

SUPPLY NETWORKS: STRUCTURES, STRATEGIES AND RESEARCH TRENDS

REDES DE SUPRIMENTOS: ESTRUTURAS, ESTRATÉGIAS E TENDÊNCIAS DE PESQUISA

REDES DE SUMINISTRO: ESTRUCTURAS, ESTRATEGIAS Y TENDENCIAS DE INVESTIGACIÓN

 <https://doi.org/10.56238/sevened2025.036-010>

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ABSTRACT

Supply Networks (SN) represent one of the most dynamic and strategic areas of supply chain management, encompassing complex interactions among suppliers, manufacturers, distributors, customers, and institutional actors. Despite the growing relevance of the topic, there are still few reviews that synthesize the state of the art and point to directions for future research. This article aims to classify, analyze, and discuss the main contributions of the literature on SN, proposing conceptual and methodological insights to guide new studies. The research was conducted through a systematic literature review, based on the Scopus database, which initially resulted in 2,901 publications. From alignment filters, scientific recognition, and full-text reading, 12 core articles published between 1987 and 2014 were selected. The findings reveal that most investigations focus on the focal firm's relationships with upstream suppliers, as well as on structural analyses of the network as a whole, with significant gaps in studies addressing downstream customers and the interaction of SN with the external environment. Emphasis was also observed on themes such as outsourcing, internationalization, knowledge transfer, and mathematical modeling, yet with limited exploration of emerging topics such as sustainability, resilience, digitalization, and interorganizational governance. As a contribution, the study organizes the conceptual field of SN, highlights research gaps, and proposes an agenda that considers empirical, sectoral, and interdisciplinary approaches. It concludes that the consolidation of the supply networks concept depends on its integration into contemporary challenges, such as Industry 4.0, the circular economy, and cooperation among distinct networks.

Keywords: Supply Networks. Literature Review. Strategies. Governance. Research Trends.

RESUMO

As Redes de Suprimentos (RS) constituem uma das áreas mais dinâmicas e estratégicas da gestão da cadeia de suprimentos, abarcando interações complexas entre fornecedores, fabricantes, distribuidores, clientes e atores institucionais. Apesar da relevância crescente do tema, ainda são escassas as revisões que sintetizam o estado da arte e apontam direções para futuras pesquisas. Este artigo tem como objetivo classificar, analisar e discutir as principais contribuições da literatura sobre RS, propondo subsídios conceituais e

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metodológicos para orientar novos estudos. A pesquisa foi conduzida por meio de revisão sistemática da literatura, baseada na base Scopus, que resultou inicialmente em 2.901 publicações. A partir de filtros de alinhamento, reconhecimento científico e leitura integral, foram selecionados 12 artigos centrais publicados entre 1987 e 2014. Os resultados revelam que a maior parte das investigações concentra-se nas relações da empresa focal com fornecedores a montante, bem como em análises estruturais da rede como um todo, havendo lacunas expressivas em estudos sobre clientes (jusante) e sobre a interação das RS com o ambiente externo. Também se observou ênfase em temas como terceirização, internacionalização, transferência de conhecimento e modelagens matemáticas, mas ainda com baixa exploração de tópicos emergentes como sustentabilidade, resiliência, digitalização e governança interorganizacional. Como contribuição, o estudo organiza o campo conceitual de RS, evidencia lacunas e propõe uma agenda de pesquisa que contemple abordagens empíricas, setoriais e interdisciplinares. Conclui-se que a consolidação do conceito de redes de suprimentos depende de sua integração a desafios contemporâneos, como a Indústria 4.0, a economia circular e a cooperação entre redes distintas.

Palavras-chave: Redes de Suprimentos. Revisão de Literatura. Estratégias. Governança. Tendências de Pesquisa.

RESUMEN

Las Redes de Suministro (RS) constituyen una de las áreas más dinámicas y estratégicas de la gestión de la cadena de suministro, abarcando interacciones complejas entre proveedores, fabricantes, distribuidores, clientes y actores institucionales. A pesar de la creciente relevancia del tema, todavía son escasas las revisiones que sintetizan el estado del arte y señalan direcciones para futuras investigaciones. Este artículo tiene como objetivo clasificar, analizar y discutir las principales contribuciones de la literatura sobre RS, proponiendo aportes conceptuales y metodológicos para orientar nuevos estudios. La investigación se llevó a cabo mediante una revisión sistemática de la literatura, basada en la base de datos Scopus, que inicialmente resultó en 2.901 publicaciones. A partir de filtros de alineación, reconocimiento científico y lectura completa, se seleccionaron 12 artículos centrales publicados entre 1987 y 2014. Los resultados revelan que la mayoría de las investigaciones se concentran en las relaciones de la empresa focal con los proveedores aguas arriba, así como en análisis estructurales de la red en su conjunto, existiendo vacíos significativos en estudios sobre clientes (aguas abajo) y sobre la interacción de las RS con el entorno externo. También se observó énfasis en temas como la subcontratación, la internacionalización, la transferencia de conocimiento y los modelos matemáticos, aunque con poca exploración de temas emergentes como la sostenibilidad, la resiliencia, la digitalización y la gobernanza interorganizacional. Como contribución, el estudio organiza el campo conceptual de las RS, evidencia vacíos y propone una agenda de investigación que contemple enfoques empíricos, sectoriales e interdisciplinarios. Se concluye que la consolidación del concepto de redes de suministro depende de su integración a los desafíos contemporáneos, como la Industria 4.0, la economía circular y la cooperación entre redes distintas.

Palabras clave: Redes de Suministro. Revisión de la Literatura. Estrategias. Gobernanza. Tendencias de Investigación.

1 INTRODUCTION

Since the early 1990s, Supply Networks (SR) have inspired a number of academic studies and practical implications (STÄDTLER, 2005). In academia, researchers have taken multiple perspectives and developed many theories to understand the activities involved in interorganizational relationships (CHANG; CHIANG and PAI, 2012).

Several essential characteristics of SR have been investigated (CHANG; CHIANG and PAI, 2012). For Kothandaraman and Wilson (2001); Lamming; Johnsen; Zheng and Harland (2000), a company inserted in a business environment does not only act with linear relationships, but also with network relationships. This structure covers both the direct relationship (e.g. a single supplier and buyer relationship) and the multiple relationship (e.g. the network, upstream or downstream) (RITTER and GEMÜNDEN, 2003). Each particular type of relationship in an SR has a specific context and characteristics (CHANG; CHIANG and PAI, 2012).

In an attempt to synthesize the state of the art of the literature on Supply Chain, this work evaluated 2,901 publications related to the concept of business networks ((business OR supply OR enterprise) AND network) and the supply chain ("suppl* chain*"). Of these, only 12 publications that had a strong relationship with the research theme were selected for a thorough evaluation. The literature analyzed made it possible to structure a general picture of the research situation as well as a view of the development of this field of research. In addition, at the end, several ideas are suggested for future research that can contribute to the evolution of the concepts of Supply Networks. It is hoped that this research will serve as a work roadmap and help to further stimulate the interest of academics and practitioners in this field.

The article is organized as follows. Section 2 presents the research methodology and the stages of obtaining the bibliographic portfolio. Section 3 presents a brief conceptual discussion of Supply Networks and the classification system of the analyzed articles. In section 4, an analysis of the publications is made and in section 5, the results are discussed. Finally, in section 6, the final considerations and suggestions for future research are made.

2 METHODOLOGY

The construction of the bibliographic portfolio made use of a methodological procedure based on the proposal of the Laboratory of Multicriteria Methodologies in Decision Support at UFSC (LAbMCDA), employed by Vieira (2012), allowing a reliable literature review. The

method consists of eight steps: definition of databases, definition of keywords, search and filtering in the database, selection of articles by alignment of title to the search, selection by scientific recognition, recapping of excluded references, reading of abstracts and, finally, full reading.

The SCOPUS database was chosen to carry out the research, since it encompasses the most relevant journals in the field of Production Engineering and Logistics (VIEIRA, 2012).

Two groups of keywords were defined: the first addresses the concept of business networks ((business OR supply OR enterprise) AND network) and the second deals with the supply chain ("suppl* chain*"). Another important point is related to the selection by scientific recognition, only articles between the years 1987 and 2009 were selected, given that the most recent articles (last five years) have not yet had the opportunity to be cited in new publications. Thus, articles from the period from 2010 to 2014 were filtered exclusively through the alignment of the title with the research theme. The specific procedures are found in Table 1:

Table 1

Methodological Procedures

Steps	SCOPUS
Search and Filtering	<u>Filters:</u> -Research sub-area: <i>Business, Management and Accounting; Engineering; Decision Sciences; Social Sciences; Economics, Econometrics and Finance; Multidisciplinary; Undefined;</i> -Language: English and Portuguese; -Document type: Article; -Year of publication: beginning in 1987; Result: 2,901 articles.
Selecting articles by title alignment	<u>Result:</u> 161
Selection by scientific recognition	<u>Search for citations:</u> Google Scholar <u>Pareto rule (1987-2009):</u> 80.06% of the citations corresponded to 26% of the articles; Result: 27 articles
Repechage of excluded references	<u>Selection by title of interest (1987-2009):</u> Those that deal with concepts and characteristics, as well as case studies. Result: 18
Reading abstracts	<u>Criteria:</u> concepts, characteristics, advantages/disadvantages or difficulties/facilities; case studies. <u>Total abstracts read (1987-2009):</u> 45 <u>Total abstracts read (2010-2014):</u> 33
Full Reading	Result: 35
Selected Articles	Result: 12

Source: The authors.

3 SUPPLY NETWORKS

3.1 CONCEPTS ABOUT SUPPLY NETWORKS

A network consists of a series of nodes connected by connections. In the case of business networks, nodes comprise the source of certain capabilities and resources, and links are the interfaces that allow these capabilities or resources to be applied to create value in the market (CHRISTOPHER and GAUDENZI, 2009).

Supply Networks are according to Chang; Chiang and Pai (2012), a set of supply chains, representing the flow of goods and services from the first supplier to the final customer. For Surana *et al.* (2005), the concepts of networks and supply chains are closely related: the supply chain is considered as a network with a high number of interactions and interdependencies between different entities, processes and resources. The network is characterized by being a non-linear structure, which encompasses several business levels, evolving and self-organizing based on the interaction between the structures present (organizations, flows, channels) and their function (objective) (LAMMING *et al.*, 2000).

Supply Networks comprise an important area of study in supply chain management. A supply network can be defined as a set of supply chains, representing the flow of goods and services from the first supplier to the end customer. (HARLAND, 1996). According to Lamming *et al.* (2000), the term "network" was incorporated into the supply chain in an attempt to make the concept broader and more strategic. Cunningham (1990) explained that networks would compete with networks, and not firms with firms. For this to occur, networks must be dynamic, reconfigurable, agile and adaptable: the network must perceive changes in the external environment and have the ability to respond efficiently and effectively to satisfy consumer demand (LAMMING *et al.*, 2000).

3.2 – Definitions of the article classification system

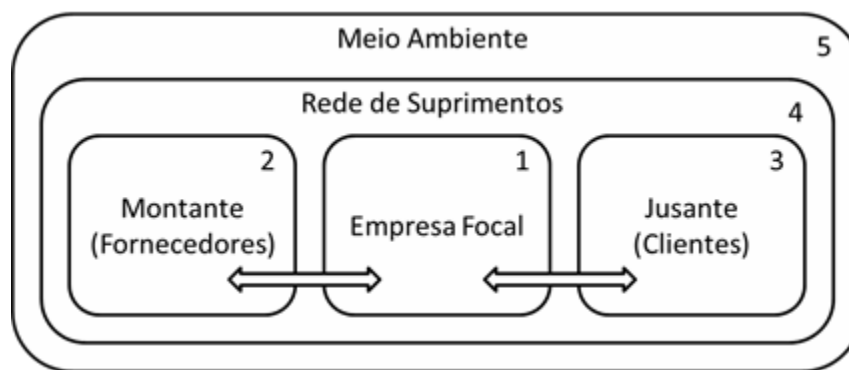
According to the research definition adopted in this study, Supply Networks (SR) are structured with business relationships between suppliers (upstream), manufacturer (focal company) and their distributors and customers (downstream) (CHANG; CHIANG and PAI, 2012; WATHNE and HEIDE, 2004). In addition, there is the environment in which other elements that can interact with SR are inserted, such as the government, other Supply Chains, suppliers or customers – commonly called *stakeholders* – that do not participate directly in the Network in question.

Based on this definition of Supply Networks, the analysis of the content of the works will be focused on these elements and their relationships. The reason for this approach is to

understand how and with what results knowledge about SR has developed. The main elements about Supply Networks (SR) are shown in the figure. 1, whose construction was guided by a review of the existing structures on inter-organizational relations, providing anchor points for organizing and analyzing the literature.

Figure 1

Structure for analysis of the literature on Supply Networks



Source: The authors.

In view of the complexity and diversity of studies that try to explain how relationships develop in a Supply Network, starting from the structure proposed in figure 1, we try to classify, analyze and provide subsidies that can guide future research on the subject. The analysis of the publications is done in the following section.

4 LITERATURE ANALYSIS

In the following sections, a review of the articles and their main contributions on the subject of Supply Chain is presented. Although this analysis is not exhaustive, it provides reasonable subsidies about the research carried out in the area. The articles were analyzed according to their units of analysis, shown in Figure 1.

4.1 FOCAL COMPANY (1) AND ITS AMOUNT (2)

Research on Focal Enterprises and their Montante (suppliers), within the context of Supply Networks, has attracted considerable attention among researchers, resulting in a significant amount of contributions dedicated to the analysis of the factors of the external and internal context that influence the structure and development of relationships in these parts of the Network.

With regard to the strategic factors that impact the relationship between the focal company and its upstream, according to Wathne and Heide (2004), the existing theory proposes several strategies or governance mechanisms that can be used to manage relationships with business partners. In general, two methods are the most used: the qualification of suppliers and incentive programs, especially in highly volatile markets with products with short life cycles (WATHNE and HEIDE, 2004). These two governance strategies were identified through a *survey* that was applied in a Supply Network of a U.S. apparel production chain involving 23 companies in this segment. As a result, Wathne and Heide (2004) were able to prove that supplier qualification and incentive programs are two important strategies when the Supply Network needs to be flexible and efficient, especially in the relations between the focal company and its upstream.

Another important element in the strategy of a Supply Network is related to supply policies. In this way, relationships between buyer and supplier can be directed, reducing future uncertainties of information, technology and costs (WATHNE and HEIDE, 2004).

A practice that can help companies benefit from competition among their suppliers is outsourcing, also called *Sourcing* (BALDWIN and CLARK, 2000), but it does not work effectively without a broad effort from the focal company (TAKEISHI, 2001).

In view of this, Agrawal; Van Wassenhove and De Meyer (2013), discuss a Supply Network of the South Korean automobile industry manufacturer of heavy trucks. This Network is formed by a Focal company with 23 suppliers, and its main raw material is steel. This case study shows how the creation of a *Hub Sourcing* (raw material outsourcing department) can help reduce the final costs of the product in the Supply Network.

Hub Sourcing is maintained by the Focal Company and benefits all suppliers in the Network. The purchase of steel is carried out in a substantial quantity from a single supplier to the Focal Company that distributes the material as needed to its suppliers. This practice, which involves suppliers and suppliers' suppliers, has made it possible to reduce product costs by between 3% and 6% throughout the Network. In addition, such interaction helped disseminate information on market demand, production schedules, and new product introductions among all upstream partners (AGRAWAL; VAN WASSENHOVE and DE MAYER, 2013).

Another practice anchored in upstream outsourcing is the *triadic sourcing strategy*. This strategy is based on the creation and management of business relationships between a buyer and two suppliers that overlap in the partial supply of some resource (product and/or

service) (DUBOIS and FREDRIKSSON, 2008). In addition to considerably reducing the number of suppliers of a given item, it facilitates management by the buyer and provides a long-term relationship between partners. Another relevant point in this practice is related to the two suppliers who necessarily cooperate and compete to supply the resource and, in this way, exchange information, knowledge and technology to remain in business (DUBOIS and ARAÚJO, 2006).

In their research, Dubois and Fredriksson (2008) present, through a case study of Volvo, an automotive industry that applied the *triadic sourcing strategy* with two seat suppliers for its lines of utility cars. As a result of this application, the authors report that this practice provides suppliers with superior performance, as they are constantly being pressured by competition with each other. In addition, the frequent opportunities to win more business also motivate suppliers to perform well in their operations (DUBOIS and FREDRIKSSON, 2008).

In addition to applying *national sourcing*, there is the possibility of carrying out a third-party internationalization process. This practice has developed as an alternative strategy for Supply Networks, when it seeks to reduce production costs, improve flexibility, avoid labor or resource shortages, and be close to global markets (CAMUFFO *et al.*, 2006).

In their research, Camuffo *et al.* (2006), examined nine case studies of a network of Supplies of the textile and footwear industry in northern Italy to understand how the internationalization process of suppliers in this segment takes place. As a result, the authors identified three types of process: i) traditional subcontracting; (ii) coordinated subcontracting; and iii) relocation of the supply system. Regardless of the typology adopted by the companies, internationalization enables an increase in knowledge about other markets, customers and new sources of supply. These effects of internationalization have a direct impact on the sustainability of the competitive advantage of the companies that are inserted in the Supply Network (CAMUFFO *et al.*, 2006).

Still on outsourcing, a relevant factor that has challenged companies is the construction of knowledge within this process. This practice can be understood as the improvement resulting from the transfer of knowledge between companies, thus making it possible to effectively develop and manage Supply Networks. However, the way in which this knowledge is created, accumulated, shared and applied is still little explored by academic research (MASON and LEEK, 2008).

Mason and Leek (2008) try to fill this gap by analyzing how the transfer of knowledge between companies in an aerospace Supply Network occurs. The research is carried out in

a single case study in which the authors are able to identify four types of knowledge, *Know-How*, *Know-Why*, *Know-What*, and *Know-Who*, as well as two means of transfer, "*Hard*" and "*Soft*", which enable its development and sharing among companies. However, for the authors, their research is only an initial understanding of the topic within a Supply Network.

4.2 FOCAL COMPANY (1), ITS UPSTREAM (2) AND ITS DOWNSTREAM (3)

Research involving these three elements, from the perspective of the Supply Network, is little explored. In the *portfolio* of articles on the subject, only one work was found. This, in turn, proposes a conceptual model for the development of cooperation strategies as a means to enable the focal company to achieve competitive advantage with its partner companies (i.e., upstream suppliers and downstream customers).

For Chang; Chiang and Pai (2012), the focal company maintains different relationships through specific activities (e.g., knowledge transfer, complementary routines and resources, and capabilities) with upstream and downstream partners that form their own network environment. Therefore, an appropriate cooperation strategy must take into account the position of the focal company within the Supply Network, which can be one of dominance or obedience in relation to both upstream and downstream, or dominance on the part of the upstream or downstream (RITTER *et al.*, 2004). In addition to considering the focal company's position in the development of the strategy model, four determining factors must be worked on, namely: (1) relationship-specific assets, (2) knowledge-sharing routines, (3) complementary resources and capabilities, and (4) network position (DYER and SINGH (1998). These determinants can be a useful guide to how a particular company should cooperate with its partners (CHANG; CHIANG and PAI, 2012).

4.3 SUPPLY NETWORK (4)

In this item, articles are presented that discuss topics that cover the supply chain in a broad way, without looking at the elements in isolation within the structure. As presented in item 4.1 (articles on focal companies and their upstream), studies focused on the Supply Network, and not only on some elements that compose it, have attracted considerable attention from researchers.

This is proven by the quantity and diversity of research that was selected. Even so, little is known about the creation and management of Supply Networks. The path to building

the foundations of this strategic concept must take into account work carried out from different areas of interest, operations strategies, purchasing and business (HARLAND, 1996).

An initial discussion was held by the *Industrial Marketing and Purchasing* (IMP) group, providing the conceptual basis on business networks (HARLAND, 1996). In his research, Häkansson (1982; 1987) considered in his interaction model the context between customer and supplier and, later, added some key elements in this structure that the author called actors, resources and activities. However, this theory is of little help from a strategic perspective for Supply Networks, as it does not make it clear how they should be formulated or how they could be implemented (HARLAND, 1996).

In an attempt to contribute to this theme, Harland (1996) proposes a strategic model using the theoretical basis of operations and business strategies from the classical view of Porter (1985) and Ansoff (1991), structured in four elements derived from the works of Hayes and Wheelwright (1984) and Hill (1993), which are: *the decision elements of supply network strategies; the supply network strategy process; the supply network strategy hierarchy; and the supply network strategy implementation*. This model was tested in a single case study of a Supply Network in the health area, providing initial empirical support for the model, however, for the authors, research in other sectors is needed to enable a generalization of the use of the model.

A question that arises with the development of Supply Network Strategy models is how will these guidelines be deployed and managed? Currently, researchers from various areas of knowledge have been concerned with the development and understanding of this issue, among them are Häkansson and Snehota (1995), Harland (1996) and Verwaal and Hesselmanns (2004). For these authors, management is almost impossible due to the complexity and dynamic relationship between its actors, resources and activities that make up the structure (KNIGHT and HARLAND, 2005). However, there is evidence in longitudinal studies that the engagement of actors creates opportunities for planning and control (management) - an example is the case of Benetton presented in the work of Jarillo and Stevenson (1991).

In this context, Knight and Harland (2005) suggest, through a case study in a Supply Network in the health area, a model for its management. This was developed based on the work of Mintzberg (1990) and Snow *et al.* (1992), and has a framework of six functions in which it considers the Focal Company the proactive and dominant agent in the task of managing its Supply Network. These roles are defined as: *Network structuring agent, Co-*

ordinator, Advisor, Information broker, Relationship broker and Innovation sponsor. For the authors, this structure can be used to manage the entire Network, and may be constituted only by members of the Focal Company, or be formed by several members of different companies in the Network, or even be managed by an organization outside the network. However, other studies should be carried out to prove the efficiency of the model in situations different from the research carried out (HARLAND and KNIGHT, 2001).

In addition to the importance of issues related to the development of cooperation strategies and structures that enable their management throughout the Supply Network, Information Technology (IT) also plays a relevant role. For Surana, *et al.* (2005), with the advent of IT, Networks have acquired a complexity almost equivalent to that of biological systems. However, there are major challenges that need to be overcome, such as the implementation of coordinated tactics that consider adaptation, collective behavior, the logic of the Networks and their typology (SURANA, *et al.*, 2005; PATHAK; DILTS and BISWAS, 2007).

A key point to solve this problem is to consider the Supply Network as a *Complex Adaptive Systems* (CAS). The concept of CAS allows us to understand how Supply Networks evolve in a complex and dynamic environment and to identify patterns that emerge in such evolution (SURANA, *et al.*, 2005).

In their research, Surana, *et al.* (2005), carry out a conceptual theoretical survey on the subject to establish connections between the CAS tools applied in Supply Chain environments. As a result, this article provides some mathematical models that can be used for future research on this topic.

Pathak; Dilts and Biswas (2007) used CAS in conjunction with *industrial growth theory, network theory, market structure, and game theory* to perform the programming and optimization of Supply Networks. This method allows the generation of network typologies (structures), so that it is possible to analyze the possible factors that explain their evolution. Using data and parameters from the U.S. automotive industry, the authors are able to apply the method. As a result, they are able to show that certain environmental factors at the level of the companies that make up the network affect the evolution of such structures. However, other studies in areas other than the automobile industry need to be carried out to prove the efficiency of the method (PATHAK; DILTS and BISWAS, 2007).

Similarly, Nagurney; Dong and Zhang (2002) developed a mathematical model called the *Equilibrium Model of a Competitive Supply Network*, developed in *Fortran* language and

applied in the DEC Alpha software at the University of Massachusetts. To show the possibilities of the model, four numerical examples were used. As a result, it was possible to capture the independent behavior of the various actors within the network, as well as the effect of their interactions, providing bases for understanding the evolution of Supply Networks (NAGURNEY; DONG and ZHANG, 2002).

5 CONCLUSIONS AND DISCUSSIONS ABOUT THE ARTICLES ANALYZED

The discussion on the topic of Supply Networks (SR) can be considered recent, however, several of its essential characteristics have been investigated (CHANG; CHIANG and PAI, 2012). As this research is a bibliographic review on the subject, in order to enable the analysis and understanding of its state of the art, the selected articles were classified into two large groups. First, the unit of analysis, covering the elements that make up an SR, which were separated into Focal Company, Upstream, Downstream, Supply Network and the Environment. The analysis of the literature showed that 42% of the studies dealt with the relationships between the Focal Company (1) and its Upstream (2); 50% of the publications deal with the Supply Network (4) as a whole and only 8% discuss the relationships between the Focal Company (1), its Upstream (2) and Downstream (3).

The second group considered the topics discussed, that is, strategies used in the Networks, structures for their management, form of knowledge transfer, development of mathematical modeling, *sourcing* (outsourcing) and the process of internationalization of suppliers. A summary of the results of this classification is presented in Table 2, which shows the concentration of the researches, as well as the themes that were addressed in each study.

From this initial classification (Table 2), it was evident that a significant portion of the research is focused on investigating the relationships of the manufacturer with its suppliers and the impacts of these actions on the Supply Network. In addition, more than half of the works researched the various forms of *sourcing* that are employed in this business relationship. They are: the *hub sourcing* applied in an automotive company in South Korea that manufactures heavy trucks; the *triadic sourcing strategy* used by the automotive company Volvo in conjunction with two suppliers of seats for the line of utility cars; and a process of internationalization of supplier sourcing in textile and footwear companies in northern Italy.

Table 2

Overview of the Publications Analyzed

References	Unit of Analysis					Themes					
	Focal Enterprise (1)	Amount (2)	Downstream (3)	Supply Chain (4)	Environment (5)	Strategy	Management	Knowledge Transfer	Mathematical Modeling	Sourcing	Internationalization Process
Chang; Chiang and Father (2012)	X	X	X			X					
Agrawal; Van Wassenhove and De Meyer (2013)	X	X								X	
Nagurney; Dong and Zhang (2002)				X					X		
Dubois and Fredriksson (2008)	X	X								X	
Mason and Leek (2008)	X	X						X			
Knight and Harland (2005)				X			X				
Wathne and Heide (2004)	X	X				X					
Harland (1996)				X		X					
Harland and Knight (2001)				X			X				
Surana <i>et al.</i> (2005)				X					X		
Camuffo <i>et al.</i> (2006)	X	X									X
Pathak; Dilts and Biswas (2007)				X					X		

Source: The authors.

Another element of the structure suggested in figure 1 that presented an expressive classification among the articles was the Supply Networks. This unit of analysis took into account works that researched the chain in general without focusing on specific elements of the Network. On the topics addressed, 50% of the publications developed mathematical models, with the works of Surana, *et al.* (2005), which considers SR as a *Complex Adaptive Systems* (CAS) and based on this concept develops mathematical modeling to try to explain the creation and development of SR. Therefore Pathak; Dilts and Biswas (2007) use CAS in conjunction with other concepts such as *industrial growth theory*, *network theory*, *market structure*, and *game theory* to perform the programming and optimization of Supply Networks. With this modeling, the authors, in addition to explaining the evolution of networks, are able to capture the factors that influence this evolution. Nagurney; Dong and Zhang (2002) develop a mathematical model called the *Equilibrium Model of a Competitive Supply Network*, which in turn can capture the independent behavior of the various actors within the network, as well as the effect of their interactions. The other part of the articles is focused on strategic issues of SR, such as Harland (1996), which suggest a strategic model using concepts from

Porter (1985), Ansoff (1991), Hayes and Wheelwright (1984) and Hill (1989). Knight and Harland (2005), Harland and Knight (2001), develop a management model based on the work of Minzberg (1990) and Snow *et al.* (1992), for this they suggest a framework of six specific functions that need to exist in a process of administration of the Supply Network.

Lamming; Johnsen and Harland (2000), in their work entitled "*An initial classification of supply networks*", comment that the term Network was incorporated into the supply chain in an attempt to make the concept broader and more strategic. In this proposal, networks would compete with networks, rather than simply companies with companies. However, so far, according to the research carried out, no studies have been found that studied the mechanisms of different Supply Networks, that is, as shown in Figure 1, SR (4) with its Environment (5). In addition to this specific point about competition between different networks, other studies that addressed the relationship of the network with its borders were also not discussed.

Studies aimed at the downstream analysis unit were also not found. Chang's article only; Chiang and Pai (2012), which deals with the development of a cooperation strategy model that involves the Focal Company, its Upstream and its Downstream. However, specific research aimed at the development of downstream relationships within the Supply Network is still scarce. Perhaps one of the reasons for this result is the fact that the Focal Company has little influence over its distributors and customers, so the development of research and partnership work are more difficult and unattractive. These conclusions reinforce the statements made by Frazier (1999), that there is an emerging need for empirical research to understand the relationships of Focal Enterprises with their distributors and end customers. In addition, many issues of managerial importance related to the organization and management of distribution channels also need to be investigated.

6 FINAL CONSIDERATIONS

Since the early 1990s, Supply Networks have inspired a number of academic studies and practical implications (STÄDTLER, 2005). In academia, researchers have taken multiple perspectives and developed many theories to understand the activities involved in interorganizational relationships (CHANG; CHIANG and PAI, 2012). This work contributed to provide a framework on the research carried out on the subject so far. However, there are some research limitations. First, only articles from academic journals were included in the review, since they are generally considered the highest level of research for the acquisition

of information and dissemination of new discoveries (VIEIRA, 2012). Other knowledge on the subject can be found in annals of events, master's dissertations, doctoral theses, books, etc. Considering these sources of knowledge, the results and conclusions can be changed. Second, some articles published and chosen as an important part of the collection of publications were not available for reading or simply the full text was not found in the indexed journals. A third potential limitation is related to the choice of terms for the literature search. Although it is believed that the constructs used are adequate, it is possible that other studies that study Supply Networks have not been selected due to the terms used in the title or abstract. And, finally, despite a conscious effort to identify the main theme and the approach of each article, the analysis and classification of the publications was carried out subjectively, based on the authors' knowledge of the subject.

Despite these limitations, the study provides admissible subsidies on the state of the art in the field of Supply Networks (SR). In addition, based on the review, classification and analysis of the articles, it was possible to presume future research on the topic. In fact, despite the significant development achieved to date, there are many relevant questions that need to be investigated in this field of research.

In this study, several opportunities were identified that should be worked on in order to contribute to the development of the field of research on Supply Networks, they are: I) to conduct research through case studies and quantitative analysis to enable the understanding of the forms of alliance and the performance of companies in SR; II) to study the workflows in the SR to understand the dynamics of these relationships and possible labor migrations between companies belonging to the same network; III) to analyze the sequences of activity between the various actors of the SR over time, as well as the negotiation process used in the various units of analysis of the network; IV) investigate the different SRs in different industrial sectors to provide an understanding of the different management strategies and tools used; V) to study the relationships between agility and performance of companies belonging to RS, emphasizing the synergy of these factors; VI) the study of the displacement of companies within the SR in order to remain competitive in relation to their direct competitors; VII) to understand how support institutions and interorganizations relate to each other and which public policies should be developed to help in the sustainability of SR; VIII) to study the behaviour of industrial procurement in order to understand the effects of the various strategies used, i.e. the relationships not only with individual suppliers or with certain categories of suppliers, but with interdependent supplier networks, which necessarily

generate vast effects and dynamics that cannot be easily measured or understood; (IX) specify in greater detail the types of governance mechanisms that can be used to manage the relationships of Supply Networks and the properties of each mechanism with respect to specific governance problems; and finally, X) to study the types of initiatives in the SR, in order to obtain quick and efficient responses in the service to the end customer, describing how each one manifests itself in the network and the role of each component in relation to specific governance problems.

The review carried out in this work showed that the efforts aimed at the development of the Supply Networks theme are seminal. It was evidenced that some units of analysis require more efforts for their development within the context of SR, especially the relations between the Network and its Downstream and the Environment. From future research that takes into account what has been proposed here, it is possible to affirm that the theme will develop contributing to the understanding and consolidation of the concept of Supply Networks in all its units of analysis.

REFERENCES

- Agrawal, A., Van Wassenhove, L. N., & De Meyer, A. (2014). The sourcing hub and upstream supplier networks. *Manufacturing & Service Operations Management*, 16(2), 238–250. <https://doi.org/10.1287/msom.2013.0460>
- Ansoff, H. I. (1991). Critique of Henry Mintzberg's 'The design school: Reconsidering the basic premises of strategic management'. *Strategic Management Journal*, 12(6), 449–461. <https://doi.org/10.1002/smj.4250120605>
- Baldwin, C. Y., & Clark, K. B. (2000). *Design rules: The power of modularity*. MIT Press.
- Camuffo, A., Furlan, A., Romano, P., & Vinelli, A. (2006). The process of supply network internationalization. *Journal of Purchasing and Supply Management*, 12(3), 135–147. <https://doi.org/10.1016/j.pursup.2006.07.002>
- Chang, C. W., Chiang, D. M., & Pai, F. Y. (2012). Cooperative strategy in supply chain networks. *Industrial Marketing Management*, 41(7), 1114–1124. <https://doi.org/10.1016/j.indmarman.2012.04.011>
- Christopher, M., & Gaudenzi, B. (2009). Exploiting knowledge across networks through reputation management. *Industrial Marketing Management*, 38(2), 191–197. <https://doi.org/10.1016/j.indmarman.2008.12.016>
- Cunningham, M. T. (1990). Survival and growth strategies in new technology markets. In *Proceedings of the 6th IMP Conference* (pp. 346–372). Milan, Italy.

- Dubois, A., & Araujo, L. M. (2006). The relationship between technical and organizational interfaces in product development. *The IMP Journal*, 1(1), 21–38.
- Dubois, A., & Fredriksson, P. (2008). Cooperating and competing in supply networks: Making sense of a triadic sourcing strategy. *Journal of Purchasing and Supply Management*, 14(3), 170–179. <https://doi.org/10.1016/j.pursup.2008.05.002>
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679. <https://doi.org/10.5465/amr.1998.1255632>
- Frazier, G. L. (1999). Organizing and managing channels of distribution. *Journal of the Academy of Marketing Science*, 27(2), 226–240. <https://doi.org/10.1177/0092070399272007>
- Håkansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. Routledge.
- Håkansson, H. (1987). *Industrial technological development: A network approach*. Croom Helm.
- Håkansson, H. (Ed.). (1982). *International marketing and purchasing of industrial goods: An interaction approach*. John Wiley & Sons.
- Harland, C. M., & Knight, L. A. (2001). Supply network strategy: Role and competence requirements. *International Journal of Operations & Production Management*, 21(4), 476–489. <https://doi.org/10.1108/01443570110381400>
- Harland, C. M. (1996). Supply network strategies: The case of health supplies. *European Journal of Purchasing & Supply Management*, 2(4), 183–192. [https://doi.org/10.1016/S0969-7012\(96\)00013-7](https://doi.org/10.1016/S0969-7012(96)00013-7)
- Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: Competing through manufacturing*. Wiley.
- Hill, T. J. (1993). *Manufacturing strategy* (2nd ed.). Macmillan.
- Jarillo, J. C., & Stevenson, H. H. (1991). Co-operative strategies—The payoffs and the pitfalls. *Long Range Planning*, 24(1), 64–70. [https://doi.org/10.1016/0024-6301\(91\)90073-8](https://doi.org/10.1016/0024-6301(91)90073-8)
- Knight, L., & Harland, C. (2005). Managing supply networks: Organizational roles in network management. *European Management Journal*, 23(3), 281–292. <https://doi.org/10.1016/j.emj.2005.04.006>
- Kothandaraman, P., & Wilson, D. T. (2001). The future of competition: Value-creating networks. *Industrial Marketing Management*, 30(4), 379–389. [https://doi.org/10.1016/S0019-8501\(00\)00152-2](https://doi.org/10.1016/S0019-8501(00)00152-2)

- Lamming, R., Johnsen, T., & Harland, C. (2000). An initial classification of supply networks. *International Journal of Operations & Production Management*, 20(6), 675–691. <https://doi.org/10.1108/01443570010321676>
- Mason, K. J., & Leek, S. (2008). Learning to build a supply network: An exploration of dynamic business models. *Journal of Management Studies*, 45(4), 774–799. <https://doi.org/10.1111/j.1467-6486.2008.00769.x>
- Mintzberg, H. (1975). The manager's job: Folklore and fact. *Harvard Business Review*, 53(4), 49–61.
- Nagurney, A., Dong, J., & Zhang, D. (2002). A supply chain network equilibrium model. *Transportation Research Part E: Logistics and Transportation Review*, 38(5), 281–303. [https://doi.org/10.1016/S1366-5545\(01\)00020-5](https://doi.org/10.1016/S1366-5545(01)00020-5)
- Pathak, S. D., Dilts, D. M., & Biswas, G. (2007). On the evolutionary dynamics of supply network topologies. *IEEE Transactions on Engineering Management*, 54(4), 662–672. <https://doi.org/10.1109/TEM.2007.906851>
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. Simon and Schuster.
- Ritter, T., & Gemünden, H. G. (2003). Interorganizational relationships and networks: An overview. *Journal of Business Research*, 56(9), 691–697. [https://doi.org/10.1016/S0148-2963\(01\)00254-5](https://doi.org/10.1016/S0148-2963(01)00254-5)
- Ritter, T., Wilkinson, I. F., & Johnston, W. J. (2004). Managing in complex business networks. *Industrial Marketing Management*, 33(3), 175–183. <https://doi.org/10.1016/j.indmarman.2003.10.016>
- Snow, C. C., Miles, R. E., & Coleman, G. J. (1992). Managing 21st century network organizations. *Organizational Dynamics*, 20(3), 5–20. [https://doi.org/10.1016/0090-2616\(92\)90021-E](https://doi.org/10.1016/0090-2616(92)90021-E)
- Stadtler, H. (2005). Supply chain management and advanced planning—Basics, overview and challenges. *European Journal of Operational Research*, 163(3), 575–588. <https://doi.org/10.1016/j.ejor.2004.03.001>
- Surana, A., Kumara, S., Greaves, M., & Raghavan, U. N. (2005). Supply-chain networks: A complex adaptive systems perspective. *International Journal of Production Research*, 43(20), 4235–4265. <https://doi.org/10.1080/00207540500142274>
- Takeishi, A. (2001). Bridging inter- and intra-firm boundaries: Management of supplier involvement in automobile product development. *Strategic Management Journal*, 22(5), 403–433. <https://doi.org/10.1002/smj.164>
- Verwaal, E., & Hesselmanns, M. (2004). Drivers of supply network governance: An explorative study of the Dutch chemical industry. *European Management Journal*, 22(4), 442–451. <https://doi.org/10.1016/j.emj.2004.06.008>

Wathne, K. H., & Heide, J. B. (2004). Relationship governance in a supply chain network. *Journal of Marketing*, 68(1), 73–89. <https://doi.org/10.1509/jmkg.68.1.73.24036>