

Article

Cross-Border Innovation: Assessing Concepts, Contexts, and Content

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Abstract: This study provides an outlook of the evolution of cross-border innovation literature. A sample of 226 articles addressing cross-border innovation and knowledge transfer published between 1997 and 2022 was screened using bibliometric methods. Data are split over three time slices and a thematic analysis is conducted, suggesting three main themes in literature: research-and-development, mostly linked with mergers and acquisitions and competitiveness, knowledge creation and transfer linked with innovations systems and performance, and innovation linked with networks, firms' capabilities, and absorptive capacity. A co-citation analysis was also conducted which showed that the background literature of the research stream is based on the internationalization process, knowledge transfer and competitiveness, research-and-development, business performance and innovation systems. Results further introduce a geographic boundary to the research in knowledge and innovation, particularly frontier and regional innovation systems. Based on the results, future research lines are suggested, including the role of organizational learning and knowledge creation, towards the innovation of new products and services of companies seeking internationalization, and how disruptive events in worldwide supply chains affect cross-border innovation.



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Keywords: cross-border; innovation; knowledge; knowledge exchange; literature analysis

1. Introduction

During the last few years, the number of cross-border deals has declined as the United States of America (US) has become less open to trade and foreign investments. Other countries and economic blocs have also become more protectionist due to the rise of populism [1]. According to Baker McKenzie [2], investors and corporations remained cautious, facing mounting economic and geopolitical challenges, and mergers and acquisitions (M&A) will fall. Additionally, the COVID-19 pandemic worsened this scenario. The world merchandise exports plummet by 8% and services trade shrank by 21% in 2020 and, despite an expected recovery, the evolution is still dependent on the duration of the outbreak and the effectiveness of global response [3] with several countries implementing strict measures to control COVID-19 outbreaks, particularly China [4], which plays a critical role in worldwide supply chains. Moreover, the recent developments in Ukraine and the ongoing war caused additional stress in international trade, causing a surge in commodity prices. Both events caused similar problems, including turmoil in supply chains and a lack of raw materials and critical parts for industry, as well as fears of scarce food supply worldwide. Jointly, these aspects led to a surge in inflation, lowering growth and worldwide disruption [5].

Notwithstanding the recent adverse effects of the COVID-19 pandemic and the war in Ukraine, the downturn in international trade was felt in 2019, when the merchandise trade fell by 0.1%. However, the value of commercial services exports rose by 2% in the same period and, if the COVID-19 pandemic was brought under control, despite the high uncertainty, a recovery was expected, [6]. Nevertheless, this recovery is dependent on a solution to the war in Ukraine which brought additional turmoil [5].

The challenges of the world economy and international trade led many companies to assess the reliability of extended production lines, and industrialized economies began a process of deglobalization [7]. This is the case, for instance, of the semiconductors industry, which faces high demand and shortage supply [8], leading governs to implement incentives, such as subsidies to new chips factories [9].

Despite the current state of world affairs, the weight of cross-border trade, knowledge transfer, and innovation in enhancing economic development, remains critical to surpass the current crisis. In fact, the introduction of innovative products and services depends on knowledge sharing and transfer and on organizational learning [10–12], in which networks play a critical role in knowledge management and sharing towards innovation [13]. Consequently, innovation appears critical to soften the current economic turmoil, particularly cross-border innovation, due to higher contextual costs, particularly those related to distance, to foster economic growth and development.

Accordingly, knowledge sharing, knowledge transfer, organizational learning and networks play a relevant role in the innovation process. The existing scientific documents on cross-border innovation concepts and content have been focused within the scope of multinational corporations [14], on the role of cultural distance and its effects on cross-border diffusion of innovation [15], or regional innovation systems [16–18]. Furthermore, to the extent of the author's knowledge, despite previous studies addressing similar related issues [15,19], the recent and current international turmoil, including the COVID-19 pandemic, the war in Ukraine, the worldwide generalized disruption in supply chains and higher inflation, which the full consequences are yet to be seen, have been absent in cross-border innovation literature. Therefore, this study aims to evaluate the nature and course of development of cross-border innovation using quantitative methods [20] and qualitative methods to highlight its concepts, content, and context. It further aims to identify the main underlying themes, and deliver a roadmap for future research. To achieve this goal bibliometric methods, specifically a thematic analysis and a co-citation analysis are used to identify the main underlying themes on this subject. Data from the co-citation diagram is then analysed, to portray the main underlying ideas in cross-border innovation background literature, and contrasted with results from the thematic analysis.

To accomplish the study's objective, the following section focuses on the literature review, Section 3 describes the research data and methods. Results are evaluated in Section 4, and Section 5 delivers the results discussion, avenues for future research, and main conclusions.

2. Literature Review

Despite the downturn in cross-border deals in recent years, cross-border dynamics play a critical role in creating wealth. For instance, border regions generally present a worse economic performance than other regions. This is the case of the European integration process, which helped the European internal border regions to transform, from mainly peripheral areas, into areas of growth and opportunities, as a result of the funding directed to support cross-border cooperation programmes along the EU regions. These measures led to increasing trade by 15% over ten years and 2.5 million jobs [21].

According to the Merriam-Webster Dictionary [22], innovation implies a “new idea, device or method” or the “act or process of introducing new ideas, devices, or methods”. On the other hand, according to the Encyclopædia Britannica [23], innovation is the “creation of a new way of doing something, whether the enterprise is concrete or abstract”. Both definitions agree that innovation implies new ideas, devices, or methods to create a new way of doing something.

Accordingly, innovation involves new combinations of knowledge, resources, firm's organization, or other factors to produce new products and services [24], further including “the generation, acceptance, and implementation of new ideas, processes, products or services” ([25], p. 2) to change organizations, either to respond to shifts in the external environment or as a proactive action to influence the contextual environment [26]. Glob-

alisation increasingly intensified economic competition, and jointly with technological progress shortened the products' life cycle [27], forcing existing and new organizations to adapt and adopt measures to face the globalization challenges. Moreover, the acceleration of technological change, continuous learning, and innovation turned out to be critical in achieving sustaining competitiveness, growth, and prosperity. Cross-border innovation and knowledge transfer decisively influence economic development, particularly the Regional Innovation Systems (RIS), highlighting the importance of proximity and favorable institutional structures in evolving innovation activities that, for instance, the EU intensively seeks to foster [28]. Consequently, a cross-border exchange of goods and knowledge, labour mobility, and direct investments offer opportunities for mobilization of synergies and growth, which can result from shared scientific and economic strengths, complementary know-how, and innovation capabilities [29].

Knowledge transfer and innovation depend on complex interactions between people, firms, and institutions, which, ultimately leads to innovation systems [30]. Furthermore, economic development relies heavily on innovation, and companies depend on innovation speed to succeed in developing both radical product and radical process innovations to have a competitive advantage [31]. Moreover, new product development is dependent on a company's ability to introduce new products consistently and successfully in multiple markets. In pursuing this goal, companies engage in knowledge harnessing, from several sources, in multiple countries to foster their technological strength and manufacturing know-how [32]. Ultimately, this could happen through several approaches, from cross-border interconnections leading to innovation and knowledge transfer to M&A.

From an international level perspective, cross-border knowledge integration depends on how multinational companies transfer knowledge. Nevertheless, the resulting integration of knowledge improves transnational product capabilities, through cross-national collaboration teams [33], which ultimately leads to economic development. From a regional perspective, strongly integrated transnational cross-border regions can develop an integrated innovation space through a considerable flow of knowledge, expertise, and skills, across the border, fostered through people's mobility, innovation networking among firms, academic collaborations, and university–industry partnerships [34]. Therefore, despite the recent downturn in international trade and cross-border deals, strong transnational cross-border interconnections towards knowledge sharing and innovation are decisive to economic development.

Departing from this perspective, innovation, particularly cross-border innovation, represents a source of sustained competitive advantage [14] and regional innovation systems represent an opportunity to generate wealth. Innovation, involving the combination of resources, a new organizational process to produce new products and services, or develop the existing ones, further depends, to a great extent, on knowledge sharing [35–37] to which regional innovation systems are critical [17,34,38,39].

Departing from this stance, cross-border knowledge transfer can be used as a tool to foster innovation [18], which enables product and service development, builds customer value and business performance, and surpasses the present challenges in the economy worldwide, provided that the right conditions are settled. Therefore, in the next section, this study's research data and methods are presented.

3. Data and Methods

3.1. Data Sources

Following the study's objective of representing the cross-border innovation research stream, the procedure involves a broad scope and uses a mix of quantitative and qualitative methods. Hence, bibliometric methods are adequate to conduct the analysis [40,41]. A search was conducted on 19 July 2022 in the Web of Science (WoS) database. The main collection of the WoS was searched for publications (articles), published in the English language, with the terms ("cross-border" AND "knowledge" AND "innovation") in "title", "abstract", "author keywords", and "Keywords plus", in the indexes SSCI and ESCI. The

complete search query was: TS = (“cross-border” AND “knowledge” AND “innovation”), refined by language: “English”; document types: “Article”; publication date: 1 January 1900 to 19 July 2022. The complete procedure can be observed in Figure 1. The search criteria English language, despite potentially excluding some documents, enables the standardization of results, represents the overall poll of published documents in most research fields, and has been found in similar studies [42,43].

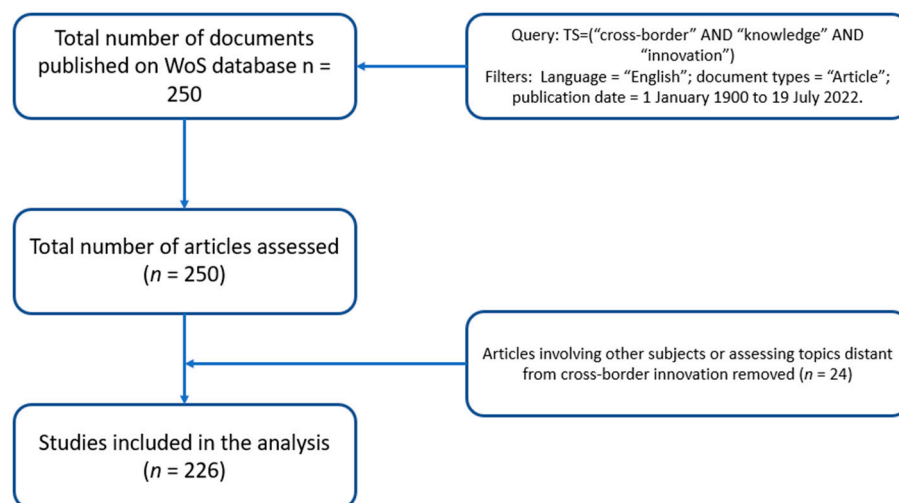


Figure 1. Flow diagram of the dataset gathering.

Results returned 250 documents published over the period 1997–2022. The decision to rely exclusively on the WoS database was based on the need for the use of standardized data, which data from a single database allow [44,45]. Moreover, the WoS database is the oldest, one of the largest databases, and is a reliable source of published scientific documents [46]. Next, all the abstracts were read and documents not complying with the including criteria, i.e., involving other subjects or assessing topics distant from cross-border innovation were removed from the analysis. During this process, 24 articles were considered to be off-topic and were excluded. The final sample for analysis was 226 articles. Despite the number of articles in the dataset, which according to some authors should be at least around 300 or 500 [45], a number of 200 can be considered an analytical minimum [47]. This study follows the later suggestion.

3.2. Procedures

Bibliometrics are useful for literature reviews, as it guides researchers to the most relevant works and maps a scientific field without subjective bias [40]. Furthermore, have two main pillars: science mapping and performance analysis [40,48,49]. Bibliometrics performance methods aim to analyze the scientific production of individuals and institutions [40,48–50]. On the other hand, science mapping methods aim to portray the structural and dynamic aspects of a research field to determine its evolution and main actors [40,48,49,51].

This study follows the guidelines provided by Cobo et al. [48] and Zupic and Čater [40], similarly to several studies in different research streams [52–60]. Accordingly, in the first stage, bibliometric methods are employed. The bibliometric package, which includes a set of tools for research in bibliometrics and scientometrics [61], for R Core Team [62] is used to produce a thematic map, based on a co-word analysis [63] and a co-citation diagram [64] to depict the most co-cited documents. In the second stage, departing from a literature review to the most co-cited documents, the main ideas represented by the co-citation clusters’ are described and contrasted to depict the content, concepts, and context of the research stream, further delivering a set of future research lines.

4. Results

4.1. Descriptive Analysis

The current analysis comprises the period 1997–2022. Table 1 provides the main information about data, showing that the 226 documents were published in 151 journals, obtaining 18.3 average citations each, and including references to 13.768 documents.

Table 1. Main Information about data.

Main Information About Data	
Timespan	1997–2022
Sources (Journals, Books, etc.)	151
Documents	226
Average citations per document	18.3
References	13.768

Concerning the evolution of the publishing output, Figure 2 shows the number of published articles over time. It shows that the first document was published in 1997 and over the period 1997–2009, only 13 documents were published; over the period 2010–2019, 137 articles; and over the timespan 2020–2022, 76 papers. Overall, the data highlight an increasing relevance of the research field, additionally showing that the publishing output increased after the 2007–2008 financial and economic crisis, suggesting that the recent turmoil concerning to the COVID-19 pandemic and the war in Ukraine are positing to contribute to relevance of the research stream among the scientific community, and the number of papers published over 2020–2022 (76 papers), from which 24 documents were published in the first seven months of 2022, seem to confirm this.

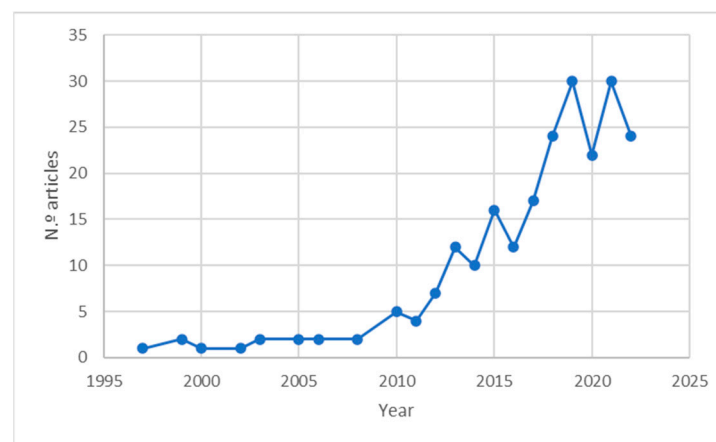


Figure 2. Number of published documents over the period 1997–2022.

Table 2 presents the top 15 most relevant sources publishing articles within the scope of cross-border innovation, according to the number of documents published.

Results (Table 2) show that the journal *Sustainability* is the most relevant source, according to the number of published documents in the dataset. When analyzing the total citations (local documents) of the most productive journals, the *Journal of International Business Studies* appears as the most cited journal. However, considering the publishing time frame and h-index, results show several journals, such as *Sustainability*, *International Business Review*, *Technological Forecasting and Social Change*, and *Management International Review*, that over a shorter period of time, achieved an interesting h-index.

Table 2. Top 15 most relevant journals.

Sources	Articles	h-Index (Local Articles)	Total Citations (Local Articles)	Publishing Year Start
Sustainability	12	5	45	2017
Journal of International Business Studies	9	7	559	1997
Journal of Knowledge Management	9	4	122	2014
European Planning Studies	7	5	99	2000
International Business Review	7	6	170	2014
Chinese Management Studies	6	3	13	2015
Technological Forecasting and Social Change	6	5	148	2016
Journal of Business Research	5	3	79	2017
Journal of International Management	5	4	107	2010
Management International Review	5	5	74	2012
Regional Studies	5	4	166	1999
International Journal of Emerging Markets	4	2	27	2019
Journal of World Business	4	3	69	2016
Research Policy	4	3	55	2013
Technovation	4	4	148	2014

4.2. Thematic Analysis

This section depicts the conceptual structure of the research stream. It is based on the analysis of the underlying concepts portrayed in the published literature and uses a co-word analysis. Co-word analysis is based on the premise that it is possible to identify a network of problems and its evolution (also called problematic networks), based on the analysis of documents, and is designed to analyze all types of scientific, technical, and political inscriptions [63,65]. From this perspective, co-word analysis is a type of content analysis technique. It uses the content of the documents (words) to establish relationships and to determine the conceptual structure of a subject on the basis that if words frequently co-occur, the underlying concepts are closely related [40].

Therefore, to describe the evolution of the research stream, main themes, and underlying ideas, the publishing timeline was split in three periods, following the publishing output: 1997–2009, a period characterized by only thirteen documents published; 2010–2019, a period within a research stream which experienced an increasing interest, with 137 published articles; and 2020–2022, a period with 76 published documents, characterized by events such as the COVID-19 pandemic and the war in Ukraine, which caused worldwide turmoil, causing the collapse of supply chains and cross-border business.

The thematic map is represented by a diagram depicting the most relevant themes into a two-dimensional grid (in this study, based in the articles Keywords Plus), following the guidelines from Aria and Cuccurullo [61], Cobo et al. [48], and Zupic and Čater [40]. According to Callon, Courtial, and Laville [66] ‘centrality’ measures the intensity of the interaction of one cluster with other clusters, while ‘density’ measures the strength of the links that tie the words of the cluster together. Centrality can be understood as a measure of the importance of a theme in the development of the entire research field, while density can be used as an indicator of the development of the theme [67]. According to Cobo et al. [48], the topics in the upper-right quadrant are both well-developed and important for the structuring of a research field. These are known as the motor themes of the speciality once they have strong centrality and high density. The upper-left quadrant presents themes with well-developed internal ties, but unimportant external ties, meaning that they are of only marginal importance for the research field. These themes are very

specialized, nevertheless, on the fringe to the underlying field. The lower-left quadrant represents both weakly developed and marginal themes with low density and low centrality, representing emerging or disappearing themes. Finally, themes presented in the lower-right quadrant, despite being important for a research stream, are not well developed, representing, therefore, transversal and general, basic themes.

Figure 3 shows the thematic map from the first time slice (1997–2009) and shows the main themes regarding cross-border innovation.

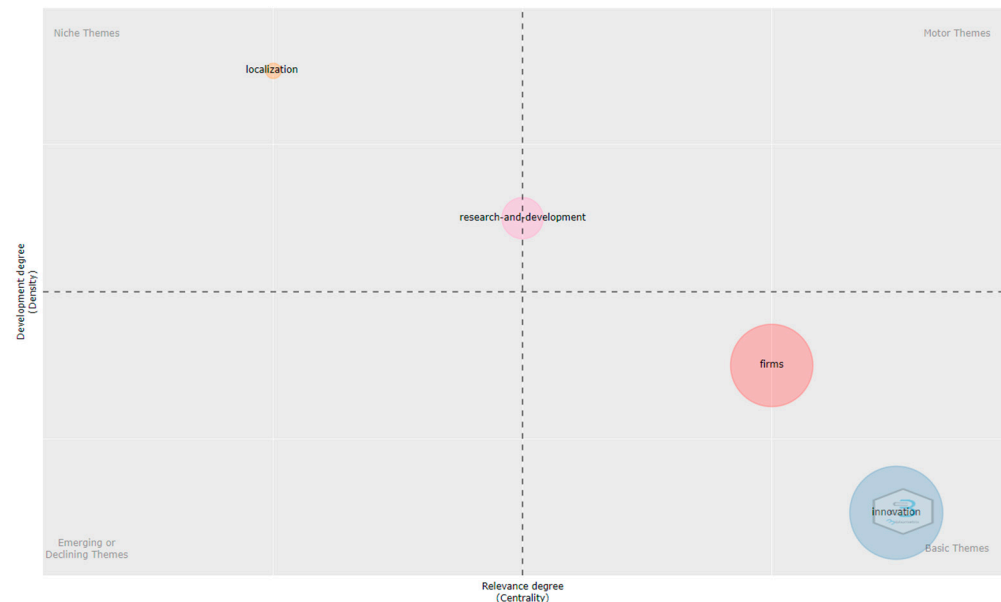


Figure 3. Thematic map—period 1997–2009.

Results (Figure 3) show four main themes depicted in the 1997–2009 period thematic map: ‘localization’, ‘research-and-development’, ‘firms’, and ‘innovation’. Following guidelines from Callon, Courtial, and Laville [66] each one of these themes includes a cluster of linked topics or co-words that are analyzed together to enlighten about the main underlying idea and are shown in Table 3.

Table 3. 1997–2009 clusters themes.

Quadrant	Cluster Name	Cluster Topics
Lower-right	Innovation	Innovation, networks, capabilities, competitiveness
	Firms	Firms, knowledge, and performance
Upper-left	Localization	Localization
	Research-and-development	Research-and-development, trade

A deeper analysis of the period 1997–2009 leading themes (Figure 3 and Table 3) shows that scientific literature was mostly centred on aspects concerned with innovation networks and capabilities towards competitiveness, targeting firms’ performance. Nevertheless, results also show that research and development as well as trade were highly dense topics, indicating their relevance to firms’ performance and cross-border innovation.

Figure 4 presents the thematic map of the second period (2010–2019) and reveals that the main themes over this period were, ‘capabilities’, ‘knowledge’, ‘innovation’, ‘research-and-development’, ‘technology’, and ‘firms’.



Figure 4. Thematic map—period 2010–2019.

Departing from the set of main themes presented in Figure 4, Table 4 presents the topics composing each one of the clusters over the period 2010–2019.

Table 4. 2010–2019 cluster themes.

Quadrant	Cluster Name	Cluster Topics
Upper-right	Capabilities	Capabilities, integration, mergers, acquisitions, cross-border acquisitions, cultural differences, innovation performance, competitive advantage, diversification
	Knowledge	Knowledge, firm, distance, collaboration, innovation systems, dynamic capabilities, proximity, and cooperation
Lower-right	Innovation	Innovation, performance, absorptive capacity, networks, impact, knowledge transfer, product development, and acquisition
	Research-and-development	Research-and-development multinational enterprises, globalization, growth, trade, cross-border mergers, location, competitiveness, and technology-transfer
Upper-left	Firms	Firms, internationalization, framework, investment, opportunities, enterprises
Lower-left	Technology	Technology, acceptance, evolution, information

Concerning the leading ideas in cross-border innovation scientific literature, over the period 2010–2020 (Table 4), results demonstrate that firms’ capabilities towards cross-border mergers and acquisitions were the basis for firms’ diversification targeting innovation, competitive advantages, and performance. Moreover, results indicate that these themes were central to cross-border innovation literature and firms’ mergers and acquisitions decisions were decided considering companies’ dynamic capabilities, geographical distance or proximity, and collaboration and cooperation opportunities in cross-border innovation. Furthermore, the absorptive capacity and the impact of networks in product development were also among the main subjects towards firms’ innovation in cross-board mergers and acquisitions.

Figure 5 presents the thematic map concerning the period 2020–2022, showing seven clusters: ‘research-and-development’, ‘performance’, ‘innovation’, ‘integration’, ‘impact’, ‘knowledge’, and ‘globalization’.

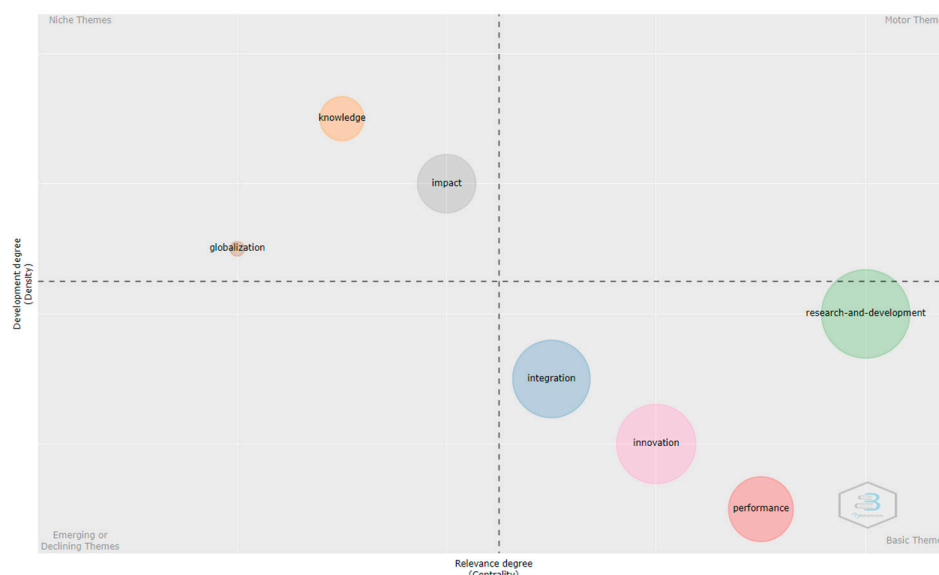


Figure 5. Thematic map—period 2020–2022.

Regarding the set of topics composing each one of the clusters over the period 2020–2022, the results are presented in Table 5.

Table 5. 2020–2022 cluster themes.

Quadrant	Cluster Name	Cluster Topics
Lower-right	Research-and-development	Research-and-development, foreign direct investment, internationalization, acquisitions, multinationals, competitive advantage, location choice.
	Performance	Performance, firms, development internationalization, strategies, flows, information, diversity, knowledge integration, patent citations, and social identity
	Innovation	Innovation, absorptive capacity, knowledge transfer, multinational corporations, cultural distance, firm performance, cultural-differences
	Integration	integration, proximity, networks, collaboration, empirical evidence, strategy, systems, economic geography, framework, science, tacit knowledge, clusters, cooperation, dynamics, and geography
	Impact	impact, capabilities, entrepreneurial orientation, exploitation, exploration, open innovation, value creation.
Upper-left	Knowledge	knowledge, determinants, corporate social responsibility, cross-border cooperation, dynamic capabilities, and legitimacy
	Globalization	globalization, innovation performance, acquiring firms, location, and slack resources.

The fourth period (2020–2022), presented in Figure 5 and Table 5, highlights that cross-border innovation literature was mainly focused on research-and-development targeting innovation, firms’ integration and performance, which were highly central and developed topics. Overall, results show that the research-and-development was highly connected with foreign direct investment and internationalization, and topics such as acquisitions, multinationals, competitive advantage, and location choice. Moreover, innovation was among the most central and developed themes in literature, highly connected with absorptive capacity, knowledge transfer, multinational corporations, cultural distance and differences, and firms’ performance. Furthermore, over this period, results evidence further central topics such as integration networks, collaboration and cooperation as well as geographic proximity. These themes appear together with less central topics, yet more developed ones, including the impact of dynamic capabilities, exploitation and exploration, open innovation, and value creation, as well as knowledge determinants, corporate social responsibility, and cross-border cooperation and globalisation. Furthermore, the overall main themes over the 2020–2022 period suggest that the role of extended supply chains

in a period characterized by the COVID-19 pandemic, raised increasing awareness in the scientific community, particularly due to the caused disruption in entire economic sectors and pressure on companies' performance, which is emphasized by topics, such as location choice, social identity, cultural distance, cultural differences, and proximity.

4.3. The Intellectual Structure

Citation and co-citation analysis provide evidence about the intellectual structure of a research field [40,64]. The citation analysis represents the sum of citations that a document received. On the other hand, co-citation is defined as the frequency with which two items of earlier literature are cited together in more recent literature. Thus, co-citation is a relationship established by the citing authors, and its strength relies on the degree of relationship or association between articles [64]. Therefore, the co-citation analysis aims to detect when two documents from different sources are cited together in a third document, connecting articles, and consequently, the authors who produced them [68] and the main themes that build the background for the clusters of documents. Figure 6 represents the co-citation network and shows the most co-cited documents, which, following Zupic and Čater [40] were limited to the 50 most co-cited documents to retain the set of documents to a manageable size and to ensure that only cited papers that contain enough citation data are retained for the analysis.

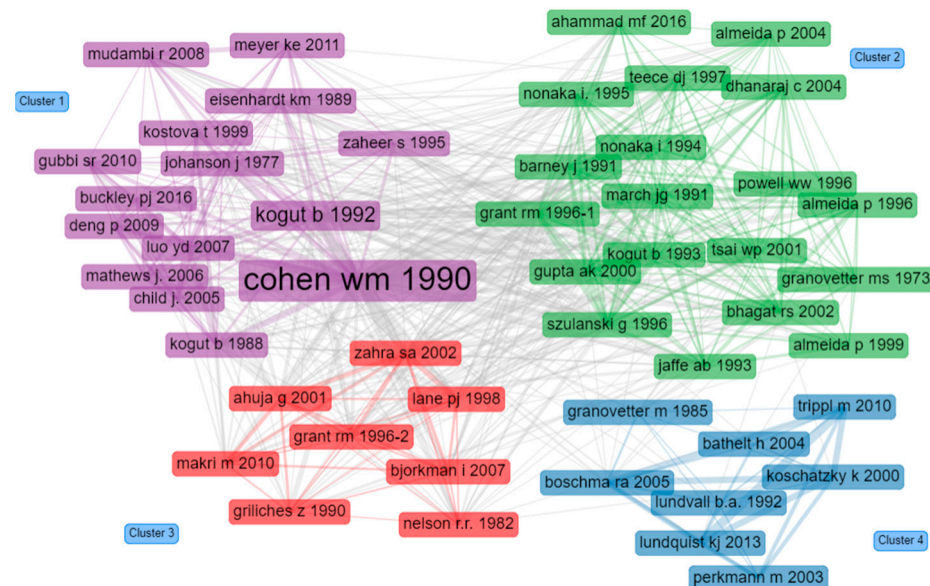


Figure 6. Co-citation network [17,29,69–116].

The co-citation network map (Figure 6) shows four main clusters. A threshold of 50 most co-cited documents was used, which was settled to limit the set of documents to a manageable size and to ensure that only documents containing enough citation data for analysis are retained [40].

4.3.1. Cluster 1—Purple

Cluster 1 includes fifteen documents involving contextual challenges of a firm's internationalization process and competitiveness. On the one hand, a range of topics related to the challenges of the internationalization process and competitiveness of emerging markets multinational firms: patterns and motives for internationalization, particularly the decision whether to buy technological and brand assets to build a competitive position in international markets [69–72]; the strategic positioning when facing incumbents fierce resistance [72]; integration and use of knowledge about international markets and operations [115]; cultural influences of foreign markets in entry choices [74], including the decision of whether firms should import home-country organizational capabilities or copy-

ing local companies' successful practices in doing business abroad [113]; and antecedents of internationalization of emerging economies multinationals through cross-border acquisitions [116].

On the other hand, the relevance of a firm's knowledge creation and transfer in the internationalization process [72,78,79]. This second theme is assessed in the scope of the absorptive capacity and in the innovation process, particularly through the ability to recognize the value of new and external information to foster innovation [75], and the role of the agency theory in dealing with uncertainty, incentives, and risk [101].

Moreover, despite the relevance of the internationalization process and competition in cluster 1, the internationalization process is contrasted with the role of local contexts' distinctive differences, which present themselves as critically relevant in the world stage [90].

4.3.2. Cluster 2—Green

Cluster 2 includes nineteen documents and embraces two main ideas. The first one relates to the innovation process, fostered by firms' individual actions or network efforts [95]. This theme appears under the scope of how knowledge creation and transfer, within multinational corporations [99] and within international joint ventures [88], cross-border acquisitions [85], and manufacture capability transfer across borders [97], affect cross-border innovation, and how to use the innovation process [88,89], particularly throughout new products and technologies [89] and the role of managing and dissemination of innovative procedures within companies' departments [91] towards competitive advantage.

The second main idea presented in cluster 2 involves organizational learning and knowledge transfer [92,93] and how the ties between individuals affect it [100]. Knowledge transfer and organizational learning appear jointly studied with the use of strategic resources for competitive advantage [92], patents [96,97], innovation in multinational firms subsidiaries [86], innovation production and higher performance [98], staff knowledge integration [93], and the dichotomy between the exploration of new opportunities and the exploitation of older certitudes in organizational learning [94].

4.3.3. Cluster 3—Red

Cluster 3 includes eight studies having on their background, first the conceptualization of absorptive capacity [102,103] and an evolutionary theory of the capabilities and behaviour of firms operating a market environment [84], second the impact of mergers and acquisitions on innovation performance [105,106], on capability transfer [82], and the knowledge-based approach, based on the way firms combine and integrate specialized knowledge [93], including the interdependence between research and development and patent numbers, and patent numbers and the innovation process [83].

4.3.4. Cluster 4—Blue

Cluster 4 includes eight studies involving cross-border innovation systems and how geographical proximity [108], regional innovation systems (RIS) [29] cross-border networking activities [109], and the emergence of cross-border institutions in public governance [111], as well as its main characteristics and barriers [17] affect internationalization and innovation [110]. Literature included in cluster 4 seems mostly related to the contextual and spatial clustering aspects of the emergence of cross-border innovation systems and its relationship with economic activity, knowledge creation in shared learning processes [107] and to the extent to which social relations are affected and immersed in economic action [117].

5. Discussion, Avenues for Further Research Future Research, and Conclusions

5.1. Discussion

Results showed that scientific literature about cross-border innovation was developed recently. The first document available in the dataset was published in 1997 and between 1997 and 2009 only 13 documents were published. During the 2010s the research field gained relevance and 137 articles were published. Over the period from 2020 to July 2022,

76 papers were published. The main emerging evidence from these results shows that cross-border innovation has gained relevance as a research theme. Several reasons can be pointed to the increasing relevance. Nevertheless, the explosion of references to globalization at the end of the 1990s [118], defined as “the compression of the world and the intensification of the consciousness of the world as a whole” ([116], p. 8), and global companies, which instead adapt to different consumers preferences between nations, sensible force, suitable and standardized products, services, and practices to entire world [119,120] seem to lead to the emergence of cross-border innovation as a relevant research topic. Yet, times of crises, such as the 2007–2008 financial crisis and the following economic crisis, as well as the current worldwide turmoil regarding the COVID-19 pandemic and the war in Ukraine, seem to be positively related to the publishing output.

Concerning the thematic evolution of cross-border innovation literature, an integrated analysis of the obtained results shows three main relevant themes in the overall time-frame: research-and-development, innovation, and knowledge. Research-and-development passed from a somewhat central theme over the periods 1997–2009 and 2010–2019 to highly central in the period (2020–2022). However, its centrality evolved from mostly related to trade, to incorporating several relevant ideas for cross-border innovation. For instance, over the period 2010–2019, research-and-development was mostly viewed inside the globalization context, connected with themes such as globalization, trade, cross-border mergers, competitiveness, and technology transfer. During the period 2020–2022, the links between research-and-development in cross-border innovation literature and the globalization process emerged fundamentally through the process of internationalization, including foreign direct investment and acquisitions targeting competitive advantage.

Knowledge remained highly central to cross-border innovation, starting closely related to firms and performance over the period 1997–2009, incorporated relevant aspects to knowledge creation and transfer, such as collaboration, cooperation, dynamic capabilities, and innovation systems between 2010 and 2019, and appeared closely related with dynamic capabilities and cross-border cooperation, representing an autonomous cluster over the period 2020–2022. Despite representing an autonomous cluster over the last period, knowledge also presented close ties with the innovation and performance clusters, emphasizing the relevance of knowledge creation and transfer in the innovation process.

Innovation being at the centre of the conducted analysis remained a highly central theme over the analyzed period. However, results show how innovation relates to the remaining relevant themes. It passed from mostly connected with networks, capabilities, and competitiveness (1997–2009) to incorporating links with the absorptive capacity, knowledge transfer, product development, cultural distance and differences, and firm’s performance over the periods 2010–2019 and 2020–2022.

Concerning the co-citation analysis, results showed four clusters: cluster one emphasized the internationalization process and competitiveness [69–72], on the one hand, and knowledge creation and transfer [72,78,79], on the other hand; cluster two included works involving the dichotomy between firms’ individual actions compared with network efforts targeting the innovation process [95] and included, essentially, the role of themes such as knowledge creation and transfer and organizational learning in this process [84,85]; cluster 3 included key aspects to the innovation process, such as the firm’s absorptive capacity and firm’s capabilities [102–104], and the role of mergers and acquisitions in capabilities transfer targeting innovation and business performance [105,106]; cluster 4 involved the role of innovation systems, RIS, cross-border network activities, and institutions in public governance, being mostly related to the spatial aspects of the cross-border innovation process [29,109,110,113]. Hence, resuming the main underlying ideas from the co-citation analysis, the obtained results show that cross-border innovation literature is based, first, on fostering the internationalization process and competitiveness, the contrasting point of view of individual actions and network efforts targeting knowledge creation and transfer and organizational learning, the role of firms’ capabilities and the absorptive capacity and cross-border innovation systems and RIS.

Contrasting results from the thematic map with the co-citation network results indicate that the cross-border innovation scientific literature has been mostly centered on firms' internationalization process and competitiveness, including how companies use their capabilities to create and transfer knowledge, develop a learning organization, and foster research-and-development practices targeting innovation, including new products and services and, ultimately, business performance. Moreover, the obtained results indicate that the process leading to cross-border innovation is mostly understood through a logic of cross-border mergers and acquisitions, i.e., cross-border literature shows an overwhelming emphasis on mergers and acquisitions, supporting the idea that this is the preferred firms' policy. Instead, in cross-border collaboration and cooperation, the obtained results seem to indicate that particularly multinational companies prefer to acquire cross-border assets rather than develop them [69–73].

Consequently, results present several practical and theoretical consequences. From a practical point of view, results emphasize firms' capabilities, absorptive capacity, and networks to foster cross-border innovation, particularly in an internationalization process. Furthermore, the centrality of innovation ecosystems, particularly regional ecosystems, highlights how cross-border regions play a critical role in fostering innovation through partnerships between companies, and between companies and universities and research centres, to create and share knowledge and foster the innovation process targeting the development of a new product, services and practices, build customer value, and business performance. Therefore, companies must implement policies to generate information, recognize its value, assimilate it and apply this information to commercial ends [75], which is on the basis of the innovation process. On the other hand, public institutions should act as facilitators, and the emergence of cross-border institutions in public governance could help to create/improve cross-border innovation networks, particularly in frontier regions, to promote and foster economic development, businesses, and jobs creation, ultimately, transforming these regions from peripheral to central in terms of economic development. These aspects represent a pressing opportunity in a time of disruption and when companies rethink the way their supply chains work.

From a theoretical point of view, this study provides relevant results that depict the state-of-the-art scientific literature regarding cross-border innovation. Results showed the thematic evolution as well as the foundations of the cross-border innovation research stream. The obtained evidence emphasizes the relevance of firms' internationalization in cross-border innovation, also stressing the power of networks and innovation ecosystems, particularly regional innovation ecosystems. Furthermore, considering the relevance of the spatial aspects of cross-border innovation, namely regional context, cultural distance/proximity, and the role of organizational learning and knowledge creation and transfer in absorptive capacity, results in highlighting where the focus of researchers was, which combined with the current turmoil involving the COVID-19 pandemic and the war in Ukraine, highlights the need for further emphasis in building regional innovation systems in a context of deglobalization [7]. These results provide the basis for further studies by showing what the main source of interest by researchers was.

Therefore, the main outcomes of this study involve the role of the internationalization process in cross-border innovation, which companies, particularly those seeking to expand their activities to foreign markets through mergers and acquisitions, should consider. This outcome implies a further consequence for companies and researchers, and deals with the assessment of innovation as an antecedent of the internationalization process or, on the other hand, the internationalization process as an antecedent of innovation, particularly through knowledge sharing and transfer.

5.2. Avenues for Future Research

Concerning future research, the obtained results show two main lines. On the one hand, the overall literature regarding cross-border innovation evolved mostly departing and encompassing the globalization process and the explosion of references to globalization

at the end of the 1990s [118]. Furthermore, the globalization process has been led by companies seeking economies of scale, reduction in costs and prices based in two vectors, technology and globalization, to offer high quality, more or less standardized products at optimal low prices, expanding markets and prices [120]. The emergence of the internet and its spread around the world led to an exponential amount of information, the development of new ways of doing business, knowledge transfer, innovation, economies of scale, and the emergence of new companies such as Alphabet, Amazon, among others, which became global companies and show the power technology in fostering globalization.

Therefore, departing from the obtained results, the first proposed future research should involve organizational learning and knowledge creation towards the innovation of new products and services of companies seeking internationalization, particularly barriers and enablers of organizational learning and cross-border innovation, i.e., how companies face the internationalization process in highly competitive environments. Do they face difficulties using technology, through economies of scale to reduce costs and prices, or innovate products and services, acting individually or through networks in cross-border collaboration/cooperation.

Concerning the second proposed research line, the recent turmoil regarding the COVID-19 pandemic showed how fragile global supply chains are. Entire economic sectors were shut down due to the pandemic, causing equally strong effects in entire industries all over the world. Similarly, the effects of the war in Ukraine caused disruption in several sectors, particularly in commodities markets, imposing economic uncertainty among customers and higher costs to firms, which passed to customers imposing higher inflation and economic downturn. Both the COVID-19 pandemic and the war imply companies need to assess ways to shorten their supply chain, many times to rely on local suppliers or invest in culturally close contexts to surpass uncertainty. Therefore, the combined effects of the pandemic, the war and the disruption of global supply chains appear among the topmost promising research lines in cross-border innovation, as well as how companies face cross-border innovation in times of market uncertainty and disruption. Do they implement cross-border partnerships or merge or acquire competing business? How does international turmoil affect cross-border innovation and knowledge transfer?

5.3. Conclusions

The innovation process, particularly by generating new ideas, is linked to individuals' and entities' absorptive capacity, in which networks play a relevant role in providing the knowledge to fuel them. Cross-border interconnections, on the other hand, represent an important opportunity to share knowledge, in which entities should participate to compete in an increasingly interconnected world. Consequently, due to firms' internationalization, globalization, and interdependency between countries and regions, the observed traits of cross-border regions, such as the growing exchange of goods and knowledge, labor mobility and direct investments, offer opportunities for mobilization of synergies and growth, which shared scientific and economic strengths complement, fostering cross-border innovation.

Despite the enlightening conclusions, this study faces several limitations, with these two being the most relevant ones: first, the use of a single database. The WoS database represents a source of reliable data and is one of the largest scientific databases. However, additional data from databases such as SCOPUS could provide further insights and readers must be aware of this limitation. Second, the number of documents in the dataset, despite allowing strong confidence in the obtained results, could be higher. Yet, the relevance of the research stream shows that, despite the number of papers in the dataset, cross-border innovation represent a relevant topic that should be analyzed through the used procedure in this study.

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