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Article

Mapping the Landscape of the Business Model and Open Innovation Scientific Field to Set Proposals for Directions of Future Research

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Abstract: In recent years increasing attention has been paid to theory building and empirical research that explore the links between the business model and open innovation (BM&OI). Nevertheless, studies presenting the results of bibliometric analyses merging these two terms are still scarce. Therefore, the main aim of this paper was to present the results of a comprehensive bibliometric analysis focused on the determination and mapping of the evolving cognitive and social structures in the BM&OI literature to set proposals for directions of future research. Our research was based on the dataset obtained from the Scopus database and made use of the Biblioshiny and the VOSviewer software. Descriptive and network analyses were conducted to demonstrate an overview of the scientific field under consideration. We identified the leading authors, sources, countries and institutions in the BM&OI literature. The most influential publications on the BM&OI and the most cited references by documents covering the BM&OI research were indicated. Based on the thematic evolution and thematic maps, the evolving structures of key sub-fields of the BM&OI research were determined and discussed. Moreover, the major clusters and the specificity of scientific collaboration in the analyzed research domain were identified and described. Our intention was to demonstrate to both scholars and practitioners the wide-ranging landscape of multifaceted research on the BM&OI.

Keywords: business model; open innovation; bibliometric analysis; network analysis

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1. Introduction

The dynamically changing business environment and the development of digital technologies have resulted in business models becoming more open and collaborative. Consequently, increasing attention is being paid to theory building and empirical research that explore links between the business model and open innovation.

The term 'business model' appeared for the first time in the scientific literature in 1957 [1], and in the title of a paper in 1960 [2]. However, a significant increase in interest in this concept has been observed since the mid-1990s. The literature on the business model mainly focuses on such fundamental issues as innovation, technology, strategy and organizational design [3,4]. Nevertheless, there is still no consensus on its unequivocal understanding and explanation. A business model depicts the content, structure, and governance of transactions designed so as to create value through the exploitation of business opportunities [5]. The other definitions focus on concise representation of how an interrelated set of decision variables in the areas of venture strategy, architecture, and economics are addressed to create sustainable competitive advantage in defined markets [6] or articulating the logic and providing data and other evidence that demonstrates how a business creates and delivers value to customers and outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value [7]. In fact, a business model comprises several characteristics (i.e., value propositions, market segments, revenue generation mechanism, value chain structure, complementary assets, cost structure and profit potential, position in the value network, and competitive strategy) [8–10].

Notwithstanding, a business model can be conceptualized as an architecture that connects various activities focused on the three interrelated key elements: value proposition, value creation, and value capture [7,11,12], and it refers to the logic of the firm, and how it operates and creates value for stakeholders [13]. Furthermore, it can be also depicted as a device for structuring and designing organization [14].

Open innovation has become a topical issue widely discussed by academics and practitioners in the last two decades. This notion was introduced by Chesbrough as a mode of innovation in which firms use purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation [15]. The more participatory and decentralized approach to innovation is extremely important in developing new technologies and products because the value of reusing the knowledge is limited, especially in the rapidly changing business environment [9,16–18]. Open innovation is a broad concept that has been studied from various perspectives [19], and can be implemented in many different ways [20]. This comprises issues related to the open innovation process and relevant practices [21–23], including the transition from closed towards open innovation [18,24], the context dependency of open innovation [25], and the internal and external environment characteristics affecting open innovation performance [20]. Open innovation can be analyzed at the intra-organizational, organizational, extra-organizational, inter-organizational, as well as industry, regional innovation systems and society level [26]. The researchers tend to use different definitions of openness and open innovation and focus on its different aspects which entailed conceptual ambiguity and inhibited the building of a coherent body of knowledge in this area [27]. Nevertheless, linkages to particular theories and relevant phenomena are still evolving [28,29]. It should be emphasized that the notion of open innovation overlaps with numerous other terms, such as collaborative innovation, inbound innovation, outbound innovation, coupled innovation, user innovation and other forms of distributed innovation [19,30,31]. Furthermore, due to the interconnection of perspectives and boundaries between different levels of open innovation analysis, the recent research focused on the role of cross-level approaches and complex interplays of multiple mechanisms across different levels of open innovation [26].

A few years ago, Chesbrough and Bogers [32] redefined open innovation as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries. According to this definition, open innovation is a concept that essentially resides at the organizational level. Therefore, aligning the open innovation process with the organization's business model is needed and it is perceived as a crucial type of organizational change [18,33]. Collaboration and co-creation in the business model development are vital to sustaining open innovation. Therefore, the openness is perceived as a key factor influencing development of a business model [34], and appropriate business model alignment enables co-development relationships and increases the chances that the external partnerships can be sustained over time [35]. Opening up the business model empowers new business opportunities, and enhances its quality and development [16,36,37]. However, while novel open innovation-based business models create further opportunities for the user, they may constitute additional risks for companies [38]. Furthermore, different open innovation strategies require different business models and they determine the extent of the business model reconfiguration [39]. It is worth mentioning that the concepts of the business model and open innovation can be combined diversely. Based on the differences and relationships between these two terms, the following typology was suggested: (1) open innovation relates to the business model concept if it contributes to a company's sustained value creation and value capturing, (2) a business model is open if the collaboration with partners in creating and capturing value is a central issue, (3) open innovation relates to the open business model concept if collaboration is an essential part of the business model [40].

The immense attention given by academics and practitioners to the business model research and the open innovation research has resulted in numerous bibliometric analyses showing the structure and trends in these scientific fields.

The identified bibliometric studies performed so far in the extensive scientific field of the business model research have encompassed general and more specific analyses focused on the business model [3,41,42], business model innovation [43,44], sustainable business model [45–49], business models for sustainability [50,51], sustainable business model innovation [52,53], sustainable business models for innovation [54], circular economy business models [55], marketing business model [56], business models and marketing [57], business model for industrial marketing [58], business models and Industry 4.0 [59,60], business models and digitalization [61], digitalization and new technologies for sustainable business models [62], digitalization-driven retail business model innovation [63], business models in supply chains [64], business models for green buildings [65], innovative business models for vertical farm entrepreneurs [66], business models and air transport [67], business models and electric cars [68], and business models, service relationships and technology [69].

When it comes to studies presenting the results of bibliometric analyses comprising the extensive open innovation research field, there have also been more general and more specific explorations focusing on open innovation [19,28,70–77], open innovation and crowdsourcing [28], open innovation and entrepreneurship [78], knowledge sharing and transfer in an open innovation [79], open innovation and the university [80], open innovation in SMEs [81,82], open innovation and sustainability [83–86], open eco-innovation [87,88], open innovation and sustainable tourism [89], open innovation and solar energy technologies [90], and open innovation in medical and pharmaceutical research [91].

There are very few examples of research demonstrating the findings from bibliometric analysis merging the business model research and the open innovation research so far. The only exceptions are the publications on the sustainable business model based on open innovation—the case study of Iberdrola [92]—and the open business model and open innovation [93]. However, the first study focused on a Spanish multinational company—Iberdrola—and the second was a conference paper with the bibliometric analysis limited just to the network of keywords. Addressing the growing interest in studies linking the business model and open innovation (BM&OI) to fill in the identified research gap seemed appropriate and interesting both from the cognitive and the practical point of view. Therefore, the main aim of our paper was to present the results of a comprehensive bibliometric analysis focused on the determination and mapping of the evolving cognitive and social structures in the BM&OI literature to set proposals for directions of future research. In particular, our study was expected to answer the following research questions:

- What are the most prolific authors, sources, countries and organizations in the BM&OI research field?
- What are the most influential papers in the BM&OI literature and what is the most substantial literature background for the scientific field under consideration?
- What are the existing research hotspots and how are publications on the BM&OI clustered?
- What do the thematic maps in the research on BM&OI reveal and how do they evolve?
- What is the specificity of scientific collaboration in the BM&OI literature?

The remainder of the paper is organized as follows. The research methodology is described in Section 2. Section 3 presents the research results. The obtained findings are discussed in Section 4. Finally, concluding remarks with identified limitations are presented in Section 5.

2. Materials and Methods

To gain an insight into the BM&OI literature and determine and map its evolving cognitive and social structures, a bibliometric analysis was performed [94].

In the first step of the study, an online bibliographic database was selected for the analysis. It was decided to use Scopus as the largest bibliographic database of peer-reviewed literature with consistent scientific output in the various subject areas and better coverage compared to other databases [95]. Furthermore, it is characterized by ease of access to bibliographic sources with the largest range of dataset [96,97].

In the second step, search query words were identified and the data required for the bibliometric analysis were collected. It was decided that the searched keywords would be combinations of 'business model' and different terms related to open innovation. Therefore, apart from 'open innovation', additional searched keywords included 'collaborative innovation', 'coupled innovation', 'user innovation', 'inbound innovation', 'outbound innovation', and 'distributed innovation' [19,30,31]. Furthermore, the other terms related to open innovation such as 'openness', 'crowdsourcing', 'co-creation', 'co-design', 'collaboration', 'cooperation', 'external knowledge', 'external resources', and 'partnership' were explored [87]. Combinations of these key words using relevant Boolean operators were searched in title, abstract, and keywords. All types of peer-reviewed publications were taken into account in the primary sample. There were no restrictions regarding the publication period of the analyzed documents. However, due to the first publication in the BM&OI literature appearing in 2003, the analysis timespan was narrowed from 2003 to 2022. The data were retrieved on 1 July 2022 and a total of 2126 documents that met all of the specified criteria were found. The initial research sample was subjected to a screening process. The retrieved data were checked to assure that an English version of the title, abstract, or keywords were available for all publications, as well as to eliminate duplicate publications and erroneous entries (i.e., inconsistent with the research area under consideration). To avoid distorting the results of bibliometric analysis, publications with an undefined author were excluded. Furthermore, to ensure the high quality of the dataset, the following document types were eliminated: conference review, note, short survey, erratum, letter, and items published in trade journals. As a result, the final research sample of 1892 documents was obtained. A general description of the research protocol and characteristic of the final research sample is presented in Figure 1.

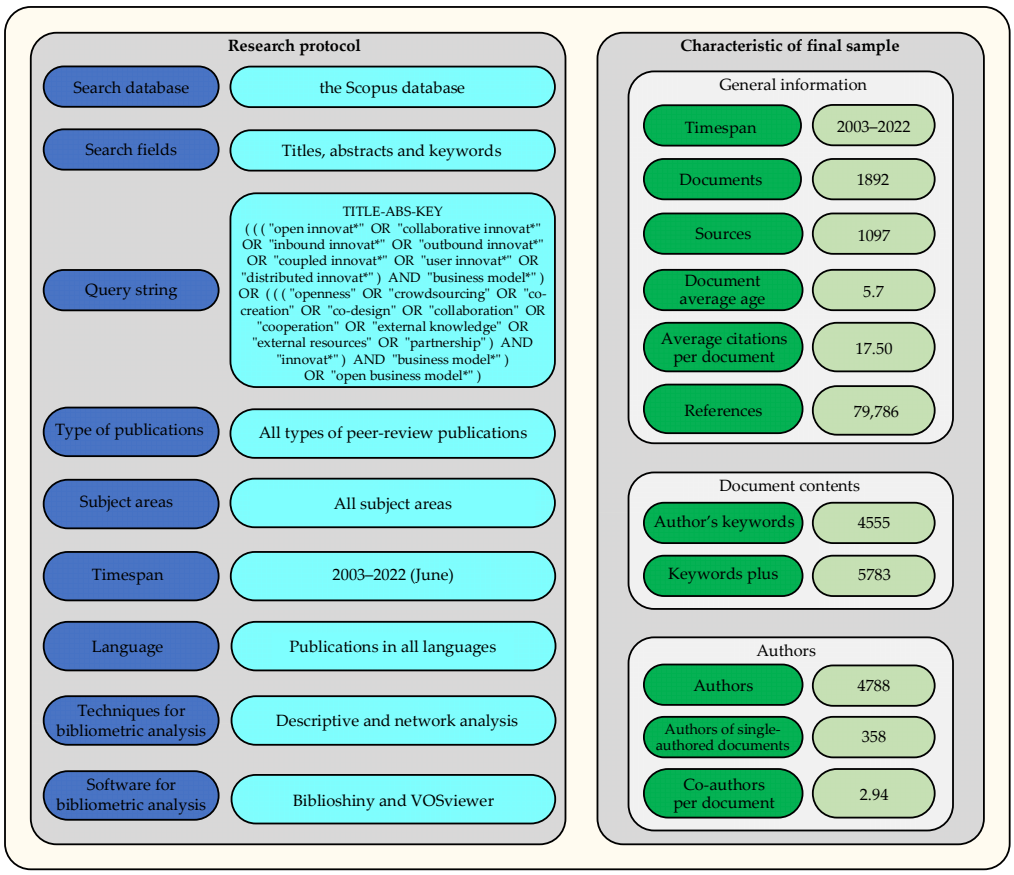

Figure 1. Research protocol and characteristic of research sample.

In the third step, descriptive analysis and network analysis were selected as bibliometric techniques to determine and map the research patterns in the BM&OI literature: the analyses were performed using Biblioshiny (R version 4.2.1, Bibliometrix package version 4.0.0) and VOSviewer (version 1.6.18). These software packages are effective tools for the exploration of bibliometric networks and thorough analysis of multi-element structures, in particular [98].

The descriptive analysis identified the main subject areas, document types and relevant number of publications and citations. Moreover, the most prolific authors, sources, countries and organizations in the research field under consideration were indicated. Furthermore, the most cited publications in this area and the most cited references by publications covering the BM&OI research were characterized using quantity and quality bibliometric indicators.

The network analyses started with the identification of issues that were the most frequently addressed in the BM&OI literature. They were determined based on the authors' keywords. The dynamics of the occurrence of the keywords was presented on the time axis. The keywords were then subjected to a network analysis in the VOSviewer program.

The structure of the most important research areas and the changes in them were determined using the thematic evolution based on the Sankey diagram with a division into three time intervals. The thematic map was developed for each time period based on the methodology proposed by [99] and taking account of the techniques of the co-word network analysis and clustering. According to the methodology adopted in this analysis, based on density and centrality metrics, the themes are divided into the following categories: (1) motor themes (MT), which are well developed and significant for the analyzed field of knowledge; (2) basic themes (BT), which have not been explored well enough yet, but are important in the analyzed research field; (3) niche themes (NT), which are more specific, with intense internal relationships within a particular cluster, but with less intense external relationships; their impact on the field of study is thus slight; and (4) emerging or declining themes (EDT), which are poorly developed and peripheral. The identified contemporary basic, motor, niche, and emerging themes in the BM&OI research made it possible to indicate and analyze publications assigned to relevant themes, which formed the basis for the proposal of the future research agenda in the scientific field under consideration.

The next step was to carry out network analyses aiming at mapping the geographical scientific collaboration of countries using the co-authorship and citation networks. Further analyses conducted after that concerned the mapping of the scientific collaboration of sources using the citation and co-citation networks, and bibliographic coupling network of documents. The network analyses performed in the VOSviewer are perfectly suited for visualization of network relationships between elements [98]. The nodes are represented depending on the type of the analysis subject by keywords, sources, or countries. Each of the network elements is assigned to a cluster represented by a different color. The clustering technique used by this program is based on the smart local moving algorithm introduced by Waltman, Van Eck, and Noyons [100,101]. The relationships (e.g., co-occurrence, co-citation) between them are represented by lines. The size of the circles obtained from the analysis corresponds to the frequency of the co-occurrence or the number of occurrences of a given element in the network (it can represent the number of the occurrences of a keyword, the number of publications, the number of citations). The higher the number, the bigger the circles and vice versa. The location of the circles in relation to each other is the effect of the strength (number) of links between them. The bigger the strength, the closer the circles are to each other.

The links between the main sources, authors and authors' keywords were visualized using the three fields plot analysis. The diagram comprises the most relevant elements represented by rectangles where their height is determined by the existing links between the element that the specific rectangle represents and other elements of the diagram. The more links there are for the element, the higher the rectangle representing it [102].

3. Results

3.1. Descriptive Analysis of the BM&OI Literature

The descriptive analysis is comprised of 1892 publications covering the BM&OI literature indexed in the Scopus database. These works included 977 articles, 573 conference papers, 182 book chapters, 98 reviews, 49 books, and 13 editorials. The vast majority of identified documents were written in English (1809 works). Publications on the BM&OI encompassed various subject areas. In particular, they were assigned to business, management and accounting (921 works), engineering (485), computer science (452), social sciences (392), and economics, econometrics and finance (317).

Further analysis revealed that the most prolific authors in terms of contributions to the BM&OI literature were Henry Chesbrough who published 18 works, and Nancy Bocken with 14 papers. The most productive Scopus-indexed sources publishing studies on BM&OI were *Sustainability* (46 records), the *Journal of Open Innovation: Technology Market and Complexity* (42), the *Journal of Cleaner Production* (34), and the book series *IFIP Advances in Information and Communication Technology* (21). The most active countries in the scientific field under consideration were the United States (273 items), Germany (219), the United Kingdom (186), and Italy (155). Finally, the most prolific organizations in the area under analysis were Delft University of Technology (30 items), University of California, Berkeley (26), Politecnico di Milan (23), and Aalto University (22). The most productive authors, sources, organizations, and countries in the BM&OI literature are presented in Table 1.

Table 1. Most prolific authors, sources, countries, and organizations in the BM&OI literature.

Author	Number of Publications	Source	Number of Publications	Country	Number of Publications	Organization	Number of Publications
Henry Chesbrough	18	*Sustainability*	46	United States	273	Delft University of Technology	30
Nancy Bocken	14	*Journal of Open Innovation: Technology Market and Complexity*	42	Germany	219	University of California, Berkeley	26
Marcel Bogers	8	*Journal of Cleaner Production*	34	United Kingdom	186	Politecnico di Milan	23
Elidjen	7	*IFIP Advances in Information and Communication Technology*	21	Italy	155	Aalto University	22
Vinit Parida	7	*California Management Review*	16	Netherlands	128	LUT University	20
Antonio Ghezzi	6	*Journal of Business Research*	16	China	125	University of St. Gallen	20
Sasmoko	6	*Lecture Notes In Business Information Processing*	16	Finland	101	Chalmers University of Technology	18
Jinhyo Joseph Yun	6	*Proceedings of the International Astronautical Congress*	14	Spain	97	Technical University of Munich	18
Arthur A. Boni	5	*Research Technology Management*	14	Sweden	97	Lund University	17
Thomas Kohler	5	*R&D Management*	13	France	76	University of Cambridge	16

The analysis results revealed that 1892 identified publications on the BM&OI received 33,892 global citations in the period of 2003–2022. Furthermore, 57.2% of all these documents were published in 2017–2022, and 60.6% of all global citations obtained by works in the research field under consideration were received between 2019 and 2022. Figure 2 presents the number of publications on the BM&OI and number of global citations received by these documents in the period of 2003–2022.

The first document recorded in the Scopus database that mentioned the terms 'business model' and 'open innovation' together was a conference paper by Chesbrough [103] from 2003. The most cited publications in the research field under consideration were the following documents:

- Research by Xu [104], with 1381 global citations. This paper presented cloud computing as one of the major enablers for the manufacturing industry, transforming the traditional manufacturing business model, helping it to align product innovation with business strategy, and creating intelligent factory networks that encourage effective collaboration.

- A paper by Enkel et al. [105], cited 1223 times. This editorial for a Special Issue of *R&D Management* emphasized the role of processes of open innovation (i.e., outside-in process, inside-out process, and coupled process) and business models in the context of adding value in knowledge-intensive processes.
- A study by West and Bogers [31], with 1030 citations. This review explored open innovation-related research to determine how and why firms commercialize external sources of innovations.

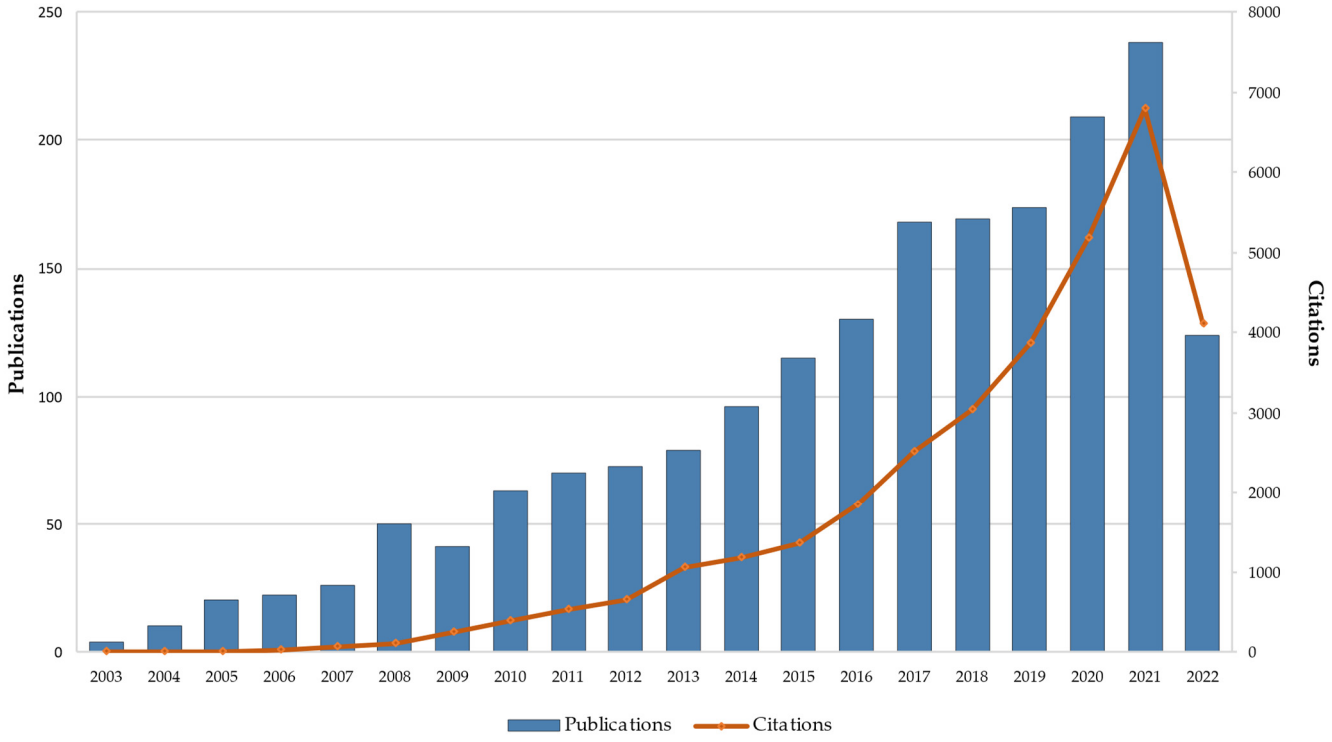

Figure 2. The number of publications on the BM&OI and number of global citations received in the period of 2003–2022.

It is worth mentioning that among the ten publications with the highest number of global citations, there were four papers authored or co-authored by Henry Chesbrough. The most cited Scopus-indexed publications on the BM&OI are presented in Table 2.

In the last step of the descriptive analysis, the reference literature most frequently cited by publications on the BM&OI indexed in the Scopus database was explored. The intention behind this analysis was to determine the most significant literature background for the scientific field under consideration. The performed analysis revealed that 1892 publications on the BM&OI cited 79,786 references. It was indicated that the most cited reference was research by Zott et al. [106], with 86 local citations. The runner-up was a study published by Teece [7], with 62 local citations. A paper by Enkel et al. [105] took third place with 56 local citations. It is worth mentioning that this paper took second place among the most cited publications in the BM&OI research field.

In general, the most cited references comprised seminal works covering the business model research, the open innovation research, or both these research areas explored together. The most cited references by publications covering the BM&OI research are presented in Table 3.

Table 2. Most cited publications in the BM&OI literature.

Authors	Title	Source Title	GC	GC/y	LC	LC/y	LC/GC	FWCI
Xu, X. (2012)	From cloud computing to cloud manufacturing	*Robotics and Computer-Integrated Manufacturing* 28(1), 75–86	1381	125.55	5	0.45	0.36	65.36
Enkel, E., Gassmann, O., Chesbrough, H. (2009)	Open R&D and open innovation: Exploring the phenomenon	*R&D Management* 39(4), 311–316	1223	87.36	56	4.00	4.58	21.80
West, J., Bogers, M. (2014)	Leveraging external sources of innovation: A review of research on open innovation	*Journal of Product Innovation Management* 31(4), 814–831	1030	114.44	41	4.56	3.98	26.64
Gassmann, O., Enkel, E., Chesbrough, H. (2010)	The future of open innovation	*R&D Management* 40(3), 213–221	970	74.62	31	2.38	3.20	195.32
Chesbrough, H.W., Appleyard, M.M. (2007)	Open innovation and strategy	*California Management Review* 50(1), 57–76	705	44.06	42	2.63	5.97	12.23
Gretzel, U., Sigala, M., Xiang, Z., Koo, C. (2015)	Smart tourism: foundations and developments	*Electronic Markets* 25(3), 179–188	695	86.88	3	0.38	0.43	23.00
Baden-Fuller, C., Haefliger, S. (2013)	Business models and technological innovation	*Long Range Planning* 46(6), 419–426	550	55.00	34	3.40	6.18	17.64
Chesbrough, H.W. (2007)	Why companies should have open business models	*MIT Sloan Management Review* 48(2), 22–28	478	29.88	50	3.13	10.46	10.63
Bogers, M. et al. (2017)	The open innovation research landscape: established perspectives and emerging themes across different levels of analysis	*Industry and Innovation* 24(1), 8–40	463	77.17	23	3.83	4.97	53.34
Chesbrough, H. (2004)	Managing open innovation	*Research Technology Management* 47(1), 23–26	390	20.53	26	1.37	6.67	5.80

Note: GC—global citations; GC/y—global citations per year; LC—local citations; LC/y—local citations per year; LC/GC—LC/GC ratio (%); FWCI—field-weighted citation impact.

Table 3. Most cited references by publications covering the BM&OI research.

Authors	Title	Source Title	LC	LC/y	GC	GC/y	LC/GC	FWCI
Zott, C., Amit, R., Massa, L. (2011)	The business model: Recent developments and future research	*Journal of Management* 37(4), 1019–1042	86	7.16	2266	188.83	3.80	39.39
Teece, D.J. (2010)	Business models, business strategy and innovation	*Long Range Planning* 43(2–3), 172–194	62	4.77	3593	276.38	1.73	69.21
Enkel, E., Gassmann, O., Chesbrough, H. (2009)	Open R&D and open innovation: Exploring the phenomenon	*R&D Management* 39(4), 311–316	56	4.00	1223	87.36	4.58	21.80
Eisenhardt, K.M. (1989)	Building Theories from Case Study Research	*Academy of Management Review* 14(4), 532–550	53	2.65	n.a.	n.a.	n.a.	n.a.
Chesbrough, H.W. (2007)	Why companies should have open business models	*MIT Sloan Management Review* 48(2), 22–28	50	3.13	478	29.88	10.46	10.63
Amit, R., Zott, C. (2001)	Value creation in e-business	*Strategic Management Journal* 22(6–7), 493–520	47	2.14	2868	130.36	1.64	44.28
Chesbrough, H.W., Appleyard, M.M. (2007)	Open innovation and strategy	*California Management Review* 50(1), 57–76	42	2.63	705	44.06	5.97	12.23
West, J., Bogers, M. (2014)	Leveraging external sources of innovation: A review of research on open innovation	*Journal of Product Innovation Management* 31(4), 814–831	41	4.56	1030	114.44	3.98	26.64
Chesbrough, H. (2010)	Business model innovation: Opportunities and barriers	*Long Range Planning* 43(2–3), 354–363	39	3.25	1827	152.25	2.13	36.78
Saebi, T., Foss, N.J. (2015)	Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions	*European Management Journal* 33(3), 201–213	37	4.63	235	29.38	15.74	10.13

Note: The abbreviations in the header row are identical to those in Table 2.

3.2. Network Bibliometric Analysis of the BM&OI Literature

3.2.1. Thematic Evolution of the BM&OI Literature

The analysis of the development and current structure of research themes in the BM&OI literature started with the analysis of the authors' most frequent keywords and the structure of the links between them. The analysis of the keywords indicated the main research themes in the field of study. Figure 3 presents the dynamics of the increment in the number of occurrences of the 10 most frequent keywords appearing in the time period of 2003–2022. It follows from the analysis that the most frequent keywords were related to the main research areas and included open innovation, business model/business models, and business model innovation. They appeared at the beginning of research concerning the period and the number of their occurrences rose continuously. The other words, including collaboration and crowdsourcing, appeared a bit later. The latest to observe was the increase in interest in aspects concerning value co-creation, sustainability and circular economy.

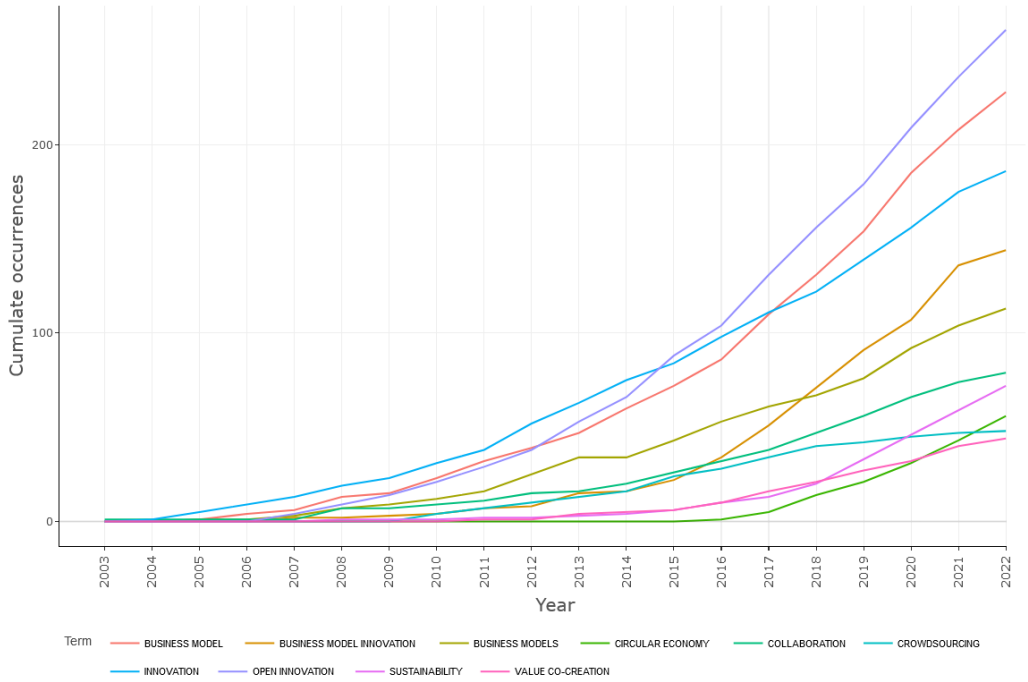

Figure 3. Dynamics of top ten authors' keywords of the BM&OI.

The results of the network analysis of the authors' keywords in the BM&OI literature (analyses with a general division into obtained clusters and analyses on the time axis) are presented in Figure 4a,b, respectively; additional parameters of the most important elements of the network are presented in Table A1.

In order to avoid including less important themes in the network, the keyword co-occurrence threshold was set to five, which made it possible to distinguish 192 most important keywords out of 455. They became elements of the resultant network. The analysis pointed to the existence of six clusters representing the most significant research sub-areas in the BM&OI scientific field. The clusters comprised the following keywords, which were the most important considering the total link strength (TLS):

- Yellow cluster: open innovation, business model, value creation, value capture, case study, innovation management, SMEs, ecosystem, intellectual property, R&D, big data, open source, platform, collaborative innovation, digital innovation, open data, coopetition.
- Red cluster: business model innovation, co-creation, value co-creation, digitalization, digital transformation, industry 4.0, artificial intelligence, design thinking, service innovation, Internet of things, servitization, value proposition.
- Green cluster: business models, sustainability, circular economy, disruptive innovation, sustainable development, networks, sustainable business model, services, innovation

ecosystem, value chain, sustainable entrepreneurship, circular business models, smart cities, sustainable innovation.

- Dark blue cluster: innovation, collaboration, crowdsourcing, entrepreneurship, strategy, governance, knowledge, technology, creativity, cooperation, corporate venturing, ecosystems, new business models, knowledge management.
- Violet cluster: partnerships, value, fintech, start-ups, crowdfunding, innovations, drug development, technology transfer, venture capital, 5G, drug discovery, globalization, open design.
- Light blue cluster: social innovation, social entrepreneurship, social enterprise, healthcare, India, base of the pyramid, social enterprises, development, change management.

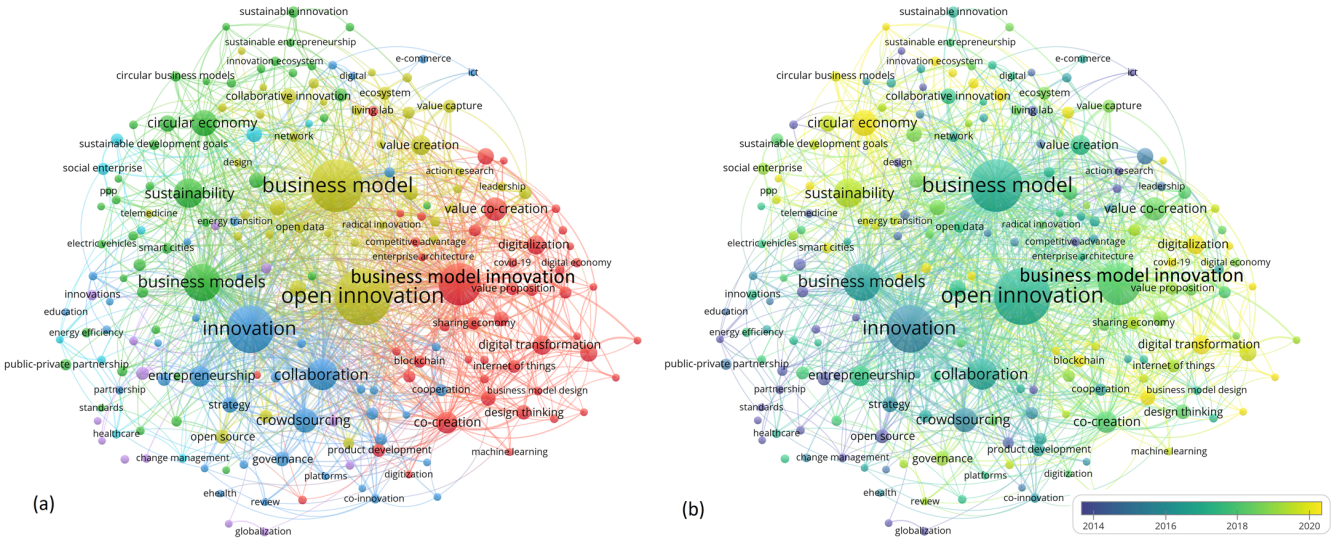

Figure 4. Co-occurrence network of authors' keywords of the BM&OI literature: (**a**) general division into clusters, and (**b**) division on the time axis.

The fundamental topics in the BM&OI research with the highest TLS were as follows: open innovation, business model, innovation, business model innovation, business models, collaboration, sustainability, value creation, circular economy, and crowdsourcing.

The results of the co-occurrence of authors' keywords analyzed over time, shown in Figure 4b, indicated that as the research on the BM&OI developed, the research themes were enriched with additional and important economic and societal aspects. The keywords that appeared later on include first of all the ones related to sustainable development (sustainability, sustainable development, sustainable business model), ecological challenges (circular economy, circular business models, bioeconomy), the development of digitalization and of the ICT and the smart city concept (digital transformation, digitalization, blockchain, artificial intelligence, smart cities, IoT) and the onset of the COVID-19 pandemic (COVID-19).

The thematic evolution of the main sub-areas of the BM&OI literature was investigated next. The analysis was conducted for three time intervals: 2003–2010, 2011–2016, and 2017–2022. The span of the intervals was adjusted to the increasing intensity of publishing in the period under analysis, and the results are shown in Figures 5 and 6.

The results presented in Figure 5 indicated that during the first analyzed period (2003–2010) the researchers focused primarily on issues such as innovation, open source, business model, strategy, entrepreneurship, public–private partnership and service-oriented architecture. With time, some of the themes evolved, e.g., open source, business model innovation, innovation, business model into open innovation; web2.0 into innovation networks, or sustainable and collaborative innovation into sustainable development. Others emerged, e.g., dynamics capabilities, big data, or sustainable innovation. It should also be noted that such now-vital themes as energy efficiency, sustainable development or smart cities gradually became important research themes of the BM&OI literature.

In the next stage, the thematic evolution of the research undertaken in the periods under consideration was expanded by creating the thematic maps for each relevant period. The outcome of this analysis is illustrated in Figure 6, and Table A2 presents the most important characteristics of identified clusters.

The analysis results demonstrated that:

- In the 2003–2010 period, nine main primary research themes were identified. Three of them were motor themes: A1: innovation, open innovation, business models; A2: business model, open-source software, value creation; A3: web 2.0, knowledge management system; one was classified as a basic theme: A4: business model innovation, crowdsourcing. Two of them were emerging or declining themes: A5: competitive advantage; A6: mobile communication. Three were classed as niche themes: A7: virtual enterprise; A8: decentralized design, mass collaboration, open design and A9: cluster enterprise, innovation mechanism, knowledge spillover, value chain analysis.

Here are some example publications from the 2003–2010 period that covered the identified research areas: among motor themes: A1 [35,107,108], among basic themes: A4 [109], among emerging or declining themes: A6 [110], and among niche themes: A8 [111].

- In the 2011–2016 period twenty-seven themes were distinguished, the most important of which were:
  - Motor themes: B9: innovation, crowdsourcing, collaboration; B7: healthcare, emerging economies; B4: disruptive innovation, radical innovation, startup, B3: open business models, innovation strategy, inbound/outbound open innovation; B11: sustainable innovation, social responsibility, sustainable business;
  - Basic themes: B14 open innovation, business model, business model innovation; B15: service innovation, service design: B16: collaborative innovation;
  - Emerging and declining themes: B20: eco-innovation; B21: cooperation;
  - Niche themes: B25: social entrepreneurship, social change, social enterprise; B27: open collaboration, supply chain.

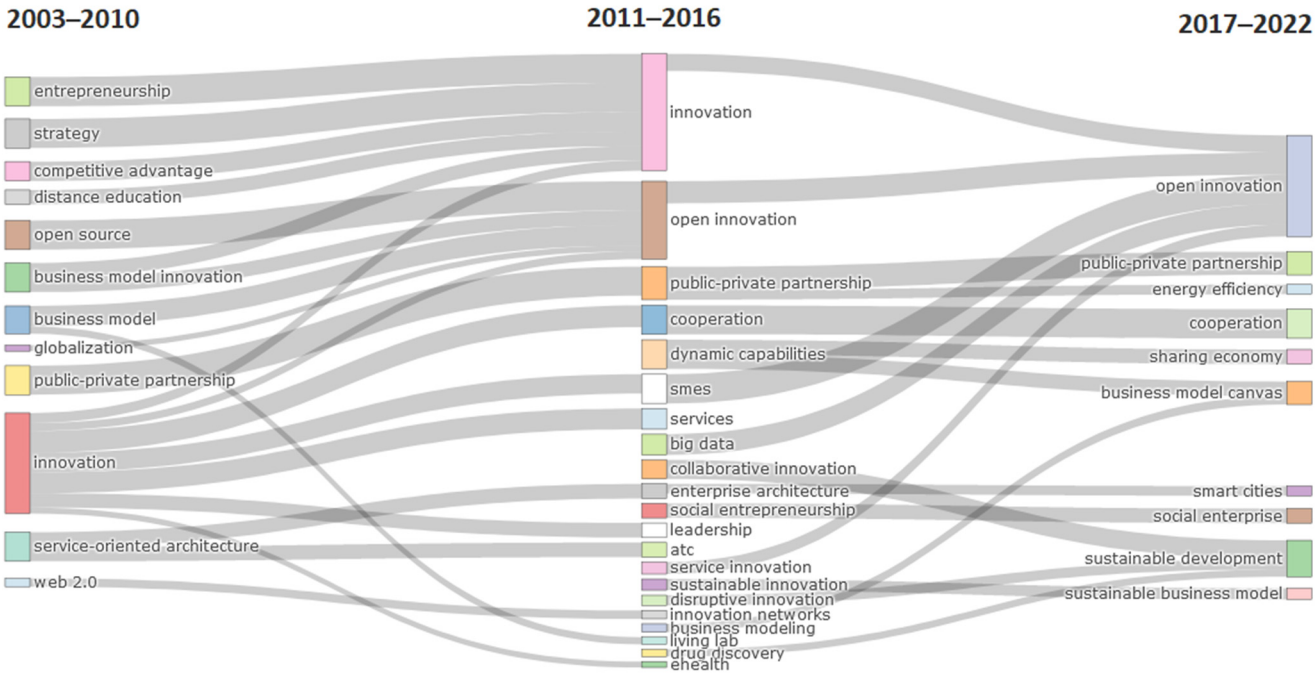

Figure 5. Thematic evolution of the BM&OI literature.

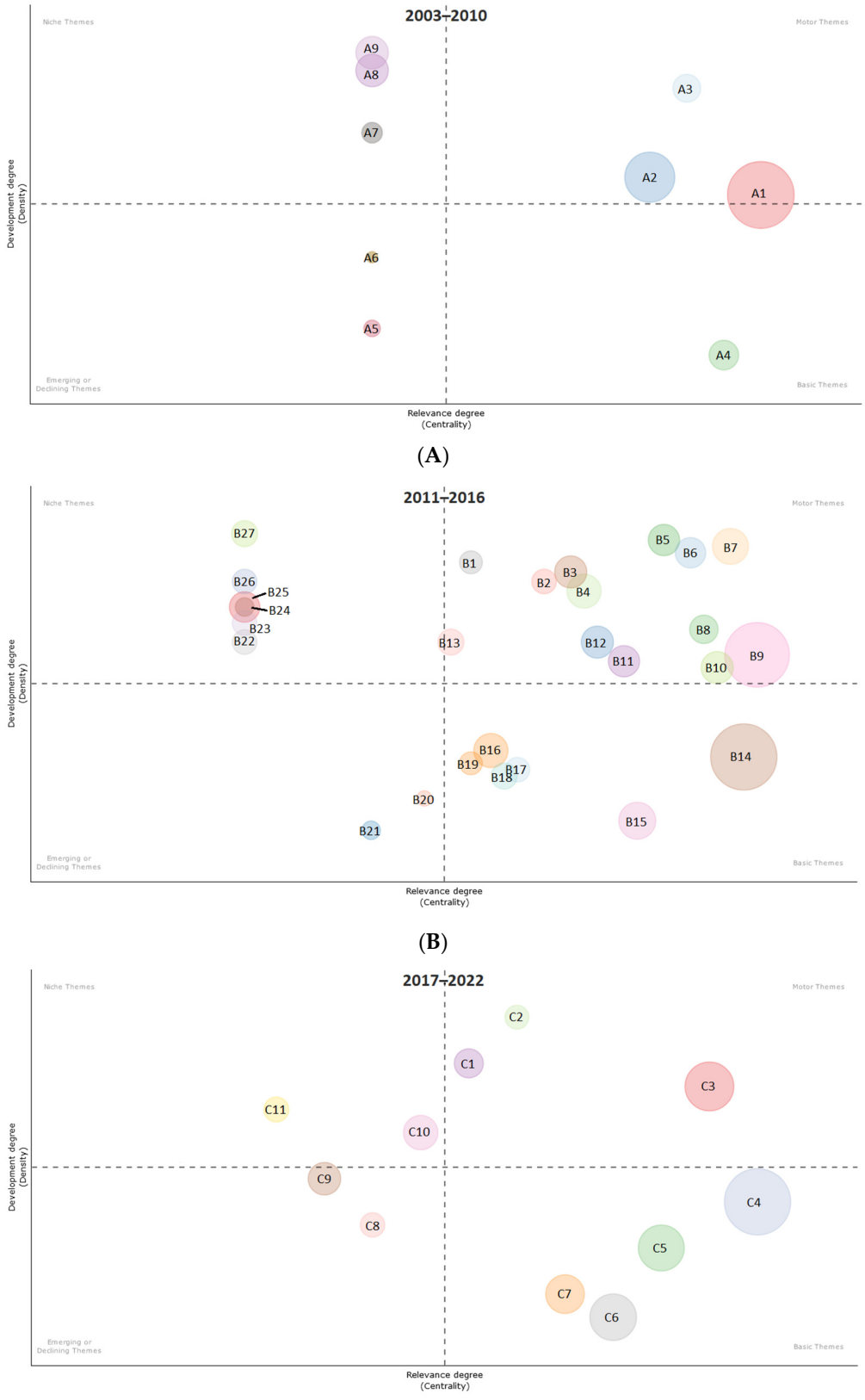

Figure 6. Thematic maps of the BM&OI literature. (**A**). Thematic map for the 2003–2010 period. A1: innovation, open innovation, business models; A2: business model, open-source software, value

creation; A3: web 2.0, knowledge management system; A4: business model innovation, crowdsourcing; A5: competitive advantage; A6: mobile communication; A7: virtual enterprise; A8: decentralized design, mass collaboration, open design; A9: cluster enterprise, knowledge spillover, value chain analysis. (**B**). Thematic map for the 2011–2016 period. B1: enterprise architecture, service-oriented enterprise architecture; B2: design innovation, digital manufacturing, distributed manufacturing; B3: open business models, innovation strategy, inbound/outbound open innovation; B4: disruptive innovation, radical innovation, startup; B5: business, marketing, ICT; B6: drug development, medical devices, technology transfer; B7: healthcare, emerging economies; B8: e-health, health 2.0; B9: innovation, crowdsourcing, collaboration B10: big data, ecosystem; B11: sustainable innovation, social responsibility, sustainable business; B12: cloud computing, cloud manufacturing, manufacturing industry; B13: business innovation, industrial service; B14 open innovation, business model, business model innovation; B15: service innovation, service design: B16: collaborative innovation; B17: services; B18: living lab, transition; B19: public–private partnership; B20: eco-innovation; B21: cooperation; B22: innovation networks, software engineering; B23: software services, collaborative networks; B24: leadership, patents; B25: social entrepreneurship, social change, social enterprise; B26: business modeling, value proposition; B27: open collaboration, supply chain. (**C**). Thematic map for the 2017–2022 period. C1: smart cities, open data, energy transition; C2: cooperation, new business models, start-ups; C3: digital transformation, digitalization, industry 4.0, artificial intelligence, Internet of things; C4: open innovation, business model, business model innovation; C5: sustainable development, social innovation, collaborative innovation; C6: sustainability, circular economy, circular business models; C7: business model canvas, design thinking, value proposition; C8: sustainable business model, sustainable innovation; C9: social enterprise, social entrepreneurship, partnerships; C10: sharing economy, dynamic capabilities; C11: COVID-19, digitalization, knowledge sharing.

The following are example publications from the 2011–2016 period covering individual research areas: for the motor themes: B3 [33], B9 [112,113], B11 [114], for the basic themes: B14 [115–117], B15 [118], for the emerging or declining themes: B20 [119], and for the niche themes: B25 [120].

In the last period under analysis, 2017–2022, eleven themes were identified. Three were classed as motor themes: C1: smart cities, open data, energy transition; C2: cooperation, new business models, start-ups; C3: digital transformation, digitalization, industry 4.0, artificial intelligence, Internet of things. Four were considered as basic themes: C4: open innovation, business model, business model innovation; C5: sustainable development, social innovation, collaborative innovation; C6: sustainability, circular economy, circular business models; C7: business model canvas, design thinking, value proposition. Two themes were considered as emerging or declining: C8: sustainable business model, sustainable innovation; C9: social enterprise, social entrepreneurship, partnerships. Two turned out to be niche themes: C10: sharing economy, dynamic capabilities; C11: COVID-19, digitalization, knowledge sharing.

The example publications from the 2017–2022 period covering the identified research areas included: for the motor themes: C1 [121], C2 [122,123], C3 [124], for the basic themes: C4 [26,125], C6 [126–128], C7 [129], for the emerging or declining themes: C8 [130,131], C9 [132] and for the niche themes: C10 [133].

The impact should be noted of modern hot issues on the themes of recent research publications in the area of the business model and open innovation. In the last period under consideration, the following aspects began to appear as research themes: smart cities, artificial intelligence, IoT, the COVID-19 pandemic, sustainable development, and circular economy.

3.2.2. Mapping Scientific Collaboration in the BM&OI Literature

In the first step of mapping scientific collaboration the structures of collaboration between countries were analyzed using: the co-authorship network (Figure 7) and the citation network (Figure 8). The networks point to instances of regional collaboration and scientific regional communities among authors of the BM&OI literature from different

countries of the world. In order to identify the most important countries, the documents number per country threshold was set to five. This made it possible to establish the 52 most significant countries out of 143, which became elements of the resultant networks. The countries with the highest TLS are presented in Table A3 (for the co-authorship network) and Table A4 (for the citation network).

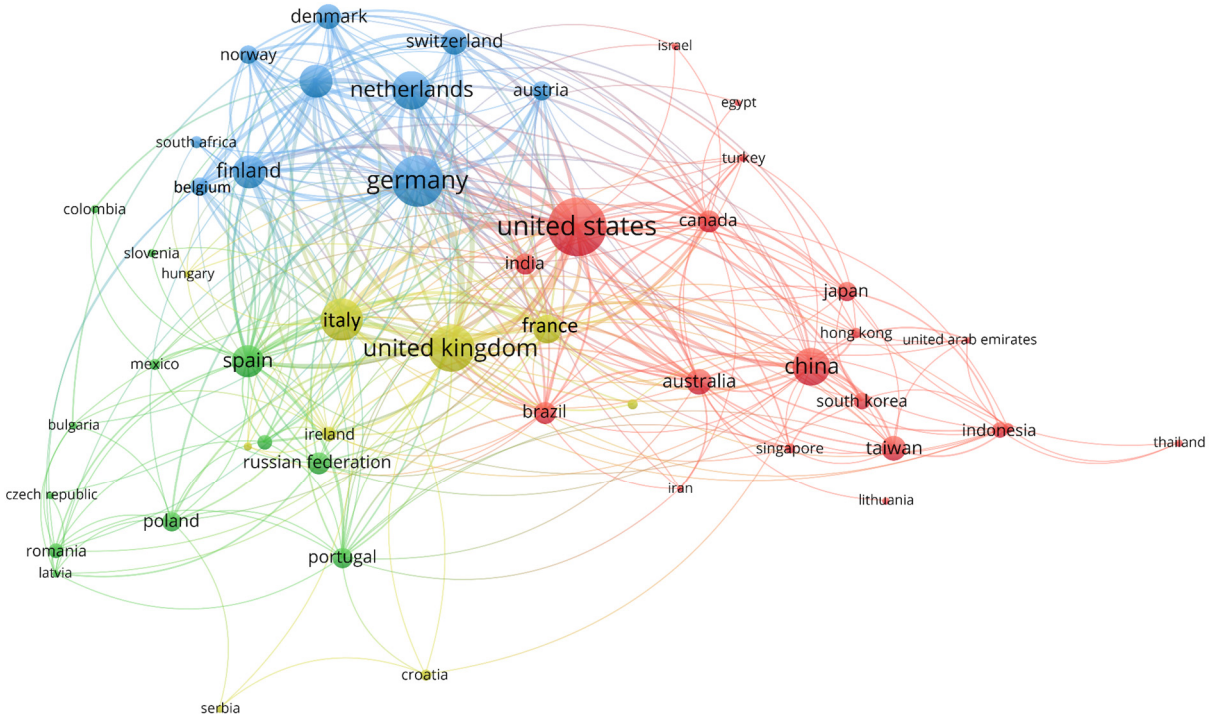

Figure 7. Co-authorship network of countries in the BM&OI literature.

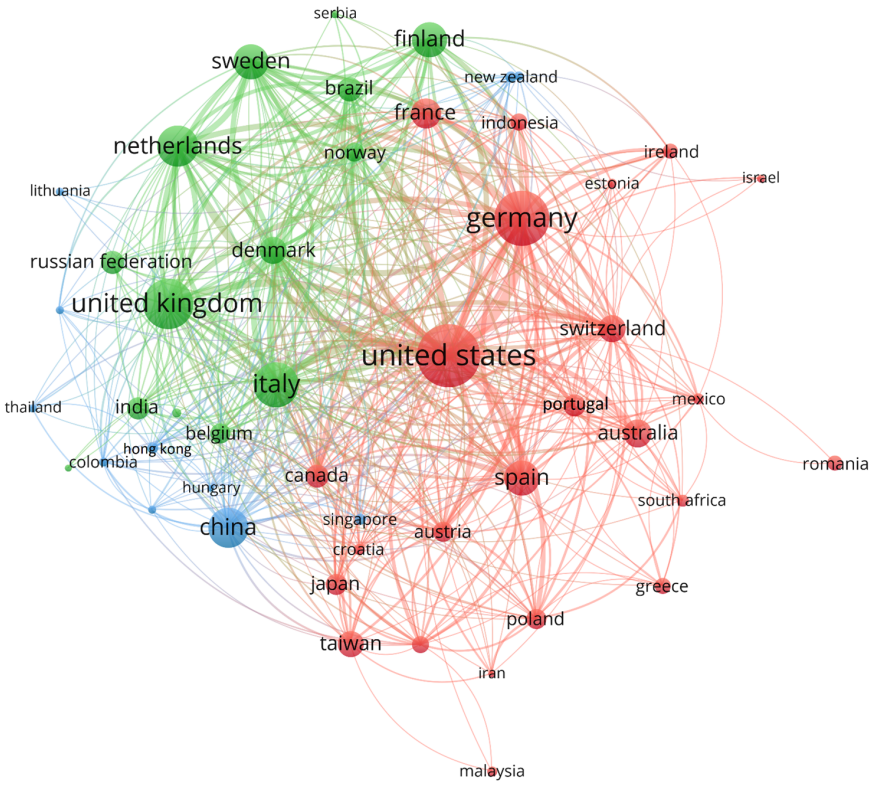

Figure 8. Citation network of countries in the BM&OI literature.

The results of the co-authorship network of countries indicated that:

- The countries with the highest TLS were: the United States, the United Kingdom, Germany, the Netherlands, and Italy.
- The number of works from a particular country did not always translate into the TLS proportionally: the United States, Italy, and Finland demonstrated a relatively low TLS, and the Netherlands, Sweden, and Switzerland—a relatively high TLS compared to the number of works.
- Four significant regional collaboration camps (clusters) were formed, the most important members of which (with the highest TLS) were:
    - Red cluster: the United States, Canada, China, Brazil, Australia, India, Japan, Taiwan, South Korea, and Turkey.
    - Yellow cluster: United Kingdom, Italy, France, Ireland, Hungary, Croatia, Estonia, New Zealand, and Serbia.
    - Green cluster: Spain, Portugal, Greece, Poland, Russian Federation, Latvia, Romania, Bulgaria, Mexico, Colombia. Slovenia, and Czech Republic.
    - Blue cluster: Germany, Netherlands, Sweden, Switzerland, Finland, Denmark, Belgium. Norway, and Austria.

The Citation network of countries demonstrated that:

- The countries with the highest TLS were: the United States, Germany, Denmark, Italy, the United Kingdom, and the Netherlands.
- Three significant regional scientific communities (clusters) were identified, the most important members of which (with the highest TLS) were:
    - Red cluster: the United States, Germany, Switzerland, Spain, Austria, Canada, Australia, Poland, South Korea, and France.
    - Green cluster: Denmark, Italy, United Kingdom, Netherlands, Sweden, Finland, Norway, Brazil, Belgium, and India.
    - Blue cluster: China, Hong Kong, Colombia, New Zealand, Hungary, Czech Republic, Latvia, Singapore, Thailand, and Turkey.

The next step was to investigate the specificity of collaboration between sources in the BM&OI area. The citation network of sources was created first. In order to identify the most important sources in the analyzed scientific field, the documents number per source threshold was set to five. This made it possible to identify 54 sources which were the most collaboration-oriented out of 1097. The obtained network is presented in Figure 9, and the most significant sources with the highest TLS are presented in Table A5.

The results of the analysis indicated that:

- There were 1097 sources publishing works in the field of BM&OI. The network was formed by 42 sources that had at least five published documents cited by other sources.
- The most vital sources based on the number of mutual citations were: *R&D Management*, *Journal of Open Innovation: Technology, Market, and Complexity*, *Sustainability*, *California Management Review*, and *Journal of Cleaner Production*.
- Despite the small number of documents published in *R&D Management*, this journal was characterized by relatively high TLS values.
- Four sources with the strongest mutual citation value were identified. They make up:
    - Red cluster—*R&D Management*, *Journal of Product Innovation Management*, *International Journal of Technology Management*, and *Technological Forecasting and Social Change*.
    - Green cluster—*Sustainability*, *Journal of Cleaner Production*, *British Food Journal*, *Business Strategy and the Environment*, and *Technology Analysis and Strategic Management*.
    - Blue cluster—*Research Technology Management*, *European Journal of Innovation Management*, and *International Journal of Entrepreneurship and Innovation Management*.

- Yellow cluster—*Journal of Open Innovation: Technology, Market, and Complexity*, *California Management Review*, *Journal of Business Research*, and *International Journal of Business Innovation and Research*.

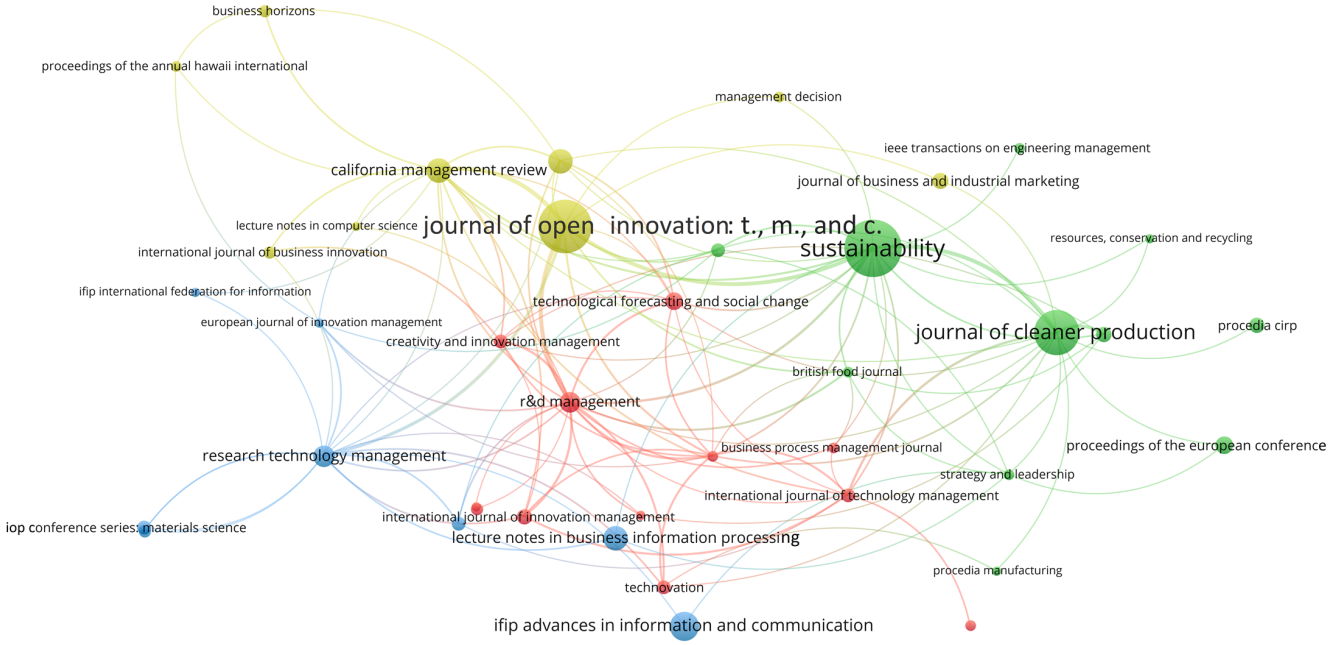

Figure 9. Citation network of sources in the BM&OI literature.

The analysis of the relations between the sources of publications on issues related to the BM&OI was expanded by the analysis of the co-citation network of sources. In this case the threshold (the number of citations) was set to 50, which made it possible to identify the 109 most significant sources from the total of 33,118. The network is presented in Figure 10, and the sources with the highest TLS are presented in Table A6.

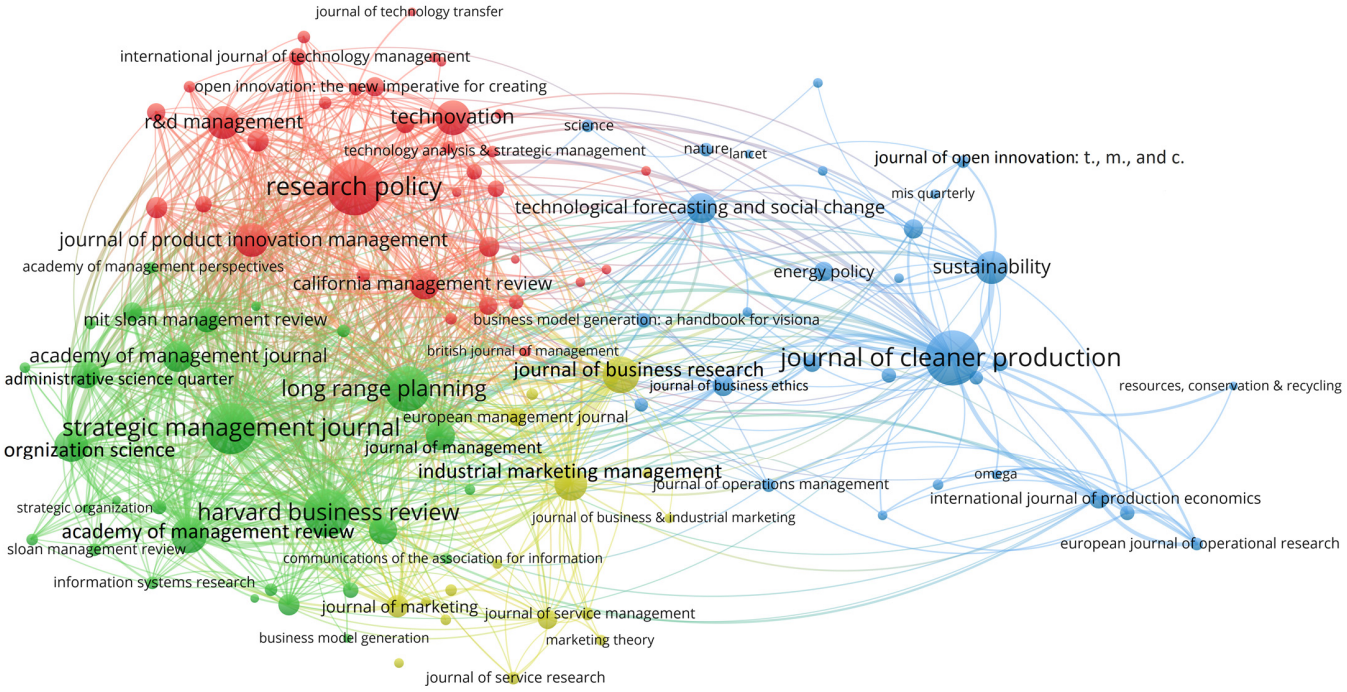

Figure 10. Co-citation network of sources in the BM&OI literature.

The results of the analysis indicated that:

- Publications on the BM&OI cited 33,118 different sources. Furthermore, 109 of these sources were cited at least 50 times.
- The sources with the highest TLS in the co-citation network were: *Strategic Management Journal*, *Research Policy*, *Long Range Planning*, *Harvard Business Review*, *Organization Science*, *Academy of Management Review*, *Journal of Product Innovation Management*, and *Journal of Cleaner Production*.
- Four clusters grouping the most often co-cited sources were identified, and they made up:
  - Red cluster—*Research Policy*, *Journal of Product Innovation Management*, *Technovation*, *R&D Management*, and *California Management Review*.
  - Green cluster—*Strategic Management Journal*, *Long Range Planning*, *Harvard Business Review*, and *Organization Science*.
  - Blue cluster—*Journal of Cleaner Production*, *Technological Forecasting and Social Change*, *Sustainability*, and *International Journal of Production Economics*.
  - Yellow cluster—*Journal of Business Research*, *Industrial Marketing Management*, *Journal of Marketing*, and *Journal of the Academy of Marketing Science*.

The analysis of the existing collaboration networks was supplemented with a bibliographic coupling network of documents. In it, the relatedness of the items is determined by the number of references shared by two documents. To present the important, strong relations, the threshold of the number of citations of a document was set to 50. This condition was satisfied by 131 works out of the total number of 1892 publications, and 114 of them were related and became elements of the resultant network, which is illustrated in Figure 11. The most significant documents with the highest TLS are presented in Table A7.

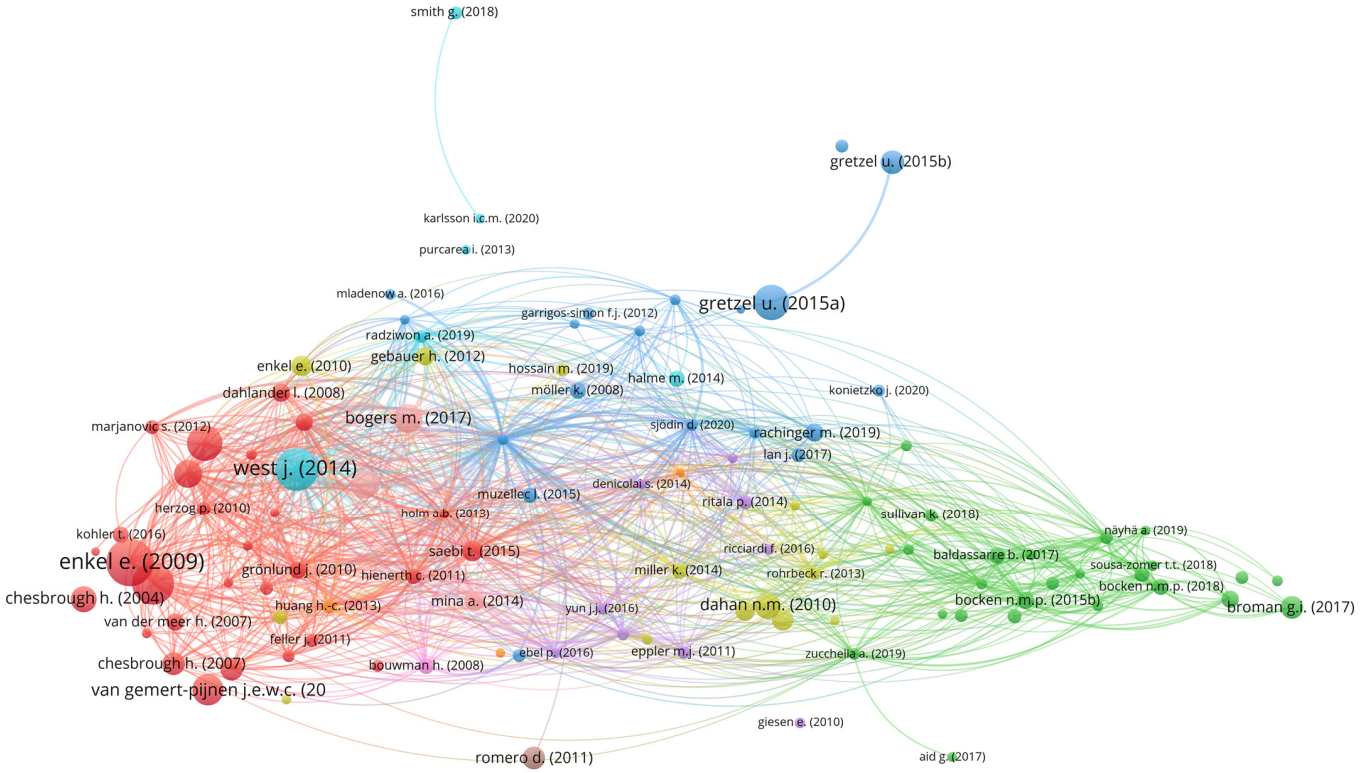

Figure 11. Bibliographic coupling network of documents in the BM&OI literature.

The results of the analysis indicate that:

- The references with the highest TLS were: Afuah [134], West and Bogers [31], Foss and Saebi [14], Bogers et al. [26], and Grönlund et al. [135].

- There were five main clusters made of publications whose topics were similar. The most important representatives of the three biggest clusters (in terms of publications with the highest TLS) are grouped in:
  - Red cluster, comprising studies by Kohler [136], Ebel et al. [36], and Denicolai et al. [137].
  - Green cluster—comprising studies by West and Bogers [31], Foss and Saebi [14], and Bogers et al. [26].
  - Blue cluster—comprising studies by Afuah [134], Bouwman et al. [138], and Muzellec et al. [139].

In order to supplement the performed network analyses, Figure 12 presents relations between the main sources, authors, and authors' keywords in the BM&OI area obtained from the three fields plot analysis. The analysis demonstrates in which sources the authors of the BM&OI publications have published the most frequently and which research topics (i.e., the authors' keywords) of the BM&OI concept they have explored.

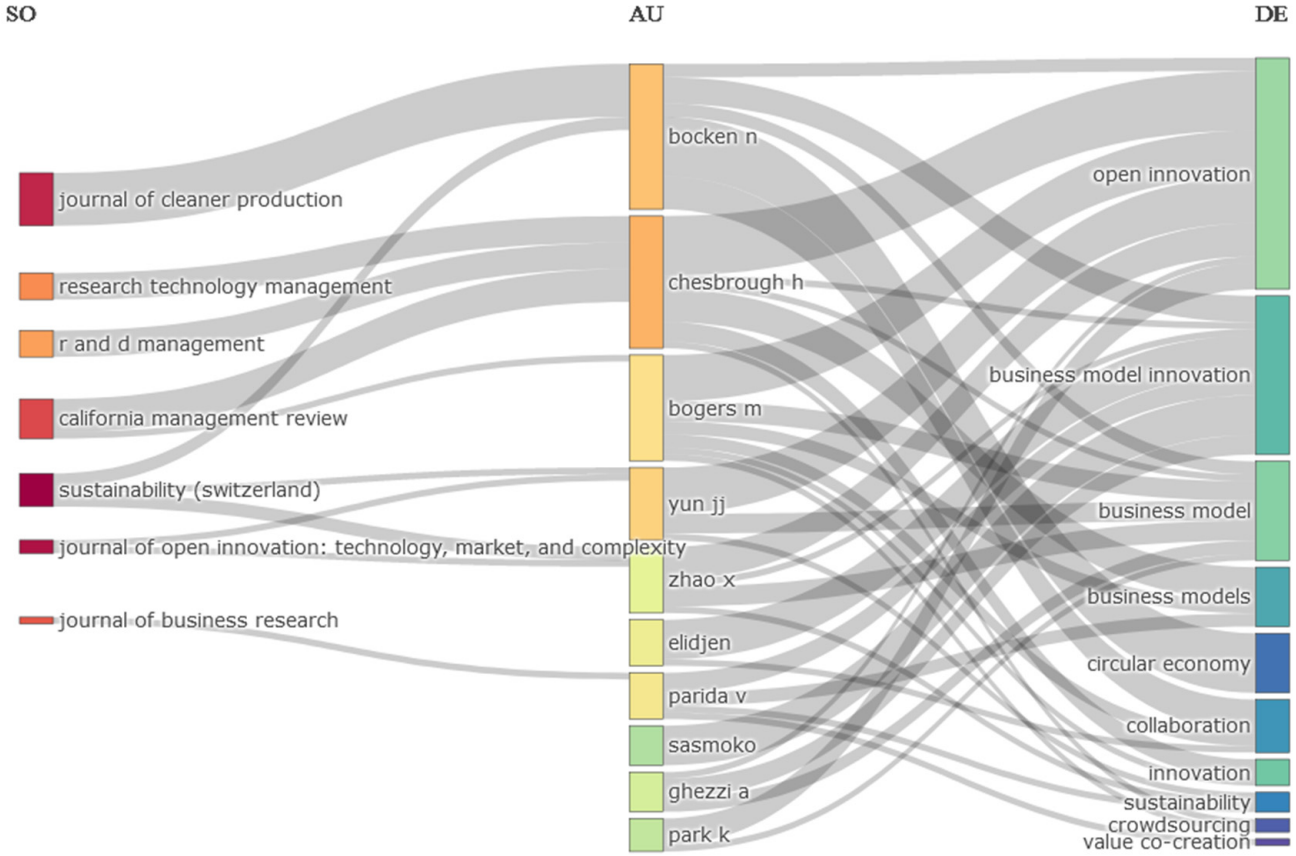

Figure 12. Relations between selected sources, authors, and authors' keywords in the BM&OI literature.

The analysis indicated that the most prolific authors in the BM&OI literature (i.e., Henry Chesbrough, Nancy Bocken, and Marcel Bogers) published mainly in the following journals: *Journal of Cleaner Production*, *Research Technology Management*, *R&D Management*, *California Management Review*, and *Sustainability*. They contributed enormously to the BM&OI literature main research topics, such as 'open innovation', 'business model innovation', 'business model/business models', 'circular economy', 'collaboration', 'innovation', and 'crowdsourcing'.

4. Discussion—Searching for the Future BM&OI Research Agenda

The application of bibliometric analysis makes it possible to overcome some of the shortcomings of the literature reviews that are considered subjective [3]. Bibliometric analy-

sis is an objective tool for selecting the most important research sub-areas and determining the structure of scientific collaboration in the analyzed field [42,99]. This is particularly important when a significant number of publications must be included in the analysis [44].

So far, there has been no comprehensive bibliometric analysis of the BM&OI research area, which is still relatively new and developing rapidly. The increase in the number of papers published on the business model [41] and open innovation [71], as well as on the area combining the two notions [92], is an obvious proof.

The analysis presented in our paper was to determine the most essential aspects of the BM&OI literature and, in particular, to identify the areas that need to be developed and studied in greater depth to enrich the existing theory in this field and to make the search for specific practical applications more effective and efficient [41]. The presented results can also be a springboard for a thorough analysis of this topic based on a systematic review of the literature and qualitative analyses of the content of mainstream publications and the identified BM&OI research sub-areas.

The analyses made it possible to characterize the thematic structure of the BM&OI literature and to identify the most important research sub-areas. They showed the multifaceted and multidisciplinary nature of the issues of the BM&OI research. In addition to the concepts which are the most relevant to the scientific field under analysis, such as the business model and open innovation, the analyzed research included other related issues: the business model innovation, innovation, the open source, strategy, entrepreneurship, collaboration, sustainability, value creation, the circular economy, and crowdsourcing [19,92,93]. It was also demonstrated that the BM&OI research, primarily focused on issues such as innovation, the open source, the business model, the business model innovation, strategy, and entrepreneurship, had, with time, evolved to take account of the influence of newly emerging concepts and global challenges to the world, such as the proliferation and increased relevance of the concepts of sustainability, smart cities, digitization, and the COVID-19 pandemic [3,44,55].

The authors of the BM&OI publications should streamline their research efforts to adequately respond to current and emerging new concepts and challenges in this area [41,85]. Therefore, the thematic structures of the identified research sub-areas determined in this bibliometric analysis can provide important guidance for present and future researchers in precise setting of research directions and relevant publication strategies [102]. We identified the thematic maps indicating contemporary basic, motor, niche, and emerging themes in the BM&OI research. This typology and content analysis of publications assigned to relevant themes to identify potential research gaps made it possible to form the basis for the proposal for the future research agenda in the scientific field under consideration.

In the coming years, we suggest that the BM&OI research should focus mainly on those basic themes, which have not been explored well enough yet, but are important in the analyzed area. In particular, this concerns the interconnections between:

- Open innovation, the business model and business model innovation—potential interesting directions of research in this area include approaches, organizational designs, practices and processes related to coupling inbound and outbound knowledge flows, combining open business models with closed innovation strategies, and aligning open innovation with the business model in terms of activities aimed at value creation and value capture taking into account the organizational and ecosystem level, including public and non-profit organizations [125]. Another interesting area seems to be the dynamics and co-evolution of business models organized as platforms that connect multiple stakeholders, including issues related to sharing risks and rewards, as well as developing new business models adapted to the involvement and motivations of specific groups of stakeholders [26]. There are also other promising areas for investigations concerning the basic themes. These are co-creation, co-design, and crowdsourcing based on innovation communities as well as the antecedents and the organizational forms of platforms for innovation communities designed for accelerating value provision by different users in open business models [140], innovation

contests used as an instrument for open innovation to generate ideas for creating new or significantly improved products or processes [141], open innovation markets (i.e., product and service markets, markets for collaboration, technology markets, markets for financing and corporate control) supporting business models when creating and capturing value, including technology acquisition and exploitation, and strategies for inbound and outbound innovation [142].

- Sustainability, the circular economy and circular business models—possible interesting future research in this domain includes analyses of the drivers of and the barriers to the development and the diffusion of circular business models, as well as issues related to effective orchestration and collaboration among members of circular networks and circular ecosystems [128]. There is also a need for comprehensive knowledge in the area of designing and developing circular models oriented towards value creation and value capture, including effective partner selection and alignment, procedural and structural governance, and collaborative dynamic capabilities [126].
- Sustainable development, social innovation and collaborative innovation—examples of potential research on these themes comprise the development of new business models aimed at initiation, acquisition, transformation, and assimilation of collaborative ventures focused on the implementation of social innovations and sustainable solutions [143], as well as the deployment of collaborative innovation to address societal challenges [144].
- The business model canvas, design thinking and value proposition—possible research streams in this area may cover designing and developing business ecosystems to create, deliver, and capture value based on the business model canvas approach using the design thinking methods [129].

Moreover, the upcoming studies in the BM&OI literature may embrace the emerging themes to expand the existing research on:

- Sustainable business model and sustainable innovation—potential research areas to be explored in this domain to a larger extant are the antecedents and especially the consequences of sustainable innovation, the development of dynamic capabilities and effective configurations of sustainable business models, the development and transformation of business models into sustainable business models, as well as ecosystem business models with multiple actors, in parallel with the provision of sustainability benefits [131]. The new approach to business model innovation and design for strategic sustainable development is also worth mentioning [130].
- Social enterprise, social entrepreneurship and partnerships—examples of possible research on these themes include the antecedents and the configurations of social business models [132], the drivers and success factors of open innovation in social enterprises [145], as well as the ecosystem intermediaries in social entrepreneurship and business model innovation in social enterprises [146].

Furthermore, the future studies on the BM&OI are expected to cover niche themes, including:

- Sharing economy and dynamic capabilities—potential research on these themes may explore processes and enablers of cooperative partnership innovation and effective value co-creation in sharing economy business models taking into account specific contexts and different consumer and prosumer behaviors [133], as well as the relationships between the development of dynamic capabilities and the business models of companies operating in the sharing economy (e.g., platform enterprises) [147].
- COVID-19, digitalization, and knowledge sharing—potential research in this area may investigate digital solutions as well as knowledge-based and agile-based open ecosystems to improve flexibility and adaptability of health organizations in the post-pandemic conditions [148].

When it comes to the identified recent motor themes in the BM&OI literature that are relatively well-developed and significant for the analyzed field of knowledge, we

especially expect that further research should be advanced in the area of practical solutions dedicated to:

- Development of the smart city and smart city ecosystems based on open urban innovation and digitalization supported by open data and open architectures [121];
- Digital transformation based on artificial intelligence, the Internet of things, and especially Industry 4.0 business models. This includes issues related to designing new Industry 4.0 business models or redesigning existing business models to address challenges specific to Industry 4.0 solutions [124].

The future research should be based on scientific collaboration networks. The effectiveness of their configuration can be supported by conclusions from bibliometric analyses [82]. The mapping of the scientific collaboration in the BM&OI research conducted in our paper made it possible to identify the most important countries, sources, and organizations with the greatest potential for collaboration for present and future researchers. It seems that the authors investigating this research domain should first of all consider finding opportunities to collaborate and publish their research results with authors from the most productive countries in this area (i.e., the United States, the United Kingdom, Germany, Denmark, and Italy), and with the most active institutions (i.e., Delft University of Technology, University of California, Berkeley, Politecnico di Milan, and Aalto University). Moreover, they should consider and have their research results published in journals which are the most prolific and influential in the BM&OI area (i.e., *R&D Management*, *Journal of Open Innovation: Technology*, *Market and Complexity*, *Sustainability*, *California Management Review*, and *Journal of Cleaner Production*).

5. Conclusions

Due to the dynamic changes in the business environment and in the development of digital technologies, increasing attention is now being paid to studies that explore the links observed between the business model and open innovation in recent years. Nevertheless, the research presenting the results of bibliometric analyses merging these two terms is still scarce, and our study was intended to fill in the identified gap and examine the knowledge structure of the BM&OI literature.

The descriptive analysis demonstrated that 57.2% of all works in the BM&OI research field appeared in the period of 2017–2022, and the number of works within this area grows dynamically year by year. Publications on the BM&OI covered various subject areas, especially Business, Management and Accounting; Engineering; Computer Science; Social Sciences; and Economics, Econometrics and Finance. The most prolific authors in the domain under consideration were Henry Chesbrough and Nancy Bocken. The most productive sources publishing studies on BM&OI were *Sustainability*, *Journal of Open Innovation: Technology Market and Complexity*, and *Journal of Cleaner Production*. Furthermore, the analyzed research field was mainly developed by scientists from the United States, Germany, and the United Kingdom, and when it comes to organizations, the most active was Delft University of Technology.

The network analyses identified the sources with the highest number of mutual citations, the sources with the highest TLS in the co-citation network, the countries with the highest TLS in the co-authorship network, and the countries with the highest TLC in the citation network. The co-occurrence network of authors' keywords determined the topics most frequently explored in the BM&OI research, and the thematic evolution analysis revealed how these themes evolved and others emerged. Furthermore, the thematic maps indicated contemporary basic, motor, niche, and emerging themes in the BM&OI research. This typology and analysis of publications assigned to relevant themes enabled the formulation of the basis for the proposal for the future research agenda in the scientific field under consideration. Based on the results of descriptive analysis and network analyses, potential authors can adjust their publication strategies to decide whether, as well as how and where, to contribute to the development of specific sub-fields identified in the BM&OI research. In the future, they may also use the obtained results to find and join the most

stimulating and meaningful scientific collaborations among the most influential authors in the BM&OI literature.

Our research, like other studies, has some limitations. First, the performed analyses were based on the dataset obtained from the Scopus database. This is the largest database of peer-reviewed papers ensuring the highest quality standards, but there are others (e.g., Web of Science) that cover documents not indexed in the Scopus database. Therefore, to achieve a more complete picture of the BM&OI research, further studies should be based also on the other bibliometric databases. This may also cover the grey literature on the BM&OI to ensure better coverage of the evolving structures of this research field. Second, due to the dynamic growth in the number of scientific works on the BM&OI, new papers are emerging and the existing documents are receiving more citations. The obtained results should, therefore, be treated with caution and interpreted within the context of the analyzed period. Third, we used the number of publications and citations to measure the productivity and influence of different research channels regardless of the fact that these indicators do not necessarily reflect the actual scientific merit of the works. There are also more advanced indicators and other measures, such as applications by practitioners and mentions in the social media, etc., which are possible alternatives that can be used in future research.

Notwithstanding this, the main aim of our paper was to present the results of a comprehensive bibliometric analysis focused on the determination and mapping of the evolving cognitive and social structures in the BM&OI literature to set proposals for directions of future research. It was also intended to demonstrate to scholars and practitioners an up-to-date wide-ranging landscape of multifaceted research on the BM&OI.

Author Contributions: Conceptualization, A.R. and M.S.; methodology, A.R. and M.S.; formal analysis, A.R. and M.S.; investigation, A.R. and M.S.; writing—original draft preparation, A.R. and M.S.; writing—review and editing, A.R. and M.S.; visualization, A.R. and M.S. All authors have read and agreed to the published version of the manuscript.

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Appendix A

Table A1. Structural bibliometric indicators for the top ten authors' keywords (ranked by TLS).

Keyword	Links	TLS	Occurrences
open innovation	132	492	260
business model	130	430	228
innovation	136	378	186
business model innovation	95	259	144
business models	99	229	113
collaboration	84	204	79
sustainability	66	151	72
value creation	51	113	32
circular economy	51	106	56
crowdsourcing	42	104	48

Table A2. Specific indicators for the identified thematic maps.

Time Period	Themes Type	Cluster (Occurrences)	Centrality	Density
2003–2010	MT	A1: innovation (31), open innovation (21), business models (12)	0.89	54.98
		A2: business model (23), open-source software (3), value creation (3)	0.15	58.47
		A3: web 2.0 (3), knowledge management systems (2)	0.17	69.44
	BT	A4: business model innovation (4), crowdsourcing (4)	0.21	28.13
	EDT	A5: competitive advantage (3)	0	33.33
		A6: mobile communication (2)	0	50.00
	NT	A7: virtual enterprise (2)	0	62.5
		A8: decentralized design (2), mass collaboration (2), open design (2)	0	100
		A9: cluster enterprise (2), knowledge spillover (2), value chain analysis (2)	0	150
2011–2016	MT	B1: enterprise architecture (2), service-oriented enterprise architecture (2)	0.25	75
		B2: design innovation (3), digital manufacturing (2), distributed manufacturing (2)	0.33	63.89
		B3: open business models (5), innovation strategy (3), inbound (3)/outbound open innovation (2)	0.36	70.56
		B4: disruptive innovation (6), radical innovation (2), startup (2)	0.40	63.43
		B5: business (2), marketing (2), ICT	0.5	50
		B6: drug development (3), medical devices (3), technology transfer (2)	0.56	80.56
		B7: healthcare (4), emerging economies (2)	1	90.80
		B8: e-health (3), health 2.0 (2)	0.61	59.03
		B9: innovation (67), crowdsourcing (24), collaboration (23)	4.66	58.27
		B10: big data (4), ecosystem (3);	0.71	56.39
		B11: sustainable innovation (6), social responsibility (3), sustainable business (2)	0.47	57.64
		B12: cloud computing (7), cloud manufacturing (3), manufacturing industry (2);	0.41	58.33
		B13: business innovation (4), industrial service (2)	0.21	58.33
	BT	B14: open innovation (83), business model (63), business model innovation (30)	3.81	47.60
		B15: service innovation (11), service design (5):	0.50	32.27
		B16: collaborative innovation (6)	0.26	48.67
		B17: services (5), standard (2)	0.32	40.00
		B18: living lab (6), transition (2)	0.31	37.5
		B19: public–private partnership (2)	0.25	43.75
	EDT	B20: eco-innovation (3)	0.11	33.33
		B21: cooperation (4)	0.08	25.00
	NT	B22: innovation networks (3), software engineering (2)	0.00	58.33
		B23: software services (3), collaborative networks (2)	0.00	61.11
		B24: leadership (2), patents (2)	0.00	62.50
		B25: social entrepreneurship (4), social change (2), social enterprise (2)	0.00	62.50
		B26: business modeling (3), value proposition (2)	0.00	63.89
		B27: open collaboration (3), supply chain (2)	0.00	125.00
2017–2022	MT	C1: smart cities (9), open data (8), energy transition (6)	0.10	17.95
		C2: cooperation (6), new business models (6), start-ups (5)	0.13	24.07
		C3: digital transformation (31), digitalization (28), industry 4.0 (25), artificial intelligence (18), internet of things (14)	0.68	17.73
	BT	C4: open innovation (157), business model (142), business model innovation (110)	1.55	14.83
		C5: sustainable development (21), social innovation (16), collaborative innovation (13)	0.48	14.58
		C6: sustainability (62), circular economy (55), circular business models (10)	0.29	13.05
		C7: business model canvas (15), design thinking (!5), value proposition (12)	0.26	13.95
	EDT	C8: sustainable business model (8), sustainable innovation (2)	0.06	14.62
		C9: social enterprise (10), social entrepreneurship (9), partnerships (8)	0.03	15.68
	NT	C10: sharing economy (14), dynamic capabilities (10)	0.10	17.10
		C11: COVID-19 (8), digitalization (6), knowledge sharing (5)	0.02	17.50

Table A3. Structural bibliometric indicators for the top 10 countries included in the co-authorship network (ranked by TLS).

Country	Links	TLS	Documents
United States	34	204	273
United Kingdom	35	195	186
Germany	34	183	219
Netherlands	25	144	128
Italy	30	132	155
Sweden	19	125	97
Spain	30	100	97
Switzerland	22	92	63
Finland	26	89	101
France	25	80	76

Table A4. Structural bibliometric indicators for the top ten countries included in the citation network (ranked by TLS).

Country	Links	TLS	Documents
United States	45	723	273
Germany	42	483	219
Denmark	38	336	60
Italy	37	323	155
United Kingdom	40	299	186
Netherlands	37	290	128
Sweden	33	249	97
Switzerland	37	223	63
Spain	33	196	97
Finland	26	161	101

Table A5. Structural bibliometric indicators for the top ten sources included in the citation network (ranked by TLS).

Source	Links	TLS	Documents	Global Citations
R&D Management	21	56	13	2750
Journal of Open Innovation: Technology, Market, and Complexity	11	51	42	443
Sustainability	18	47	46	730
California Management Review	17	37	16	1528
Journal of Cleaner Production	16	34	34	1995
Research Technology Management	18	30	14	1196
Journal of Product Innovation Management	12	26	6	1208
International Journal of Technology Management	10	20	8	510
Technological Forecasting and Social Change	10	15	11	497
Creativity and Innovation Management	8	14	8	281

Table A6. Structural bibliometric indicators for the top ten sources included in the co-citation network (ranked by TLS).

Source	Links	TLS	Global Citations
Strategic Management Journal	108	73,818	1365
Research Policy	108	64,898	1605
Long Range Planning	106	48,831	1090
Harvard Business Review	108	46,172	1159
Organization Science	103	42,411	601
Academy of Management Review	108	39,671	695
Journal of Product Innovation Management	106	34,562	606
Journal of Cleaner Production	108	33,303	1553
Academy of Management Journal	105	28,447	511
Journal of Business Research	108	27,694	727

Table A7. Structural bibliometric indicators for the top ten documents included in the bibliographic coupling network (ranked by TLS).

Document	Links	TLS	Global Citations
Afuah [134]	91	858	71
West and Bogers [31]	81	452	1030
Saebi and Foss [39]	84	429	235
Bogers et al. [26]	83	419	463
Grönlund et al. [135]	75	370	174
West and Bogers [125]	75	361	181
Holm et al. [149]	80	360	52
Hienerth et al. [150]	84	275	124
Mina et al. [118]	84	247	247
Kohler [136]	71	245	87

References

1. Bellman, R.; Clark, C.E.; Malcolm, D.G.; Craft, C.J.; Ricciardi, F.M. On the Construction of a Multi-Stage, Multi-Person Business Game. *Oper. Res.* **1957**, *5*, 469–503. Available online: http://www.jstor.org/stable/167246 (accessed on 5 July 2022). [CrossRef]
2. Jones, G.M. Educators, Electrons, and Business Models: A Problem in Synthesis. *Account. Rev.* **1960**, *35*, 619–626. Available online: http://www.jstor.org/stable/243430 (accessed on 5 July 2022).
3. Belussi, F.; Orsi, L.; Savarese, M. Mapping Business Model Research: A Document Bibliometric Analysis. *Scand. J. Manag.* **2019**, *35*, 101048. [CrossRef]
4. Foss, N.; Saebi, T. Fifteen years of research on business model innovation: How far we come, and where should we go? *J. Manag.* **2017**, *43*, 200–227. [CrossRef]
5. Amit, R.; Zott, C. Value creation in e-business. *Strateg. Manag. J.* **2001**, *22*, 493–520. [CrossRef]
6. Morris, M.; Schindehutte, M.; Allen, J. The entrepreneur's business model: Toward a unified perspective. *J. Bus. Res.* **2005**, *58*, 726–735. [CrossRef]
7. Teece, D.J. Business models, business strategy and innovation. *Long Range Plan.* **2010**, *43*, 172–194. [CrossRef]
8. Osterwalder, A.; Pigneur, Y.; Tucci, C.L. Clarifying Business Models: Origins, Present, and Future of the Concept. *Commun. Assoc. Inf. Syst.* **2005**, *16*, 1–25. [CrossRef]
9. Chesbrough, H. Business model innovation: Opportunities and barriers. *Long Range Plan.* **2010**, *43*, 354–363. [CrossRef]
10. Osterwalder, A.; Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*; John Wiley and Sons: Hoboken, NJ, USA, 2010; pp. 1–288.
11. Hock-Doepgen, M.; Clauss, T.; Kraus, S.; Cheng, C.F. Knowledge management capabilities and organizational risk-taking for business model innovation in SMEs. *J. Bus. Res.* **2021**, *130*, 683–697. [CrossRef]
12. Dobrowolska, M.; Knop, L. Fit to Work in the Business Models of the Industry 4.0 Age. *Sustainability* **2020**, *12*, 4854. [CrossRef]
13. Casadesus-Masanell, R.; Ricart, J.E. From strategy to business models and onto tactics. *Long Range Plan.* **2010**, *43*, 195–215. [CrossRef]
14. Foss, N.J.; Saebi, T. (Eds.) Business models and business model innovation: Bringing organization into the discussion. In *Business Model Innovation: The Organizational Dimension*; Oxford University Press: Oxford, UK, 2015; pp. 1–23. [CrossRef]
15. Chesbrough, H.W. Open innovation: A new paradigm for understanding industrial innovation. In *Open Innovation: Researching a New Paradigm*; Chesbrough, H.W., Vanhaverbeke, W., West, J., Eds.; Oxford University Press: Oxford, UK, 2006; pp. 1–12.
16. Brasseur, T.; Mladenow, A.; Strauss, C. Open business model innovation: Literature review and agenda for future research. *Bus. Inform.* **2017**, *4*, 7–16. [CrossRef]
17. Chesbrough, H.W. *Open Innovation: The New Imperative for Creating and Profiting from Technology*; Harvard Business School Press: Boston, MA, USA, 2003; pp. 1–227.
18. Chiaroni, D.; Chiesa, V.; Frattini, F. The Open Innovation Journey: How firms dynamically implement the emerging innovation management paradigm. *Technovation* **2011**, *31*, 34–43. [CrossRef]
19. Randhawa, K.; Wilden, R.; Hohberger, J. A Bibliometric Review of Open Innovation: Setting a Research Agenda. *J. Prod. Innov. Manag.* **2016**, *33*, 750–772. [CrossRef]
20. Huizingh, E. Open Innovation: State of the Art and Future Perspectives. *Technovation* **2011**, *31*, 2–9. [CrossRef]
21. Aquilani, B.; Abbate, T.; Codini, A. Overcoming cultural barriers in open innovation processes through intermediaries: A theoretical framework. *Knowl. Manag. Res. Pract.* **2017**, *15*, 447–459. [CrossRef]
22. Fetterhoff, T.J.; Voelkel, D. Managing Open Innovation in Biotechnology. *Res. Technol. Manag.* **2006**, *49*, 14–18. [CrossRef]
23. Wallin, M.W.; von Krogh, G. Organizing for open innovation: Focus on the integration of knowledge. *Organ. Dyn.* **2010**, *39*, 145–154. [CrossRef]
24. Adamides, E.D.; Karacapilidis, N.I.; Konstantinopoulos, K. Argumentation Schemes in Technology-Mediated Open Innovation Product-Service Models: An Activity Systems Perspective. *Systems* **2021**, *9*, 91. [CrossRef]

25. Gassmann, O. Opening up the innovation process: Towards an agenda. *R&D Manag.* **2006**, *36*, 223–228. [CrossRef]
26. Bogers, M.; Zobel, A.; Afuah, A.; Almirall, E.; Dahlander, L.; Frederiksen, L.; Gawer, A.; Haefliger, S.; Hagedoorn, J.; Hilgers, D.; et al. The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. *Ind. Innov.* **2017**, *24*, 8–40. [CrossRef]
27. Dahlander, L.; Gann, D.M. How open is innovation? *Res. Policy* **2010**, *39*, 699–709. [CrossRef]
28. Cricelli, L.; Grimaldi, M.; Vermicelli, S. Crowdsourcing and open innovation: A systematic literature review, an integrated framework and a research agenda. *Rev. Manag. Sci.* **2022**, *16*, 1269–1310. [CrossRef]
29. Gao, H.; Ding, X.H.; Suming, W. Exploring the domain of open innovation: Bibliometric and content analyses. *J. Clean. Prod.* **2020**, *275*, 122580. [CrossRef]
30. Usman, M.; Roijakkers, N.; Vanhaverbeke, W.; Frattini, F. A systematic review of the literature on open innovation in SMEs. In *Researching Open Innovation in SMEs*; World Scientific Publishing: Singapore, 2018; pp. 3–35. [CrossRef]
31. West, J.; Bogers, M. Leveraging External Sources of Innovation. *J. Prod. Innov. Manag.* **2014**, *31*, 814–831. [CrossRef]
32. Chesbrough, H.; Bogers, M. Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation. In *New Frontiers in Open Innovation*; Chesbrough, H., Vanhaverbeke, W., West, J., Eds.; Oxford University Press: Oxford, UK, 2014; pp. 3–28.
33. Huang, H.C.; Lai, M.C.; Lin, L.H.; Chen, C.T. Overcoming organizational inertia to strengthen business model innovation: An open innovation perspective. *J. Organ. Chang. Manag.* **2013**, *26*, 977–1002. [CrossRef]
34. Baden-Fuller, C.; Haefliger, S. Business models and technological innovation. *Long Range Plan.* **2013**, *46*, 419–426. [CrossRef]
35. Chesbrough, H.; Schwartz, K. Innovating Business Models with Co-Development Partnerships. *Res. Technol. Manag.* **2007**, *50*, 55–59. [CrossRef]
36. Ebel, P.; Bretschneider, U.; Leimeister, J.M. Leveraging virtual business model innovation. *Inf. Syst. J.* **2016**, *26*, 519–550. [CrossRef]
37. Yun, J.J.; Yang, J.; Park, K. Open innovation to business model: New perspective to connect between technology and market. *Sci. Technol. Soc.* **2016**, *21*, 324–348. [CrossRef]
38. Chesbrough, H.W. Why companies should have open business models. *MIT Sloan Manag. Rev.* **2007**, *48*, 22–28.
39. Saebi, T.; Foss, N.J. Business models for open innovation: Matching heterogenous open innovation strategies with business model dimensions. *Eur. Manag. J.* **2015**, *33*, 201–213. [CrossRef]
40. Weiblen, T. The Open Business Model: Understanding an Emerging Concept. *J. Multi. Bus. Model Innov. Technol.* **2016**, *2*, 35–66. [CrossRef]
41. Budler, M.; Župič, I.; Trkman, P. The development of business model research: A bibliometric review. *J. Bus. Res.* **2021**, *135*, 480–495. [CrossRef]
42. Maucuer, R.; Renaud, A. Business model research: A bibliometric analysis of origins and trends. *Management* **2019**, *22*, 176–215. [CrossRef]
43. Filser, M.; Kraus, S.; Breier, M.; Nenova, I.; Puumalainen, K. Business model innovation: Identifying foundations and trajectories. *Bus. Strategy Environ.* **2021**, *30*, 891–907. [CrossRef]
44. Schaller, A.A.; Vatananan-Thesenvitz, R. Business Model Innovation (BMI) Process: A Systematic Literature Review with Bibliometric Analysis. In Proceedings of the PICMET 2019—Portland International Conference on Management of Engineering and Technology, Portland, OR, USA, 25–29 August 2019; pp. 1–12. [CrossRef]
45. Batlles-delaFuente, A.; Belmonte-Ureña, L.J.; Plaza-Úbeda, J.A.; Abad-Segura, E. Sustainable Business Model in the Product-Service System: Analysis of Global Research and Associated EU Legislation. *Int. J. Environ. Res. Public Health* **2021**, *18*, 10123. [CrossRef]
46. Chang, J. Sustainable Business Model: A Bibliometric Study. *E3S Web Conf.* **2020**, *218*, 02010. [CrossRef]
47. Di Vaio, A.; Syriopoulos, T.; Alvino, F.; Palladino, R. "Integrated thinking and reporting" towards sustainable business models: A concise bibliometric analysis. *Meditari Account. Res.* **2020**, *29*, 691–719. [CrossRef]
48. Ferreira, J.J.; Fernandes, C.I.; Veiga, P.M.; Hughes, M. Prevailing theoretical approaches predicting sustainable business models: A systematic review. *Int. J. Product. Perform. Manag.* **2022**, *71*, 790–813. [CrossRef]
49. Marczewska, M.; Kostrzewski, M. Sustainable Business Models: A Bibliometric Performance Analysis. *Energies* **2020**, *13*, 6062. [CrossRef]
50. Preghenella, N.; Battistella, C. Exploring business models for sustainability: A bibliographic investigation of the literature and future research directions. *Bus. Strat. Environ.* **2021**, *30*, 2505–2522. [CrossRef]
51. Ogrean, C.; Herciu, M. Business Models Addressing Sustainability Challenges—Towards a New Research Agenda. *Sustainability* **2020**, *12*, 3534. [CrossRef]
52. Minatogawa, V.; Franco, M.; Rampasso, I.S.; Holgado, M.; Garrido, D.; Pinto, H.; Quadros, R. Towards Systematic Sustainable Business Model Innovation: What CanWe Learn from Business Model Innovation. *Sustainability* **2022**, *14*, 2939. [CrossRef]
53. Pan, L.; Xu, Z.; Skare, M. Sustainable business model innovation literature: A bibliometrics analysis. *Rev. Manag. Sci.* 2022, *in press*. [CrossRef]
54. Bilan, Y.V.; Pimonenko, T.V.; Starchenko, L.V. Sustainable business models for innovation and success: Bibliometric analysis. *E3S Web Conf.* **2020**, *159*, 04037. [CrossRef]
55. Ferasso, M.; Beliaeva, T.; Kraus, S.; Clauss, T.; Ribeiro-Soriano, D. Circular economy business models: The state of research and avenues ahead. *Bus. Strat. Environ.* **2020**, *29*, 3006–3024. [CrossRef]

56. Maucuer, R.; Renaud, A.; Ronteau, S.; Muzellec, L. What can we learn from marketers? A bibliometric analysis of the marketing literature on business model research. *Long Range Plan.* **2022**, *55*, 102219. [CrossRef]
57. Coombes, P.H.; Nicholson, J.D. Business models and their relationship with marketing: A systematic literature review. *Ind. Mark. Manag.* **2013**, *42*, 656–664. [CrossRef]
58. Coombes, P. A review of business model research: What next for industrial marketing scholarship? *J. Bus. Ind. Mark.* **2022**. [CrossRef]
59. Agostini, L.; Nosella, A. Industry 4.0 and Business Models: A Bibliometric Literature Review. *Bus. Process. Manag. J.* **2021**, *27*, 1633–1655. [CrossRef]
60. Grabowska, S.; Saniuk, S. Business Models in the Industry 4.0 Environment—Results of Web of Science Bibliometric Analysis. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 19. [CrossRef]
61. Caputo, A.; Pizzi, S.; Pellegrini, M.M.; Dabić, M. Digitalization and business models: Where are we going? A science map of the field. *J. Bus. Res.* **2021**, *123*, 489–501. [CrossRef]
62. Del Giudice, M.; Di Vaio, A.; Hassan, R.; Palladino, R. Digitalization and new technologies for sustainable business models at the ship-port interface: A bibliometric analysis. *Marit. Policy Manag.* **2021**, *49*, 410–446. [CrossRef]
63. Mostaghel, R.; Oghazi, P.; Parida, V.; Sohrabpour, V. Digitalization driven retail business model innovation: Evaluation of past and avenues for future research trends. *J. Bus. Res.* **2022**, *146*, 134–145. [CrossRef]
64. Delafenestre, R. New Business Models in Supply Chains: A Bibliometric Study. *Int. J. Retail Distrib. Manag.* **2019**, *47*, 1283–1299. [CrossRef]
65. Zhao, X.; Pan, W. The characteristics and evolution of business model for green buildings: A bibliometric approach. *Eng. Constr. Archit. Manag.* **2021**. [CrossRef]
66. Biancone, P.P.; Brescia, V.; Lanzalonga, F.; Alam, G.M. Using bibliometric analysis to map innovative business models for vertical farm entrepreneurs. *Br. Food J.* **2022**, *124*, 2239–2261. [CrossRef]
67. Bergiante, N.C.; Santos, M.P.; Santo, R.A.E. Bibliometric study of the relationship between business model and air transport. *Scientometrics* **2015**, *105*, 941–958. [CrossRef]
68. Secinaro, S.; Brescia, V.; Calandra, D.; Biancone, P. Employing bibliometric analysis to identify suitable business models for electric cars. *J. Clean. Prod.* **2020**, *264*, 1–15. [CrossRef]
69. Yoo, B.; Jang, M. A bibliographic survey of business models, service relationships, and technology in electronic commerce. *Electron. Commer. Res. Appl.* **2019**, *33*, 100818. [CrossRef]
70. De Paulo, A.F.; Carvalho, L.C.; Costa, M.T.G.V.; Lopes, J.E.F.; Galina, S.V.R. Mapping Open Innovation: A Bibliometric Review to Compare Developed and Emerging Countries. *Glob. Bus. Rev.* **2017**, *18*, 291–307. [CrossRef]
71. Fernandes, C.; Ferreira, J.; Peris-Ortiz, M. Open innovation: Past, present and future trends. *J. Organ. Chang. Manag.* **2019**, *32*, 578–602. [CrossRef]
72. Hossain, M.; Anees-ur-Rehman, M. Open innovation: An analysis of twelve years of research. *Strateg. Outsourc. Int. J.* **2016**, *9*, 22–37. [CrossRef]
73. Kovács, A.; Van Looy, B.; Cassiman, B. Exploring the scope of open innovation: A bibliometric review of a decade of research. *Scientometrics* **2015**, *104*, 951–983. [CrossRef]
74. Le, H.T.T.; Dao, Q.T.M.; Pham, V.-C.; Tran, D.T. Global trend of open innovation research: A bibliometric analysis. *Cogent Bus. Manag.* **2019**, *6*, 1633808. [CrossRef]
75. Lopes, A.P.V.B.V.; de Carvalho, M.M. Evolution of the open innovation paradigm: Towards a contingent conceptual model. *Technol. Forecast. Soc. Chang.* **2018**, *132*, 284–298. [CrossRef]
76. Santos, A.B. Open Innovation research: Trends and influences—A bibliometric analysis. *J. Innov. Manag.* **2015**, *3*, 131–165. [CrossRef]
77. Wang, W.; Tang, J. Mapping development of open innovation visually and quantitatively: A method of bibliometrics analysis. *Asian Soc. Sci.* **2013**, *9*, 254–269. [CrossRef]
78. Ortiz-de-Urbina-Criado, M.; Nájera-Sánchez, J.-J.; Mora-Valentín, E.-M. A Research Agenda on Open Innovation and Entrepreneurship: A Co-Word Analysis. *Adm. Sci.* **2018**, *8*, 34. [CrossRef]
79. Alvarez-Meaza, I.; Pikatza-Gorrotxategi, N.; Rio-Belver, R.M. Knowledge Sharing and Transfer in an Open Innovation Context: Mapping Scientific Evolution. *J. Open Innov. Technol. Mark. Complex.* **2020**, *6*, 186. [CrossRef]
80. de las Heras-Rosas, C.; Herrera, J. Research Trends in Open Innovation and the Role of the University. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 29. [CrossRef]
81. Odriozola-Fernández, I.; Berbegal-Mirabent, J.; Merigó-Lindahl, J.M. Open innovation in small and medium enterprises: A bibliometric analysis. *J. Organ. Chang. Manag.* **2019**, *32*, 533–557. [CrossRef]
82. Sabando-Vera, D.; Yonfa-Medranda, M.; Montalván-Burbano, N.; Albors-Garrigos, J.; Parrales-Guerrero, K. Worldwide Research on Open Innovation in SMEs. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 20. [CrossRef]
83. Bigliardi, B.; Filippelli, S. Sustainability and Open Innovation: Main Themes and Research Trajectories. *Sustainability* **2022**, *14*, 6763. [CrossRef]
84. Cano, J.A.; Londoño-Pineda, A. Scientific Literature Analysis on Sustainability with the Implication of Open Innovation. *J. Open Innov. Technol. Mark. Complex.* **2020**, *6*, 162. [CrossRef]

85. Cano, J.A.; Londoño-Pineda, A.; Castro, M.F.; Paz, H.B.; Rodas, C.; Arias, T. A Bibliometric Analysis and Systematic Review on E-Marketplaces, Open Innovation, and Sustainability. *Sustainability* **2022**, *14*, 5456. [CrossRef]
86. Payán-Sánchez, B.; Belmonte-Ureña, L.J.; Plaza-Úbeda, J.A.; Vazquez-Brust, D.; Yakovleva, N.; Pérez-Valls, M. Open Innovation for Sustainability or not: Literature Reviews of Global Research Trends. *Sustainability* **2021**, *13*, 1136. [CrossRef]
87. Chistov, V.; Aramburu, N.; Carrillo-Hermosilla, J. Open eco-innovation: A bibliometric review of emerging research. *J. Clean. Prod.* **2021**, *311*, 127627. [CrossRef]
88. Sanni, M.; Verdolini, E. Eco-innovation and openness: Mapping the growth trajectories and the knowledge structure of open eco-innovation. *Sustain. Futures* **2022**, *4*, 100067. [CrossRef]
89. Della Corte, V.; Del Gaudio, G.; Sepe, F.; Sciarelli, F. Sustainable Tourism in the Open Innovation Realm: A Bibliometric Analysis. *Sustainability* **2019**, *11*, 6114. [CrossRef]
90. De Paulo, A.F.; Porto, G.S. Solar energy technologies and open innovation: A study based on bibliometric and social network analysis. *Energy Policy* **2017**, *108*, 228–238. [CrossRef]
91. Yeung, A.W.K.; Atanasov, A.G.; Sheridan, H.; Klager, E.; Eibensteiner, F.; Völkl-Kernsock, S.; Kletecka-Pulker, M.; Willschke, H.; Schaden, E. Open Innovation in Medical and Pharmaceutical Research: A Literature Landscape Analysis. *Front. Pharmacol.* **2021**, *11*, 2084. [CrossRef]
92. Alvarez-Meaza, I.; Pikatza-Gorrotxategi, N.; Rio-Belver, R.M. Sustainable Business Model Based on Open Innovation: Case Study of Iberdrola. *Sustainability* **2020**, *12*, 10645. [CrossRef]
93. Matějíček, M.; Marešová, P. Open Business Model and Open Innovation: Bibliographic Analysis. *Hradec Econ. Days* **2020**, *10*, 515–526. [CrossRef]
94. Donthu, N.; Kumar, S.; Mukherjee, D.; Pandey, N.; Lim, W.-M. How to conduct a bibliometric analysis: An overview and guidelines. *J. Bus. Res.* **2021**, *133*, 285–296. [CrossRef]
95. Singh, V.K.; Singh, P.; Karmakar, M.; Leta, J.; Mayr, P. The journal coverage of Web of Science, Scopus and Dimensions: A comparative analysis. *Scientometrics* **2021**, *126*, 5113–5142. [CrossRef]
96. Janik, A.; Ryszko, A.; Szafraniec, M. Exploring the Social Innovation Research Field Based on a Comprehensive Bibliometric Analysis. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 226. [CrossRef]
97. Harzing, A.W.; Alakangas, S. Google Scholar, Scopus and the Web of Science: A longitudinal and cross-disciplinary comparison. *Scientometrics* **2016**, *106*, 787–804. [CrossRef]
98. Moral-Munoz, J.A.; Herrera-Viedma, E.; Santisteban-Espejo, A. Software tools for conducting bibliometric analysis in science: An up-to-date review. *Prof. Inf.* **2020**, *29*, e290103. [CrossRef]
99. Cobo, M.J.; Lopez-Herrera, A.G.; Herrera-Viedma, E.; Herrera, F. An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the fuzzy sets theory field. *J. Informetr.* **2011**, *5*, 146–166. [CrossRef]
100. Waltman, L.; Eck, N.J.; Noyons, C.M. A unified approach to mapping and clustering of bibliometric networks. *J. Informetr.* **2010**, *4*, 629–635. [CrossRef]
101. Waltman, L.; Eck, N.J. A smart local moving algorithm for large-scale modularity-based community detection. *Eur. Phys. J. B* **2013**, *86*, 471. [CrossRef]
102. Janik, A.; Ryszko, A.; Szafraniec, M. Scientific Landscape of Smart and Sustainable Cities Literature: A Bibliometric Analysis. *Sustainability* **2020**, *12*, 779. [CrossRef]
103. Chesbrough, H. Open innovation and the business model: Implications for industrial research. In Proceedings of the AIChE and ACS Management Conference 2003: Innovation Across Boundaries, Amelia Island, FL, USA, 4–7 May 2003; pp. 119–148.
104. Xu, X. From Cloud Computing to Cloud Manufacturing. *Robot. Comput. Integr. Manuf.* **2012**, *28*, 75–86. [CrossRef]
105. Enkel, E.; Gassmann, O.; Chesbrough, H. Open R&D and open innovation: Exploring the phenomenon. *R&D Manag.* **2009**, *39*, 311–316. [CrossRef]
106. Zott, C.; Amit, R.; Massa, L. The business model: Recent developments and future research. *J. Manag.* **2011**, *37*, 1019–1042.
107. Giesen, E.; Berman, S.J.; Bell, R.; Blitz, A. Three ways to successfully innovate your business model. *Strategy Leadersh.* **2007**, *35*, 27–33. [CrossRef]
108. Herzog, P.; Leker, J. Open and closed innovation—Different innovation cultures for different strategies. *Int. J. Technol. Manag.* **2010**, *52*, 322. [CrossRef]
109. Chanal, V.; Caron-Fasan, M.L. The Difficulties involved in Developing Business Models open to Innovation Communities: The Case of a Crowdsourcing Platform. *Management* **2010**, *13*, 318–341. [CrossRef]
110. Murata, Y.; Hasegawa, M.; Murakami, H.; Harada, H.; Kato, S. The architecture and a business model for the open heterogeneous mobile network. *IEEE Commun. Mag.* **2009**, *47*, 95–101. [CrossRef]
111. Panchal, J.H.; Fathianathan, M. Product realization in the age of mass collaboration. In Proceedings of the IDETC/CIE 2008 ASME 2008 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, Brooklyn, NY, USA, 3–6 August 2008; DETC2008-49865. pp. 219–229. [CrossRef]
112. Marjanovic, S.; Fry, C.; Chataway, J. Crowdsourcing based business models: In search of evidence for innovation 2.0. *Sci. Public Policy* **2012**, *39*, 318–332. [CrossRef]
113. Valkokari, K.; Paasi, J.; Rantala, T. Managing knowledge within networked innovation. *Knowl. Manag. Res. Pract.* **2012**, *10*, 27–40. [CrossRef]

114. Bocken, N.M.P. Sustainable Venture Capital—Catalyst for Sustainable Start-up Success? *J. Clean. Prod.* **2015**, *108*, 647–658. [CrossRef]
115. Bocken, N.M.P.; Rana, P.; Short, S. Value mapping for sustainable business thinking. *J. Ind. Prod. Eng.* **2015**, *32*, 67–81. [CrossRef]
116. Chesbrough, H. Open innovation: Where we've been and where we're going. *Res. Technol. Manag.* **2012**, *55*, 20–27. [CrossRef]
117. Ritala, P.; Sainio, L. Coopetition for radical innovation: Technology, market and business-model perspectives. *Technol. Anal. Strateg. Manag.* **2014**, *26*, 2. [CrossRef]
118. Mina, A.; Bascavusoglu-Moreau, E.; Hughes, A. Open service innovation and the firm's search for external knowledge. *Res. Policy* **2014**, *43*, 853–866. [CrossRef]
119. Pansera, M.; Owen, R. Eco-Innovation at the "Bottom of the Pyramid". In *Collaboration for Sustainability and Innovation: A Role for Sustainability Driven by the Global South?* Greening of Industry Networks Studies; Vazquez-Brust, D., Sarkis, J., Cordeiro, J., Eds.; Springer: Dordrecht, The Netherlands, 2014; Volume 3, pp. 293–313. [CrossRef]
120. Phillips, W.; Lee, H.; Ghobadian, A.; O'Regan, N.; James, P. Social innovation and social entrepreneurship: A systematic review. *Group Organ. Manag.* **2015**, *40*, 428–461. [CrossRef]
121. Ahlers, D.; Wienhofen, L.W.M.; Petersen, S.A.; Anvaari, M. A Smart City Ecosystem Enabling Open Innovation. In *Innovations for Community Services*; I4CS 2019. Communications in Computer and Information Science; Lüke, K.H., Eichler, G., Erfurth, C., Fahrnberger, G., Eds.; Springer: Cham, Switzerland, 2019; p. 1041. [CrossRef]
122. Brenner, B. Transformative Sustainable Business Models in the Light of the Digital Imperative—A Global Business Economics Perspective. *Sustainability* **2018**, *10*, 4428. [CrossRef]
123. Müller, M.; Vorraber, W.; Slany, W. Open Principles in New Business Models for Information Systems. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 6. [CrossRef]
124. Müller, J.; Buliga, O.; Voigt, K. The role of absorptive capacity and innovation strategy in the design of industry 4.0 business Models—A comparison between SMEs and large enterprises. *Eur. Manag. J.* **2020**, *39*, 333–343. [CrossRef]
125. West, J.; Bogers, M. Open Innovation: Current status and research opportunities. *Innov. Organ. Manag.* **2017**, *19*, 43–50. [CrossRef]
126. Brown, P.; von Daniels, C.; Bocken, N.M.P.; Balkenende, A.R. A process model for collaboration in circular oriented innovation. *J. Clean. Prod.* **2021**, *286*, 125499. [CrossRef]
127. Veleva, V.; Bodkin, G. Corporate-entrepreneur collaborations to advance a circular economy. *J. Clean. Prod.* **2018**, *188*, 20–37. [CrossRef]
128. Zucchella, A.; Previtali, P. Circular business models for sustainable development: A "waste is food" restorative ecosystem. *Bus. Strateg. Environ.* **2019**, *28*, 274–285. [CrossRef]
129. Polydoropoulou, A.; Pagoni, I.; Tsirimpa, A.; Roumboutsos, A.; Kamargianni, M.; Tsouros, I. Prototype business models for Mobility-as-a-Service. *Transp. Res. Part A Policy Pract.* **2020**, *131*, 149–162. [CrossRef]
130. França, C.L.; Broman, G.; Robèrt, K.H.; Basile, G.; Trygg, L. An approach to business model innovation and design for strategic sustainable development. *J. Clean. Prod.* **2017**, *140*, 155–166. [CrossRef]
131. Parida, V.; Wincent, J. Why and how to compete through sustainability: A review and outline of trends influencing firm and network-level transformation. *Int. Entrep. Manag. J.* **2019**, *15*, 1–19. [CrossRef]
132. Akter, S.; Jamal, N.; Ashraf, M.; McCarthy, G.; Varsha, P. The rise of the social business in emerging economies: A new paradigm of development. *J. Soc. Entrep.* **2019**, *11*, 282–299. [CrossRef]
133. Lan, J.; Ma, Y.; Zhu, D.; Mangalagiu, D.; Thornton, T.F. Enabling Value Co-Creation in the Sharing Economy: The Case of Mobike. *Sustainability* **2017**, *9*, 1504. [CrossRef]
134. Afuah, A. *Business Model Innovation. Concepts, Analysis, and Cases*; Routledge: New York, NY, USA, 2014; pp. 1–358. [CrossRef]
135. Grönlund, J.; Sjödin, D.R.; Frishammar, J. Open Innovation and the Stage-Gate Process: A Revised Model for New Product Development. *Calif. Manag. Rev.* **2010**, *52*, 106–131. [CrossRef]
136. Kohler, T. Crowdsourcing-Based Business Models: How to Create and Capture Value. *Calif. Manag. Rev.* **2015**, *57*, 63–84. [CrossRef]
137. Denicolai, S.; Ramirez, M.; Tidd, J. Creating and capturing value from external knowledge: The moderating role of knowledge intensity. *R&D Manag.* **2014**, *44*, 248–264. [CrossRef]
138. Bouwman, H.; Vos, H.; Haaker, T. *Mobile Service Innovation and Business Models*; Springer: Berlin/Heidelberg, Germany, 2008; pp. 1–295. [CrossRef]
139. Muzellec, L.; Ronteau, S.; Lambkin, M. Two-sided Internet platforms: A business model lifecycle perspective. *Ind. Market. Manag.* **2015**, *45*, 139–150. [CrossRef]
140. Chesbrough, H.; Lettl, C.; Ritter, T. Value creation and value capture in open innovation. *J. Prod. Innov. Manag.* **2018**, *35*, 930–938. [CrossRef]
141. Greco, A.; Eikelenboom, M.; Long, T.B. Innovating for sustainability through collaborative innovation contests. *J. Clean. Prod.* **2021**, *311*, 127628. [CrossRef]
142. Holgersson, M.; Granstrand, O. Value capture in open innovation markets: The role of patent rights for innovation appropriation. *Eur. J. Innov. Manag.* **2022**, *25*, 320–339. [CrossRef]
143. Mirvis, P.; Herrera, M.E.B.; Googins, B.; Albareda, L. Corporate social innovation: How firms learn to innovate for the greater good. *J. Bus. Res.* **2016**, *29*, 5014–5021. [CrossRef]

144. McGahan, A.M.; Bogers, M.; Chesbrough, H.; Holgersson, M. Tackling Societal Challenges with Open Innovation. *Calif. Manag. Rev.* **2021**, *63*, 49–61. [CrossRef]
145. Yun, J.J.; Park, K.; Im, C.; Shin, C.; Zhao, X. Dynamics of social enterprises—Shift from social innovation to open innovation. *Sci. Technol. Soc.* **2017**, *22*, 425–439. [CrossRef]
146. Guerrero, M.; Santamaría-Velasco, C.A.; Mahto, R. Intermediaries and social entrepreneurship identity: Implications for business model innovation. *Int. J. Entrep. Behav. Res.* **2020**, *27*, 520–546. [CrossRef]
147. Lin, P.; Zhang, X.; Yan, S.; Jiang, Q.; Huang, C. Dynamic Capabilities and Business Model Innovation of Platform Enterprise: A Case Study of DiDi Taxi. *Sci. Program.* **2020**, *2020*, 8841368. [CrossRef]
148. Kokol, P.; Blažun Vošner, H.; Kokol, M.; Završnik, J. Role of Agile in Digital Public Health Transformation. *Front. Public Health* **2022**, *10*, 899874. [CrossRef]
149. Holm, A.B.; Grunzel, F.; Ulhoi, J.P. Openness in innovation and business models: Lesson from the newspaper industry. *Int. J. Technol. Manag.* **2013**, *61*, 324–348. [CrossRef]
150. Hienerth, C.; Keinz, P.; Lettl, C. Exploring the Nature and Implementation Process of User-Centric Business Models. *Long Range Plan.* **2011**, *44*, 344–374. [CrossRef]