics*, *106*(1), 213–228.
Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, *71*(3), 75–86.
Moore, J. F. (2016). *The death of competition: Leadership and strategy in the age of business ecosystems*. HarperCollins.
Nambisan, S., & Baron, R. A. (2013). Entrepreneurship in innovation ecosystems: Entrepreneurs' self–regulatory processes and their implications for new venture success. *Entrepreneurship Theory and Practice*, *37*(5), 1071–1097.
Oh, D. S., Phillips, F., Park, S., & Lee, E. (2016). Innovation ecosystems: A critical examination. *Technovation*, *54*, 1–6.
Porter, M. E., & Kramer, M. R. (2011). Criação De valor compartilhado. *Harvard Business Review*, *89*(1/2), 62–77.
Ritala, P., Agouridas, V., Assimakopoulos, D., & Gies, O. (2013). Value creation and capture mechanisms in innovation ecosystems: A comparative case study. *International Journal of Technology Management*, *63*(3–4), 244–267.
Rong, K., Wu, J., Shi, Y., & Guo, L. (2015). Nurturing business ecosystems for growth in a foreign market: Incubating, identifying and integrating stakeholders. *Journal of International Management*, *21*(4), 293–308.
Russell, M. G., & Smorodinskaya, N. V. (2018). Leveraging complexity for ecosystemic innovation. *Technological Forecasting and Social Change*, *136*, 114–131.
Scaringella, L., & Radziwon, A. (2018). Innovation, entrepreneurial, knowledge, and business ecosystems: Old wine in new bottles? *Technological Forecasting and Social Change*, *136*, 59–87.
Selander, L., Henfridsson, O., & Svahn, F. (2013). Capability search and redeem across digital ecosystems. *Journal of Information Technology*, *28*(3), 183–197.
Shou, Y., Shi, Y., & Ren, G. J. (2022). Deconstructing business ecosystems: Complementarity, capabilities, co-creation and co-evolution. *Industrial Management & Data Systems*, *122*(9), 1977–1986.
Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, *41*(1), 49–72.
Suuronen, S., Ukko, J., Eskola, R., Semken, R. S., & Rantanen, H. (2022). A systematic literature review for digital business ecosystems in the manufacturing industry: Prerequisites, challenges, and benefits. *CIRP Journal of Manufacturing Science and Technology*, *37*, 414–426.
Tansley, A. G. (1935). The use and abuse of vegetational concepts and terms. *Ecology*, *16*(3), 284–307.
Teece, D. J. (2018). Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, *47*(8), 1367–1387.
Thomas, L. D., Autio, E., & Gann, D. M. (2014). Architectural leverage: Putting platforms in context. *Academy of Management Perspectives*, *28*(2), 198–219.
Tsujimoto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y. (2018). A review of the ecosystem concept—towards coherent ecosystem design. *Technological Forecasting and Social Change*, *136*, 49–58.
Van Eck, N., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538.
Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: An extension and update of service-dominant logic. *Journal of the Academy of Marketing Science*, *44*(1), 5–23.
Vargo, S. L., Wieland, H., & Akaka, M. A. (2015). Innovation through institutionalization: A service ecosystems perspective. *Industrial Marketing Management*, *44*, 63–72.
Waltman, L. (2016). A review of the literature on citation impact indicators. *Journal of Informetrics*, *10*(2), 365–391.
Wei, Z., & Li, M. (2023). Platform strategy, Niche Strategy, and firm growth: A Business Ecosystem Positioning Perspective. *IEEE Transactions on Engineering Management*.
Winkler, C., Vico, E. P., & Widén, K. (2023). Challenges to business ecosystem alignment when implementing solar photovoltaic systems. *The Swedish built environment, Building Research & Information.*
Yi, Y., Chen, Y., & Li, D. (2022). Stakeholder ties, organizational learning, and business model innovation: A business ecosystem perspective. *Technovation*, *114*, 102445.

Yoon, C., Moon, S., & Lee, H. (2022). Symbiotic relationships in business ecosystem: A systematic literature review. *Sustainability*, *14*(4), 2252.
Zhao, T., Koo, J. M., & Lee, M. J. (2022). How firms can improve sustainable performance on belt and Road initiative. *Sustainability*, *14*(21), 14090.
Zhu, X., & Du, K. (2023). Incumbent business ecosystems in the face of new entry: An event study of Google's autonomous car announcement. *Information & Management*, *60*(3), 103760.
Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods*, *18*(3), 429–472.