



# I NNOVATION AND NETWORKS IN SME'S: A BIBLIOMETRIC STUDY

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## ABSTRACT

Innovation in interorganizational networks has achieved the status of a relevant subject matter in managerial studies. Research shows positive effects and major problems in cooperation to achieve innovations among small and medium enterprises (SMEs). There are 130 documents with the topics Innovation, Networks and SME's since 1991, year of the first one. We aim to use bibliometric approach in order to identify the authors, journals and the state-of-art of the themes as well as to map the main themes and empirical research. We held the research in three databases. Results indicates an emerging and prominent field of study and gaps in literature leading to future research.

**Keywords:** Innovation; Networks; Medium Entreprises; Bibliometric Study; Review.

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# I NOVAÇÃO E REDES NAS MÉDIAS EMPRESAS: UM ESTUDO BIBLIOMÉTRICO

## RESUMO

A inovação nas redes interorganizacionais alcançou o status de uma matéria relevante nos estudos gerenciais. A pesquisa mostra os efeitos positivos e os grandes problemas na cooperação para conseguir inovações entre pequenas e médias empresas. Existem 130 documentos com os temas Inovação, Redes e PMEs desde 1991. Pretende-se utilizar a abordagem bibliométrica para identificar os autores, as revistas e o estado-da-arte dos temas, assim como mapear os principais temas e pesquisas empíricas. Realizamos a pesquisa em três bases de dados. Os resultados indicam um campo emergente e proeminente do estudo e lacunas na literatura que conduzem à pesquisa futura.

**Palavras-chave:** Inovação; Redes; Médias Empresas; Estudo Bibliométrico; Revisão.

## INTRODUCTION

Innovation is vital to advancing living standards of firms (Gronum et al., 2012). Innovation in firms takes place when knowledge is commercialized, in the forms of new products, services, or business models (Baldwin and Gallantly, 2003). Since Schumpeter (1950) suggested that large firms are more likely to innovate than smaller ones, researcher have investigated the relationship among innovation, performance and firm size (Gronum et al., 2012) i.e. Rosenbusch et al., 2011. Investigating this process in small and medium firms is more recent and, although the evidence of strong correlations between innovation and small and medium enterprises (SME) performance is overwhelming (Gronum et al. 2012), e.g., (Baldwin and Gallantly, 2003; Mansury and Love, 2008; Roper et al. 2002), the dynamics of this relationship remain ambiguous (Gronum et al 2012).

Innovation in inter-organizational networks has achieved the status of a relevant subject matter in managerial studies (Dagnino et al. 2015).

The direct effects of network connections may differ in the case of SME's (Gronum et al., 2012). Yet, the dominant view in literature is that networks and the relationships embedded are positive associated with innovations performance (Pettaway et al., 2004; van Wilk et al., 2008) but empirical evidence is inconclusive (Gronum et al. 2012).

Although the phenomenon of innovation of SME's has captured the interest of many scholars, few studies recorded on studying the issue from developing countries perspective (Zeng et al. 2010).

Previous studies such as Dagnino (2015), Pittaway et al. (2004) and Phelps et al. (2012) have offered reviews on networks and innovation in bibliometric approach and Santos et al. (2015) researched innovation and technological capabilities. The missing point is that no one of them had research only in SME's context.

Our main goal is to map the authors and journals and the evolution of publication about innovation, networks and SME's. We may believe this article as a guide to whoever want to study these themes, in as integrated way, and this study may build theoretical insights on it. To achieve our objectives, we

conducted a bibliometric approach on the terms – innovation, networks and SME's.

It becomes important to say that this study is not only concerned about innovation networks – networks that aim mainly to achieve innovation outcomes – but to verify the innovation performance of firms and the network itself in firms collaborating in any kind of network as well.

This paper is organized as follows. In the following section we resume the concepts researched, in an integrated way. In Method we present the methodological features. In Findings, we bring the analysis of literature and propose possibilities for future research and gaps founded. The final section acknowledges the limitations of the study.

## INNOVATION, NETWORKS AND SME'S

It's important, based on the objective of the study, to bring concepts of "Innovation", "Networks" and "Small and Medium Enterprises". It is difficult to define SME's, not only with the fact that the definitions changes with time but also the definition varies from countries to countries and in different size ranges (Peres and Stumpo, 2000). In China, for example, the criteria are based in number of employees or annual revenue, for those with fewer than 2000 employs or an annual turnover less than RMB Yuan 400 million, equivalent to US\$5,6 million.

In Brazil, the criteria is based on annual revenue, witch it's up to US\$1 million per year for being considered Small Enterprise and up to ~US\$3 million for being considered medium enterprise. Therefore, it can be followed the American Small Business Administration (SBA's) definition of SME which is the most widely used in business literature, and considers SME the ones who have fewer than 500 employees.

Innovation, according to the Oslo's Manual definition (2005) is the implementation of any new or significantly improved product (goods or services), operational process, any new marketing methods or new organizational or managerial methods or process in business practices, workplace organization or external relations. Innovation can be viewed both as output and a process (Gronum et al. 2012).

As an output, in the result of innovation process, the types of innovations created by a firm, or the actual implementation of a new product or method. Also indicates the development and commercial exploitation of a new idea or invention, according to van de Ven and Poole (1989) the process of innovation refers to a temporal sequence of events that occur as people interact with others in order to develop and implement their innovation ideas within as institutional context. Both can affect the firm performance (Rosenbusch et al. 2011).

Networks have been identified as an important factor in numerous studies of the innovations process (Gronum et al. 2012). Burt (2004) and Ahuja (2000) showed that the number and the structure of connections in networks can improve innovations outcomes.

Chesbrough (2006) demonstrated the importance of networks in open innovation, where firms achieved and sustain it by using a wide range of external actors and knowledge sources. Literature on innovation indicates that since the 90' there has been a systematic and fundamental change in the way firms undertake innovation activities. There has been a growth in the use of external networks by firms of all sizes. Innovation is seen as a process which results from various interactions among different actors (Zeng et al., 2010).

The topic of innovation in SMEs has received a great deal of attention from scholar (Batterink et al. 2010), such as Edwards et al. (2005). Nooteboom (1994) addressed a number of characteristics of SME's that can be considered either strengths or weaknesses for their innovation process. Well-known strengths are motivated management and labor, effective internal communication and few bureaucracies. Weaknesses include limited absorptive capacity, lack of innovation funding, lack of functional expertise, diseconomies of scale and the short-term perspective of management.

Such weakness are cited as a justification for establishing relations with external actors. There are several reasons why SME find it difficult to establish and benefit from inter-organizational innovations projects (Batterink et al. 2010):

- SME's are often managed by owners, who are used to operate independently and cooperation does not come naturally (Wissema and Euser, 1991);

- Cultural differences and lack of joint research experience (Hoffman and Schlosser, 2001).

- Small firms can not enforce their will upon other;

- Inter-organizational project may involve organizations with divergent institutional and cultural backgrounds.

Networking can be a complementary factor in situations where cooperation and networking are need to achieve economies of scale and/or to merge and integrate diverse skills, technologies and competencies (Mancinelli and Mazzanti, 2008). SMEs maintain few external relationships in their innovative process (Kaminski et al., 2008).

The requirement of SMEs to collaborate, as a means of supplementing and complementing internal resources, has dominated much of the academic debate (Cumbers et al., 2003; Fukugawa, 2006).

Considering that, it becomes important to investigate the role of SME Networks over innovation process and innovation as an outcome.

## **METHOD**

Considering the object of the study, we conduct a bibliometric study, looking for the evolution of the topics: most relevant authors, most relevant journals and the evolution in time as well. In order to attend to that, we choose to use three different databases: Scopus, Science Direct and Web of Science. A bibliometric study refers to applying statistical methods to determine qualitative and quantitative changes in a scientific research topic, establish the profile of publications on the topics and detect tendencies (According to De Bakker et al. 2005).

Yet, bibliometric tools make it possible to explore research studies in terms of analytical influential contributions and their connections that have supported the conceptual development of a field (Di Stefano et al. 2010).

The first search was conducted in Web of Science database only. The search protocol we used was "TITLE: ("INNOVATION" AND "NETWORK") AND TOPIC: ("SME" OR "SMALL FIRM)". This protocol has established searches to documents in which contain the words "Innovation" and "Network" in the title of document, and the words "sme" or "small firm" along

the entire document. In relation to year of publication we used the interval from 1945 to 2016. The first search related to 130 documents, which are part part of the evolution data we show in findings. In order to guarantee the reliability, the same protocol was conducted in Scopus database. From this search, two new documents were added to the select ones, considering citation number.

Then, aiming to perform qualitative analysis, we created criteria, which was the selection of the thirty most cited documents. Among them, we used the following criteria:

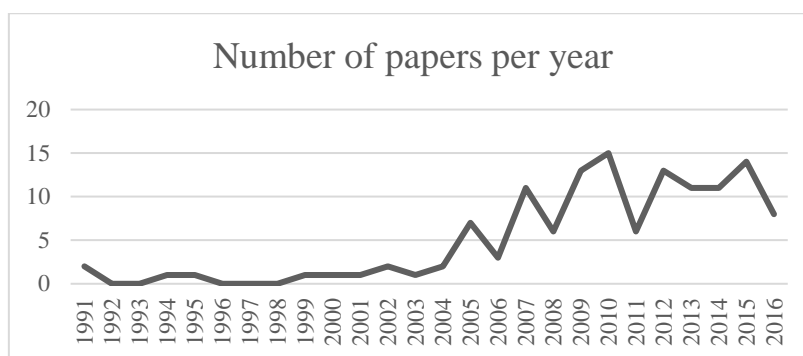
- Documents Type: Only Article;
- Only Journals rated Q1 in business area, according to Scimago.

In short, for the purpose of bibliometric data the sample used was 130 documents and for building better theoretical bases, through qualitative analysis of 30 documents, only Q1 publishing journals and only articles were selected.

## FINDINGS

The first appearance of all these themes integrated was in 1991. The following decade publication kept low. Since 2002 it was turning up, in 2010 it has reached the highest peak with 15 publications. From 2011 until now has been stable with an average 10 publications per year.

Figure 01: Number of publications using the terms Innovation, Networks and SME's per year, total amount:130.



The results also shows the most publishing journals considering the topics. The three first positions are occupied by Technovation, European Planning Studies and Research Policy.

These three journals represent around 13% of all publications. Despite this distribution, there does not seem to have any dominant journal. Considering the object of the analysis (SME's), seems to be relevant the fact that there are two journals dedicated

exclusively to this size of firm – Journal of Small Business Management and International Small Business Journal.

Table 01: Number of documents published per journal

Journal	Count	%
Technovation	8	6.2
European Planning Studies	6	4.6
Research Policy	6	4.6
International Journal of Technology Management	5	3.9

Journal of Small Business Management	5	3.9
Creativity and Innovation Management	4	3.1
R D Management	4	3.1
Regional Studies	4	3.1
Annals of Regional Science	3	2.3
Innovation and Management Policy Practice	3	2.3
International Small Business Journal	3	2.3
Management Science	3	2.3
Others	76	58.5
<b>Total</b>	<b>130</b>	<b>100</b>

Among the authors, and similar to the journals, there is not one that we could refer as the most relevant in area, since there is fair distribution of publications. No author has published more than 4%

of all publications related to the topics. This demonstrate that there are a large number of authors researching the issues.

**Table 02: Top authors**

Author	Count	%
Cowan R	4	3.1
Jonard N	4	3.1
Gellynck X	3	2.3
Kuhne B	3	2.3
Ortqvist D	3	2.3
Wincent J	3	2.3
Xie XM	3	2.3
Zeng SX	3	2.3
Other	94	72.3
<b>Total</b>	<b>130</b>	<b>100</b>

In **Table 03** we show the 30 most cited articles. The most cited is "Interfirm collaboration networks: The impact of large-scale network structure on firm innovation", with 278 citations. We can also check

External networking and innovation in small and medium-sized manufacturing firms in Europe" from 1991, which is considered the first paper regarding the topics with 117 citations.

**Table 03: Most cited papers**

#	Title	Authors	Year	Journal	Citations
1	Interfirm collaboration networks: The impact of large-scale network structure on firm innovation	Schilling, M. A., & Phelps, C. C.	2007	Management Science	278

2	Sectorial patterns of small firm innovation, networking and proximity	Freel, M. S.	2003	Research policy	166
3	Innovation, networks, and vertical integration	Robertson, P. L., & Langlois, R. N.	1995	Research policy	158
4	Networks, firm size and innovation	Rogers, M.	2004	Small business economics	144
5	Relationship between cooperation networks and innovation performance of SMEs	Zeng, S. X., Xie, X. M., & Tam, C. M.	2010	Technovation	138
6	Heterogeneity and specificity of inter-firm knowledge flows in innovation networks	Sammarra, A., & Biggiero, L.	2008	Journal of Management Studies	132
7	Open innovation in SMEs-An intermediated network model	Lee, S., Park, G., Yoon, B., & Park, J.	2010	Research policy	126
8	External networking and innovation in small and medium-sized manufacturing firms in Europe	Rothwell, R.	1991	Technovation	117
9	Bilateral collaboration and the emergence of innovation networks	Cowan, R., Jonard, N., & Zimmermann, J. B.	2007	Management Science	98
10	The glue and the pieces: Entrepreneurship and innovation in small-firm networks	Lipparini, A., & Sobrero, M.	1994	Journal of Business Venturing	91
11	Innovation and network structural dynamics: Study of the alliance network of a major sector of the biotechnology industry	Gay, B., & Dousset, B.	2005	Research policy	88
12	There are two sides to every story": Innovation and collaboration within networks of large and small firms	Smith, H. L., Dickson, K., & Smith, S. L.	1991	Research Policy	80
13	Social networks: Effects of social capital on firm innovation	Molina-Morales, F. X., & Martínez-Fernández, M. T.	2010	Journal of Small Business Management	68
14	Small firm networks: a successful approach to innovation?	Hanna, V., & Walsh, K	2002	R&D Management	59
15	R&D networks and product innovation patterns - academic and non-academic new technology-based firms on Science Parks	Löfsten, H., & Lindelöf, P.	2005	Technovation	46
16	The Role of Networks in Small and Medium-Sized Enterprise Innovation and Firm Performance	Gronum, S., Verreyne, M. L., & Kastle, T.	2012	Journal of Small Business Management	46
17	Power in firm networks: What it means for regional innovation systems	Christopherson, S., & Clark, J.	2007	Regional Studies	45

18	Inter-firm market orientation as antecedent of knowledge transfer, innovation and value creation in networks	Cambra-Fierro, J., Florin, J., Perez, L., & Whitelock, J.	2011	Management Decision	41
19	Learning about innovation through networks: The development of environment-friendly viticulture	Chiffolleau, Y.	2005	Technovation	41
20	Designing interorganizational networks for innovation: An empirical examination of network configuration, formation and governance	Thorgren, S., Wincent, J., & Örtqvist, D	2009	Journal of Engineering and Technology Management	38
21	Network-Independent Partner Selection and the Evolution of Innovation Networks	Baum, J. A., Cowan, R., & Jonard, N.	2010	Management Science	37
22	Knowledge portfolios and the organization of innovation networks	Cowan, R., & Jonard, N	2009	Academy of Management Review	33
23	Determining factors in innovation of small firm networks: A case of cross industry groups in Japan	Fukugawa, N.	2006	Small Business Economics	31
24	The importance of public research institutes in innovative networks - Empirical results from the metropolitan innovation systems Barcelona, Stockholm and Vienna	Diez, J. R	2000	European Planning Studies	30
25	Networks, weak signals and technological innovations among SMEs in the land-based transportation equipment sector	Julien, P. A., Andriambelason, E., & Ramangalahy, C.	2004	Entrepreneurship & Regional Development	28
26	Orchestrating innovation networks: The case of innovation brokers in the agri-food sector	Batterink, M. H., Wubben, E. F., Klerkx, L., & Omta, S. W. F.	2010	Entrepreneurship and regional development	28
27	Innovation and networking in peripheral areas - A case study of emergence and change in rural manufacturing	Virkkala, S.	2007	European Planning Studies	27
28	Learning and innovation in inter-organizational network collaboration	Westerlund, M., & Rajala, R.	2009	Journal of Business & Industrial Marketing	25
29	Personal relationships and innovation diffusion in SME networks: A content analysis approach	Ceci, F., & Iubatti, D.	2012	Research Policy	25



30	. State and development of innovation networks: Evidence from the European vehicle sector	Dilk, C., Gleich, R., Wald, A., & Motwani, J	2008	Management decision	22
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After reviewing all 30 articles, we identified difference and clustered them on the criteria of the level of analysis. We identified three levels of analysis: a) Industry level; b) Network (interorganizational) level; and c) firm level. This dimensions were also found in Dagnino (2015). Yet,

we found articles that relates to brokers and four theoretical issues. The following tables and discussion brings the 3 dimensions found and specials sessions dedicated to brokers and the theoretical issues.

Table 04: Firm Level

Article	Objective	Sample	Method	Instrument	Results
Rogers, M. (2004)	To investigate the determinants of innovation	3,400 Australian firms	Quantitative	Survey	Small manufacturing companies show a relationship between work and network and innovation. In Non- manufacturing this relationship is only found in medium and large firms
Rothwell, R. (1991)	To investigate cooperation with external and internal agents for innovation	400 UK firms	Quantitative	Survey	10 topics on size , external access and knowledge
Lipparini, A., & Sobrero, M. (1994)	To provide directions to the role of suppliers in new product development process, and the entrepreneur cardboard in the promotion and management of external relations innovative	110 Italian Firms	Quantitative	Survey	The number and quality of relationships cannot be explained by local factors. 1) when the entrepreneur leads and manages the business , more vendors are involved with development of new products; 2) the type of supplier contribution varies according to the presence of the same
Smith, H. L., Dickson, K., & Smith, S. L. (1991)	To explore the motivations and problems of relationships between small and large networks	50 networks	Qualitative	Multiple case study	The existence of informal and personal networks is a key factor in establishing collaborative links

Though the research is about inter-organizational theme, we found articles that used the firm as a level of analysis. Rogers (2014) says that small manufacturing firms achieve more innovation than non-manufacturing ones. Smith et. Al (1991), which is

the first article regarding the themes, investigated relationships and said that the more personal the relations are the more potential to collaboration between small and large companies.

**Table 05: Network Level**

Authors	Year	Objective	Sample	Method	Instrument	Results
Schilling, M. A., & Phelps, C. C.	2007	To investigate if firms embedded in alliance networks that exhibit both high clustering and high reach (short average path lengths to a wide range of firms) will have greater innovative output than firms in networks that do not exhibit these characteristics	1,106 firms in 11 industry-level alliance networks.	Quantitative	Secondary Data	" Clustering " and "reach " operate for the creation and diffusion of innovation
Zeng, S. X., Xie, X. M., & Tam, C. M.	2010	To explore the relationships between different cooperation networks and innovation performance of SME	137 Chinese manufacturing SMEs,	Quantitative	Survey	There is a positive relationship between co-operation between firms, with government agencies, with intermediate institutions with innovation performance. With greater impact on the first .
Sammarra, A., & Biggiero, L.	2008	To explore if collaborating firms exchange more than one type of knowledge through collaborative relationships	aerospace industrial cluster of Rome	Qualitative	Case Study	There is exchange of the three types of knowledge.
Molina-Morales, F. X., & Martínez-Fernández, M. T.	2010	To analyze the role played by the dimensions of social capital, that is, social interactions, trust, shared vision and involvement of local institutions, in the process and product innovation	220 manufacturing firms in the Valencia Region (Spain)	Quantitative	Survey	There is positive relationship between district affiliation, social capital and involvement of institutions with in innovation performance ;
Gronum, S., Verreyne, M. L., & Kastle, T.	2012	To understand the contribution of networks to innovation and firm performance in small and medium enterprises (SMEs)	1,435 SMEs,	Quantitative	Longitudinal Survey	There is no direct association between networks and profitability or productivity. Innovation is a mechanism for such.
Christopherson, S., & Clark, J.	2007	To understand variable power within networks through Transnational Companies.	57 firms	Quantitative	Survey	TNC access to critical resources for innovation (University research and hand - qualified labor ) affects the potential of SMEs
Cambra-Fierro, J., Florin, J., Perez, L., & Whitelock, J.	2011	To establish a framework for clarifying and extending the concept of inter-firm market orientation (IMO) and to complement the relatively small body of literature related to this concept	A set of six case studies (two vertical and four inter-industry relationships)	Qualitative	Case Study	A framework proposition: Link between IMO (Inter - firm market orientation) with value creation networks. Also positive relationship between IMO and innovation

<b>Chiffolleau, Y.</b>	2005	To propose the use of network sociology to link innovation and learning theories and thus highlight the diverse social practices contributing to changes and underlying learning processes in such contexts	A small wine co-operative in the Languedoc region of Southern France	Qualitative	Case Study	There are two types of networks : a) daily dialogue and changeovers ; b ) pragmatism in decisions for competence
<b>Thorgren, S., Wincent, J., &amp; Örtqvist, D</b>	2009	To examines the influence of the number of member firms (network size), the extent to which a network is based on firm incentives (bottom-up formation), and the extent of development of the governance structure (size of administrative function) on a network's innovative performance	53 Sweden SME Networks	Quantitative	Longitudinal Survey	The larger the network, the formation is bottom-up and the higher the formal mechanism ( governance ) most innovative performance of the network
<b>Fukugawa, N.</b>	2006	To examine the relationship between network characteristics and innovation under different phases of innovation	1064 Japanese SME	Quantitative	Survey	To connect an external source of knowledge has a positive relationship with technical success of innovation. Cooperation in sales leads to market success of innovation
<b>Julien, P. A., Andriambelason, E., &amp; Ramangalahy, C.</b>	2004	To support the empirical Strength theory of weak ties	147 SMEs, all in the land-based transportation equipment sector	Quantitative	Survey	It confirms the importance of weak tie networks as opposed to other types of networks, recognizing their complementary contribution to technological innovation. The organization's absorptive capacity is also found to be a significant intermediary factor in taking advantage of weak tie networks
<b>Virkkala, S.</b>	2007	To examine the features of successful forms of innovation in rural areas characterized by geographical distance and sparse population	Finland Cluster	Qualitative	Case Study	Success due to: a) highly specialized companies in niches ; b ) proactivity of local technology institutes
<b>Westerlund, M., &amp; Rajala, R.</b>	2009	To relate the learning-orientation and collaboration in networks, in particular the co- innovation	90 SME's	Quantitative	Survey	a) Direction of explorative learning fosters collaboration network through co- innovation of the product; b ) exploitative learning orientation promotes innovations but discourages networks

The majority of the studies (47%) includes the Network Level of Analysis, in which we can observe some similarities. Schilling et al. (2007), the most cited paper, concluded that "Clustering" and "reach" operate for the creation and diffusion of innovation and suggested to include other properties of alliances (strength, governance structure and scope).

Innovation performance was research in several articles as a dependent variable. In Zeng et al. (2010), its relation with co-operation with several agents (government, firms, agencies and institutions); Gronum et al. (2012) found no positive relationship between networking an innovation performance; Thorgren et al. (2009) found that the larger the network is and the higher formals mechanisms of governance are the greater innovation performance

becomes. Zeng (2010) suggested to replicate study in different countries and to include moderating effects such as industry, innovation type and company size.

Knowledge was considered in Sammara and Biggiero (2008), when investigating the exchange of knowledge and left seven proposition to future studies. Cambra-Fierro et al. (2011) investigated market-orientation as an antecedent for innovation. Chiffolleau (2005) and Westerlund and Rajala (2009) investigated knowledge and learning theories as a determinant for innovation. Westerlund and Rajala (2009) found differences between exploitative and explorative learning. Molina-Moralez et al. (2010) suggested investigating the role of intermediaries. Intermediaries or brokers were found in the research and show in Table 07.

**Table 06: Industry Level**

Authors	Objective	Sample	Method	Instrument	Results
Freel, M. S. (2003)	To investigate the extent to which cooperation for innovation is associated with firm-level product and process 'innovativeness	597 Manufacturing SME's in high-technology industry	Quantitative	Survey	"Reach " of bonds tends to be higher for companies that innovate more incremental. Smaller companies that innovate in incrementally form are immersed locally.
Gay, B., & Dousset, B. (2005)	To investigate the evolution of industrial networks in area of radical evolution ( biotechnology) .	Biotechnology industry	Quantitative	Secondary Data	Firms should position themselves strategically and global networks that lead to radical innovations.
Dilk, C., Gleich, R., Wald, A., & Motwani, J (2008)	To explore the goals and performance of innovation networks as well as their formation and governance	European automotive sector	Quali-Quanti	Survey	Confirm that innovation networks are of high relevance in the automobile sector.

High technological industries, such as biotechnology, automotive, pharmaceuticals and software were observed in the articles classified as Industry Level of analysis. Dilk et al. (2008) approached the automotive supply chain and investigated innovative performance and governance and according to them It can be expected that innovation networks will spread further and gain

more importance in the coming years. The most important goals that the involved companies aim to realize by using innovation networks include flexible access to technologies, intensified contact with clients and markets and long-term bonding of suppliers and clients. Freel (2003) concluded that "reach" is higher for large firms while in small firms the local factor becomes predominant.

**Table 07: Brokers**

Authors	Objective	Sample	Method	Instrument	Results
Lee, S., Park, G., Yoon, B., & Park, J. (2010)	To place the concept of open innovation in the context of SMEs	2400 Korean SMES	Quantitative	Survey	Confirms the potential of MPES in open innovation and indicates the work on networks effective to achieve it.
Molina-Morales, F. X., & Martínez-Fernández, M. T. (2010)	To analyze the role played by the dimensions of social capital, that is, social interactions, trust, shared vision and involvement of local institutions, in the process and product innovation	220 manufacturing firms in the Valencia Region (Spain)	Quantitative	Survey	There is positive relationship between district affiliation, social capital and involvement of institutions with in innovation performance
Hanna, V., & Walsh, K. (2002)	To investigate in which extension co-operation lead to innovation	Innovation network brokers	Qualitative	Multiple case study	Exclude competitors have more positive implications than we think. The brokers should encourage trust and ensure synergy goals
Löfsten, H., & Lindelöf, P. (2005)	To explore the R&D networks and product innovation patterns made by the NTBFs	134 NTBF (Science Parks)	Quantitative	Secondary Data	Both (Corporate Spinoff and University) cooperate with universities. But USO underperform patent.
Diez, J. R. (2000)	To explore the real importance of research institutes supporting innovative activities in businesses	450 European firms	Quantitative	Survey	Vertical cooperation (suppliers and buyers) has greater contribution than institutions. Small businesses are not reached by PR.
Batterink, M. H., Wubben, E. F., Klerkx, L., & Omta, S. W. F. (2010)	To investigate how innovation brokers successfully orchestrate innovation networks of SMEs	Four in-depth case studies in the agri-food sector from different countries: The Netherlands, Germany and France.	Qualitative	Multiple case study	Framework for successful network orchestration by innovation brokers.

Brokers or intermediates were found to be an important agent over network innovation process. According to Hanna and Walsh (2002) brokers identify opportunities, bring small firms together and facilitate co-operation. Diez (2000) found that vertical cooperation has greater contribution than institutions. Though, Molina-Moralez et. Al (2010) found positive relation between institutions and innovation. Löfsten and Lindelöf (2005), examined corporate Spin-offs and University Spin-offs and found that both are effective to innovation activity but the first over perform in patents.

It does not seem to be clear the effectiveness of brokers, mainly Institutions and Universities in their

relation no innovative performance of SME's. Lee et. Al (2010) suggested to investigate the characteristics of SMEs that are more likely to benefit from the intermediary. Also, Batterink et. Al (2010) suggested quantitative studies on innovation brokers, both at the level of innovation networks (comparing networks that are being orchestrated by an innovation broker with networks that are not) and at the level of the innovation broker, comparing different types of innovation brokers and the impact of their specific tools and instruments, and certain organizational characteristics on performance.

**Table 08:** Theoretical Issues

Authors	Objective	Results
Robertson, P. L., & Langlois, R. N. (1995)	To debate the structures: vertically integrated and horizontal and concentrated network firms	There is not the best form "a priori". The context of innovation is complex and varied.
Cowan, R., Jonard, N., & Zimmermann, J. B. (2007)	To check the effects of knowledge in the formation of the network. The results of innovation result from the combination and how they complement each other	"Embedded " Relationships are key to explaining the structure of the networks, and also to understand how companies combine knowledge to create innovations.
Baum, J. A., Cowan, R., & Jonard, N. (2010)	To oppose the theory of social capital and includes the knowledge (technology or knowledge)	
Cowan, R., & Jonard, N. (2009)	To complement social theory (relational or social embedded ) capital and includes the knowledge (technology or knowledge)	

Four Theoretical discussions were also found in the 30 most cited papers. Three of them (Coan et. Al., 2007; Baum et. Al., 2010; Cowan and Jonard, 2009) included knowledge to discuss innovation and networks in SME contexts. Cowan et. Al (2007) considered the embeddedness to explain how companies combine knowledge to create innovation. Yet, two articles (Baum et. Al., 2010; Cowan and Jonard, 2009) opposes or combine with base theories including knowledge. In relation to structures (vertically or horizontally) Robertson and Langlois (1995) pointed that there is best form *a priori*, since the context of innovation is complex and varied.

Considering the 30 analyzed articles, regarding method, most of empirical studies used quantitative approach (65%), and most of these (71%) used survey as the research instrument. Another 35% of empirical studies used qualitative approach, and case of study was the most used instrument. We suggest the research about the themes is dominated by quantitative methods.

We identified in some papers, the explicit use of base theories, such as Social Capital Theory in Molina-Moralez and Martínez-Fernandez (2010), Relational View in Cambra-Fierro et al. (2011), Strength of Weak Ties in Julien et al. (2004) and RBV in Virkkala (2007).

We concluded that there is not a dominant base theory in the topics researched.

We also observed that most of the studies used as an empirical object high-technology industries, which is according to Dagnino (2015) research. We suggested, as futures studies, to analyze low-tech industries. For Santamaria et al. (2009) literature in innovation management overestimates the role of research and development activity (R &D) as an internal determinant of innovative ability of companies, and likewise, Schmierl and Köhler (2005), Hirsh-Kreinsen et al. (2006) and Gil Barge et al. (2008) highlight that this is due to the predominance of the linear model of innovation, for R&D statistics and the lack of knowledge of how is the process of innovation in low- tech companies.

Most of studies were conducted in developed countries. We suggest to replicate or even apply new studies in development countries. Few of the studies were conducted in BRICS, which can be replicated and compared to future studies in Brazil. In fact, we recommend to conduct studies in Brazil.

Another recommendation for future studies refers to governance structure in networks or inter-organizational environments, which was also proposed by Robertson and Langlois (1995). When defining the best governance structure, or even the structure of the network itself (vertically you horizontally integrated) private and public initiative could benefit from the best structure to obtain best gains in innovative performance. Thus, the network members would benefit as well.

Regarding intermediaries or brokers there does not seem to be consensus about the effective role of them, mainly about universities and public research institutes. Well, if even in high-technology industries this is observed, further investigation could examine this in small and medium enterprises in low-tech industries. In fact, even in high-technology cluster, such as automotive we observe that small enterprises do not maintain a P&D budget. Which, as a consequence reveals more exploitation and incremental innovations in process. Universities and

research institutes should also focus on developing small companies in relation to their exploration – innovations in product level.

Finally, as also proposed by Dagnino (2015) a multi-level approach to the themes is a gap in the literature. As well as Dagnino (2015) we identified three levels of analysis of the themes: firm level, industry level and network (or inter-organizational) level. No document in the sample proposed a multi-level analysis.

## CONCLUSION

Innovation and networks in the small and medium firms context seems to be a prominent field of study. Publications considering them increased over last decade and through bibliometric studies and content analysis we identified few dominance, even in methods, base theories and in conclusions as well.

As one limitation of the study, we consider the fact of analyzing just the most cited articles. Considering that, the state-of-art regarding the subjects of the research could had been missed, as long as the most current studies were not considered within the research. At the same, further studies, considering the most current studies, could verify and even integrate their results with the research showed over this paper. Another limitation is due to the exclusivity of searching only documents in English. Further studies could include documents published in Italian, Spanish and French.

Finally, further studies could consider the recommendations already mentioned, such as investigating on how innovative performance could enhanced in low technological industries or firms. Also, replicate studies in development countries, specially in BRICS. Investigating the effectiveness of intermediaries in this process. Yet, the main gap found in the literatures – conduct multi-level investigations. There is also possibility for further studies to explore the evolution of propositions and hypotheses brought by the 4 theoretical issues.

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