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The influence of supply chain on the innovation process: a systematic literature review

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Abstract

Purpose – The importance of innovation as a generator of competitive advantage and the collaborative nature of this process are recurring themes in the literature. This paper aims to contribute to the improvement of knowledge about the relationship between supply chains and the innovation process by means of a systematic literature review.

Methodology/approach – The method used consists of the identification, selection, analysis and synthesis of existing research on the subject and aims to ensure that the review is transparent, auditable and replicable. This paper presents the analysis of 94 papers from 37 journals and the major contributions are explored.

Findings – The identification and analysis of relevant articles showed the complexity, timeliness and the wide-ranging character of the theme. The analysis of articles allowed the identification of facilitators of the innovation process, as well as five approaches applicable to supply chains to drive the innovation process. From these analyses, a model synthesising the main practices identified for improving innovation performance is presented.

Research limitations/implications – When carrying out literature reviews, the selection of articles might be considered subjective. To circumvent this limitation, the papers have been assessed by three researchers.

Practical implications – The results presented can be applied in the decision-making process by managers in the areas of innovation and supply chain.

Originality/value – This paper synthesises knowledge involving the relationships between supply chains and the innovation process. The analysis is based on quantitative and qualitative criteria.

Keywords Innovation, Innovation performance, Supply-chain management, Systematic literature review

Paper type Literature review

1. Introduction

Innovation generation is increasingly seen as a collaborative process carried out with the participation of different actors within or outside the companies (Arlbjorn and Paulraj, 2013; Berghman *et al.*, 2012; Chesbrough, 2003; Ozman, 2009; Roy *et al.*, 2004). Several studies refer the importance of supply chains and their actors in the innovation process (Ageron *et al.*, 2013; Golgeci and Ponomarov, 2013; Narasimhan and Narayanan, 2013; Oke *et al.*, 2013; Roy *et al.*, 2004).

Being the supply chain, a network in which suppliers and customers have the common goal of providing products or services to their end-customers, companies increasingly rely on their partners to obtain innovative inputs. Soosay *et al.* (2008) argue that a supply chain management strategy requires integration, co-operation and collaboration, which in turn require aligned goals, open communication, sharing of resources, risks and rewards.

Historically, a vital area for companies because of its strategic and financial impact, supply chain management has become even more relevant as we become a society increasingly focused on knowledge (Narasimhan and Narayanan, 2013). As a result, knowledge and information flows are added to the traditional monetary and physical flows which increase its management complexity, as well as its importance for processes undergoing little impact before such as innovation management.

Although the importance of innovation for the competitiveness of companies has been studied for decades, the changes experienced by the society make innovation vital to businesses. If innovation is important to: (a) improve performance; (b) increase the demand; and (c) reduce costs, developing and managing innovation effectively is a challenge for most companies.

In this sense, this paper aims at contributing to the improvement of the knowledge about the relationship between supply chains and the innovation process. For that purpose, this systematic literature review was conducted by analysing

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published papers about the topic to know what has been studied in the literature and identify gaps and possible areas for future research. The question the paper aims to answer is: considering that the innovation process is affected by external factors, how do supply chains affect the innovation process and performance?

The answer to this question will help to understand the relations between supply chains and the innovation process. The article contributes for the definition of themes for future research and also intends to provide useful information for decision-making by managers in the areas of supply chain and innovation management.

The next section presents the methodology used for the systematic review of literature, including the formulation of research questions and the definition of the articles selection criteria, as well as the analysis of criteria. Afterwards, the results are presented following two different strands: a quantitative and a qualitative analysis. In this second phase, two main aspects are discussed:

- 1 the influence of supply chains in the innovation process, including facilitators and barriers to this process; and
- 2 the different approaches or strategies used in the context of the supply chains to manage or enhance innovation.

Then, a summary of the major features identified with a potential to improve innovation performance is drawn. Finally, the conclusions of the research, including the implications, the limitations of the work and recommendations for future research, are presented.

2. Method

This article uses the systematic literature review method as presented by Denyer and Tranfield (2009). A systematic literature review consists of the identification, selection, analysis and synthesis of existing research on a particular topic and its presentation in a clear manner to meet what is known and not known about the topic (Denyer and Tranfield, 2009).

This study follows the five steps proposed by Denyer and Tranfield (2009):

- 1 definition of the research question;
- 2 location of studies;
- 3 selection and evaluation of studies;
- 4 analysis and synthesis; and
- 5 presentation of results.

The method tries to ensure that the review is transparent, auditable and replicable (Figure 1).

2.1 Question formulation

The first step in conducting a systematic review of the literature is the definition of the research question, which should be clear to establish the focus of the study. The research question is the following:

RQ1. Considering that the innovation process is affected by external factors, how do supply chains affect the innovation process and performance?

The following supplementary questions are also going to be addressed:

- Q1.* What are the main factors that affect positively and negatively the innovation process in the supply chains context?
- Q2.* What are the main approaches or strategies used within the supply chains to manage or enhance the innovation process?

2.2 Locating studies

This step involves the location of relevant studies to answer the research questions. The ISI Web of Science database was defined as the source of research. This strategy is used in other reviews of literature in the area. To search for studies to be analysed, three categories of keywords were defined:

- 1 Words related to innovation: innovation, innovate, innovativeness. We decided to use the term innovat* to cover all possibilities.
- 2 Words related to supply chain: supply chain, SCM.
- 3 Words related to alignment/relationship/partnership: we decided again to use the asterisk in the following terms: align*, partner*, coordinat*, collaborat*, relation*.

The search was based on all possible combinations of the three groups of keywords, using the “Topic” field to search. Only journals (articles and reviews) were searched, limited to the areas of “Business Economics”, “Engineering” and “Operations Research Management Science”. There was no restriction for the date of publication. The first search presented a total of 684 items (survey conducted in March 2015).

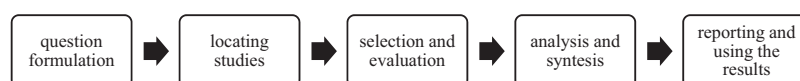
2.3 Study selection and evaluation

After the first search stage, the articles were entered into an electronic spreadsheet and the abstracts and keywords were read, knowing that this analysis focuses on the following criteria: Are the articles dealing with the relationship between the supply chain and the innovation process of organisations? Using this criterion, 129 articles were selected.

Finally, the articles were fully read and the criterion for selection was the answer to the following question: Do the articles help answer the research questions? After this step, 94 articles were selected for analysis.

Following the suggestion of other studies, and as a way to increase the reliability of the selection, the articles were evaluated simultaneously by the three researchers and doubts and disagreements were discussed until consensus was

Figure 1 Five steps carried out for the systematic review of the literature



Source: Adapted from Denyer & Tranfield (2009)

reached. The articles were only included if all reviewers agreed (Figure 2).

2.4 Analysis and synthesis

After selecting the most relevant studies for the purposes of this research, the articles were analysed and synthesised in two steps. The goal of the analysis is to examine and dissect individual studies and identify relationships between the components (Denyer and Tranfield, 2009). On the other hand, the synthesis is the process of grouping the results of different studies “into a new or different arrangement and developing knowledge that is not apparent from reading the individual studies in isolation” (Denyer and Tranfield, 2009, p. 685).

To ensure the uniformity of the analysis by the three researchers, a sample was set by each researcher who presented their findings to others. After this phase, the articles were divided between the three reviewers. The first step of the analysis focuses on the categorisation of studies according to the criteria shown in Table I.

The second step, basically qualitative, sought to identify and synthesise the main contributions of articles to answer the research questions. They addressed two main aspects:

- 1 the influence of supply chains in the companies’ innovation process, including the facilitators and barriers of this process; and
- 2 the different approaches or strategies used to manage or enhance innovation (Table II).

As such, the aggregative synthesis approach that incorporates quantitative and qualitative elements was used (Denyer and Tranfield, 2009). The explanatory approach was also used to synthesise the studies while trying to determine causal

Figure 2 Location and selection of the articles

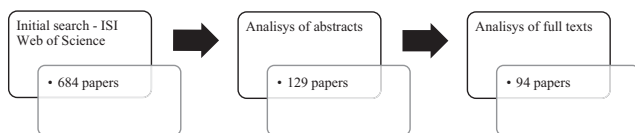


Table I Criteria for quantitative analysis of the articles

Criterion	Type of analysis
Date of publication	Verification of the timeliness of the theme
Publication source	Articles must be published in peer-reviewed journals and the analysis is based on the journal’s impact factor
Location	Analysis of the geographical dispersion of the papers based on the location of the authors
Methodology used	Analysis of the classification of articles (articles or reviews) and the approaches used in the studies (empirical research, survey, case studies)
Nature of the sample	Analysis of the realities studied (sector of activity and size of firms)
Theoretical perspective	Identification and analysis of the main theories used as a basis for carrying out the studies

Table II Criteria for the qualitative analysis of the articles

Criterion	Type of analysis
Influence of supply chains in the innovation process	Analysis of the contribution of articles to answer the research question
Barriers and facilitators	Identification and analysis of the facilitators and barriers to innovation
Approaches or strategies	Identification and analysis of the approaches or strategies used in the supply chains to manage or enhance firm’s innovation process

mechanisms in the data and explain how they work (Denyer and Tranfield, 2009).

The following sections are intended to present the main contributions of the studies, that is, reporting and using the results, according to Denyer and Tranfield (2009). Appendix 1 presents the main information of the 94 articles analysed.

3. Descriptive results: characterising the literature about the relation between innovation and supply chain

This section aims at showing the context of the literature regarding the relationship between the themes of innovation and supply chain, that is, it analyses quantitatively the papers. For this analysis, we used the HistCite software.

3.1 Date of publication

The relationship of innovation with the supply chain is a relatively new theme in literature. Most of the articles identified are quite recent as 25 of 94 articles were published in 2014 and 19 were published in 2013; moreover, five articles were published until March 2015. More than 50 per cent of the articles were published in the past three years (Figure 3).

3.2 Publication source

The articles have been published in 37 different journals. It is a clear indication of the relevance of the theme and of its embracing character. The journals with the largest number of articles are the International Journal of Production Economics and the Journal of Supply Chain Management. Table III presents the publications with more than one article analysed.

The publications with the largest number of articles feature high impact factor according to the Journal Citation Report, being that the four most cited journals are in the first quartile amongst the publications in their categories.

3.3 Location

The articles feature a considerable geographic dispersion (authors from 24 countries were identified), demonstrating

Figure 3 Number of articles per year of publication

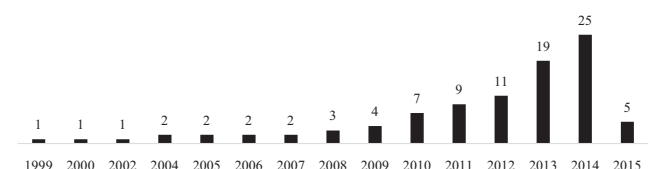


Table III Main sources of publication

Journal	No. of articles
<i>International Journal of Production Economics</i>	12
<i>Journal of Supply Chain Management</i>	9
<i>Journal of Operations Management</i>	7
<i>Supply Chain Management – An International Journal</i>	7
<i>International Journal of Production Research</i>	4
<i>Journal of Product Innovation Management</i>	4
<i>Production and Operations Management</i>	4
<i>Research Policy</i>	4
<i>Industrial Management & Data Systems</i>	3
<i>Technology Analysis & Strategic Management</i>	3
<i>Decision Sciences</i>	2
<i>Expert Systems with Applications</i>	2
<i>International Journal of Computer Integrated Manufacturing</i>	2
<i>International Journal of Operations & Production Management</i>	2
<i>Journal of Business Research</i>	2
<i>Journal of Purchasing and Supply Management</i>	2
<i>Journal of Technology Management and Innovation</i>	2
<i>Production Planning and Control</i>	2
<i>Technovation</i>	2
<i>The International Journal of Logistics Management</i>	2

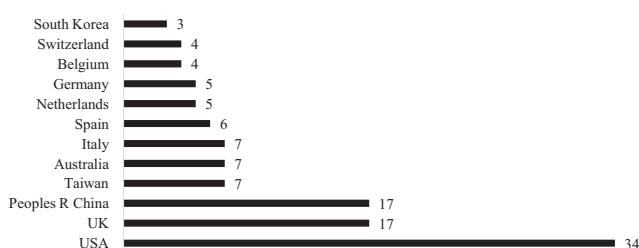
that the subject is of global interest. Although there are a large number of papers written by authors from the USA (36 per cent of articles), the number of articles from Europe, Asia and Oceania is also relevant (Figure 4).

With respect to the authors, once again, there is a wide dispersion, as 22 authors present more than one article, although only two authors published more than two articles: Xenophon Koufteros, professor of Texas A&M University, and Alain Y.L. Chong, of The Hong Kong Polytechnic University, both with three papers.

3.4 Methodology used

With respect to the nature of the analysed studies, there was a predominance of quantitative empirical studies – 60 of the 94 articles. In contrast, 14 papers consisted of case studies, 13 of conceptual studies and 7 of qualitative empirical studies besides one literature review.

Figure 4 Countries with the largest number of publications



3.5 Nature of the sample

Regarding the characteristics of the samples used in the studies, there was a predominance of the use of information from industrial companies (77 of 94 articles, corresponding to 73 per cent), however coming from the most varied sectors, such as consumer goods, automobiles, equipment, food and chemical industry. In all, 4 studies examined exclusively the reality of service companies and 17 studied the reality of industrial and service companies. Six studies have focused specifically on small- and medium-sized enterprises.

3.6 Theoretical perspective

The analysis of the papers highlighted the lack of a dominant theory in the study on the relationship between innovation and supply chains. Amongst the 94 articles, more than 30 different theories were cited. The resource-based view was the theory with the largest number of articles – ten – followed by the knowledge-based view with eight papers and transaction cost economics with seven. The network theory and the relational view theory were referenced five times each. Table IV lists the theories used throughout the years of publication of the articles.

There is a recent trend regarding the use of the resource-based view of the firm, which was cited in five publications in 2014, and of the knowledge-based view, that started to be used in 2008. On the other hand, within the remaining theories with larger number of citations, one can witness a steady use over time of transaction cost economics theory, used since 2002, and the relational view theory and network theory used since 2004. Another important factor that has to be highlighted is that 29 of the papers analysed do not mention its theoretical basis.

The most used theories in the papers analysed – the resource-based view and the knowledge-based view approach – share the relevance of inter-organisational relationships to build competitive advantages, which increase the importance of the subject treated in this study.

4. Qualitative results: the influence of the supply chain context on the innovation process

The economic crisis that started in 2008 has revealed the importance of conjectural aspects related with opportunities and vulnerabilities (Dervitsiotis, 2010). Clearly, if innovation is affected by the reduction of economic investment, then it is also an antidote against the crisis both at the organisational and at the territorial level (Filippetti and Archibugi, 2011), as firms and countries which maintained or even raised efforts toward innovation have demonstrated a higher resilience in times of difficulty.

The innovation capacity of organisations is the result of internal and external factors (Berghman et al., 2012; Dervitsiotis, 2010; Fawcett et al., 2012; Hadjimanolis, 1999; Madrid-Guijarro et al., 2009; Roy et al., 2004). Amongst the major internal factors that influence innovation are: organisational culture, leadership for innovation, innovation strategy, availability of internal resources, technology ownership and participation of employees (Dervitsiotis, 2010; Gnyawali and Srivastava, 2013). External factors, however, include various aspects that relate to environmental, market and the relations of companies with other actors. The

Table IV Theories per year of publication

Theory	Year																	Total
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Resource-based view									1		1	1		2		5		10
Knowledge-based view										1	1	1	1		2	2		8
Transaction cost economics				1			1	1				1	1			2		7
Relational view theory						1				1		1		1		1	1	6
Network theory						1								1	2		1	5
Contingency theory							1						2	1				4
Dynamic capabilities theory															2	1	1	4
Organisational learning theory												1	1				1	3
Social exchange theory																3		3
Social network theory									1						1	1		3
Institutional theory																2		2
Resource dependence theory														1	1			2
Theory of modular systems															2			2
Ambidexterity theory															1			1
Collaboration theory												1						1
Complementarity theory															1			1
Complexity theory															1			1
Diffusion of innovation theory														1				1
Game theory																	1	1
Knowledge transfer theory															1			1
Optimal control theory		1																1
Organisational behaviour theory													1					1
Organisational Design theory							1											1
Organisational information-processing theory																1		1
Process view															1			1
Relationship governance theory																	1	1
Resource advantage theory																1		1
Stakeholder theory																1		1
System theory													1					1
Theory building process										1								1
Theory of complementarity														1				1
Trust theory																1		1

increasing complexity of entrepreneurial environments, result of globalisation, increases the impact of external factors on the overall performance of organisations. These factors, therefore, tend to be more affected in times of crisis.

Great innovators depend on external actors to ensure most of their advantage when it comes to innovation (Fawcett *et al.*, 2012). Ozman (2009) and Radas and Bozic (2009), in turn, claim that innovation is most effective when seen as a collective process and the collaboration with other firms is an important part of the effort of the firms for innovation. For Hsieh and Tidd (2012), the higher the degree of newness, the greater the intensity of knowledge sharing and communication.

Many companies rely on their supply chain partners for innovative inputs. To adopt an innovation strategy, it is necessary to be aligned with other actors in the supply chain, which must share the same innovation strategy. To reduce this dependency, firms can implement strategies to develop their products internally, using new components, materials and technologies (Oke *et al.*, 2013). However, this kind of strategy

is not always possible because companies may lack some internal competencies.

Innovation must be faced by organisations as a collaborative process, where the supply chain has a fundamental role. Narasimhan and Narayanan (2013) strengthen this hypothesis to the point of defining innovation as:

[...] the process of generating changes in products, processes and services that results in the creation of value for the firm and its customers, through the knowledge generated by the company and/or its supply chain partners.

Thus, the main reason to collaborate with other companies is to share and leverage resources unavailable internally (Rese *et al.*, 2013). Few companies have the capabilities or the necessary resources for the development of all the parts that make up their final products (Yeniyyurt *et al.*, 2014). To Fitjar and Rodriguez-Pose (2013), companies engaged in external collaboration tend to be more innovative than firms that rely solely on their own resources and knowledge. As such, companies are aware that sharing knowledge with their supply chain partners can be an important factor for obtaining

competitive advantage (Saenz *et al.*, 2014). In addition, Roy *et al.* (2004) claim that innovation is not only influenced by the relationships with suppliers but is largely a result of these interactions.

Cao and Zhang (2010) adopt the concept of collaborative advantage, understood as the strategic benefits obtained over competitors through partnerships with actors across the supply chain that generate results that could not be achieved by any of the companies alone.

Typically, supply chains are designed to harmonise routine activities between partners, not including the innovation process (Bouncken, 2011). As a result of the growing market rivalry, companies try to build relationships with partners to complement their internal resources, especially with other supply chain actors (Ertlie and Pavlou, 2006; Oke *et al.*, 2013).

Partners located downstream in the supply chain provide up-to-date information about the preferences of consumers and on new trends. Partners located upstream, in turn, tend to provide knowledge about new technologies (Bouncken, 2011). The level of participation of the partners in the innovation process also depends on their position in the chain. The farther upstream or downstream an actor is on the value chain, the lower its participation in the innovation process of a focal company (Wynstra *et al.*, 2010).

As companies become more specialised, the importance of engaging in the innovation process with the supply chain partners also increases. It becomes crucial that companies align their internal research and development strategies with the knowledge available in the supply chain to achieve better performance with regard to innovation (Narasimhan and Narayanan, 2013). Soosay *et al.* (2008) claim that the ability to work in partnership with other supply chain actors allows companies to integrate their operations, generating greater efficiency and facilitating innovation, both radical and incremental.

For Petersen *et al.* (2005), suppliers have different levels of responsibility within the new product development (NPD) process. When the supplier is involved informally and superficially and all decisions are taken by the customer, the relationship is called White Box. In these cases, “discussions are held with suppliers about specifications/requirements but the buying company makes all design and specifications decisions” (Petersen *et al.*, 2005, p. 379). When there is a formalised integration and decisions and product development are conducted jointly, one can call it a Grey Box. The buyer and supplier enter into a joint development effort, which may include information and technology sharing and joint decision-making regarding design specifications. Finally, when the development is coordinated and carried out primarily by the supplier, according to customer specifications, one can call it a Black Box. The supplier is informed of customer requirements and then is given almost complete responsibility for the purchased item (Petersen *et al.*, 2005).

For Modi and Mabert (2010), the efficient management of the supply chain leads the organisation to improve its performance and stability within the supply chain. These elements, in turn, lead to improved performance in factors related to innovation.

Measuring innovation, however, is a controversial subject in the literature. The measurement implies comparison, which requires some degree of similarity. The problem is that innovation, by definition, is something new and, therefore, difficult to compare (Smith, 2005). Much has been discussed in the literature on ways of measuring innovation, and a large number of quantitative and qualitative indicators are defended by different authors. One of the concepts relevant to performance-related innovation is the “persistence of innovation”, which concerns the extent to which organisations that innovate once have greater or lesser ability to innovate again in subsequent periods (Clausen *et al.*, 2012).

For Golgeci and Ponomarov (2013), the ability and the magnitude of the firms’ innovations are related to the supply chain resilience. Considering the growing importance of the supply chain and the impact of disruptions of supply on the firms’ results, the increased resilience can be understood as an improvement in performance, as it reduces risks. For them, companies must invest on their innovation capacity, not only to be competitive and improve their financial and market performance but also to respond to the risks of disruptions in uncertain environments. Thus, considering the studies analysed, the relationships amongst actors in the supply chain are potentially the facilitators of the innovation process. Some features of the supply chains, however, can act as barriers to this process. One of these barriers is the difference of technology used by the actors, especially between the client and the supplier (Peitz and Shin, 2013). This barrier is more critical in markets where technology exerts an important role for the competitiveness of firms.

Another important barrier is the difficulty to establish trust-based relationships amongst actors of the supply chains. Fawcett *et al.* (2012) claim that building trust-based relationships, beyond being hard, is also potentially expensive, both because of demanding investments and the vulnerability that these relations impose. The authors argue that the effort and the risk exposure are worth it. The same reasoning applies to building lasting relationships (Fawcett *et al.*, 2012; Kim, 2000).

For Narasimhan and Narayanan (2013), in knowledge-intensive industries, value-creation activities are scattered amongst the firms within the supply chain that specialise themselves in a particular activity or technology, with the focal firm acting as a knowledge integrator. In this context, the difficulty of the focal firm in integrating knowledge is considered as a barrier to innovation. Finally, Wang *et al.* (2011) conclude that certain supplier-client contracts can negatively influence the innovation performance.

5. Supply chain approaches to conduct the innovation process

As discussed earlier, there are different characteristics of supply chains capable of positively influencing innovation performance. Companies embrace different strategies when involving the rest of the supply chain actors in its innovation process. The following are amongst the most important ones:

- partnerships for specific purposes (PEP) – the development of a new product or process;
- project coordination by the client company (PCCC);

- integration of the new product development process (INPDP) amongst actors in the supply chain;
- strategic alignment (SA) between actors of the supply chain (in addition to the innovation process); and
- open innovation strategy (OI).

Table V shows the approaches used by the year of publication of the papers. We see the prevalence of INPDP, SA and OI approaches in recent articles. On the other hand, the PEP approach is cited in only one paper in 1999.

Table VI compares the use of the basic theories amongst papers with the approaches used. We highlight some relationships, such as the use of the resource-based view, the knowledge-based view, the relational view theory and the network theory in articles that use the SA approach. We can also highlight how the INPDP approach is distributed amongst different theories.

5.1 Partnerships for specific purposes

The accomplishment of partnerships amongst actors of the supply chains for the development of new products or processes is characterised by the use of short-term contracts and may indicate the absence of trust-based relationships amongst the actors, once relationships tend not to be long lasting (Bruce and Moger, 1999).

This approach was identified in only one of the paper analysed, dating from 1999, which shows that its use, despite being relatively common amongst companies, has been hardly addressed in the literature, especially recently.

5.2 Project coordination by the client company

The coordination of innovation projects by the client company was mentioned by only three papers. Tracey and Neuhaus (2013) maintain that any development of new products or processes must be treated as projects and should involve key partners of the supply chain. In these cases, however, the level of responsibility and participation of the partners is limited.

The incorporation of suppliers in project teams raises the level of information and knowledge for the generation of ideas and the use of technologies. It also allows the early

identification of potential problems, the elimination of rework, the increase of likelihood of meeting deadlines and the reduction of costs (McIvor and Humphreys, 2004).

For Kim (2000), this type of relationship can be beneficial for both parties. The results will be positive for both actors if the market responds favourably to the innovation developed. Kim (2000) approaches the coordination of the innovation process aiming at the supplier innovation, considering that the innovation generated by the client company can lead to reduced costs on the supplier and, consequently, the reduction in the prices of their products.

The approach of project coordination by the client company shows greater focus on short-term results and the actions or projects are conditioned by the interests of the client company, often with a cost reduction view. Companies that use this kind of approach can behave opportunistically (Wang et al., 2011) to get the most out of the relationship only for the period that they understand to be more profitable.

The successful use of this approach, on the other hand, can lead to the improvement of the relationship between the companies (McIvor and Humphreys, 2004), which, in turn, can generate new cooperative projects or lead to the use of new approaches, such as an integrated NPD process or a strategic alignment.

The partnerships for specific purposes are little studied in the literature, as well as the project coordination by the client firm, which reflects the low interest that these approaches leverage in the innovation process.

5.3 Integration of the new product development process

The integration of the NPD process was the most widely used approach, in 44 of the 94 papers, and occurs when supply chain partners provide information and directly participate in the decision-making process related to the new products, processes or services (Petersen et al., 2005). For Yenyurt et al. (2014), the involvement of suppliers in the client’s NPD process is mutually beneficial.

Salvador and Villena (2013) claim that the integration of suppliers in the client’s NPD process occurs not only for the clients to have access to their skills and knowledge but also as a way of overcoming financial limitations and risk-sharing issues. The participation of partners in this process also contributes to reduce the likelihood of failure in launching new products, as it reduces the risk of ruptures of supply (Pero et al., 2010).

This approach differs from the previous ones, as to get these gains continuously, companies that adopt this approach must consider the capability to develop new products as a criterion for the selection of suppliers (Johnsen, 2011; Koufteros et al., 2012; 2007). Innovation, in this case, must be a part of the company’s strategy when building up its supply chain.

Johnsen (2011) explores specifically the integration of sub-suppliers in the NPD process. The author discusses strategies for delegating roles, and the intervention of the client firm with these suppliers as ways for participating in the process.

Although the integration of suppliers in the NPD process is the most common form of integration within supply chains,

Table V Approaches used by the year of publication

Year	Approach					Total
	PEP	PCCC	INPDP	SA	OI	
1999	1					1
2000		1				1
2002				1		1
2004		1	1			2
2005			1	1		2
2006		1	1			2
2007			1	1		2
2008			2	1		3
2009			2	2		4
2010			3	4		7
2011			7	2		9
2012			4	6	1	11
2013		1	8	8	2	19
2014			13	11	1	25
2015			1	4		5

Table VI Relationship among theories and approaches used

Theory	Approach					Total
	PEP	PCCC	INPDP	SA	OI	
Not mentioned	1	1	19	8		29
Resource-based view			3	7		10
Knowledge-based view			3	5		8
Transaction cost economics		1	3	3		7
Relational view			2	4		6
Network theory				4	1	5
Contingency theory			1	2	1	4
Dynamic capabilities theory			1	3		4
Organisational learning theory			1	2		3
Social exchange theory			1	1	1	3
Social network theory			2	1		3
Institutional theory			1	1		2
Resource dependence theory				2		2
Theory of modular systems			2			2
Ambidexterity theory				1		1
Collaboration theory			1			1
Complementarity theory				1		1
Complexity theory				1		1
Diffusion of innovation theory				1		1
Game theory				1		1
Knowledge transfer theory					1	1
Optimal control theory		1				1
Organisational behaviour theory			1			1
Organisational information-processing theory				1		1
Process view			1			1
Relationship governance theory				1		1
Resource advantage theory			1			1
Stakeholder theory			1			1
System theory			1			1
Theory building process				1		1
Theory of complementarity			1			1
Trust theory			1			1

He *et al.* (2014) discuss the benefits of the integrating customers in this process.

Two other concepts deserve to be featured within this approach: NPD outsourcing (Peitz and Shin, 2013; Roy and Sivakumar, 2010) and product modularity (Cabigiosu *et al.*, 2013; Caridi *et al.*, 2012; Lau, 2011). These two concepts are used primarily by authors who study the auto industry.

Beyond allowing firms to focus specifically on their core competencies, NPD outsourcing reduces the costs of the NPD process. On the other hand, the outsourcing of higher added value activities entails higher risks for the firm, such as the loss of critical knowledge (Jean *et al.*, 2012). Modularity, in turn, is used as a tool to facilitate the integration of external sources of innovation. It can improve the results of the development of new products in two ways:

- 1 it enables organisations to easily join the design and production of a product's components; and
- 2 it ensures easy and successful integration of components supplied externally in the architecture of the final product (Cabigiosu *et al.*, 2013).

For Lau *et al.* (2007), modularity increases the firm's flexibility, improves customer service and, consequently, improves the product's performance.

Finally, it should be noted that companies that integrate the NPD process may also adopt the strategic alignment or the open innovation strategy, once the last two approaches are more complex than the others. Lau *et al.* (2007), for example, explores the integration of the NPD process, or co-development, however following a strategic alignment perspective.

5.4 Strategic alignment

For authors who follow this approach, used in 42 papers, the innovation performance is a consequence of trust-based relationships (Roy *et al.*, 2004). For this reason, the strategic alignment, or long-term partnership between supply chain actors, can be understood as a step forward in relation to the integration of the NPD process. It involves the integration of other business processes (beyond innovation), goal alignment, inter-organisational teams, information systems integration and the constant sharing of information (Lau *et al.*, 2007; Roy

and Sivakumar, 2010; Roy *et al.*, 2004; Wong *et al.*, 2013). For Wong *et al.* (2013), this set of factors has positive effects on NPD and innovation performance as a whole.

For Wagner and Bode (2014), factors such as the duration of the contract, the age of the relationship and co-operation stimulate suppliers to share innovative ideas with their customers, which the authors call innovation push. The strategic alignment with actors of the supply chain allows firms:

- greater access to the knowledge about customers' needs; and
- the sharing of this knowledge and the requirements of the NPD process with suppliers (Jean *et al.*, 2012; Wong *et al.*, 2013).

This model allows even greater involvement of suppliers in all phases of the innovation process (Narasimhan and Narayanan, 2013).

Jayaram and Pathak (2013) and Craighead *et al.* (2009) addressed the integration of knowledge between organisations as an effective strategy for improving performance, more specifically regarding the development of new products. However, knowledge sharing with other actors of the supply chain, although necessary, is not sufficient to ensure the generation of added value. The formalisation and constant interactions amongst firms, combined with the sharing of knowledge, are important conditions for joint value creation in both the development of new products and in other shared processes (Jayaram and Pathak, 2013). Jean *et al.* (2012) also highlight the importance of knowledge sharing for the establishment of an effective relationship, which they call relationship learning. For the collaborative innovation process, we can also consider as fundamental factors: trust (Fawcett *et al.*, 2012; Jean *et al.*, 2014), the sharing of the decision-making process (Kim and Oh, 2005), the facilitated and constant information exchange (Jean *et al.*, 2012) and the co-operative behaviour of all actors (Cheng *et al.*, 2014), amongst others.

Narasimhan and Narayanan (2013) defend the importance of firm's absorptive capacity for the effective use of knowledge of other actors of the supply chain in the innovation process. The absorption capacity is defined as "the ability of firms to recognise the value of new external information, assimilate it and apply it for commercial purposes" (Cohen and Levinthal, 1990, p. 128).

Finally, Oke *et al.* (2013) approach the creation of strategic partnerships amongst actors of the supply chain from the perspective of the resource dependency theory, which sees companies as coalitions in which the structures and patterns are moulded to gain access to external resources required.

5.5 Open innovation strategy

The open innovation concept has been explored by several authors in recent years. However, as the research did not seek specifically this kind of innovation, only four studies address open innovation. However, having open innovation an emphasis on collaborative perspectives, supply chain actors stand out as potential partners.

Open innovation involves the intentional use of external expertise to accelerate internal innovation (Chesbrough, 2003). For Billington and Davidson (2013), companies can

and should use external and internal ideas when they look forward to developing or improving their products, processes and business models. For them, with the adoption of open innovation, the flow of ideas is added to the flow of goods, money and information across companies in supply chains.

The use of this approach imposes companies great challenges. On the one hand, the more open the process, the greater the variety and quality of innovation; on the other hand, the more closed the new product or service development, the lower the time needed and the cost of the process (Hsieh and Tidd, 2012).

Finally, Tomlinson and Fai (2013) emphasise the importance of open innovation for small- and medium-sized firms, as it allows an access to knowledge and technologies inaccessible internally by this type of firms.

6. Supply chain-driven innovation: some practices to improve the performance

According to Denyer and Tranfield (2009), systematic reviews of the literature in the area of management must present rules, suggestions, guidelines or protocols as outputs to be useful for the solution of managers' real problems. Wilding and Wagner (2012) state that the purpose of a systematic review is to support evidence-based decision-making. Thus, we propose some characteristics that, according to the analysis carried out, tend to improve the performance of the innovation process. Some of the factors analysed regard the characteristics of the companies that can encourage innovation, and others refer to the characteristics of the supply chain or of the relationship amongst companies.

Absorptive capacity is the first important feature that tends to encourage innovation, which is the ability of a firm to identify external knowledge and convert it into value for its products or processes (Saenz *et al.*, 2014). This capability allows companies, in addition to the better use of external resources available, to identify the best partners across the supply chain.

The definition of a supply chain strategy that includes innovation has also great potential to improve this process. For von Massow and Canbolat (2014), companies should set their goals taking into account the supply chain strategy. In addition to the minimum standards of quality required from their partners, companies should set standards for the whole supply chain regarding the specific features, such as the innovation capacity of the supply chain.

Bendoly *et al.* (2012) still address the capability of the firm's information systems as a relevant internal factor that allows the best use of the knowledge and resources of the supply chain partners to improve innovation. They discuss the importance of coordinating efforts with external actors for the success of the NPD process, suggesting that the effects of the coordination on market intelligence are moderated by the capability of the company's information systems (Bendoly *et al.*, 2012).

Regarding the relationships amongst companies, the following characteristics stand out:

- building trust relationships (Blome *et al.*, 2013; Fawcett *et al.*, 2012; He *et al.*, 2014; Jayaram and Pathak, 2013; Jean *et al.*, 2014; Kim, 2000; Kuehne *et al.*, 2013;

Lee et al., 2014; Modi and Mabert, 2010; Oke et al., 2013; Wang et al., 2011; Yenyurt et al., 2014);

- ease and frequency of information sharing between partners (Bakhshi and McVittie, 2009; Bendoly et al., 2012; Berghman et al., 2012; Blome et al., 2013; Caridi et al., 2012; Kuehne et al., 2013; Peng et al., 2013; Tomlinson and Fai, 2013);
- shared decision-making (Kim and Oh, 2005; Peng et al., 2013; Wu, 2014);
- information systems integration (Caridi et al., 2012; Cheng et al., 2014; Ettl et al., 2006; Peitz and Shin, 2013);
- compatibility of technologies used by partners (Chong and Zhou, 2014; Lee et al., 2014);
- cooperative behaviour of all actors (Cheng et al., 2014); and
- efficient management of supply chains, including their resilience (Golgeci and Ponomarov, 2013; Modi and Mabert, 2010).

In general, the characteristics addressed by the authors are related with the creation of strong relationships amongst partners. Saenz et al. (2014) claim that the construction of this kind of relationship depends on the selection of appropriate partners to facilitate social interaction, as well as the achievement of common objectives.

It should be noted that the above-mentioned factors are found mainly in three of the five innovation strategies applied to supply chains, in particular the integration of the NPD process; the strategic alignment between actors of the supply chain (in addition to the innovation process); and the open innovation strategy. It is not by chance that these are the strategies found most often in recent papers. Therefore, they can be pointed out as the most suitable for the current business scenario.

Figure 5 presents a model that relates the main facilitators of the innovation process, as well as the approaches studied. Based on the studies analysed, the model suggests features and strategies that tend to positively affect the companies' innovation performance.

7. Conclusions

The growing importance of innovation as a true driver of competitive advantage, coupled with the importance of supply chain management as a competitiveness-enhancing factor in the current competitive world, claim for conducting studies intertwining both topics. Similarly, the perception that innovation is a collaborative process involving not only internal but also external actors of the organisation explains the growing number of published studies regarding the relationship of innovation and supply chains. Additionally, the increasing complexity of business environments, as a result of globalisation, increases the impact of external factors on the overall performance of the organisations.

The systematic literature review exploring the relationship between supply chains and the innovation process demonstrated the complexity of the topic, its timeliness and its embracing character.

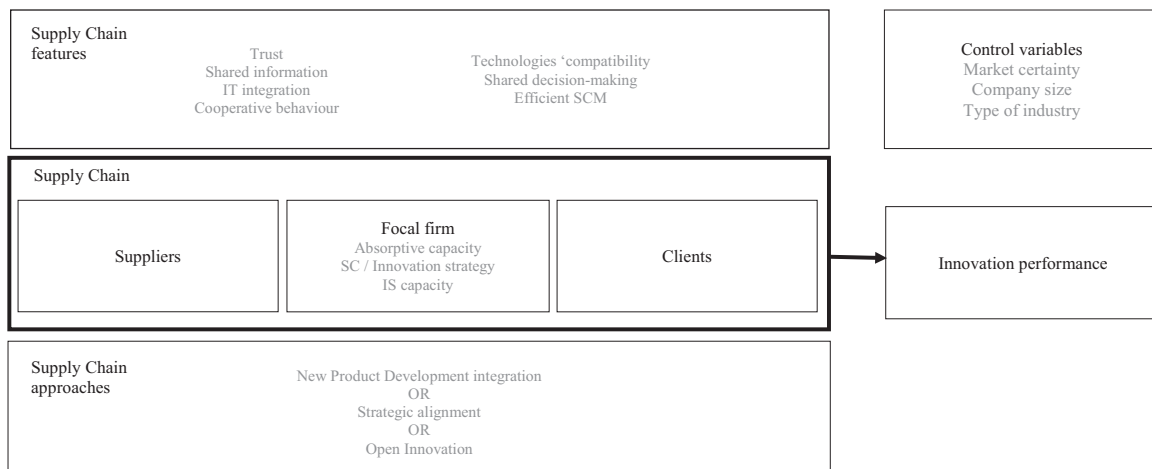
Companies, in general, do not have all the resources necessary to innovate. The main reason to collaborate with other actors is to gain access to these resources, in particular to knowledge. The co-operation with external actors becomes relevant to innovation process, and as the supply chain is an important context for relationships amongst actors, its relationship to innovation showed up as an important object of study.

Clearly, the relationships amongst actors of the supply chain are potentially the facilitators of the innovation process. The main facilitators covered by the papers analysed are the following: building trust relationships, the facility and/or frequency of information sharing, shared decision-making, the integration of information systems, compatibility of technologies used by partners, cooperative behaviour of all actors and the efficient management of supply chains, including their resilience.

Some barriers to the innovation process were identified amongst actors of the supply chain as the absence of innovation strategies, the difficulty of establishing trust-based relationships and differences in technology used by actors.

The way organisations manage the innovation process throughout the supply chain is addressed in various forms in

Figure 5 Innovation performance improvement model throughout the supply chain



the literature. Amongst the papers analysed, five key innovation strategies were identified:

- 1 partnerships for specific purposes;
- 2 projects coordinated by the client firm;
- 3 the integration of both – new products and processes development between actors in the supply chain;
- 4 the strategic alignment between actors in the supply chain; and
- 5 open innovation strategy.

The strategy of integration for the development of new products and processes, the strategic alignment and the open innovation strategy tend to generate long-lasting results for businesses. It is also important to point out that the most frequently addressed strategies are precisely those that value the innovation facilitators the most, particularly trust and the ease and frequency of information sharing between partners.

From the literature review, one can conclude that little has been studied on the influence of supply chains on the different types of innovation and the different phases of the innovation process, as well as the reality of service companies and SMEs.

7.1 Contribution to supply chain managers and innovation

In addition to addressing the importance of alignment in the context of supply chains for the innovation process, this study contributes for the management of supply chain and innovation, as it identifies and presents facilitators and barriers to innovation in the context of the supply chains, as well as possible strategies to be implemented to improve the performance of organisations.

The use of these strategies, according to the characteristics of the organisations, constitutes as an opportunity for the creation of competitive advantages.

7.2 Theoretical contribution

This study contributes to the literature, as it clearly presents what is presently known – and what is not – about the relationship between supply chain and innovation. It also contributes by means of the discussion of subjects still not widely approached, namely, the facilitators and barriers of the innovation process and innovation strategies applied to supply chains.

The study of the main theories used as a basis for studies is also a contribution to research in the area.

7.3 Recommendations for future research

An important gap identified in literature of the area is the study of the alignment of supply chain management strategies and innovation management strategies, as well as the impact of this alignment in the performance of organisations, which constitutes an opportunity for future investigations.

Another important recommendation is the development of in-depth empirical studies about the use of different strategies/ approaches to innovation applied to supply chains. Equally, it is recommended the use of empirical studies about facilitators and barriers to the innovation process. Although, as demonstrated in this article, some factors have been identified, studies that explore this theme in depth have not been found.

No studies were found dealing with possible differences between the influence of supply chains on different types of innovation, neither by its typology nor by the way innovation was generated.

Most of the studies analysed either explore the product innovation exclusively or deal with innovation generically (product, process, management practice or method of marketing). Only one paper covers exclusively process innovation.

Similarly, no studies were identified exploring the influence of supply chains on the different phases of the innovation process. The influence of supply chains on service companies and SMEs also needs greater attention by researchers.

Studying the relationship of the alignment in the context of supply chains with the performance of organisations in other areas, besides innovation, is also an interesting path for researchers. Finally, we highlight that the articles discuss predominantly learning relationships between customers and suppliers and that the study of the impact of relationships between all possible actors of the supply chains for the innovation process should be better exploited in future investigations.

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Appendix 1

Table A1 Articles analysed

Authors	Year	Journal	Theory	Factors			Approach				Context			Method				Type of innovation		
				Facilit	Bar	PSP	PCCC	INPDP	SA	OI	Ind	Serv	Gen	SME	EQT	CS	LR	Conc	Prod	Proc
Bruce, M; Moger ST	1999	Technol Anal Strateg	Not mentioned	x	x	x														x
Kim, B	2000	Eur J Oper Res	Optimal control theory	x			x													x
Sobrero, M; Roberts EB	2002	Res Policy	Transaction cost economics	x				x												x
Roy S; Sivakumar K; Wilkinson IF	2004	J Acad Market Sci	Network theory and relational view theory	x				x												x
Mclvor R, Humphreys P	2004	Omega	Not mentioned	x				x												x
Kim B, Oh H	2005	Supply Chain Manag	Contingency theory	x				x												x
Petersen K, et al.	2005	J Oper Manag	Transaction cost economics and relational view theory	x				x												x
Ettlie JE, Pavlou PA	2006	Decision Sci	Not mentioned	x				x												x
Choi TY, Krause DR	2006	J Oper Manag	Transaction cost economics	x					x											x
Lau AKW, Yam RCM, Tang EPY	2007	Ind Manage Data Syst	Resource-based view	x					x											x
Koufteros XA, Cheng TCE, Lai KH	2007	J Oper Manag	Social network theory	x																x
Soosay CA, Hyland PW, Ferrer M	2008	Supply Chain Manag	Theory building process	x					x											x
Tether BS, Tajar A	2008	Res Policy	Relational view theory	x						x										x
Lee J, Veloso FM	2008	J Prod Innov Manag	Knowledge-based view	x																x
Craighead CW, Hult GTM, Ketchen Jr DJ	2009	J Oper Manag	Resource-based view, knowledge-based view	x						x										x
Bhaskaran RS, Krishnan V	2009	Manage Sci	Not mentioned	x						x										x
Bakshi H, McVittie E	2009	Innov: Manag Policy P	Not mentioned	x						x										x
Panayides P, Lun Y	2009	Int J Prod Econ	Social capital theory	x						x										x
Modi SB, Mabert VA	2010	J Supply Chain Manag	Not mentioned	x						x										x
Pero M, et al.	2010	Supply Chain Manag	Transaction cost economics	x						x										x
Wynstra F, et al.	2010	J Prod Innov Manag	Not mentioned	x						x										x
Lin Y, Wang Y, Yu C	2010	Int J Prod Econ	Resource-based view	x						x										x
Roy S, Sivakumar K	2010	J Bus Res	Knowledge-based view	x						x										x
Cao M, Zhang Q	2010	Int J Prod Econ	Relational view theory	x						x										x
Sun H, Yau H, Suen E	2010	J Technol. Manag. Innov	Collaboration theory	x						x										x
Hilletoth P, Eriksson D	2011	Ind Manage Data Syst	Not mentioned	x						x										x
Chong AYL, et al.	2011	Ind Manage Data Syst	Not mentioned	x						x										x
Lau AKW	2011	Ind Manage Data Syst	Contingency theory, organisational learning theory, transaction cost economics	x						x										x
Johnsen TE	2011	Int J Oper Prod Man	Organisational behaviour theory	x						x										x
Zolghadri M, et al.	2011	Int J Comput Integ M	System theory	x						x										x
Wang LW, Yeung JHY, Zhang M	2011	Int J Prod Econ	Contingency theory	x						x										x
Bouncken RB	2011	EMJ-Erg Manag J	Not mentioned	x						x										x
Hernández-Espallardo M, et al.	2011	Technovation	Knowledge-based view	x						x										x
Lee KH, Kim JW	2011	Bus Strateg Environ	Not mentioned	x						x										x

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Table AI

Authors	Year	Journal	Theory	Factors			Approach			Context			Method			Type of innovation						
				Facilit	Bar	PSP	PCCC	INPDP	SA	OI	Ind	Serv	Gen	SME	EQt	CS	EQI	LR	Conc	Prod	Proc	MP
Koufteros X, Vickery SK, Droge C	2012	J Supply Chain Manag	Resource-based view	x				x												x		
Berghman L, et al.	2012	Ind Market manag	Organisational learning theory	x				x												x		
Fawcett SE, Jones SL, Fawcett AM	2012	Bus Horizons	Resource-based view and relational view theory	x				x												x		
Caridi M, et al.	2012	Int J Prod Econ	Not mentioned	x				x												x		
Hsieh KN, Tidd J	2012	Technovation	Contingency theory	x						x										x		
Jean RJ, Kim D, Sinkovics RR	2012	Decision Sci	Resource dep. theory and network theory	x				x												x		x
Langenberg K, et al.	2012	Int J Prod Econ	Not mentioned	x				x												x		
Hazen BT, Overstreet RE, Cegielski CG	2012	Int J Logist Manag	Diffusion of innovation theory	x				x												x		
Machikita T, Ueki Y	2012	Asian J Technol Inno	Not mentioned	x				x														x
Bendoly E, Bharadwaj A	2012	Prod Oper Manag	Theory of complementarity	x				x														x
Didonet SR, Diaz G	2012	J Technol Manag Innov	Not mentioned	x				x														x
Salvador F, Villena V	2013	J Supply Chain Manag	Theory of modular systems	x				x														x
Kuhne B, Gellynck X, Weaver RD	2013	Supply Chain Manag	Not mentioned	x				x														x
Golgeci I, Ponomarov SY	2013	Supply Chain Manag	Dynamic capabilities theory	x				x														x
Tomlinson P, Fai F	2013	Int J Prod Econ	Network theory	x						x												x
Peitz M, Shin D	2013	J Econ Behav Organ	Not mentioned	x				x														x
Fitjar RD, Rodriguez-Pose A	2013	Res Policy	Not mentioned	x				x														x
Cabigiosu A, Zirpoli F, Camuffo A	2013	Res Policy	Theory of modular systems	x				x														x
Jayaram J, Pathak S	2013	Int J Prod Res	Knowledge-based view	x				x														x
Tracey M, Neuhaus R	2013	J Purch Supply Manag	Not mentioned	x						x												x
Peng DX, et al.	2013	J Supply Chain Manag	Organisational information-processing theory	x						x												x
Narasimhan R, Narayanan S	2013	J Supply Chain Manag	Network theory and complexity theory	x				x														x
Oke A, Prajogo DI, Jayaram J	2013	J Supply Chain Manag	Resource dep theory.	x				x														x
Blome C, Schoenherr T, Kaesser M	2013	J Supply Chain Manag	Knowledge-based view	x				x														x
Vickery SK, Koufteros X, Droge C	2013	IEEE T Eng Manage	Complementarity Theory	x				x														x
Wong CWY, et al.	2013	Int J Prod Econ	Dynamic capabilities theory	x				x														x
Billington C, Davidson R	2013	Prod Oper Manag	Ambidexterity theory	x				x														x
Fox GL, et al.	2013	Int J Oper Prod Man	Knowledge transfer theory	x						x												x
Ganotakis P, Hsieh WL, Love JH	2013	Prod Plan Control	Social network theory	x				x														x
Germani M, et al.	2013	Int J Comput Integ M	Not mentioned	x				x														x
Cheng JH, Chen MC, Huang CM	2014	Supply Chain Manag	Process view	x				x														x
He YQ, et al.	2014	Int J Prod Econ	Institutional theory	x				x														x
			Trust theory	x				x														x

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Table AI

Authors	Year	Journal	Theory	Factors		Approach			Context			Method			Type of innovation								
				Facilit	Bar	PSP	PCCC	INPDP	SA	OI	Ind	Serv	Gen	SME	EQT	CS	EQI	LR	Conc	Prod	Proc	MP	
Jean RJ, Sinkovics RR, Hiebaum TP	2014	J Prod Innov Manag	Knowledge-based view and tran cost econ	x					x												x		
Wagner SM, Bode C	2014	J Oper Manag	Transaction cost economics	x																	x	x	
Yeniurt S, et al.	2014	J Acad Market Sci	Social exchange theory	x				x													x		
Ge ZH, Hu QY, Xia YS	2014	Prod Oper Manag	Not mentioned	x				x													x		
Schoenherr T, Griffith D, Chandra A	2014	Int J Prod Res	Resource-advantage theory	x				x													x		x
Tan YC, Ndubisi NO	2014	J Bus Ind Mark	Resource-based view	x				x													x		
Seo YJ, Dinwoodie J, Kwak DW	2014	Supply Chain Manag	Not mentioned	x				x													x		
Storer M, et al.	2014	Int J Logist Manag	Resource-based view and rel view theo	x				x													x		
Wu GD	2014	Int J Simul Model	Social exchange theory	x						x											x		
Jafarian M, Bashiri M	2014	Appl Math Model	Not mentioned	x				x													x		
Saenz MJ, Revilla M, Knoppen D	2014	J Supply Chain Manag	Dynamic capabilities theory	x				x													x		
von Massow M, Canbolat M	2014	Int J Prod Res	Not mentioned	x				x													x		
Gualandris J, Kalchschmidt M	2014	J Purch Supply Manag	Stakeholder theory, resource-based view	x				x													x		
Ma XF, Kaldenbach M, Katzy B	2014	Technol Anal Strateg	Institutional theory		x			x															x
Pulles NJ, et al.	2014	J Supply Chain Manag	Social exchange theory	x				x													x		
Hernández JE, et al.	2014	Prod Plan Control	Not mentioned	x				x															x
Chong AYL, Zhou L	2014	Int J Prod Econ	Not mentioned	x				x															x
Bellamy MA, Ghosh S, Hora M	2014	J Oper Manag	Social network theory	x				x															x
Liao SH, Kuo FI	2014	Int J Prod Econ	Resource-based view	x				x															x
Singh PJ, Power D	2014	Int J Prod Res	Knowledge-based view	x				x															x
Lee VH, et al.	2014	Expert Syst Appl	Not mentioned	x				x															x
Lefebvre VM, et al.	2014	Great Innov Manag	Resource-based view	x				x															x
Manasakis C, et al.	2014	South Econ J	Not mentioned	x				x															x
Plening EP, Salge TO	2015	J Prod Innov Manag	Dynamic capabilities theory	x				x															x
Ren S, Eisingerich AB, Tsai H	2015	J Bus Res	Org learning theory, relat governance theo	x				x															x
Wang J, Shin H	2015	J Bus Res	Not mentioned					x															x
Golgschi I, Ponomarov SY	2015	Technol Anal Strateg	Relational view theory and network theory	x				x															x
Arsenyan J, et al.	2015	Expert Syst Appl	Game theory	x				x															x

Notes: Facilit = facilitators; Bar = barriers; PSP = partnerships for specific purposes (or ad hoc); PCCC = project coordination by the client company; INPDP = integration of the new product development process; SA = strategic alignment; OI = open innovation strategy; EQI = empirical quantitative study; CS = case study; EQI = empirical qualitative study; LR = literature review; Conc = conceptual study; Ind = industry; Serv = services; Gen = generic; SME = small- and medium-sized enterprises; Prod = product; Proc = process; MP = management practice or marketing method