

Review

What Are the Topics That Business Ecosystems Navigate? Updating of Scientific Activity and Future Research Agenda

Lorena Espina-Romero ^{1,*} , Jesús Guerrero-Alcedo ² , José Gregorio Noroño Sánchez ³ 
and Angélica Ochoa-Díaz ³

¹ Escuela de Postgrado, Universidad San Ignacio de Loyola, La Molina, Lima 15024, Peru

² Carrera de Psicología, Universidad Científica del Sur, Lima 15067, Peru

³ Facultad de Derecho, Universidad del Sinú “Elías Bechara Zainúm”, Montería 230001, Colombia

* Correspondence: lespina@usil.edu.pe

Abstract: The objective of this research was to review the manuscripts registered in the Scopus database related to business ecosystems during the period 2018–2022. A total of 96 documents were selected and examined under a bibliometric and bibliographic approach. The results showed an annual growth rate of 13.21%. The United Kingdom ($n = 22$) led the countries with the most documents, computer science ($n = 40$) is the subject area with the most publications, and articles ($n = 61$) and conference papers ($n = 23$) dominated the types of documents. The nine most studied topics were innovation ecosystems, collaborative ecosystems, sustainable business ecosystems, digital business ecosystems, ecosystems of the Internet of Things, circular ecosystems in companies, regulatory frameworks for digital business ecosystems, resilience of business ecosystems, and ecosystems in smart cities. Six unexplored themes were extracted for future research: ICT industries, smart contracts, electric vehicles, serious games, energy, and blockchain. It should be noted that this study is one of the most up to date, and 85.5% of the 96 publications were original studies, i.e., valuable information that supports the results.

Keywords: sustainability; digital business ecosystems; circular ecosystem; innovation; IoT



Citation: Espina-Romero, L.; Guerrero-Alcedo, J.; Noroño Sánchez, J.G.; Ochoa-Díaz, A. What Are the Topics That Business Ecosystems Navigate? Updating of Scientific Activity and Future Research Agenda. *Sustainability* **2022**, *14*, 16224. <https://doi.org/10.3390/su142316224>

Received: 15 November 2022

Accepted: 2 December 2022

Published: 5 December 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

A business ecosystem (BE) is identified when a group of companies pool their expertise around an innovation to develop innovative products and satisfy customers [1–4]. BEs have a main objective, and that is to create value for regular customers, which is why they require good organization [5–8].

BEs are made up of a network of organizations, and this includes suppliers, customers, distributors, government agencies, and competitors, among others. Everyone is involved in supplying a particular service or product through competition and cooperation [8,9]. Companies that leverage business ecosystems will be better positioned to drive innovation and capital efficiency in creating user value. A good understanding of business ecosystems is increasingly important to keep up with and stay ahead of the pace of change [10–13].

Good development of BEs helps to strengthen economies, and consequently jobs are created and income generated, contributing to the Sustainable Development Goals (SDGs) [14–17]. The SDGs are a guide that will guarantee companies to discover if their impact on economic, social, and environmental matters offers benefits to society, and thus improve their image and their links with the different stakeholders [18–20].

Business ecosystems are considered essential contributors to many of the SDGs, such as ending poverty (SDG 1) [21], decent work and economic growth (SDG 8) [22], health and wellness (SDG 3) [23], quality education (SDG 4) [24], clean water and sanitation (SDG 6) [25], and affordable and clean energy (SDG 7) [26], etc.

The business ecosystem as a management strategy moves to a new stage with the recent changes in global scenarios [11,27,28]. This is how business ecosystems play a key

role in the knowledge applied by companies that lead to the achievements and objectives planned by this sector [13].

There are numerous study topics linked to business ecosystems, such as digital business ecosystems [4,29,30], sustainability [11,31,32], business development [33–35], business models [7,36,37], benchmarking [38], electronic commerce [7,39], supply-chain management [8,9], and blockchain [40,41], among others.

After the execution of a bibliographic review, it was possible to identify only four review-type studies related to business ecosystems during the period 2018–2022. The first was developed in [42], where they analyzed this emerging research channel focused on business ecosystems from an Asian context. The authors proposed three essential research directions within business ecosystems: integration, dynamics, and internationalization. The second study's [4] purpose was to fill a gap in the research on digital business ecosystems (DBE) through (1) the development of a framework that provides a comprehensive orientation of DBE research, (2) identifying gaps in the DBE literature, and (3) providing future research directions.

The third study [41] aimed to explore a model change and ecosystem growth in health care making use of blockchain technology. This study exposed the evolutionary development of blockchain in the context of health care and its dynamic relationship between participants. The fourth and last study of the review type [43] focused on the fragility in which multinational companies (MNE) find themselves due to global decoupling; therefore, the objective of this study was to improve the capacity of MNEs to achieve adaptation to challenging fortuitous shocks, such as the COVID-19 pandemic.

In alignment with the two previous paragraphs, the four cited manuscripts focused on a specific study topic, but none made a complete evaluation of the topics related to business ecosystems. For these reasons, this bibliometric approach is important, since its objective is to provide an exhaustive response to these issues and thus be able to identify the scope of business ecosystems. In this context, it was possible to formulate three questions:

- RQ1. What is the main information of publications on business ecosystems (production of publications by year, country, thematic area, and type of documents)?
- RQ2. What are the topics covered by business ecosystems?
- RQ3. What are the little-explored topics on business ecosystems that could be part of a future research agenda?

To answer the research questions, this bibliometric study had as its main objective to discuss the manuscripts on business ecosystems in Scopus during the period 2018–2022. This study aimed to identify the main information about business ecosystems (year, country, thematic area, and type of documents), the topics touched on, and to point out little-explored research topics. Finally, a bibliographic criterion was applied to recognize the points of view of the authors who participated in the documents selected for this study.

2. Methodology

This document was prepared with a bibliometric approach. This method is applied in multiple fields, and is gaining in importance within academia [44]. The five-step bibliometric method of Zupic and Čater [45] was applied: study design, bibliometric data collection, analysis, visualization and interpretation (Figure 1).

2.1. Study Design

After the bibliographic review, three research questions were formulated: RQ1, RQ2 and RQ3, previously described in the Introduction section. To respond to RQ1, Microsoft Excel column charts were chosen to indicate the production of publications according to the year, country, thematic area, and type of documents. To answer RQ2, a thematic map was selected, which is a bibliometric method with a conceptual structure that indicates the directions of the questioned themes. To answer RQ3, the bibliometric method “keyword co-occurrence analysis” was applied to indicate keywords with the least co-occurrence. These keywords allowed inferring the least explored topics by business ecosystems.



Figure 1. Methodological design steps.

2.2. Bibliometric Data Collection

A total of 561 documents containing the keyword “business ecosystems” in their titles were selected in Scopus. Scopus was selected because it has a wide time coverage, it currently hosts more than 40,000 peer-reviewed journals from all thematic areas, and its updating is regular, which allows access to the latest knowledge. The search was narrowed down to Open Access documents, obtaining 148. Then, the documents were limited to the period 2018–2022, obtaining 96. This time was determined because the reason for this review was to analyze recent studies. The generated search string was as follows: “TITLE (“business ecosystem”) AND (LIMIT-TO (OA, “all”)) AND (LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018)).” All countries, all types of documents, and all subject areas were included.

2.3. Data Analysis

At this stage, the data were loaded and converted to safeguard quality and viability. The data were collected from Scopus in files with CSV format for the Microsoft Excel 365 web application (Redmond, WA, USA), RIS format for VOSviewer software version 1.6.18 (Leiden, The Netherlands) and BibTex format for RStudio software version R 4.1.1 (Vienna, Austria).

2.4. Visualization

This bibliometric review was supported by column charts using the Microsoft Excel 365 web application to show the main production of publications (by year, by country, by thematic area, and by type of document). Additionally, it was based on the thematic map function of the statistical package RStudio for the visualization of the most explored study topics. Finally, it relied on the keyword co-occurrence analysis produced by the VOSviewer software to visualize the possible underexplored topics that may shape a future research agenda.

2.5. Interpretation

In this step, the results are described and represented within the framework of the specific objectives, i.e., the results obtained in the main information, the topics navigated by business ecosystems, and the little-explored topics for future research are discussed. Finally, the final document is prepared.

3. Results and Discussions

3.1. Main Information about Data

3.1.1. Synthesis of the Main Information

In accordance with Table 1, the period selected for this bibliometric review was 2018–2022. The total of selected documents ($n = 96$) contains 4932 references (average of 51.38 references for each document). The total number of authors involved in these

96 manuscripts is 261, an average of 2.72 authors for each document. All these posts indexed 287 author keywords.

Table 1. Synthesis of the main information.

Main Information about Data	
Time span	2018–2022
Documents	96
Annual growth rate, %	13.21
References	4932
Keywords (DE)	287
Authors	261

3.1.2. Document Production per Year

The production of documents during the period 2018–2022 has had an annual growth rate of 13.21%, allowing us to infer a projection of 27 documents for the year 2022. According to Figure 2, the year 2018 managed to index 14 documents, some with strong relation to the variables innovation [33,46,47] and business development [33,34].

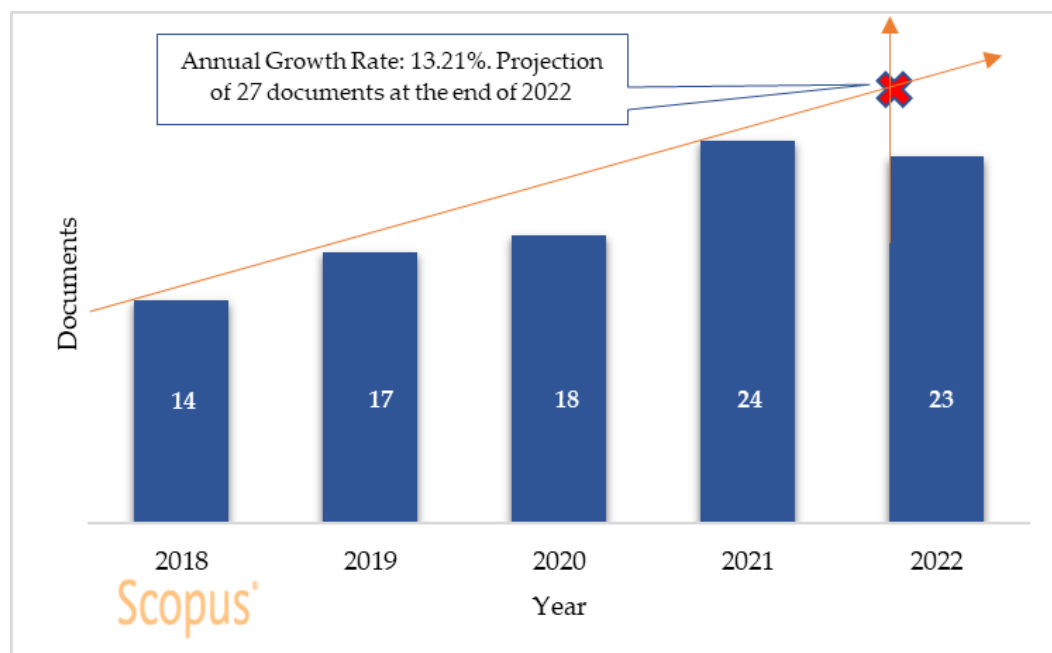


Figure 2. Documents per year.

The year 2019 registered 17 manuscripts closely related to the variable collaborative network, including [4,20,38]. In 2020, there was one more document than the previous year, registering 18 publications closely related to the circular economy variable, including [48,49].

In 2021, the publications increased to 24 documents, among them those linked to the sustainability variable stand out [11,18,19,31]. As of the date of preparation of this bibliometric document (October 2022), only 23 manuscripts had been registered, but according to the annual growth rate of 13.21%, a registration of 27 studies is expected. The publications on business ecosystems of this year (2022) are closely related to the variables digital business ecosystem and value creation [5,6,50].

3.1.3. Document Production by Country

The 32 countries involved in the 96 documents selected for this bibliometric review worked together, i.e., a document could be considered by two or more countries. Therefore,

the total number of documents selected for this study will never coincide with the total registry of the group of participating countries.

Figure 3 shows that the United Kingdom ($n = 22$) leads the production of documents [4, 34, 35, 51, 52]. Finland ($n = 16$) ranks second with the most documents [8, 36, 53]. China ($n = 14$) follows in third place [8, 36, 53–55].

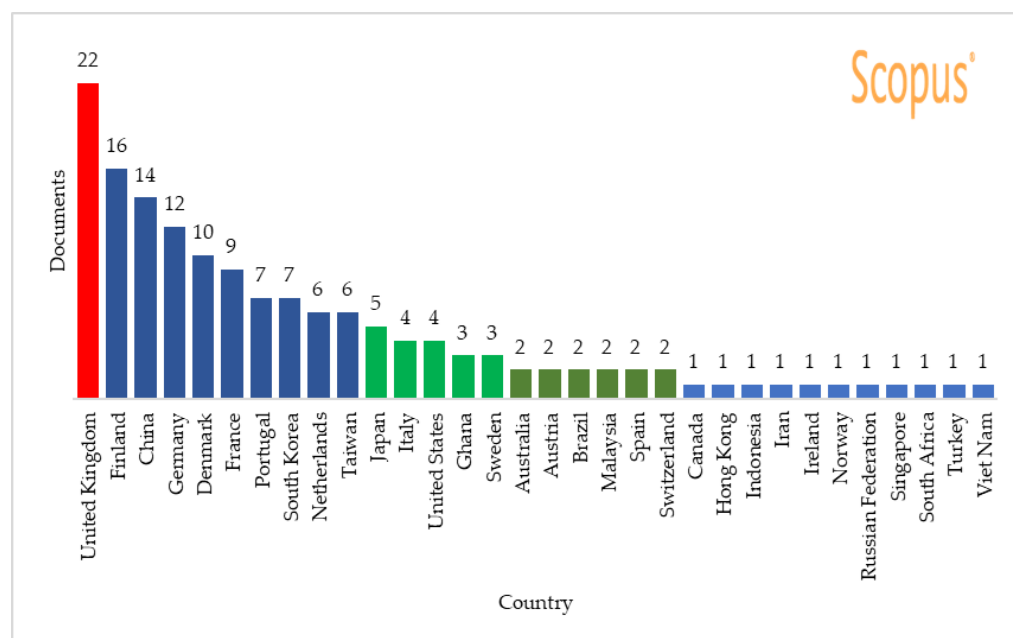


Figure 3. Documents by country.

Germany ($n = 12$) ranks fourth [56–60]. Denmark ($n = 10$) ranks fifth [27, 30, 33, 61, 62]. France ($n = 9$) ranks sixth in the figure [12, 63, 64]. Portugal ($n = 7$) and South Korea ($n = 7$) rank seventh and eighth [65, 66].

The Netherlands ($n = 6$) and Taiwan ($n = 6$) rank 9th and 10th [41, 49]. Japan ($n = 5$) is in 11th position, followed by Italy and the United States in 12th and 13th positions, with four documents each. Ghana and Sweden occupy the 14th and 15th positions, with three manuscripts each. Australia, Austria, Brazil, Malaysia, Spain, and Switzerland are in 16th, 17th, 18th, 19th, 20th, and 21st place, with two documents each. The rest of the eleven countries in Figure 3 register one document each. These countries are Canada, Hong Kong, Indonesia, Iran, Ireland, Norway, Russia, Singapore, South Africa, Turkey, and Vietnam.

3.1.4. Production of Documents by Subject Area

According to what was indicated in the methodological design, there was no restriction of the thematic areas; therefore, a combined approach of several thematic areas linked to business ecosystems is possible. Consequently, a document can be registered by more than two thematic areas linked in this investigation. Figure 4 shows the 20 thematic areas that are attributed in a combined way to the 96 documents selected for this study.

Computer science ranks first in Figure 4, with 40 papers [4, 18, 29, 54, 61, 67, 68]. Business, management, and accounting ranks second, with 39 manuscripts [13, 33, 34, 36, 69, 70]. Social sciences ranks third, with 29 publications [31, 37, 46, 59, 71]. Engineering is in fourth place, with 23 documents [9, 35, 48, 62, 72]. Decision sciences and energy register 18 manuscripts each and these occupy the fifth and sixth places [20, 52, 73–75]. Environmental science is in seventh place, with 17 publications [8, 10, 18, 19].

Economy, econometrics, and finance has 11 documents, in eighth position [76, 77]. Mathematics with four publications is positioned in ninth place, psychology in tenth position with three manuscripts, and medicine in eleventh place with two studies. The rest of the nine thematic areas register only one document each. These areas are arts and

humanities, biochemistry, genetics and molecular biology, chemical engineering, chemistry, earth and planetary sciences, materials science, multidisciplinary, neuroscience, and physics and astronomy.

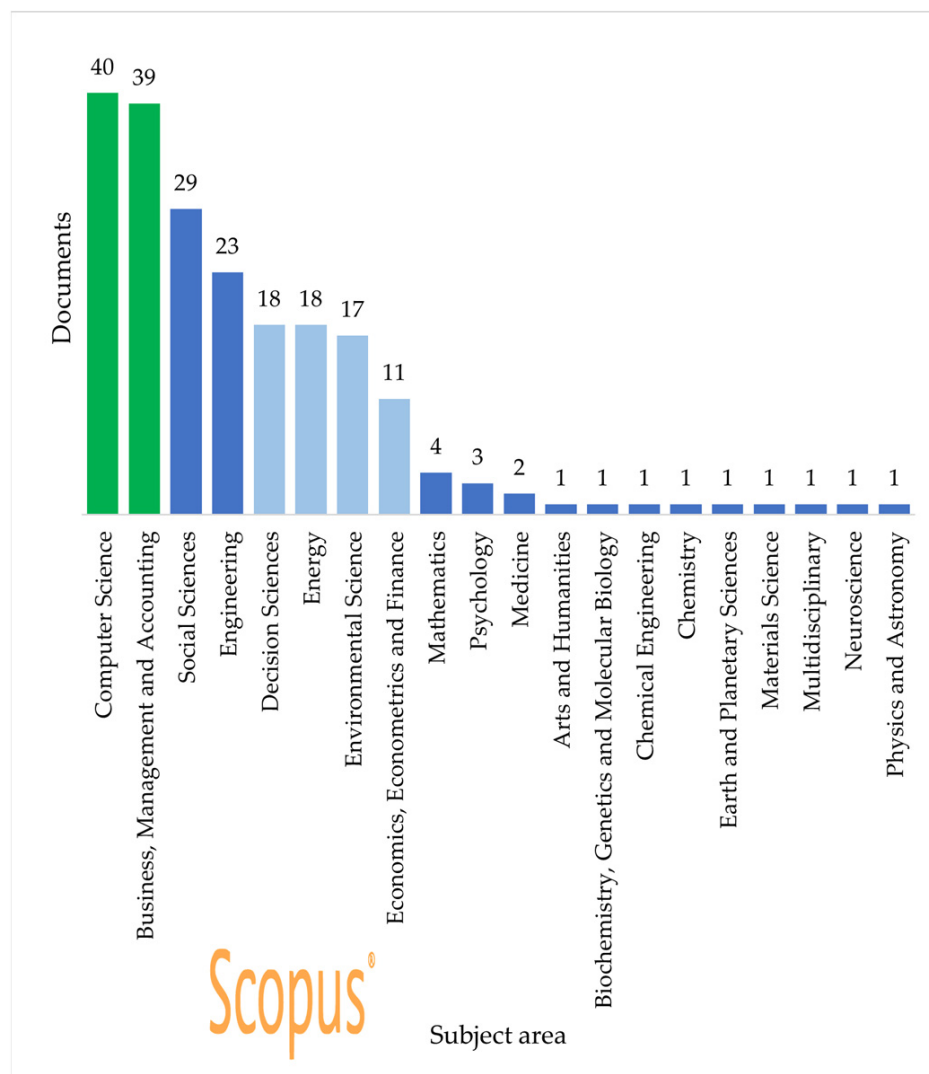


Figure 4. Documents by subject area.

3.1.5. Production by Document Type

Figure 5 shows the types of documents found in this bibliometric study. Articles account for 61 manuscripts, which represents 63.54% of the total. Conference papers account for 23 documents, 23.96% of the total. Both articles and conference papers add up to 84 documents. This means that 85.50% of the 96 publications are considered original research (primary sources); therefore, this is valuable information for this bibliometric study.

Reviews number four, 4.17% of the 96 documents [4,41–43]. These four papers allow us to infer that few reviews have been carried out and the most recent was done in 2021. Book chapter, editorial, and note number four, three, and one publications, respectively, representing 8.33% of the total.

3.2. Topics Covered by Business Ecosystems

The thematic map (Figure 6) generated by the RStudio software is made up of four blocks identified in categories: niche topics, motor topics, emerging or declining topics, and basic topics. The themes illustrated on this map are shown in clusters according to their

degree of development (density) and degree of relevance (centrality). The default criteria implemented are the minimum frequency of clusters ($n = 5$) per thousand documents, keywords ($n = 250$), and the grouping algorithm called “walk-trap”.

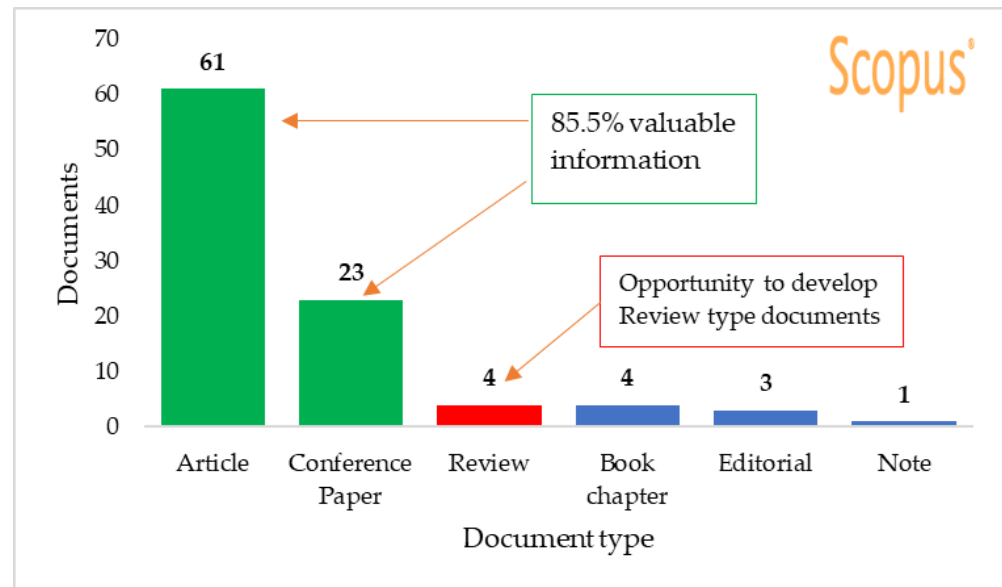


Figure 5. Documents by type.

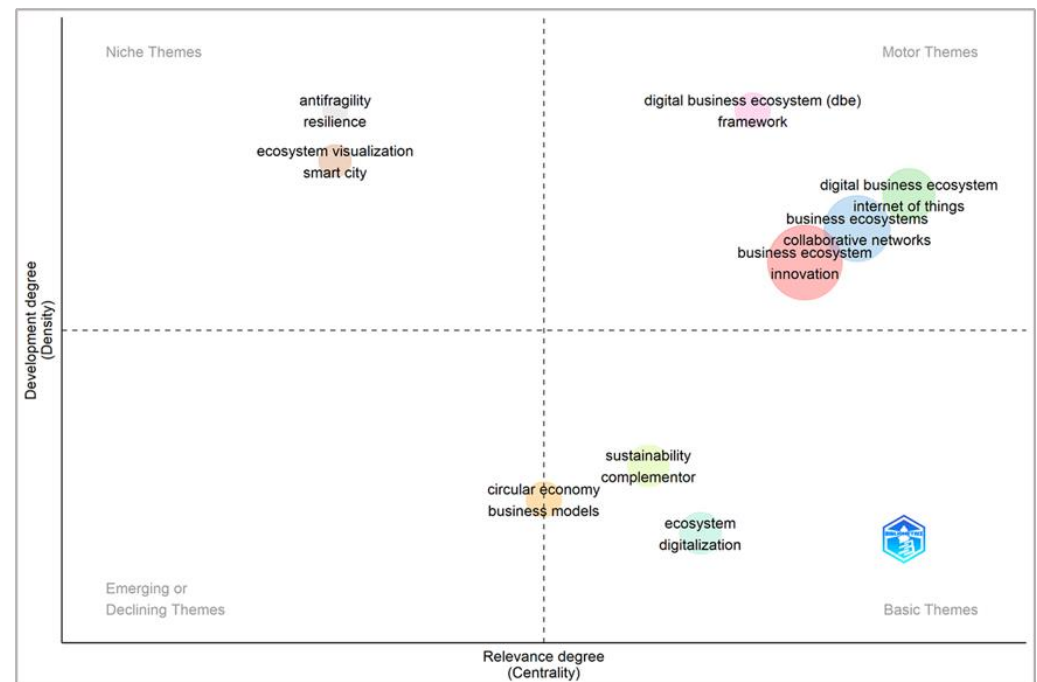


Figure 6. Thematic map.

The thematic map made it possible to identify nine clusters where business ecosystems gather. These nine clusters are shown in Table 2.

Table 2. Individualized themes in the thematic map.

Thematic	Thematic Description	Thematic Category	Definition of Category
1	Innovation ecosystems	Motor themes	Main themes of the research front
2	Collaborative ecosystems	Motor themes	
3	Sustainable business ecosystem	Basic themes	Issues caused by critical situations that affect our society
4	Digital business ecosystem	Basic themes	
5	Ecosystem of the internet of things	Motor themes	Few explored topics that should be studied in more depth
6	Circular ecosystem in companies	Basic themes	
7	Regulatory framework for digital business ecosystems	Motor themes	
8	Resilience of business ecosystems	Niche themes	
9	Ecosystems in smart cities	Niche themes	

Innovation Ecosystems: In Table 2, this is indicated as a motor theme and includes publications that deal with how companies, institutions and states relate to each other to create a collaborative and innovative framework, where they work together and make their results known, guaranteeing a profound knowledge change [7,11,12,33,46,47,78].

Collaborative Ecosystems: In Table 2, this is indicated as a motor theme and includes studies that deal with knowledge services supported by digital technologies to be applied in the distinct stages of the chains, from production, industrialization, coordination to commercialization [4,20,38,66,79].

Sustainable business ecosystem: In Table 2, this is a basic theme that deals with the ability of companies to execute long-term tasks, based on economic, social, and environmental criteria that guarantee the sustainability of the company [10,11,18,19,31,32].

Digital business ecosystem: In Table 2, this is considered a basic theme with publications that refer to the adaptations of a company and the collaborative network established to provide improved products or services (via the internet). Therefore, online collaboration is achieved by companies, their associates, and consumers, causing benefits for all [4,6,29,30,80].

Ecosystem of the Internet of Things: This is a motor theme and the studies on this subject deal with how the Internet of Things facilitates a better presence and control of the activities and budgets of a company with the help of the incorporation of software programs, machine sensors, computer systems and data storage [30,32,36,75].

Circular ecosystem in companies: This is a basic theme with studies that deal with how the circular economy leads to the development of a company, beyond harming the environment. This entails the separation of the economic activity from the use of exhaustible resources, in addition to recovering and separating the losses from the design [31,48,49,79,81].

Regulatory framework for digital business ecosystems: This is a motor theme with studies that refer to secondary laws, that is, the regulations that determine the way in which services must be provided in a particular situation, as well as the parties in charge of supervising their app [4,46,82].

Resilience of business ecosystems: This is considered a niche theme and includes publications that deal with the possibility of adaptation that companies could have in the face of circumstances that cause inconveniences for their operation, in addition to the accelerated organizational dynamics that have been taking place lately [20,83].

Ecosystems in smart cities: In Table 2, this is considered a niche theme. This subject of study deals with the improvements of urban administration to optimize resources and budget, in addition to providing optimal services to the inhabitants. To this end, they rely

on the digitization of services, to this is added the control of urban management and the works that are carried out in cities [60,84,85].

3.3. Future Research Agenda

Following the analysis of the 96 manuscripts identified for this study, in addition to the 287 keywords, it was possible to extract six topics of study that were little explored (Figure 7). The selection criterion was to search for the author's keywords with the least co-occurrence ($n = 1$) and linked to the word "business ecosystems". For this analysis, the "Association strength" feature of the VOSviewer software was applied. The six keywords were: ICT industries, smart contracts, electric vehicles, serious games, energy, and blockchain. These six themes are discussed below.

ICT industries: Studies on how information and communication technology (ICT) brings together manufacturing and supply sectors, where their products carry out the task of data processing and communication through digital means, in particular visualization and transmission [9,79].

Smart Contract: Studies that deal with the design of computer programs designed to be applied regularly as soon as the companies or people involved in a contract comply with the regulations of this [86,87].

Electric vehicles: Studies on how public policies, benefits and private initiatives try to converge to promote the introduction of electric vehicles to civilians and companies, especially for transportation, coordination, and delivery tasks. The central objective of the ecosystem is to minimize the obstacles when replacing combustion vehicles in favor of more sustainable ones [27,64].

Serious games: Studies that deal with digital applications designed for training and education, where the basic purpose is to impart experiences, train, communicate, remember, and educate end consumers. It is used as a mechanism for knowledge exchange through procedures that take advantage of the game (against oneself/others) and a scheme of rewards and sanctions to measure learning from a game-based perspective [88,89].

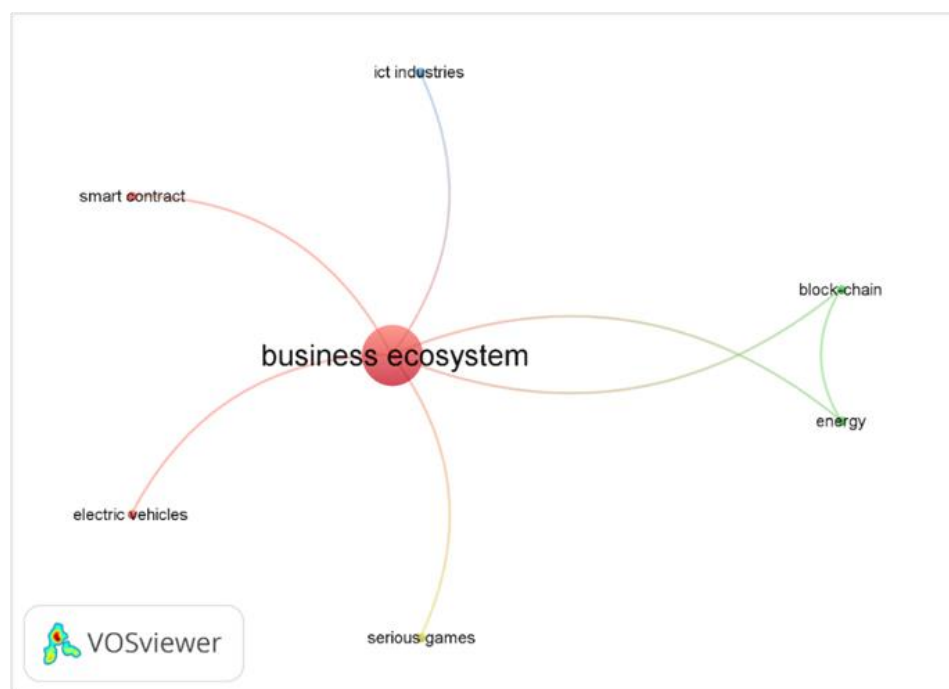


Figure 7. Keywords with the least co-occurrence.

Energy: Studies that deal with how the increase in global demand for renewable energy helps to slow down climate change. These demands encourage utilities to expand

their portfolios and drive energy transformation through the involvement of efficient, reliable, green, and sustainable technologies [6,61].

Blockchain: Studies that deal with how blockchain, based on a peer-to-peer (P2P) scheme, is considered a widespread registration technology that allows avoidance of intermediaries to execute operations with minimal risk in real time and without errors [6,18,56,90–92].

4. Limitations

This bibliometric study was based on data obtained from the Scopus database, and the reason for its selection is specified in the methodology section. Second, the document search was limited to open access documents (both open access and subscription editions). Finally, the information used was from the period 2018 to October 2022.

5. Conclusions

This study has shown that business ecosystems contribute in many ways to the Sustainable Development Goals (SDGs). Considering the main information, 85.5% of the publications in this bibliometric study are original research, so the results are based on valuable information.

To respond to RQ1, the production of publications per year showed an annual growth rate of 13.21%; therefore, research on business ecosystems is constantly growing. The UK leads in document production, with 22. Notably, the UK has a vibrant and diverse business ecosystem that is supportive of newcomers. Additionally, the government has programs that offers tax breaks for investors while lowering investment risks for early-stage startups. In addition, it has four of the top 10 universities in the world and is consistently ranked as one of the top 10 countries in the world to do business. This country has approximately 40 trade agreements with around 70 countries, thus strengthening relations of mutual economic growth; therefore, they make up a strong and global trade ecosystem.

Computer sciences, business, management and accounting, and social sciences are the top three areas of knowledge, with 40, 39, and 29 publications. This pattern in the production of publications allows us to infer the interrelation between these three areas, and that is that BEs need the intervention of the social sciences so that society can consolidate and progress.

In response to RQ2, nine study topics touched by business ecosystems were identified, of which three are basic themes, four are motor themes, and two are niche theme (Table 2). To answer RQ3, potential future research topics were discussed, giving rise to six little-explored areas (Section 3.3).

It is suggested to carry out research with the topics categorized in Table 2 as niche themes, and with the six potential topics for future research. This manuscript is one of the most up-to-date bibliometric studies on business ecosystems (October 2022).

The findings revealed the nine most explored topics during 2018–2022 and suggest another six to be explored in future research. In this sense, this study would be useful for future studies on business ecosystems due to the many topics to explore that were mentioned above.

Author Contributions: Conceptualization, L.E.-R. and J.G.-A.; methodology, J.G.N.S.; software, A.O.-D.; validation, L.E.-R., J.G.-A. and J.G.N.S.; formal analysis, A.O.-D.; investigation, L.E.-R.; resources, J.G.-A.; data curation, J.G.N.S.; writing—original draft preparation, A.O.-D.; writing—review and editing, L.E.-R.; visualization, J.G.-A.; supervision, J.G.N.S.; project administration, A.O.-D.; funding acquisition, L.E.-R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: This study has a bibliometric approach and the data used was generated from the Scopus database.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Dima, A.; Bugheanu, A.M.; Dinulescu, R.; Potcovaru, A.M.; Stefanescu, C.A.; Marin, I. Exploring the Research Regarding Frugal Innovation and Business Sustainability through Bibliometric Analysis. *Sustainability* **2022**, *14*, 1326. [\[CrossRef\]](#)
2. Gueler, M.S.; Schneider, S. The Resource-Based View in Business Ecosystems: A Perspective on the Determinants of a Valuable Resource and Capability. *J. Bus. Res.* **2021**, *133*, 158–169. [\[CrossRef\]](#)
3. Ehrensperger, R.; Sauerwein, C.; Breu, R. Current Practices in the Usage of Inter-Enterprise Architecture Models for the Management of Business Ecosystems. In Proceedings of the 2020 IEEE 24th International Enterprise Distributed Object Computing Conference (EDOC), Eindhoven, The Netherlands, 5–8 October 2020; pp. 21–29. [\[CrossRef\]](#)
4. Senyo, P.K.; Liu, K.; Effah, J. Digital Business Ecosystem: Literature Review and a Framework for Future Research. *Int. J. Inf. Manag.* **2019**, *47*, 52–64. [\[CrossRef\]](#)
5. Liu, Y.; Song, P. An Intelligent Digital Media Asset Management Model Based on Business Ecosystem. *Comput. Intell. Neurosci.* **2022**, *2022*, 1190538. [\[CrossRef\]](#) [\[PubMed\]](#)
6. Suuronen, S.; Ukko, J.; Eskola, R.; Semken, R.S.; Rantanen, H. A Systematic Literature Review for Digital Business Ecosystems in the Manufacturing Industry: Prerequisites, Challenges, and Benefits. *CIRP J. Manuf. Sci. Technol.* **2022**, *37*, 414–426. [\[CrossRef\]](#)
7. Wecht, C.H.; Demuth, M.; Koppenhagen, F. Platform-Based Business Ecosystems—A Framework for Description and Analysis. In *IFIP Advances in Information and Communication Technology*; Rannenber, K., Ed.; Springer: Berlin/Heidelberg, Germany, 2021; pp. 92–100. [\[CrossRef\]](#)
8. Leviäkangas, P.; Öörni, R. From Business Models to Value Networks and Business Ecosystems—What Does It Mean for the Economics and Governance of the Transport System? *Util. Policy* **2020**, *64*, 101046. [\[CrossRef\]](#)
9. Rissanen, M.; Pirttilä, M.; Lind, L.; Kärri, T. Reducing and Reinvesting Working Capital in Business Ecosystems. In *Lecture Notes in Mechanical Engineering*; Chaari, F., Gherardini, F., Ivanov, V., Eds.; Springer: Berlin/Heidelberg, Germany, 2020; pp. 192–199. [\[CrossRef\]](#)
10. Marsh, J.; Boszhard, I.; Contargyris, A.; Cullen, J.; Junge, K.; Molinari, F.; Osella, M.; Raspanti, C. A Value-Driven Business Ecosystem for Industrial Transformation: The Case of the EU’s H2020 “Textile and Clothing Business Labs”. *Sustain. Sci. Pract. Policy* **2022**, *18*, 263–277. [\[CrossRef\]](#)
11. Shin, M.M.; Jung, S.; Rha, J.S. Study on Business Ecosystem Research Trend Using Network Text Analysis. *Sustainability* **2021**, *13*, 10727. [\[CrossRef\]](#)
12. Attour, A.; Barbaroux, P. The Role of Knowledge Processes in a Business Ecosystem’s Lifecycle. *J. Knowl. Econ.* **2021**, *12*, 238–255. [\[CrossRef\]](#)
13. Masucci, M.; Brusoni, S.; Cennamo, C. Removing Bottlenecks in Business Ecosystems: The Strategic Role of Outbound Open Innovation. *Res. Policy* **2020**, *49*, 103823. [\[CrossRef\]](#)
14. Sharda, N. The Role of Mobile Multimedia Systems in Digital Business Ecosystems. In Proceedings of the 2007 Inaugural IEEE-IES Digital EcoSystems and Technologies Conference, Cairns, QLD, Australia, 21–23 February 2007; pp. 523–528. [\[CrossRef\]](#)
15. Laaperi, A. Disruptive Factors in the OLED Business Ecosystem. *Inf. Disp.* **2009**, *25*, 8–13. [\[CrossRef\]](#)
16. Li, Y.R. The Technological Roadmap of Cisco’s Business Ecosystem. *Technovation* **2009**, *29*, 379–386. [\[CrossRef\]](#)
17. Yamakami, T. Mobile Social Business Ecosystems with Revenue-Generating Emotional Engineering: Lessons from Mobile Business in Japan. In Proceedings of the IEEE International Conference on Digital Ecosystems and Technologies, Daejeon, Republic of Korea, 31 May 2011–3 June 2011; pp. 83–88. [\[CrossRef\]](#)
18. Awano, H.; Tsujimoto, M. The Mechanisms for Business Ecosystem Members to Capture Part of a Business Ecosystem’s Joint Created Value. *Sustainability* **2021**, *13*, 4573. [\[CrossRef\]](#)
19. Bang, D.; Lee, J.; Shin, M.M. Partner Selection Strategies in Global Business Ecosystems: Country Images of the Keystone Company and Partner Companies on the Brand Quality Perception. *Sustainability* **2021**, *13*, 12903. [\[CrossRef\]](#)
20. Ramezani, J.; Camarinha-Matos, L.M. A Collaborative Approach to Resilient and Antifragile Business Ecosystems. *Procedia Comput. Sci.* **2019**, *162*, 604–613. [\[CrossRef\]](#)
21. McCordic, C.; Frayne, B. The Network of Household Barriers to Achieving SDG 1, 2 and 3 in Maputo, Mozambique. *J. Hunger Environ. Nutr.* **2021**, *16*, 739–750. [\[CrossRef\]](#)
22. Rai, S.M.; Brown, B.D.; Ruwanpura, K.N. SDG 8: Decent Work and Economic Growth—A Gendered Analysis. *World Dev.* **2019**, *113*, 368–380. [\[CrossRef\]](#)
23. Asi, Y.M.; Williams, C. The Role of Digital Health in Making Progress toward Sustainable Development Goal (SDG) 3 in Conflict-Affected Populations. *Int. J. Med. Inform.* **2018**, *114*, 114–120. [\[CrossRef\]](#)
24. Boeren, E. Understanding Sustainable Development Goal (SDG) 4 on “Quality Education” from Micro, Meso and Macro Perspectives. *Int. Rev. Educ.* **2019**, *65*, 277–294. [\[CrossRef\]](#)
25. Sadoff, C.W.; Borgomeo, E.; Uhlenbrook, S. Rethinking Water for SDG 6. *Nat. Sustain.* **2020**, *3*, 346–347. [\[CrossRef\]](#)

26. Müller, F.; Neumann, M.; Elsner, C.; Claar, S. Assessing African Energy Transitions: Renewable Energy Policies, Energy Justice, and SDG 7. *Polit. Gov.* **2021**, *9*, 119–130. [\[CrossRef\]](#)
27. Ma, Z.; Christensen, K.; Jørgensen, B.N. Business Ecosystem Architecture Development: A Case Study of Electric Vehicle Home Charging. *Energy Inform.* **2021**, *4*, 9. [\[CrossRef\]](#)
28. Tasaka, H. Incubation Strategy for Business Ecosystem. *Seimitsu Kogaku Kaishi/J. Jpn. Soc. Precis. Eng.* **2001**, *67*, 1745–1748. [\[CrossRef\]](#)
29. Namugenyi, C.; Nimmagadda, S.L.; Reiners, T. Design of a SWOT Analysis Model and Its Evaluation in Diverse Digital Business Ecosystem Contexts. *Procedia Comput. Sci.* **2019**, *159*, 1145–1154. [\[CrossRef\]](#)
30. Rezac, F. Addressing Conceptual Randomness in Iot-Driven Business Ecosystem Research. *Sensors* **2020**, *20*, 5842. [\[CrossRef\]](#)
31. Kanda, W.; Geissdoerfer, M.; Hjelm, O. From Circular Business Models to Circular Business Ecosystems. *Bus. Strategy Environ.* **2021**, *30*, 2814–2829. [\[CrossRef\]](#)
32. Yang, X.; Cao, D.; Chen, J.; Xiao, Z.; Daowd, A. AI and IoT-Based Collaborative Business Ecosystem: A Case in Chinese Fish Farming Industry. *Int. J. Technol. Manag.* **2020**, *82*, 151–171. [\[CrossRef\]](#)
33. Scaringella, L.; Radziwon, A. Innovation, Entrepreneurial, Knowledge, and Business Ecosystems: Old Wine in New Bottles? *Technol. Forecast. Soc. Change* **2018**, *136*, 59–87. [\[CrossRef\]](#)
34. Rong, K.; Patton, D.; Chen, W. Business Models Dynamics and Business Ecosystems in the Emerging 3D Printing Industry. *Technol. Forecast. Soc. Change* **2018**, *134*, 234–245. [\[CrossRef\]](#)
35. Aksenova, G.; Kiviniemi, A.; Kocaturk, T.; Lejeune, A. From Finnish AEC Knowledge Ecosystem to Business Ecosystem: Lessons Learned from the National Deployment of BIM. *Constr. Manag. Econ.* **2019**, *37*, 317–335. [\[CrossRef\]](#)
36. Hakanen, E.; Rajala, R. Material Intelligence as a Driver for Value Creation in IoT-Enabled Business Ecosystems. *J. Bus. Ind. Mark.* **2018**, *33*, 857–867. [\[CrossRef\]](#)
37. Cook, C.; Bakker, P. Viable, Sustainable or Resilient?: Understanding the Hyperlocal Business Ecosystem. *Nord. Rev.* **2019**, *40*, 31–49. [\[CrossRef\]](#)
38. Graça, P.; Camarinha-Matos, L.M. A Model of Evolution of a Collaborative Business Ecosystem Influenced by Performance Indicators. In *IFIP Advances in Information and Communication Technology*; Springer: Cham, Switzerland, 2019; Volume 568, pp. 245–258. [\[CrossRef\]](#)
39. Mäntymäki, M.; Salmela, H.; Turunen, M. Do Business Ecosystems Differ from Other Business Networks? The Case of an Emerging Business Ecosystem for Digital Real-Estate and Facility Services. In *Lecture Notes in Computer Science (including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*; Springer: Berlin/Heidelberg, Germany, 2018; pp. 102–116. [\[CrossRef\]](#)
40. Küfeoğlu, S.; Açıkgöz, E.; Taşçı, Y.E.; Arslan, T.Y.; Priesmann, J.; Praktijnjo, A. Designing the Business Ecosystem of a Decentralised Energy Datahub. *Energies* **2022**, *15*, 650. [\[CrossRef\]](#)
41. Chang, S.E.; Chen, Y. Blockchain in Health Care Innovation: Literature Review and Case Study from a Business Ecosystem Perspective. *J. Med. Internet Res.* **2020**, *22*, e19480. [\[CrossRef\]](#)
42. Rong, K.; Lin, Y.; Li, B.; Burström, T.; Butel, L.; Yu, J. Business Ecosystem Research Agenda: More Dynamic, More Embedded, and More Internationalized. *Asian Bus. Manag.* **2018**, *17*, 167–182. [\[CrossRef\]](#)
43. Cha, H.; Wu, J.; Kotabe, M. The Vulnerability Problem of Business Ecosystems under Global Decoupling. *Manag. Organ. Rev.* **2021**, *17*, 617–623. [\[CrossRef\]](#)
44. Aria, M.; Cuccurullo, C. Bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis. *J. Informetr.* **2017**, *11*, 959–975. [\[CrossRef\]](#)
45. Zupic, I.; Čater, T. Bibliometric Methods in Management and Organization. *Organ. Res. Methods* **2015**, *18*, 429–472. [\[CrossRef\]](#)
46. Rinkinen, S.; Harmaakorpi, V. The Business Ecosystem Concept in Innovation Policy Context: Building a Conceptual Framework. *Innov. Eur. J. Soc. Sci. Res.* **2018**, *31*, 333–349. [\[CrossRef\]](#)
47. Zenezini, G.; Marco, A.D. Modelling Urban Logistics Business Ecosystems an Agent-Based Model Proposal. In Proceedings of the 8th International Conference on Simulation and Modeling Methodologies, Technologies and Applications, Porto, Portugal, 29–31 July 2018; pp. 128–135. [\[CrossRef\]](#)
48. Bellini, O.; Campioli, A.; Del Pero, C.; Talamo, C.; Atta, N.; Dalla Valle, A. Become—Business Ecosystem Design for Sustainable Settlements in Mogadishu. In *Research for Development*; Springer: Berlin/Heidelberg, Germany, 2020; pp. 3–12. [\[CrossRef\]](#)
49. De Langen, P.W.; Sornn-Friese, H.; Hallworth, J. The Role of Port Development Companies in Transitioning the Port Business Ecosystem; the Case of Port of Amsterdam's Circular Activities. *Sustainability* **2020**, *12*, 4397. [\[CrossRef\]](#)
50. Mukti, I.Y.; Firdausy, D.R.; Aldea, A.; Iacob, M.E. Architecting Rural Smartness: A Collaborative Platform Design for Rural Digital Business Ecosystem. *Electron. J. Inf. Syst. Dev. Ctries.* **2022**, e12236. [\[CrossRef\]](#)
51. Riquelme-Medina, M.; Stevenson, M.; Barrales-Molina, V.; Llorens-Montes, F.J. Coopetition in Business Ecosystems: The Key Role of Absorptive Capacity and Supply Chain Agility. *J. Bus. Res.* **2022**, *146*, 464–476. [\[CrossRef\]](#)
52. Liu, G.; Aroean, L.; Ko, W.W. A Business Ecosystem Perspective of Supply Chain Justice Practices: A Study of a Marina Resort Supply Chain Ecosystem in Indonesia. *Int. J. Oper. Prod. Manag.* **2019**, *39*, 1122–1143. [\[CrossRef\]](#)
53. Hyysalo, J.; Kelanti, M.; Sauvola, T.; Liukkunen, K.; Sauvola, J. Fenix: A Platform for Digital Partnering and Business Ecosystem Creation. *IT Prof.* **2019**, *21*, 74–81. [\[CrossRef\]](#)

54. Cui, M.; Li, W.; Cui, L.; Jia, Y.; Wu, L. How Do Keystones Govern Their Business Ecosystems through Resource Orchestration? *Ind. Manag. Data Syst.* **2022**, *122*, 1987–2011. [\[CrossRef\]](#)
55. Shi, Y.; Lu, C.; Hou, H.; Zhen, L.; Hu, J. Linking Business Ecosystem and Natural Ecosystem Together—a Sustainable Pathway for Future Industrialization. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 38. [\[CrossRef\]](#)
56. Baumann, S. Introduction to the Handbook on Digital Business Ecosystems: Strategies, Platforms, Technologies, Governance and Societal Challenges. In *Handbook on Digital Business Ecosystems: Strategies, Platforms, Technologies, Governance and Societal Challenges*; Edward Elgar: Cheltenham, UK, 2022; pp. 1–9. [\[CrossRef\]](#)
57. Waßenhoven, A.; Block, C.; Wustmans, M.; Bröring, S. Analyzing an Emerging Business Ecosystem through M&A Activities: The Case of the Bioeconomy. *Bus. Strateg. Dev.* **2021**, *43*, 259–278. [\[CrossRef\]](#)
58. Faber, A.; Hernandez-Mendez, A.; Rehm, S.V.; Matthes, F. Collaborative Modelling and Visualization of Business Ecosystems: Insights from Two Action Design Research Case Studies. *Australas. J. Inf. Syst.* **2020**, *24*, 2229. [\[CrossRef\]](#)
59. Pütz, F.; Murphy, F.; Mullins, M.; O'Malley, L. Connected Automated Vehicles and Insurance: Analysing Future Market-Structure from a Business Ecosystem Perspective. *Technol. Soc.* **2019**, *59*, 101182. [\[CrossRef\]](#)
60. Faber, A.; Rehm, S.V.; Hernandez-Mendez, A.; Matthes, F. Modeling and Visualizing Smart City Mobility Business Ecosystems: Insights from a Case Study. *Information* **2018**, *9*, 270. [\[CrossRef\]](#)
61. Ma, Z. The Importance of Systematical Analysis and Evaluation Methods for Energy Business Ecosystems. *Energy Inform.* **2022**, *5*, 2. [\[CrossRef\]](#)
62. Pereira, V.R.; Kreye, M.E.; Carvalho, M.M. Customer-Pulled and Provider-Pushed Pathways for Product-Service System: The Contingent Effect of the Business Ecosystems. *J. Manuf. Technol. Manag.* **2019**, *30*, 729–747. [\[CrossRef\]](#)
63. Attour, A.; Lazaric, N. From Knowledge to Business Ecosystems: Emergence of an Entrepreneurial Activity during Knowledge Replication. *Small Bus. Econ.* **2020**, *54*, 575–587. [\[CrossRef\]](#)
64. Værbak, M.; Ma, Z.; Demazeau, Y.; Jørgensen, B.N. A Generic Agent-Based Framework for Modeling Business Ecosystems: A Case Study of Electric Vehicle Home Charging. *Energy Inform.* **2021**, *4*, 1–26. [\[CrossRef\]](#)
65. Choi, Y.; Lee, H. How to Boost and Accelerate New Drug Development in Korea: Business Ecosystem Perspectives. *Transl. Clin. Pharmacol.* **2022**, *30*, 129–135. [\[CrossRef\]](#)
66. Graça, P.; Camarinha-Matos, L.M. Assessment of Sustainable Collaboration in Collaborative Business Ecosystems. *Computers* **2021**, *10*, 167. [\[CrossRef\]](#)
67. Liu, K.; Guo, H. Digital Innovation and Transformation to Business Ecosystems. In *Lecture Notes in Business Information Processing*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 793–803. [\[CrossRef\]](#)
68. Shou, Y.; Shi, Y.; Ren, G.J. Guest Editorial: Deconstructing Business Ecosystems: Complementarity, Capabilities, Co-Creation and Co-Evolution. *Ind. Manag. Data Syst.* **2022**, *122*, 1977–1986. [\[CrossRef\]](#)
69. Pomegbe, W.W.K.; Li, W.; Dogbe, C.S.K.; Otoo, C.O.A. Closeness or Opportunistic Behavior? Mediating the Business Ecosystem Governance Mechanisms and Coordination Relationship. *Cross Cult. Strateg. Manag.* **2021**, *28*, 530–552. [\[CrossRef\]](#)
70. Rehm, S.V.; Faber, A. Building the City's Business Networks: Using Visualisations for Business Ecosystem Governance. In *Innovations for Metropolitan Areas: Intelligent Solutions for Mobility, Logistics and Infrastructure Designed for Citizens*; Springer: Berlin/Heidelberg, Germany, 2020; pp. 245–256. [\[CrossRef\]](#)
71. Kwapong Baffoe, B.O.; Luo, W. Humanitarian Relief Sustainability: A Framework of Humanitarian Logistics Digital Business Ecosystem. *Transp. Res. Procedia* **2020**, *48*, 363–387. [\[CrossRef\]](#)
72. Krasyuk, I.; Krinov, S.; Kolgan, M.; Medvedeva, Y.; Khukhlaev, D. Conceptual Framework for Creating a Digital Business Ecosystem Based on Marketing. In *IOP Conference Series: Materials Science and Engineering*; IOP Publishing: London, UK, 2020; p. 012055. [\[CrossRef\]](#)
73. Micheli, P.; Muctor, G. The Roles of Performance Measurement and Management in the Development and Implementation of Business Ecosystem Strategies. *Int. J. Oper. Prod. Manag.* **2021**, *4*, 1761–1784. [\[CrossRef\]](#)
74. D'Souza, A.; Bouw, K.; Velthuisen, H.; Huitema, G.B.; Wortmann, J.C. Designing Viable Multi-Commodity Energy Business Ecosystems: Corroborating the Business Model Design Framework for Viability. *J. Clean. Prod.* **2018**, *182*, 124–138. [\[CrossRef\]](#)
75. Saheb, T.; Mamaghani, F.H. Exploring the Digital Business Ecosystem of the Internet of Things in Emerging Economies with a Focus on the Role of Pseudo-Private Companies. *Australas. J. Inf. Syst.* **2021**, *25*, 1–21. [\[CrossRef\]](#)
76. Bui, M.T.; Jeng, D.J.F.; Le, T.M. How Individual Experiential Fit Drives Mobile Platform Cocreation-Supportive Behaviours in a Digital Business Ecosystem. *WSEAS Trans. Bus. Econ.* **2021**, *18*, 1137–1148. [\[CrossRef\]](#)
77. Ferreira, J.J.; Teixeira, A.A.C. Open Innovation and Knowledge for Fostering Business Ecosystems. *J. Innov. Knowl.* **2019**, *4*, 253–255. [\[CrossRef\]](#)
78. Majava, J.; Rinkinen, S.; Harmaakorpi, V. Business Ecosystem Perspective on Innovation Policy: A Case Study of San Diego Life Sciences. *Int. J. Innov. Learn.* **2020**, *27*, 19–36. [\[CrossRef\]](#)
79. Trevisan, A.H.; Zacharias, I.S.; Castro, C.G.; Mascarenhas, J. Circular Economy Actions in Business Ecosystems Driven by Digital Technologies. *Procedia CIRP* **2021**, *100*, 325–330. [\[CrossRef\]](#)
80. Dimawarnita, F.; Djatna, T.; Hambali, E.; Muslich; Panji, T.; Adnan, A. Clustering Analysis for Production System Design of Emulsifier for Biodiesel B30 Based on Digital Business Ecosystem. In *IOP Conference Series: Earth and Environmental Science*; IOP Publishing: London, UK, 2021; p. 012027. [\[CrossRef\]](#)

81. Popescu, D.V.; Dima, A.; Radu, E.; Dobrotă, E.M.; Dumitrache, V.M. Bibliometric Analysis of the Green Deal Policies in the Food Chain. *Amfiteatru Econ.* **2022**, *24*, 410–428. [[CrossRef](#)]
82. Senyo, P.K.; Liu, K.; Effah, J. A Framework for Assessing the Social Impact of Interdependencies in Digital Business Ecosystems. In *IFIP Advances in Information and Communication Technology*; Springer: Berlin/Heidelberg, Germany, 2018; pp. 125–135. [[CrossRef](#)]
83. Ramezani, J.; Camarinha-Matos, L.M. Novel Approaches to Handle Disruptions in Business Ecosystems. In *IFIP Advances in Information and Communication Technology*; Springer: Berlin/Heidelberg, Germany, 2019; pp. 43–57. [[CrossRef](#)]
84. Faber, A.; Hernandez-Mendez, A.; Rehm, S.V.; Matthes, F. An Agile Framework for Modeling Smart City Business Ecosystems. In Proceedings of the 20th International Conference on Enterprise Information Systems, Funchal, Portugal, 21–24 March 2018; pp. 39–50. [[CrossRef](#)]
85. Espina-Romero, L.; Guerrero-Alcedo, J.M. Fields Touched by Digitalization: Analysis of Scientific Activity in Scopus. *Sustainability* **2022**, *14*, 14425. [[CrossRef](#)]
86. Dai, W. Optimal Policy Computing for Blockchain Based Smart Contracts via Federated Learning. *Oper. Res.* **2022**, *22*, 5817–5844. [[CrossRef](#)]
87. Mohammed Yakubu, A.; Chen, Y.P.P. Future Generation Computer Systems. *Future Gener. Comput. Syst.* **2022**, *137*, 234–247. [[CrossRef](#)]
88. Guerrero-Alcedo, J.M.; Espina-Romero, L.C.; Nava-Chirinos, A.A. Gamification in the University Context: Bibliometric Review in Scopus (2012–2022). *Int. J. Learn. Teach. Educ. Res.* **2022**, *21*, 309–325. [[CrossRef](#)]
89. Järvihaavisto, U.; Öhman, M.; Smeds, R. Towards a Serious Game on Data Sharing in Business Ecosystems. In *IFIP Advances in Information and Communication Technology*; Springer: Berlin/Heidelberg, Germany, 2021; pp. 500–509. [[CrossRef](#)]
90. Huang, L.; Zhen, L.; Wang, J.; Zhang, X. Blockchain Implementation for Circular Supply Chain Management: Evaluating Critical Success Factors. *Ind. Mark. Manag.* **2022**, *102*, 451–464. [[CrossRef](#)]
91. Niu, B.; Mu, Z.; Cao, B.; Gao, J. Should Multinational Firms Implement Blockchain to Provide Quality Verification? *Transp. Res. Part E Logist. Transp. Rev.* **2021**, *145*, 102121. [[CrossRef](#)]
92. Shen, B.; Cheng, M.; Dong, C.; Xiao, Y. Battling Counterfeit Masks during the COVID-19 Outbreak: Quality Inspection vs. Blockchain Adoption. *Int. J. Prod. Res.* **2021**, 1–17. [[CrossRef](#)]