



SUPPLY CHAIN - INNOVATION: PAST, PRESENT, AND FUTURE

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ABSTRACT

Nowadays, one of the factors that enable businesses to adapt to markets that are constantly renewed and changing due to the ever-increasing flow of information, and perhaps the most important, is innovation. Innovation is a topic that is frequently studied by both markets and academics. However, the increase in the quantity of studies conducted is far from meeting the need in this field. As a result of the shortening of product life cycles in current market conditions, companies are obliged to continuously innovate in order to sustain their existence. Increasing raw material and resource diversification requirement due to the increasing need for innovation made it necessary to examine and understand the supply chain in the context of innovation. The importance of innovation, especially in the case of participation by suppliers in innovation for a competitive advantage, has resulted in many in-depth studies published in research papers in the field. In this study, articles published in the Web of Science database between 1996-2020 and covering the topics of supply chain and innovation were analyzed in order to reveal the patterns of supply chain



management and innovation research, identify relative deficiencies and provide some guidelines. For this purpose, a systematic literature review and bibliometric analysis related has been made. It has been possible to determine the effective actors in the field by including the distribution of the concepts in question according to time, countries, universities and journals. In addition, as a result of the keyword analysis, the evolution and open points of the field over time are among the findings of the study.

Keywords: Supply Chain; Innovation; Systematic Literature Review; Bibliometric Analysis; Thematic Evolution

1. INTRODUCTION

The survival of institutions, nowadays, is closely related to whether they can develop innovations that their clients prefer (Song et al., 2017). Especially in the globally competitive environment in which we live, factors, such as quality, reliability, and low prices, all of which create differences between rival companies, can be found in almost every institution these days. For this reason, it has been widely accepted that the most significant characteristic which creates a contrast between institutions is the ability to develop innovations (Kiliç & Bilginoğlu, 2010).

Innovation is the primary resource necessary to obtain a competitive advantage for an institution. The rules of the global economy dictate that, for a company to survive in the current competitive market conditions, it either needs to follow up on innovations and absorb them into their systems in an appropriate way or develop its innovations. Although innovation seems to be an output belonging to a single institution, there may be many parties contributing to the process of producing this output. Considering that the supply chain consists of suppliers and buyers with the common goal of providing products and services to the end customer, it can be understood that innovation is not an individual but a collective phenomenon. Therefore, institutions improve the innovation process by taking advantage of both internal resources and the collaboration of external actors (Zimmermann, et al., 2016).

Despite the importance of the relationships between supply chain management and innovation, there is no clear answer to the question, "What is the academic situation of this field, respectively?" Although there is a great deal of evidence about the importance of the participation of the supply chain members in the innovation process (Ageron et al., 2013; Arlbjørn & Paulraj, 2013; Bouncken, 2011; Oke et al., 2013), the amount of studies that predict this participation in what form or in which areas in the future will be relatively sparse.



As a relatively new approach, it would be beneficial to review the relevant research regularly to obtain an overall view of the intellectual structure in the field and to predict in which directions the field can proceed (Bakker et al., 2005; Line & Runyan, 2012). Due to the qualitative and subjective nature of previous literature review studies on supply chain and innovation (Leung et al., 2013), conducting a literature review through quantitative methods may facilitate the understanding of the nature of the relationships between studies in this area. Besides, the classification of published articles improves the connection between different research fields and enables academicians to position their contributions to the research field. The integrative role of the literature analysis is vital for the observation of the development of a scientific field (Denyer & Tranfield, 2006).

Currently, literature reviews on supply chain and innovation are generally based on methods such as co-authoring and citation (Ding et al., 2001; Leung et al., 2013). Related studies are general documentation of the studies in the field. It is imperative to provide a useful classification for mapping and evaluating studies to advise on the future of the area. Also, the dimension of time is an issue that should not be ignored.

In this study, articles published in the Web of Science database between 1996-2020 and covering the topics of supply chain and innovation were analyzed in order to reveal the patterns of supply chain management and innovation research, identify relative deficiencies and provide some guidelines. The reason to choose the Web of Science database as the source of articles is that it is accessible to everyone, and it includes many journals within the scope of SCI, SSCI, ESCI and AHCI. In order to reveal the course of the publications, the study was carried out in four time periods: 1995-2000, 2001-2006, 2007-2012 and 2013-2019. The tendency of the literature was tried to be determined by analyzing the co-occurrence of the keywords used in the specified period. The importance of co-occurrence analysis stems from its ability to demonstrate the integration of the mentioned concepts.

In this context, the problems of the research can be expressed as follows:

- Which concepts are enabling the integration of supply chain and innovation topics
- How has supply chain management and innovation context evolved?

Also, the contributions of actors who are influential in this field - researchers, journals and countries - over time are also among the topics evaluated within the scope of the research.



In the ongoing part of the study, primarily the literature on supply chain and innovation issues are included. Then there is the methodology and findings section. In the last part, the outputs, limitations and suggestions obtained from the research are mentioned.

2. LITERATURE REVIEW

The essential opinion defended by the management in a supply chain is to offer the product and the service at the lowest price possible. When this is understood, a strong bond between the individuals who constitute the supply chain could form, and long-term relations between these individuals would be established to provide a maximum competitive power (Andraski, 1998).

The philosophy behind supply chain management is to emphasize the necessity of establishing a strong bond between the trading partners in order to boost the quality of the service provided to the client at the lowest cost. Companies need integration between suppliers and customers along the line, starting from the supply of the raw materials to offering the products and services to the customers (Stank, 2001). One of the main tools where supply chain relations are used is in information technology. The integration of information technology into a company's operations requires expenditure. Cooperation within supply chains can, at the same time, result in increased coordination, reconciliation and flexibility costs (Cao & Zhang, 2011).

When one considers that suppliers tend to contribute to the innovative processes of buyers due to internal dynamics, it becomes necessary for both sides to interact with each other (Schiele, 2006). Suppliers who have advanced innovation techniques are expected to contribute more to innovations for the purchaser (Pulles et al., 2014). Suppliers play a significant role in developing and marketing innovative products. Besides, suppliers represent a resource for the development of product innovation. In the literature, it has been stated that suppliers are the most enthusiastic about making investments in technology. When buyer-supplier relations are based on strategic cooperation and are open, suppliers share their ideas with their customers. Innovation by suppliers directly influences the performance of the buyer because the product of the supplier is embedded in the product of the buyer (Jajja et al., 2017).

Developing and realizing innovative ideas increase the activities of both suppliers and the purchasing companies and make them stronger as against their rivals; and as a result of this, customer satisfaction and performance of the company increases (Porter, 1990). Due to increasing global competitiveness in the modern age, companies now need to renew themselves



in order to keep up with changes in the world and to produce high-quality products. In an environment experiencing more dynamic conditions, companies need to form a more robust supply chain in order to estimate the demand for customer satisfaction and to survive in this competitive environment (Lii & Kuo, 2016). The primary goal of institutions is to decrease costs and to circulate their products and services within the supply chain in order to keep their customers satisfied. The fact that the lifetime of products has become shorter has increased the significance of Supply Chain Management.

It is generally stated in the literature that supplier sourced innovation will contribute to the performance of the central business in a chain (Veugelers, 1997). Outsourced innovation enhances central business' capabilities to the extent that contributes to the learning process (Quinn & Hilmer, 1994). Components provided by innovative suppliers increase the performance of the products they contribute. Process innovations of an innovative supplier can reduce production costs for the central business. Therefore, the procurement strategy must consider the innovative identity of the suppliers (Chesbrough & Schwartz, 2007).

Innovations, effective product launch and new product development activities significantly affect the competitiveness of organizations in the market (Story et al., 2015; Wagner & Hoegl, 2006). The tremendous technical knowledge required to develop new products in order to respond to the demand in the market in a short time pushes businesses to cooperate with suppliers during the development of new products. Manceau et al. (2012) states that firms have to establish trust-based relationships with partner organizations in the supply chain system in order to innovate efficiently and effectively. Collaborations allow open innovation, a critical phase in the service or product development process. Narayanan et al. (2015) stated that the partnership's impact on performance in the focal enterprise-supplier relationship could be neutral, positive or negative, depending on the extent of trust. A high degree of trust in the focal business-supplier relationship will provide open communication and a tendency to take risks.

Although examining the current literature reviews on the subject is not one of the main aims of the study, it is a crucial component to reveal the situation in the literature. Thus, the specificity of this study and its contribution to the literature can be put forward more clearly. In the supply chain literature, most studies on the subject refer to supply chain management, innovation, and sustainability issues separately (Gao et al., 2017). These studies reveal many outputs on all three subjects.



The existence of various outputs and opinions in terms of the effects of innovation in the context of supply chain management makes a comprehensive literature review even more necessary. Besides, although there are many literature reviews in the field of the supply chain, the proportion of literature reviews explicitly made for the innovation concept is very low. As to our knowledge, no study in the literature was highly similar to our study. Researchers have generally put forward studies focusing on a specific supply chain area (e.g. green supply chains (Srivastava, 2007)), industry (e.g. food supply chains (Nosratabadi et al., 2020)), or innovation type (e.g. product or process innovation (Marzi et al., 2017)), rather than taking a holistic view of supply chain and innovation concepts.

Studies that deal with the subject from our point of view and are thought to have made the most significant contribution to the relevant literature in this regard, Gao et al. (2017), Tebaldi et al. (2018), Wong and Ngai (2019), Yuan et al. (2019), Zimmermann et al. (2016). Zimmermann et al. (2016) dealt with the aspect of innovation being affected by external factors and examined the articles investigating the effects of supply chains on firm innovation performance. The starting point of the researchers is the view that a company cannot have all the resources required for the innovation process. Therefore, companies will use external resources to improve the innovation process and achieve higher performance. Companies that make up the supply chain come first among these external resources.

The researchers emphasized the situations in which the multi-participant innovation process was affected positively and negatively throughout the supply chain and tried to reveal the necessary strategies for companies to manage this process correctly based on the literature. Gao et al. (2017) examined the relationship between the concepts of supply chain, innovation and sustainability. They revealed the distribution of the articles they chose on the subject according to the sector, country and research methodology. In addition, the authors classified the types of innovation examined in the articles they chose in terms of incremental and radical and emphasized the innovation theories discussed in terms of sustainability.

Tebaldi et al. (2018) analyzed the literature on sustainable supply chains and innovation and presented a study similar to Gao et al. (2017). Wong and Ngai (2019) categorized published articles on supply chain innovation in terms of organizational action, outcome and output. The authors examined innovation under three headings in terms of organizational action. These headings are logistics-centered innovation activities, marketing-centered innovation activities and technological development-centered innovation activities.



According to the authors, the outcome obtained as a result of innovation activities is production efficiency and service efficiency. The authors classify the outputs of this process under three categories: economic, environmental and social. Yuan et. al. (2019) conducted a bibliometric study and tried to reveal the cooperation network between countries and authors. Also, the authors tried to identify the prominent topics in the relevant literature by dividing the dataset into two periods (1987-2011 / 2012-2018).

Although our study is similar to the other studies mentioned above, it differs from the others in terms of dataset creation, analysis method and outputs. In these studies, the authors kept the search terms very limited. We think that the reason for this is to exclude articles that are not related to the subject. However, this constraint also includes the possibility that some articles that should be in the data set may be overlooked. For example, the terms "product development" or "new product" contains innovation semantically.

Although there is no term innovation in the title, summary, or keywords, there are studies that emphasize innovation in the supply chain (e.g. (Tang et al., 2009)). Besides, a direct search for the term "innovation" may exclude the articles (e.g. (Hilletoft & Eriksson, 2011)) in which the concepts of "innovative" or "innovativeness" are used instead of "innovation" in the title, abstract or keywords.

When the above studies are examined, we can see that these two concepts are evaluated only in the study of Zimmermann et al. (2016). This situation may cause some studies that are considered to be important in terms of the literature to be excluded from evaluation. For example, Wong and Ngai (2019) did not mention a detailed data collection process in their study. The authors stated that they conducted a literature review on the concepts of "supply chain, innovation, supply chain innovation, instrument development, scale validation, and measurement model" and that they created the data set as a result of this search.

The dataset of the authors starts in 1999, and the authors describe the work of Desbarats (1999) as the first leading paper. However, in our screening, we come across the work of Ragatz et al. (1997). When this study is examined, it will be seen that it is an important study in terms of the literature.

3. METHODOLOGY

In this paper, a bibliometric analysis of 1132 articles published between 1996-2020 on the "supply chain" and "innovation" subjects in the Web of Science Core Collection was performed. In this context, in order to determine the articles written on related subjects, using



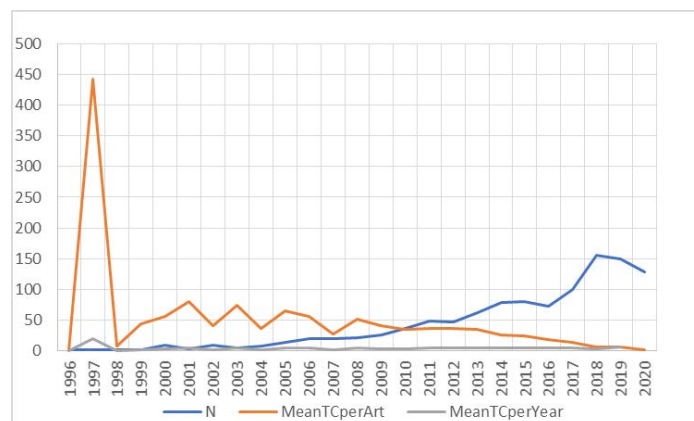
the search command "TS = (" supply chain ") AND TI = (innovat *) AND DOCUMENT TYPES: (Article)" in the advanced search section of the Web of Science database, At the same time, studies containing the concept of innovation in its title were determined. Later, considering their direct relationship with innovation, the search was repeated by substituting the terms "new process", "new product", "process develop *" and "product develop *" for "innovation *". Later, by combining these five search results and deducting the repeated studies, 1132 works were reached as of 14.09.2020.

Bibliometrix and biblioshiny tools with R source code were used for the analysis and visualization of the obtained data. Although many different tools can be used in the bibliometric analysis, the fact that the biblioshiny package contains most of the analyzes needed and its success in visualization can be presented as a reason for its use in this research.

The findings of the study include the distribution of the publications included in the data set by years, countries, universities and journals, and the map and thematic evolution of the keywords in the data set. In addition, the contributions of these publications to the relevant literature in the context of the citation levels by years, the level of influence of the journals and the citation levels of the countries are also given in the findings section of the study.

4. FINDINGS

The number of studies in the data set by years is indicated by the blue line, the total number of year-based citations of these publications with the orange line and the average number of citations per year with the grey line. It is seen that studies examining supply chain and innovation issues together started in 1996. As it is a new concept, the number of citations received in the early periods is relatively high.



Graph 1: Supply Chain-Innovation Concept Research Documents 1996-2020

In the following years, when it comes to 2010, it is seen that the number of published works exceeded the average number of citations received. The reason could be the decrease in the visibility of the works with the increasing number of publications. However, as it is a field and concept continues to develop, it is seen in Graph 1 that the increase in the number of publications continues despite the decrease in speed.

Country Statistics

When examined in terms of countries, it is seen that the studies published in the supply chain innovation concept are mostly realized in China. In Figure 1 colors show a transition from dark blue to grey depending on the number of publications. In this context, it is expected that China and the USA, which are the world's largest exporters, have darker colors on the map.

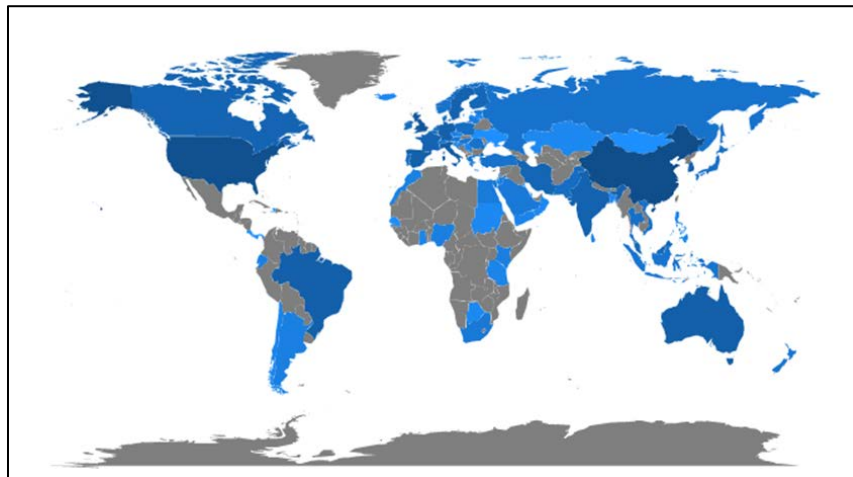
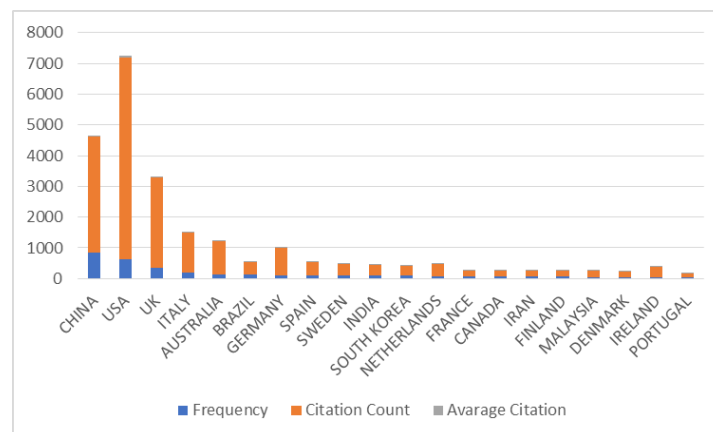


Figure 1: Supply Chain-Innovation Concept Scientific Production Distribution

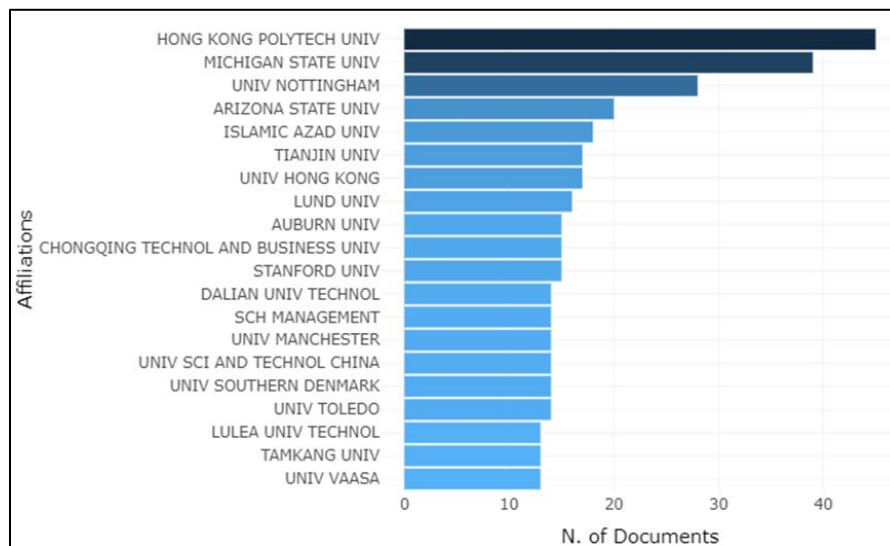
Although China ranks first in terms of number of papers, it lags behind the USA in terms of number of citations per work. While the blue parts of the columns in Graph 2 indicate the total number of papers on country basis, the orange parts show the total number of citations.



Graph 2: Publication and Citation Numbers of Countries

According to Graph 2, the fact that the USA is ahead of China in terms of number of citations can be interpreted as being more effective in the academic platform. In addition to these countries, the United Kingdom and Italy have an important place in terms of the studies and citations received in the supply chain and innovation concept. Again, considering the export dimensions of these countries, it is a predictable situation.

The top 20 universities, which are the centers of academic studies, are listed in Graph 3 according to the number of works published in the concept of supply chain and innovation.



Graph 3: Supply Chain-Innovation Concept – Top 20 Universities

According to Graph 3, the most active university in this field is Hong Kong Polytech University. Among the top 20, universities of Chinese and US origin are concentrated, while from different countries such as Islamic Azad University (Iran), Lund University (Sweden), University of Southern Denmark, University of Toledo (Spain), Lulea University (Sweden), and University of Vaasa (Finland). Universities are also active in this field.

The identity, structure and activities of the country have a guiding characteristic for academics and universities. Although it is expected that the works produced by universities and countries in the context of supply chain and innovation are in proportion to their exporter identities, it is also an indication that the academic community is not disconnected from the market.

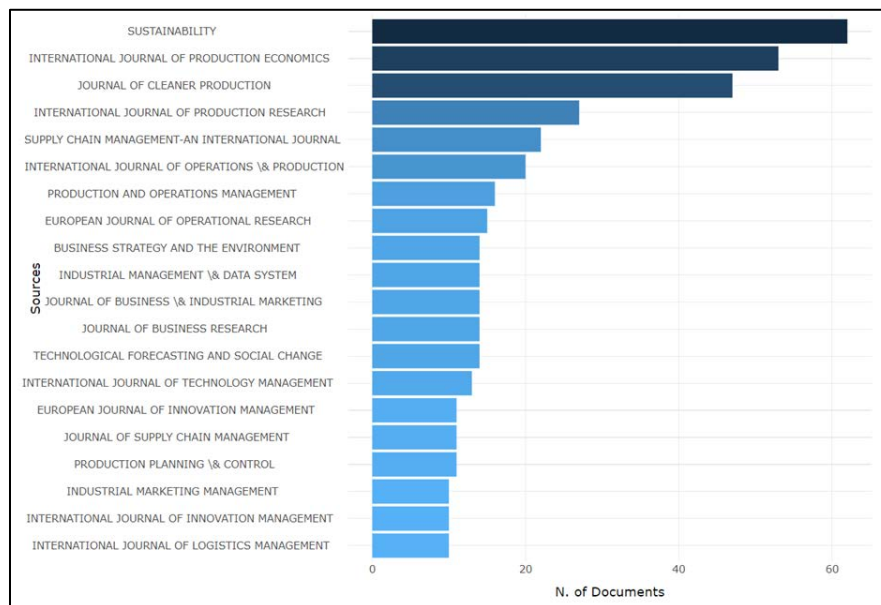
Journal Statistics

One of the main pillars of the development of an academic field is the structure of journals published in the related field. Among the factors that determine how many people will



reach the paper or how effective it will be, are the qualifications of the journal it is published in (Kim et al., 2020). The frequency and impact levels of the studies dealing with the supply chain and innovation concept discussed in this study were examined in the context of the journal.

The ranking of the first 20 journals according to the number of publications is given in Graph 4 Sustainability was determined as the journal with the highest number of works published in the related concept. Other journals that are most active ones in the field are International Journal of Production Economics and Journal of Cleaner Production.



Graph 4: Supply Chain-Innovation Concept – Top 20 Journals

Sustainability was the journal that gained the most significant momentum in the related concept. Although it started to operate later than other magazines in terms of entering the field, it has become one of the most active sources in the supply chain and innovation concept since 2016.

There are quite a few different tools available to measure the effectiveness of an academic study or journal. The H index is among the most widely used tools today. The advantages of the H index over other tools include its objective, testable and understandable features (Costas & Bordons, 2007). The ranking of the journals according to their H indexes regarding the works published in the supply chain and innovation concept is given in Graph 5 below.



Graph 5: Journal H Indexes

Considering the H index as a criterion, International Journal of Production Economics ranks first in terms of impact level. Another journal that has a high impact in terms of citation distribution is the Journal of Cleaner Production. Sustainability journal, which ranks first in terms of number of publications and development, is in the middle in terms of H index.

Keyword Analysis

Keyword refers to the concepts covered by an article and is a summary of the topic covered. Therefore, the analysis of keywords in the relevant literature in a particular field helps to examine research topics in this area. The word tree map created for the keywords of the papers published on supply chain and innovation in the Web of Science has been shaped as follows.

Since the supply chain and supply chain management in the second column of the map are considered as two separate subjects, these expressions are not subjected to the merging process. Although the concepts of “new product development” and “product development” have similar characteristics when considered in the context of innovation, they have been evaluated separately in terms of being two different subjects.

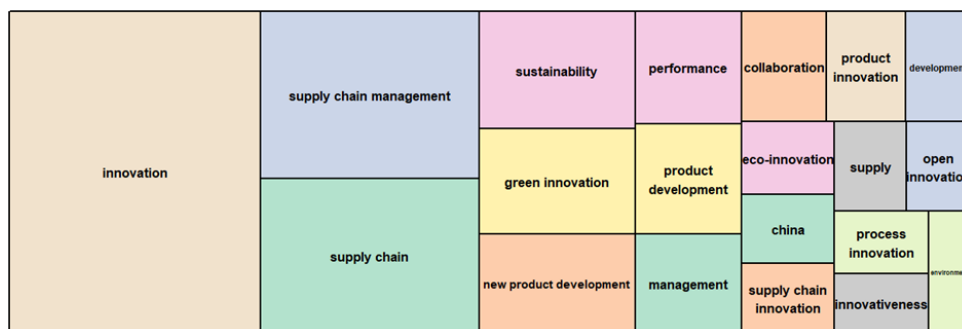


Figure 2: Treeword Map of Supply Chain-Innovation Concept

The frequencies of keywords in the data set in Figure 2 are given in Table 4. As seen in both the word tree map and the frequency table, the most relevant concepts in supply chain and innovation issues are sustainability and green innovation. Based on changing environmental awareness, both consumers and producers prefer sustainable business plans in the long term. There is no consensus here on which side leads the other.

In other words, is the preferences of the consumers driving the producers towards green innovation, or does the producers' use of green innovation and sustainability as a social marketing tool lead consumers to these preferences? Although the answer to this question is a different research topic, it can be easily stated that green innovation and sustainability are of great importance in supply chain and innovation.

Table 4: Keyword Frequencies

Keywords	Frequency	Keywords	Frequency
Innovation	276	Product innovation	30
Supply chain management	125	Development	25
Supply chain	115	Eco-innovation	23
Sustainability	63	China	22
Green innovation	56	Supply	22
New product development	53	Supply chain innovation	22
Performance	41	Open innovation	20
Product development	40	Process innovation	20
Management	36	Innovativeness	19
Collaboration	32	Environment	18

In bibliometry, cluster analysis is created by statistically processing the network structure of keywords according to the frequency of using them together in order to obtain a smaller and simpler view. The basis of cluster analysis is to treat high-frequency keywords as a class and to combine the related categories after the statistics of these classes are calculated. This process is done by the program until each keyword is included in the relevant category. The tree dendrogram is shaped according to the findings (Cobo et al., 2011; Ding, 2011).

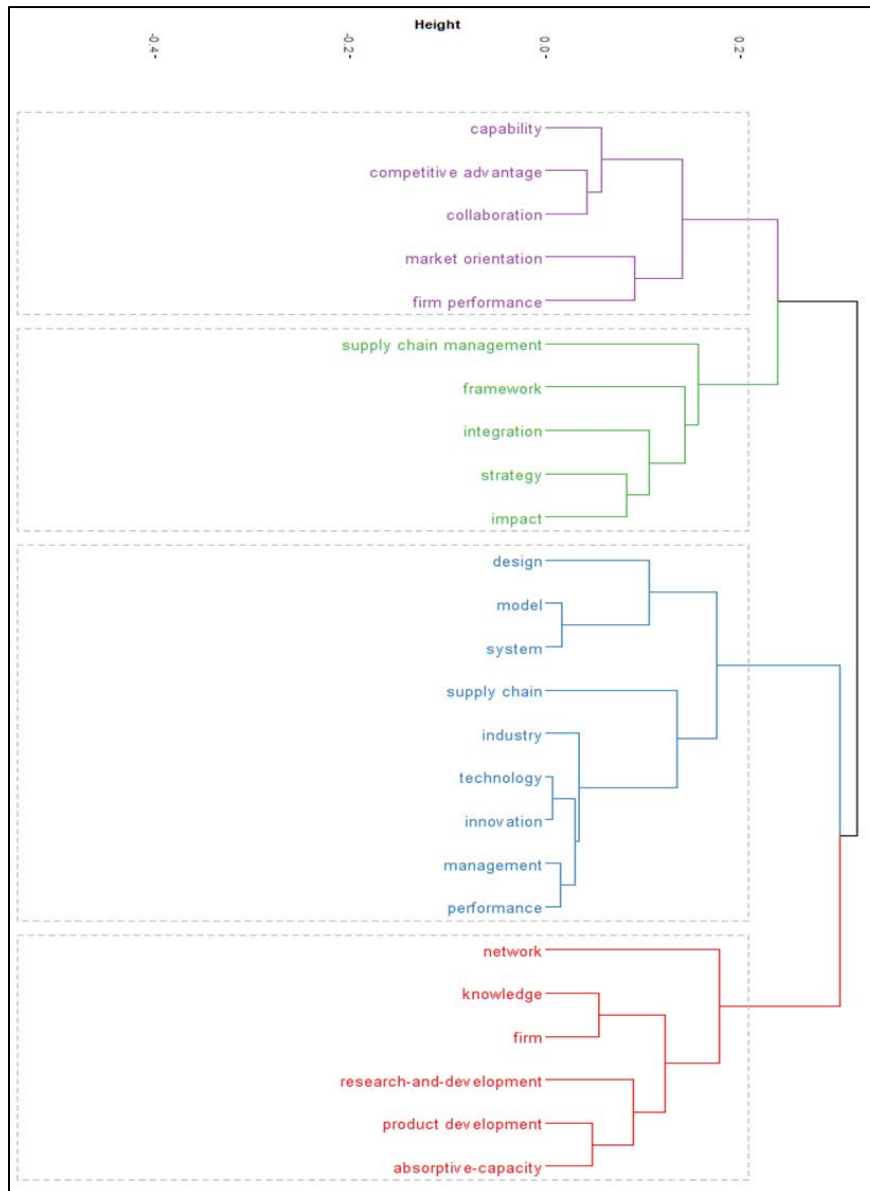


Figure 3: Tree Dendrogram of Clustering Analysis of Keywords In The Field of Supply Chain-Innovation

Multidimensional scaling analysis is an exploratory data analysis method that enables the reduction of dimensions for localization, analysis and classification of the variables of the universe while preserving the relationship between the investigated phenomena. In the graph resulting from the multidimensional scaling analysis, the analyzed keywords are distributed on the plane, and the relative position of each keyword reflects the convergence between keywords. The more converging words form a cluster. A keyword is a basis for the relevant literature to the extent that it is close to the middle of the cluster (Hoffman & Leeuw, 1992).

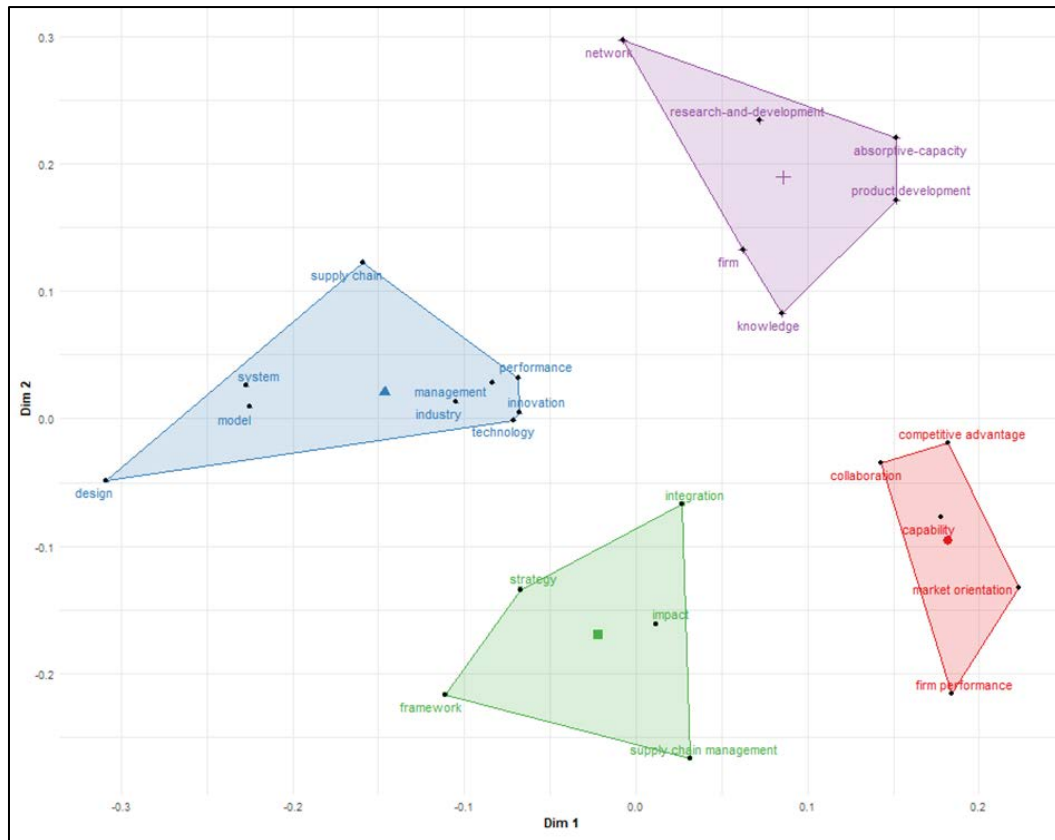


Figure 4: Multidimensional Scaling Analysis of Supply Chain-Innovation Concept Keywords

The categories presented visually in Figure 3 and Figure 4 represent the categories of the relevant literature in the context of supply chain and innovation. The first category in the field, which is reduced to four dimensions, is shaped around abilities. The first category also includes external factors such as market orientation and cooperation. When considered from the perspective of a firm, cooperation and competitiveness are criteria that affect its relations with the market and thus, its performance (Allred et al., 2011).

In the second category, supply chain management is observed as the most dominant node. If the firm sees supply chain management as a part of its strategic plans and handles its different strategies in a holistic framework, it will increase the probability of reaching the targeted strategies (Sukati et al., 2012).

In the third category, the management element is in the center. The management concept, in which the firm structure, innovation, supply chain, performance, and technology gather around, maintains its importance in the context of supply chain and innovation. The critical impact of senior management's influence on all other units (Schultz et al., 2019) is among the results of this study.

In the fourth and last category, it is a research and development center. The concept of research and development, which gathers the cognitive abilities and absorptive capacity of the firm, also has an impact on the networking behavior of companies. The fact that the R&D activities exceed the capacity of the firm in many cases may bring along a tendency to cooperate (Czarnitzki et al., 2007).

With thematic evolutionary analysis, the changing rules, evolutionary relationships and trends of thematic content, power and structure that have emerged in the literature over time can be revealed. Using thematic evolution analysis, outputs such as visualizing the development in the field, in which direction this development took place, and making future inferences about trends in the field can be obtained (Cobo et al., 2011).

Each node in the thematic diagram represents a topic, and the size of the node varies in proportion to the number of keywords included in the theme. Connections between nodes express the evolutionary aspect of the concepts discussed. The historical continuity of these connections is an indication that the concepts continue to be important in terms of space over time. The color difference in the connecting lines makes it possible to separate. The thickness of these lines indicates the number of keywords shared. That is, the stronger the connection between the subjects, the wider the line (Cobo et al., 2011).

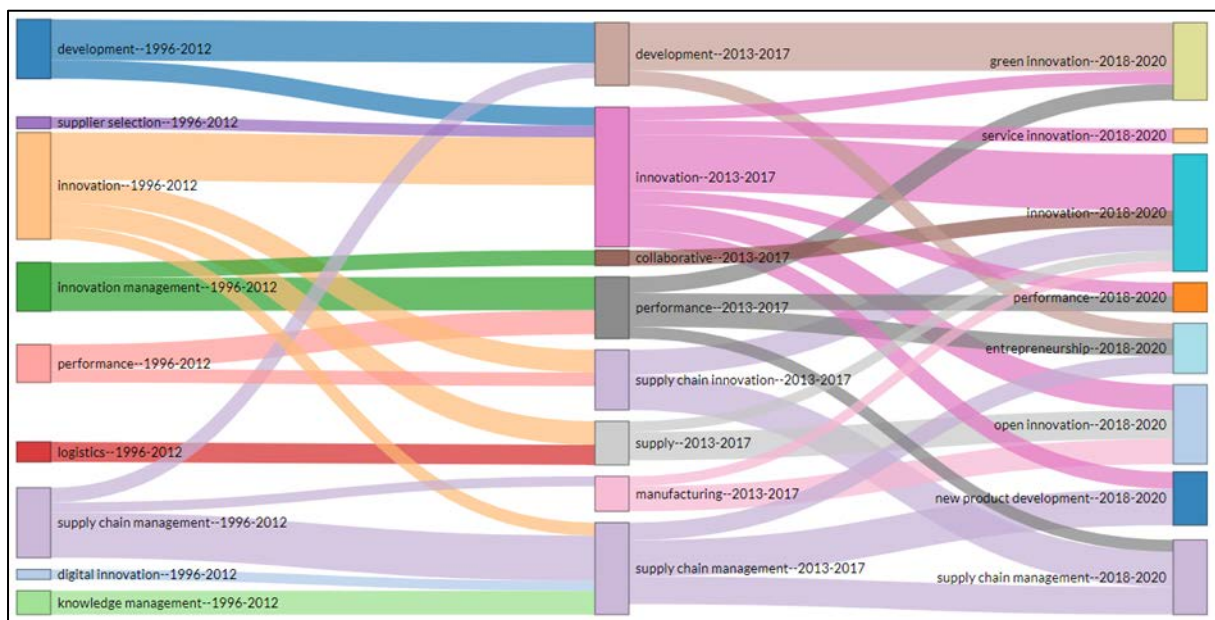


Figure 5: Thematic Evolution of Supply Chain-Innovation Concept

Between 1996-2012, which was considered as the first period, while observing the topics development, performance, knowledge management, etc., the concepts of innovation and supply chain will be interpreted due to the scope of the research. The concept of innovation;

Innovation (2013-2017) constitutes the basis for supply chain innovation, supply and supply chain management concepts. Supply chain management observed between 1996-2012; development, production, and supply chain management (2013-2017) concepts.

The concept of innovation examined in the second period; while providing resources for green innovation, innovation, service innovation, performance, open innovation, and new product development concepts, it is influenced by the concepts of development and supplier selection and innovation (1996-2012).

The concept of supply chain management in the second period is influenced by entrepreneurship, supply chain management (2018-2020), and new product development topics, while innovation (1996-2012) affects supply chain management (1996-2012), digital innovation and information management concepts.

Although many types of innovation emerged between 2018-2020, the third and last period, it is seen that the concept of innovation, which was addressed in line with the purpose of the research, was affected by innovation (2013-2017), collaboration, supply chain innovation, supply, and production. Performance, supply chain innovation and supply chain management (2013-2017) affect the concept of supply chain management between 2018-2020.

When the flow is given in Figure 5 is examined, it can be stated that while the main issues in the field maintain their importance, it can be stated that there is an intense enrichment especially in innovation. Considering the effects of innovation on sustainability, it is predictable to gain importance in every field. However, based on the findings obtained within the scope of the research, it can be argued that the recent innovation types are more than the changes based on the purely technical dimension dealt with in the classical product development processes. In this period, social and environmental-themed innovations come to the fore. In other words, it is no longer sufficient to increase the efficiency of innovations regarding a product or a process; it becomes a necessity (Berrone et al., 2013). Today, what is expected from innovation is not only to increase efficiency but also to contribute especially to the environment. If this trend continues in the future, it is possible that the effect of environmental awareness on product development processes will increase.

When the interactions of supply chain management are examined, it is seen that the concept of performance is useful in all periods. Besides, due to its effects on entrepreneurship and new product development, it is possible that supply chain management can be carried out more effectively by including it in the innovation processes of the supplier (Kim, 2000).



5. CONCLUSIONS

Innovation is a topic that is frequently studied by both markets and academics. However, the increase in the number of studies conducted is far from meeting the need in this field. As a result of the shortening of product life cycles in current market conditions, companies are obliged to continuously innovate in order to sustain their existence. Increasing raw material and resource diversification requirement due to the increasing need for innovation made it necessary to examine and understand the supply chain in the context of innovation.

Accordingly, as a result of this study, in which bibliometric analysis of works published in the context of supply chain and innovation, it was observed that the number of works in the relevant field is in an increasing trend. The countries with the largest share in this increase have been identified as China and the USA. As the largest exporters in the world, it is expected that these two countries will be influential in the literature. While China ranks first in terms of the number of published works, the USA stands out according to the citations of the relevant works. Just to state that the qualities of the studies are different, may cause many dimensions of the phenomenon to be overlooked. For example, the fact that the visibility of journals operating in this field affects the possibilities of citation of the papers they contain is ignored. In this context, the fact that US-based academic journals are more accessible in terms of having a more rooted history results in more citations for the papers published in these journals.

The analysis for determining effective universities in the field reveals a number of exceptions, albeit in a similar direction to the analysis for countries. It is also observed that universities operating in China and the USA are effective in terms of works published in the context of supply chain and innovation. At the same time, it has been determined that various European countries and Iran are included in this list. One of the common features of these countries is that they are not members but centers in the supply chain. These countries play a critical role in know-how process in the supply chain in the context of their region. Of course, there are many other academicians from many different countries and universities who have worked in this field. However, these studies are the results of individual efforts and far from an institutional direction.

The qualifications of journals in which academic studies are published are among the factors that determine the visibility of the relevant paper, the number of citations and the level of impact. Therefore, journals must also be covered when examining a field in a bibliometric context. The most effective journals in the context of supply chain and innovation are



Sustainability, International Journal of Production Economics, and Journal of Cleaner Production. In the valuation of academic journals, criteria such as impact factor, indexes, and H indexes are used. Within the scope of this research, H indexes were presented in the context of the number of works published on the relevant subject in the context of the contributions of journals to the field. Since the H index is a scale that changes depending on time and activity, Sustainability magazine, which ranks at the top in the number of publications, fell behind the International Journal of Production Economics in the H index.

The word tree and frequencies are primarily used in word analysis. Apart from the search terms supply chain, innovation, and new product development, the most frequently used terms are sustainability, green innovation, and performance. Another remarkable point in the word tree is the use of concepts such as both product development and new product development. Despite their similar features, these concepts are separable in terms of their output. Therefore, they do not need to be merged while cleaning the data set.

As a result of clustering the keywords in the data set and subjecting them to multidimensional scaling analysis, four primary categories were obtained. These categories were shaped within the framework of capabilities - collaboration, supply chain - strategy, management - performance, and R&D - cognitive abilities. Multidimensional scaling analysis makes a significant contribution in terms of showing the effect of supply chain and innovation on the functions of the organization.

It is possible to reveal the change and development of the field with the thematic evolution analysis. Considering the diversity of topics created by the related concepts in the studies conducted in the context of supply chain and innovation, it can be predicted that there will be more developments in innovation types in the coming period. The fact that innovation should be more than just product or process improvements, there is a tendency to be more sensitive to people and the environment, turning innovation into a tool to reach a more sustainable business model.

The supply chain is not outside this framework. On the contrary, the concept of innovation has become more critical than ever in supply chain processes due to the need to streamline the increasingly complex procurement processes. In the current situation, the performance of the supply chain and innovation literature, which is in the process of development, is promising, but far from reaching saturation yet. Considering that the areas



covered by innovation touch every part of life, we can conclude that many of the points that need to be investigated are not adequately studied.

Within the scope of this study, it has been observed that the works published in the context of supply chain and innovation deal with fundamental issues such as performance, collaboration, and development, as well as a flow towards topics such as green innovation, service innovation, and open innovation. In case this trend continues, it is possible to encounter different concepts and types of innovation in the future.

The most important constraint of this study is that, at the same time, one of its most important criteria, the studied papers are included in the context of supply chain and innovation. More inclusive results can be obtained in a study that examines the relationships with different fields or topics together.

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