

Examining Knowledge Transfer and Networks: An Overlook Through the Last Twenty Years

Abstract

Purpose: Knowledge transfer (KT) has attracted scientific community attention in the last years. The need to establish collaborative network relationships to achieve effective KT has led to a large volume of studies that attempt to identify how collaborative networks influences KT processes. However, papers linking KT and networks have not been systematized to date. This study aims to provide an overview of this academic field and set out an agenda for future research.

Design/methodology/approach: We carried out a systematic literature review following the PRISMA method from 2000 to 2020. We sourced the sample from the Web of Science and Scopus databases. Finally, we screened the references that fall under management and business categories and published in the two first quartiles of the Journal Citation Reports. This search returned a total of 190 impactful papers across 53 journals that were analysed.

Findings: We present the main results into two sections. First, we elaborate a conceptual model of the field and second, we review KT between firms and other agents letting us to identify KT flows withing and between companies, universities and public institutions.

Originality/value: This paper provides the first systematic review of KT and collaborative networks. We also identify five areas of action with great projection in future research, which are specified several research questions. Finally, we provide several practical implications. In a world in which more and more dynamic agents coexist,

is important to be aware of the needs of organisations that create and disseminate specific knowledge.

Keywords: Knowledge transfer; collaboration; networks; innovation; systematic literature review

1. Introduction

Knowledge transfer (KT) has been considered as one of the main determinants of business success and innovation (Tsai, 2001; Werner *et al.*, 2015). Some research has even shown how efficient KT can generate sustainable competitive advantages (O'Connor and Kelly, 2017; Zhang and Zhang, 2018). To this end, the creation and use of collaborative relationships offer access to valuable knowledge and KT processes (Hemmert, 2019; Tallman and Chacar, 2011). In other words, the generation of collaborative networks is a concept strongly linked to KT processes.

Although the concept of KT has been object of debate for a long time, it is just in the last years that academia has put the focus on this issue. Researchers have tried to provide an answer to questions such as which are the antecedents that determine a greater and better propensity to transfer knowledge (Kaminski *et al.*, 2008; Levin and Walter, 2019), what consequences in terms of innovative performance behaviour KT offers (Mariotti, 2011; Villasalero, 2013), or how different ecosystems and contexts affect the willingness to generate networks for KT (Frenz and Ietto-Gillies, 2009).

Literature has shown that the determinants and the effects are not the same for every KT collaboration process. Specifically, KT has been examined both in intraorganizational networks (Kim *et al.*, 2014), that is, between units in the same firm; and in interorganisational networks (Maggioni *et al.*, 2011; Malsch and Guieu, 2019) i.e. between different organisations. Multinational enterprises (MNEs) have received a lot of

attention given the interest in analysing knowledge flows between subsidiaries and headquarters (Claver-Cortés *et al.*, 2018; Nadayama, 2019). Literature also has revealed the importance of promoting relationships with institutions that create knowledge such as universities (Chen *et al.*, 2019) and with institutions that facilitate learning processes such as public institutions (von Malmborg, 2004).

However, even that KT and collaborative networks have been approached from multiple perspectives, there is a need to deepen on this debate with the aim of advancing towards a systematization of the theoretical and empirical findings on the topic.

To provide a comprehensive literature overview, a systematic review was carried out using the Web of Science (WoS) and Scopus databases to identify relevant publications over a 20-year time frame (2000-2020). To ensure the quality of the sample selected, only papers published in journals classified in the first two quartiles of the Journal Citation Report and specifically in the areas of “business” and/or “management” were included. This search process allowed for the analysis of 190 high impact research studies.

This study aims to contribute to the literature by answering these questions: 1. What are the main conceptual findings of the studies focusing on KT analysis and collaborative networks? 2. What does the literature say about the antecedents, determinants, and effects of KT on the innovative and thus, business performance? 3. What role different contexts and institutions play in the processes of knowledge dissemination? 4. What are nowadays the main research gaps and upcoming research trends?

Our work adds to existing research in three important ways. First, we provide the first systematic review of KT and collaborative networks. We objectively identify the studies with the greatest scientific impact to present a comprehensive overview of the current state of the art related to KT processes. Our approach allows us to identify and distinguish

the effect of KT on different collaborative networks and business typologies. Secondly, we identify aspects that are less researched, providing a direction for future research and identifying upcoming trends. Specifically, we identify five areas with great projection in future research. Finally, we provide several implications of interest for academia, policy makers and public policy.

This work is structured as follows: Section 2 presents the methodology, the screening criteria and the sample obtained. Section 3 discusses the findings obtained after an exhaustive examination of the papers under study. Finally, section 4 presents the conclusions, implications, future research agenda and limitations of the study.

2. Methodology

In this research, a systematic review of the literature was applied. This method is considered a valuable tool to provide a holistic view of existing research on a specific topic to improve its understanding and conceptualization (Booth *et al.*, 2016; Carayannis *et al.*, 2021; Tranfield *et al.*, 2003). With the support of this research method, we can identify and analyse a significant sample of published articles related to KT and its networks, thus providing a comprehensive overview of this topic.

Following the procedures outlined in Tranfield *et al.* (2003), the systematic review was conducted in a three-stage procedure. To better represent the research search process, we present Figure 1, which was developed following the PRISMA guidelines developed by Moher *et al.* (2009). These steps are explained in further detail in the following subsection. After that, the sample description is presented.

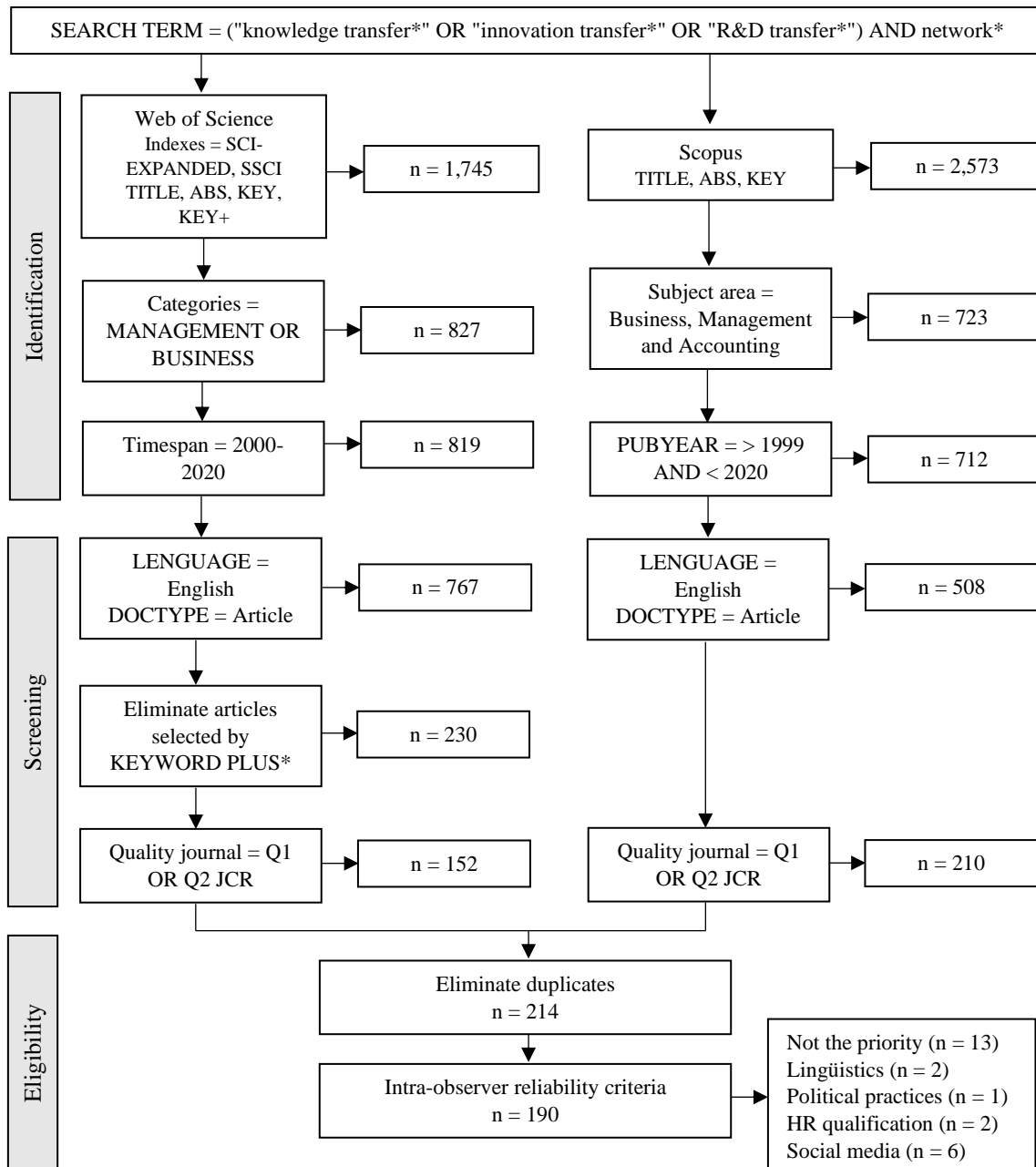


Figure 1. PRISMA diagram of the systematic literature review

Search process was done on January 1st, 2021.

2.1. Sample selection, screening, and eligibility

First, according to previous systematic literature reviews (Foss and Saebi, 2017; Sivarajah *et al.*, 2017) two scientific search engines, the WoS (Web of Science) and SJR (Scopus), were used to identify appropriate publications. It is widely recognized that these

two databases include the most relevant, impactful, and up-to-date peer-reviewed academic publications. The search was conducted on January 1st, 2021.

The search and screening processes were similar in both cases. The Boolean search was performed on the titles, abstracts, keywords, and keywords Plus. The latter refer to those articles that have received citations from other works that do use the terms we have searched. Since in this study we are strictly interested in research that analyses our keywords, we exclude the articles that WoS has selected according to the keywords Plus. This obstacle does not appear in the case of Scopus. The categories selected are Management and Business (in the case of Scopus, the area also includes Accounting), and the period under analysis covers the last 20 years.

To further guarantee objectivity, only documents that have been published in journals were included, thus excluding book chapters or documents published in conference proceedings. We restricted our search to articles published in English. At this point of selection, we apply one quality criterion. We include articles published in journals indexed in quartiles 1 and 2 of the 2018 JCR and SJR. In this way, the conclusions we draw will be based on high quality and impact publications.

After that, duplicate investigations were eliminated. Finally, the criterion of intra-observer reliability is followed to eliminate articles that do not fit with the objectives of our search. All the abstracts were read, as well as several introductions and conclusions, to determine with greater robustness the exclusion or inclusion of the articles of our sample. The key criteria for inclusion were the following: that "knowledge transfer" and "networks", or their derivatives, appear as central pieces of the article, that "knowledge" appear to be nominally linked to innovation, and that "networks" appears to be nominally linked to collaboration. 24 articles were removed because they do not fit the requirements.

13 use the terms in a collateral way, 2 analyse different aspects of the linguistics, 1 focus on political recommendations, 2 linked knowledge with qualification processes of the human resources departments and 6 use networks followed by social media (Facebook and Twitter among others). 190 articles across 53 journals met the inclusion criteria. These 190 articles were read in their entirety for the final analysis and synthesis.

2.2. Sample description

Figure 3 shows the number of articles published in each of the years considered in our sample. Even though it is a path that presents multiple peaks throughout the period, the trend is upward. If we pay attention to the first years, the number of publications is, with some exceptions, quite low (usually between 2 and 5 publications per year). However, when one advances in the timeline, the publication trend gains strength. Between 2008 and 2016, the number of articles ranges from 8 (2010) to 15 (2012). This increase in publications on innovation transfer may be due to the publication of the national innovation surveys that contribute to the European CIS in 2001, 2005, 2007, 2011, 2013 and 2015 (Dziallas and Blind, 2019). Despite the decrease in publications in 2017 and 2018, in 2019 and 2020, the trend seems to continue growing. This suggests a clear interest in the subject.

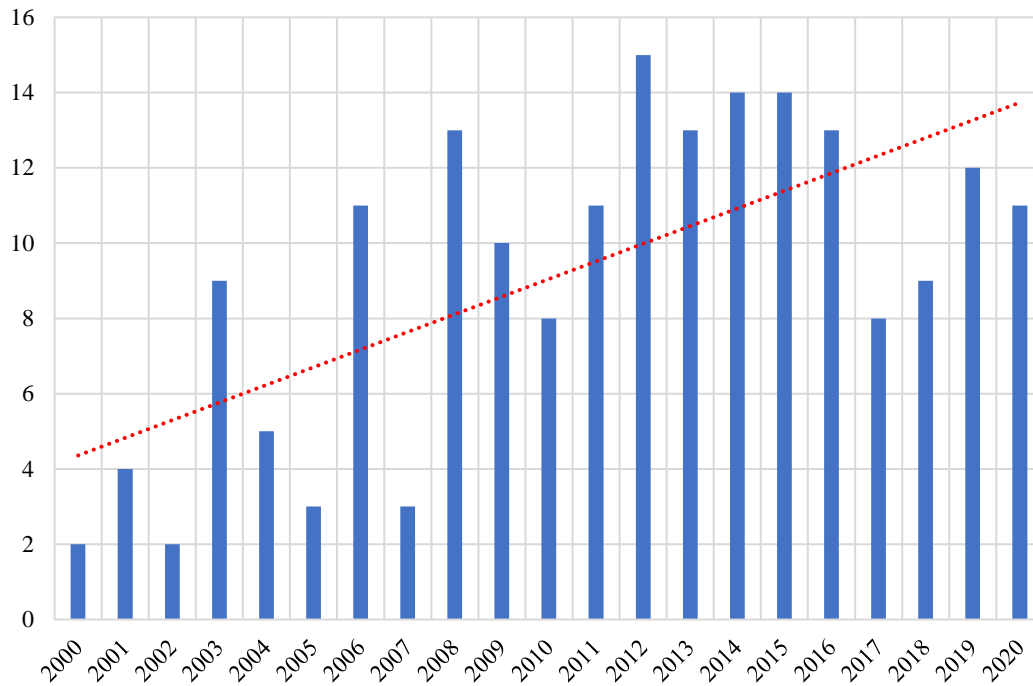


Figure 2. Number of publications (2000-2020)

■ Number of publications - - - Linear (number of publications)
 Boolean search for this research was conducted on January 1, 2021.

Figure 4 shows the number of publications per journal. Most of the articles have been published in the Journal of Knowledge Management (JKM), specifically almost 20% of the publications under analysis. Other journals that show interest in this research are Journal of Technology Transfer (JTT), Research Policy (RP), Journal of Business Research (JBR) and Organization Science (OS).



Figure 3. Paper distribution according to the journal in which there are published

In addition, 6 journals published 3 papers that fit the inclusion criteria, 10 journals published 2 and 20 published 1.

In terms of research method, most studies apply quantitative research methods (52.11%), which peaked in 2014. Qualitative methods (34.21%) dominate the first stage of the period studied (2002-2008). In contrast, in the second stage (2010-2020) there is a clear preference for the use of quantitative techniques. In this sense, even though articles using quantitative methods seems to be the trend, the four previous years this type of research suffered a significant decrease, with the number of publications very close to those using qualitative techniques. Purely theoretical articles, which have been considered as an independent category, have remained low over time, although there has been a slight increase in the interest in publishing research of a theoretical nature. This may be because all quantitative articles need a solid theoretical support behind them, which on many occasions are obsolete in time. Figure 5 illustrates these results.

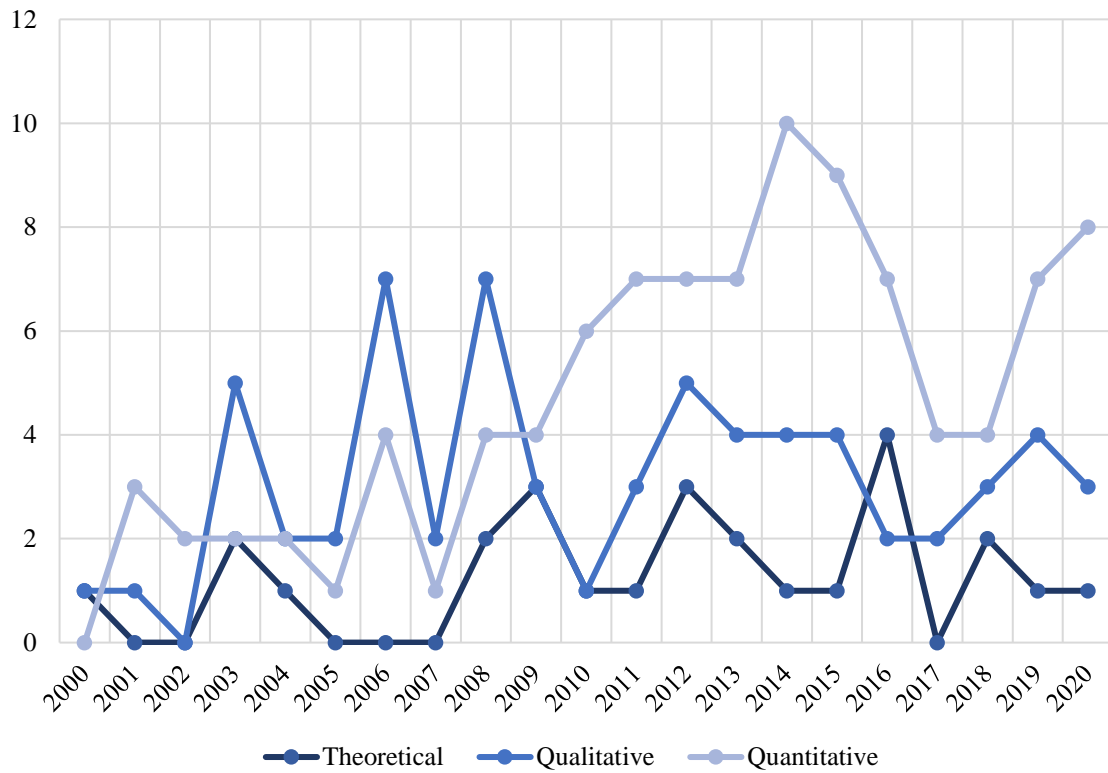


Figure 4. Evolution of the papers published according to the research method (2000-2020)

If attention is paid to the scope of study of qualitative and quantitative articles (theoretical works have been suppressed for the elaboration of this statistic), there is a tendency to research at country level (see Figure 6).

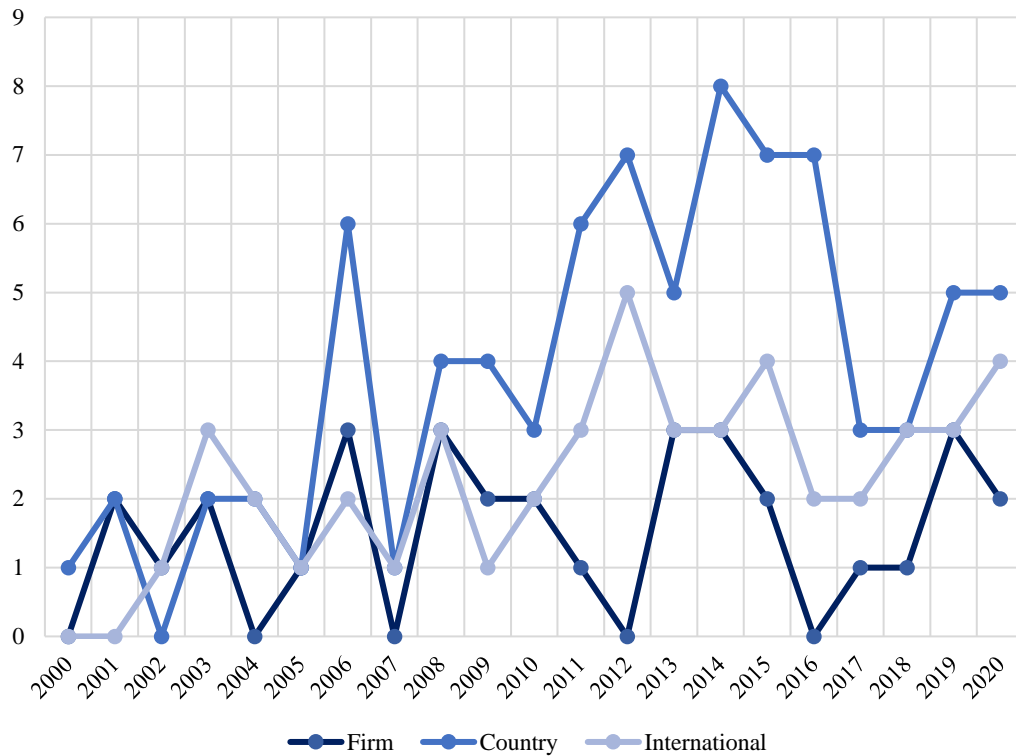


Figure 5. Evolution of the papers published according to the scope level (2000-2020)

Table 1 combines figures and percentages on the research method, either qualitative or quantitative. In both cases there is a remarkable preference for country analysis. However, this preference is significantly higher in the case of research whose methodology is quantitative. As noted above, this may be due to the greater accessibility to databases in each region by researchers. In the case of qualitative works, the study of a single company and the use of international databases does not present great differences. On the other hand, there is a greater tendency to use international data in articles whose methodology is quantitative.

Specifically, 34.77% of the studies carried out at country level ($n = 85$), are based on samples from the United Kingdom (17.65%) and the United States (14.12%). China (11.76%) and Spain (8.24%) rank third and fourth, respectively. Regarding the aggregated data by continent, research based on European data accounts for more than half of the total (51.76%). Asia (27.06%) and America (18.82%) follow.

Table 1. Synthesis of the articles analysed

Research method	Scope level	Number of papers	%*	%**	
QL	Firm	16	50	9.76	
	Country	30	36.59	18.29	
	International	18	37.50	10.98	
QT	Firm	16	50	9.76	
	Country	52	63.41	31.71	
	International	30	62.50	18.29	
Localization		Number of papers	Localization		
America (n = 16)	United States	12	Europe (n = 44)	United Kingdom	15
	Brazil	3		Spain	7
	Canada	1		Sweden	6
Asia (n = 23)	China	10		Italy	5
	South Korea	3		Germany	3
	Taiwan	3		France	2
	Pakistan	3		Austria	2
	India	2		Ireland	1
	Israel	1		Finland	1
	Arabia Saudi	1		Belgium	1
Africa	South Africa	1	Oceania	New Zealand	2

*Percentage represented by the different fields of study (Firm, Country or International) over each research method (QL or QT).
 **Percentage represented by the different fields of study (Firm, Country or International) over the total number of articles analysed (n = 162; since the theoretical ones are not counted in this statistic).

3. Findings

To achieve a better understanding of the findings of this systematic review, the arguments have been organised around two sections. The first one groups the main theoretical concepts and relationships that focus on the KT process through collaborative networks. The second section presents the applied results found in this review. This section is structured in three sub-sections articulated around the concept of collaboration.

3.1. Conceptual foundations of KT and collaborative networks

According to the knowledge-based view (KBV), knowledge is a strategic asset capable of generating successful innovations and competitive advantages (Grant, 1996;

Inkpen and Tsang, 2016; O'Connor and Kelly, 2017). However, to achieve this, collaborative complex networks that facilitate the absorption and exchange of tacit and explicit knowledge are necessary (Aalbers *et al.*, 2013; Cabrera-Suárez *et al.*, 2018; Uzzi and Landcaster, 2003; Wang, 2013). In other words, KT must be produced (McGuinness *et al.*, 2013). In this way, beneficial strategic effects created (Villasalero, 2014) are no strangers to the organisational culture and industrial ecosystems (Jakob and Ebrahimpur, 2001). Several studies based on the findings of Tsai (2001) have revealed that the interaction between knowledge absorption capacity and position in the collaboration network significantly affects the innovation and performance of business units (Chen and Hung, 2010; Fleming and Marx, 2006; Villasalero, 2013). They also warn that an improvement in the absorption capacity and an expansion of the network is fundamental to the achievement of competitive advantages (Malik *et al.*, 2012; Streb, 2003; Zhang and Zhang, 2018). These ideas have been supported by subsequent studies that have allowed a more detailed analysis of the relationships (see Figure 7).

Accessibility to collaborative knowledge does not necessarily guarantee its integration (Hardy *et al.*, 2003; Liu and Hart, 2011; Villasalero, 2017) and its innovation success (Andersson *et al.*, 2015). In order to achieve adequate integration and avoid the so-called problem of knowledge stickiness based on the difficulty of knowledge movement (Szulanski and Jensen, 2006), the literature points to the motivational disposition of the units involved, the inherent properties of knowledge (Andersson *et al.*, 2015), an intense interaction among the actors of the network, and the development of solid links among them (Kang and Hau, 2014; Moreira *et al.*, 2018; van Wijk *et al.*, 2008). Only after determining the best combination of network links, valuable knowledge can be effectively transferred between dispersed units (Schleimer and Riege, 2009). In this respect, intermediary agents and boundary spanners (Merminod and Rowe, 2012;

Tortoriello *et al.*, 2012) play a key role in facilitating knowledge flows (Jiang *et al.*, 2019; Major and Cordey-Hayes, 2000) through the creation of structured and motivated collaborative networks (Tasselli, 2015; Tóth and Lengyel, 2019). Therefore, the intermediary roles in KT processes should be occupied by actors with high responsibility (Kim *et al.*, 2014) and coordination level (Patriotta *et al.*, 2013).

There is consensus that social relations play a relevant role in the exchange of knowledge. The sustainability of collaborative networks requires strong links to facilitate the knowledge flow (Bennet and Bennet, 2008; Reagans *et al.*, 2015; Zhou *et al.*, 2010). Given its difficult exchange, high motivation is needed to transfer tacit knowledge. Consequently, close and strong social ties are required to achieve efficient transfer (Bae and Koo, 2008; Hemmert, 2019; Reagans and McEvily, 2003; Weber and Weber, 2011). To achieve strong ties, interpersonal trust among network actors is an important variable, becoming identified in the literature as one of the main predictors and drivers of KT's collaborative networks (Levin and Walter, 2019; Massaro *et al.*, 2019; van Wijk *et al.*, 2008). Other variables that the literature has positively related to KT are firm size (Kolympiris and Kalaitzandonakes, 2013; van Wijk *et al.*, 2008), strategic orientation (O'Connor and Kelly, 2017), effective leadership (Mabey *et al.*, 2012), co-creation of values (Lee *et al.*, 2008), sense of identification with values (Liu *et al.*, 2018; Lomi *et al.*, 2014; Najafi-Tavani *et al.*, 2012, 2014), previous experience (Kaminski *et al.*, 2008; van Wijk *et al.*, 2008) and geographical scope (Kolympiris and Kalaitzandonakes, 2013). Finally, although KT seems to be hampered when cultural distance is high, there is evidence that companies with experience in dealing with diverse cultures can better overcome such difficulties (van Wijk *et al.*, 2008).

To achieve a better understanding of the KT, network structure has to be analysed (Breschi y Catalini, 2010; Dyer and Hatch, 2006; Ozkan-Canbolat and Beraha, 2015; Ye

et al., 2020). Innovation requires the availability of new knowledge, but its accessibility depends on different network structure factors such as agents' location (Mason and Leek, 2008; Singh *et al.*, 2016) and links structure and composition (Ghosh and Rosenkopf, 2015). Some specific variables that impact positively in the performance and commitment of the KT (Tortoriello *et al.*, 2012) are the number of relationships (Xie *et al.*, 2016), centrality (van Wijk *et al.*, 2008; Wei *et al.*, 2011), size, strength and heterogeneity of the network (Xie *et al.*, 2016) and the correct identification of participants (Bond III *et al.*, 2008). Agents with lower distance and more equivalent position to the knowledge source tend to have a higher KT. Network density mitigates the negative effect of distance (Wei *et al.*, 2011). Several studies have pointed out how apparently opposite configurations in collaborative networks complement each other, i.e. dense networks, and structural holes (Filieri and Algezau, 2014) concluding that having structural holes in collaborative networks can be considered a driver of effective KT (Panetti *et al.*, 2020; Reagans and McEvily, 2003) and innovation (Filieri *et al.*, 2014).

KT through interorganisational networks has attracted academic attention given its implications (Martin and Salomon, 2003; Werr *et al.*, 2009). In this sense, literature points out how KT networking among organisations promotes externalities that, in turn, generate innovations (Baptista, 2001; Malsch and Guieu, 2019) and real impact on regional competitiveness, depending on the organisational characteristics of the network (Huggins *et al.*, 2012; Owen-Smith and Powell, 2004). In these networks, trust is fundamental specially in periods of uncertainty (Tsai, 2001; Tsouri, 2018) so the selection of partners requires careful attention (Knudsen, 2007). The study of KT's determinants in inter-organizational networks has aroused special interest. Thus, the R&D investment level of the knowledge receiving region, the size of the organization or region, the financial infrastructure, the scientific culture and the similarity of its productive systems (Fang *et*

al., 2013; Ghauri *et al.*, 2016; Maggioni *et al.*, 2011) determine the creation and maintenance of KT's interorganisational networks. However, although complementary knowledge is positively associated with innovative performance, too much complementarity can lead to dispersed knowledge and its consequent fragmentation (Knudsen, 2007).

Literature has not overlooked the study of intra-organisational networks as they can be more dominant than interorganizational networks (Kim *et al.*, 2014) and, moreover, can be a source of competitive advantage for the organization (Hansen, 2002; Tallman and Chacar, 2011). Common organizational values (Cao *et al.*, 2016; Schillebeeckx *et al.*, 2016), operational proximity (Tagliaventi and Mattarelli, 2006), personal and informal ties (Levine and Prietula, 2012; Pyka, 2000), job satisfaction (Fliaster and Schloderer, 2010), non-hierarchical communication structures (Guechtouli *et al.*, 2013) and commitment (Teigland and Wasko, 2009) are the most common positive and impactful determinants found in this literature stream. Also, a few studies found a positive effect of employee mobility in organisational learning (Corredoira and Rosenkopf, 2010) given the increased creativity (Lovejoy and Sinha, 2010) and labour performance (Cao *et al.*, 2016) of agents whose mobility is frequent. In this sense, mobility motivation should be an important task for responsible managers given its expected positive effect (Anne Crowne, 2009; Kumar, 2013). Both KT through inter-organisational and intra-organisational networks are discussed in more depth in the following section.

Despite these arguments, KT complexity generates difficulties (Alkhuraiji *et al.*, 2016; De Bruyn *et al.*, 2020; Herschel *et al.*, 2001; Poorkavoos *et al.*, 2016; Sorenson *et al.*, 2006) and risks (Dutton *et al.*, 2014; Mariotti, 2011; Trkman and Desouza, 2012) mostly associated to its measurement (Argote and Fahrenkopf, 2016) and to the fact that environments are dynamic (Levine and Prietula, 2012). Effective knowledge

management processes and the development of a common language considerably reduce risks (Chang *et al.*, 2012; García-Pérez *et al.*, 2015; Marabelli and Newell, 2012; Pezzillo Iacono *et al.*, 2012). KT integrated systems can exploit synergies, avoid confusion and preserve knowledge (Hutzschenreuter and Horstkotte, 2010; Sherif *et al.*, 2006). Education also plays an important role in managing and promoting KT practices (Hofer-Alfeis, 2008; Iddy, 2020; Zhao *et al.*, 2004). In this sense, the developing of comprehensive (Schlegelmilch and Chini, 2003), complex (Johnston *et al.*, 2006) and flexible (Spring, 2003) models through ICTs (Carayannis *et al.*, 2006; Peng *et al.*, 2014) can facilitate the strategic importance of KT.

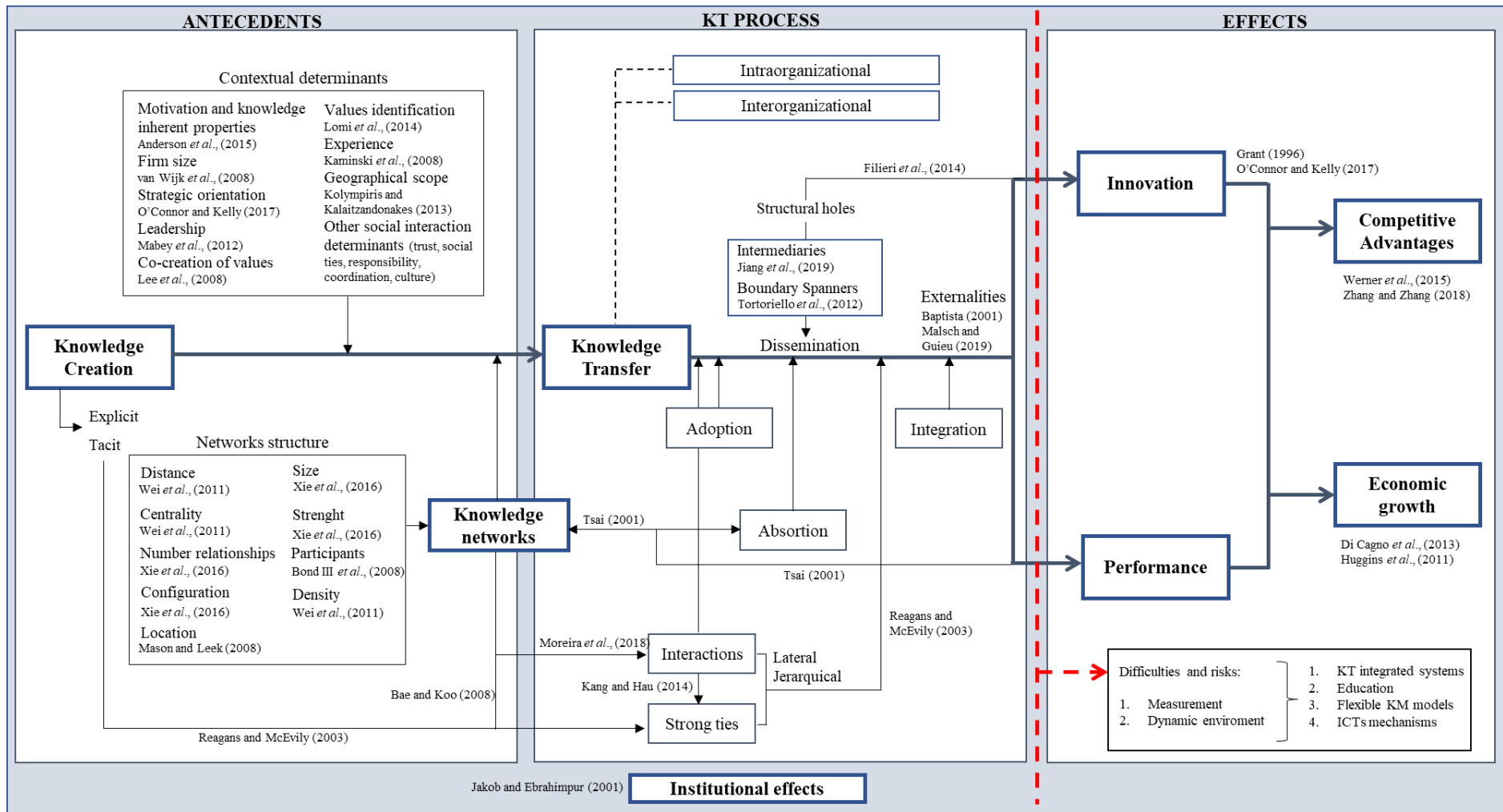


Figure 6. Conceptual framework

3.2. KT and collaboration between firms and other agents

This second section synthesises the main empirical findings that derive from the review performed. The main conclusion is that collaboration is the main driver of KT. With the aim of providing a clearer picture of the literature that analyses this issue, we organise our review into three subsections. The first one considers the relationships that are established within a company or between different firms. We distinguish between KT that takes place within different units of a MNEs and the knowledge that can be transferred as a consequence of interfirm alliances. Our second section analyses the role of universities as key agents in the process of KT. Finally, we assess the relevance of the institutional environment as a facilitator of KT.

3.2.1. KT within and between companies

As mentioned previously, this section has been structured in two sub-sections in order to provide a better understanding of the arguments. The first one identifies KT within a company, focusing on collaboration between subsidiaries in MNEs. The second one is devoted to collaboration between firms, i.e., firm alliances.

KT within companies: Intrafirm collaboration

Literature has paid wide attention to the study of KT between business units within a company, especially in MNEs, where given their intrinsic characteristics, collaboration is vital. The integration of MNEs in collaborative networks had been linked with a greater innovation capacity and performance (Ferraris *et al.*, 2018; Hallin *et al.*, 2011; Lee *et al.*, 2010; Li and Lee, 2015; Nadayama, 2019). Moreover, this relationship is enhanced when the objectives of network actors are aligned, reciprocal (Caimo and Lomi, 2015; Lomi *et al.*, 2014) and exists real interest in implementing KT practices (Mudambi *et al.*, 2009).

The directionality of knowledge flows in these companies has been subject of debate (see Figure 8). Vertical KT, i.e., between headquarters and subsidiaries, has been linked to benefits in self-learning and performance (Boussebaa *et al.*, 2014; Najafi-Tavani *et al.*, 2014, 2015). This is enhanced with experience of the subsidiary, especially when the direction of KT is upward (Rabbiosi and Santangelo, 2013). Achieving internal integration of reverse knowledge transfer (RKT), i.e., vertical, and upward flows, requires knowledge absorption capacity, adequate identification of relationships and trust among the actors involved (Isaac *et al.*, 2019; Mudambi *et al.*, 2014; Najafi-Tavani *et al.*, 2014, 2015). In addition, the RKT effects are greater in high-tech and knowledge-intensive industries and in countries with a higher competitiveness index (Nair *et al.*, 2015). When knowledge flows horizontally (Boussebaa *et al.*, 2014; Noruzi *et al.*, 2018), either between local headquarters or between lower-level subsidiaries, informal interaction (Dellestrand, 2011, 2012; Harzing and Noorderhaven, 2006) is vital. Direct involvement of headquarters helps lateral KT, but it is necessary to align subsidiary's interests with firm corporate strategy (Yamin *et al.*, 2011). Anyhow, local headquarters have access to the needs of the firm and can adapt the knowledge of the subsidiaries to make it useful and transferable to others (Lunnan and Zhao, 2014).

But these findings should be interpreted with cautiousness. Contextual factors such as market mechanisms, technological turbulence (Lee *et al.*, 2008) competitive pressure (Hallin and Lind, 2012) and cultural and linguistic distance (Harzing and Noorderhaven, 2006) need to be considered as they have been identified in the literature as KT barriers in MNEs collaboration networks. There are also industry factors that should be considered. The way KT relationships are established, the economic incentives and the organisational characteristics of firms will influence the networked collaboration structures (Dellestrand and Kappen, 2012; Tregaskis, 2003). So, achieving the full

potential of KT in MNEs requires an understanding of the needs and resources available (Dellestrand, 2011). However, while some authors find that coordination and monitoring mechanisms (Claver-Cortes *et al.*, 2018) can provide networking opportunities (Kumar, 2013; Li and Lee, 2015; Miao *et al.*, 2011), Lind and Kang (2017) identify a negative moderating effect of affiliate headquarter supervision on KT related activities.

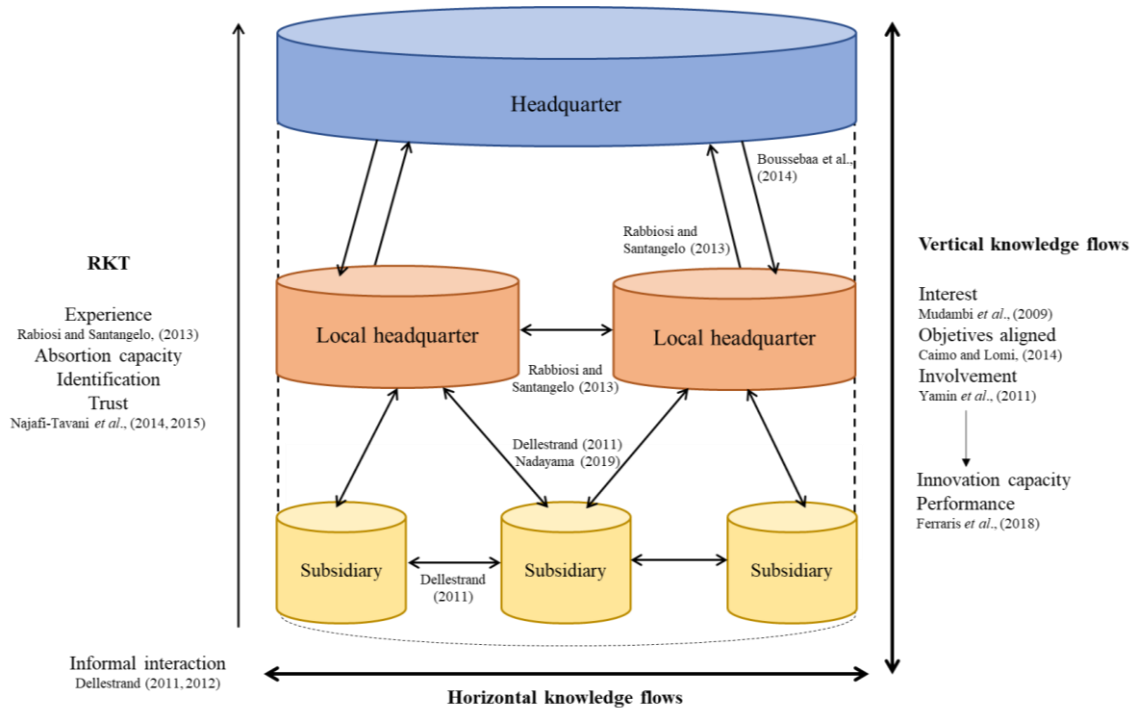


Figure 7. MNEs knowledge flows

KT between companies: Interfirm alliances

Literature has also looked at KT between business structures based on collaborative alliances. Those structures provide access to external knowledge that enable the development of new knowledge and networked learning opportunities (Paswan and Wittmann, 2009; Vătămănescu *et al.*, 2020). In other words, these alliances can generate knowledge bridges across borders (Khan *et al.*, 2015). This requires mechanisms for receiving, systematising, and managing knowledge to overcome the limits of knowledge diffusion (Zhao *et al.*, 2005) by avoiding undesirable spillovers. Although the relationship between KT in alliances and improved economic performance has not been conclusive in

the literature (Beamish and Berdrow, 2003), it has been shown that the strategic value generated in alliances networks turns into a greater innovative capacity (Harryson *et al.*, 2008; Inkpen, 2005; Verspagen and Duysters, 2004). This has generated interest in identifying the most important mechanisms and determinants for efficient KT in alliance networks.

The establishment of quality relationships i.e. strategic partnerships with adequate channels of communication, trust and commitment, either with external or internal alliance actors, allows the creation of effective collaborative learning networks (Fawad Sharif *et al.*, 2020). To access to quality partners and, therefore, knowledge flows, business units' network position represents an essential determining factor that will define the outcome of alliances learning careers (Szulanski and Jensen, 2006, 2008; Walter *et al.*, 2007). But the KT network requires stability to create long-term synergies and potential innovations that will benefit the performance of the collaborative alliance. To increase the stability of the learning network and be able to take advantage of opportunities for knowledge recombination, literature points to the need of reducing cultural barriers. To this end, building relationships with partners that share similar cultural and organisational objectives is essential (Johanson *et al.*, 2020). In this way, relationships can be strengthened and, consequently, the stability of the network of collaborative alliances can be enhanced (Faems *et al.*, 2020; Rottman, 2008). Another determinant of alliances KT refers to the co-opetition mechanism. This is especially useful when there is a clear alliance orientation and numerous partners. Although it requires a broad set of external resources, Bouncken and Fredrich (2016) suggest to young companies the use alliance networks to take advantage of co-opetition and to gain inlearning.

3.2.2. Universities as key agents in KT

Literature has traditionally identified universities (producers of ideas and knowledge) and firms (users of knowledge) as the two essential elements of the innovation system (Seibert *et al.*, 2017). More importantly, collaboration between these two agents (Chen and Lin, 2017; Novelli *et al.*, 2006; Rubin *et al.*, 2015; Thomas, 2012) build up the central axis to achieve innovation (Knudsen, 2007; Miller *et al.*, 2016) and regional economic growth (Fuster *et al.*, 2019). If the collaborative interaction fails, the innovation system can become fragmented, which is particularly pernicious when it is composed of SMEs with limited access to external knowledge (Koschatzky, 2002). According to recent studies, university-industry collaborative KT networks should be promoted (Ferrer-Serrano *et al.*, 2021; Mao *et al.*, 2020) given the development necessities of each industry and region (Fuster *et al.*, 2019).

Commercialising scientific knowledge depends on different industrial and academic factors that limit university-industry collaboration. Previous experience in KT and interpersonal links between universities and industry play a vital role in generating collaborations (Hemmert, 2019; Krabel and Mueller, 2009). Specifically, the universities' ability to generate and transfer knowledge depends on tangible factors such as economic support, administrative and contractual tasks, and also on intangible factors such as research quality, recognition, respect, ethics, and support from research groups networks (Cabeza-Pullés *et al.*, 2020; Hewitt-Dundas, 2012; Rosli *et al.*, 2018).

However, there are obstacles that can hinder KT between the two main agents of an innovation system. There are socio-cultural reasons that influence effective KT from universities to industry such as the particular social norms of a region (Mabey *et al.*, 2015). The physical distance between companies and universities (Spithoven *et al.*, 2019; Petruzzelli, 2008) coupled with the lack of efficient ICT systems (Bathelt *et al.*, 2011;

Wakefield, 2005) also difficult knowledge flows. Padilla-Meléndez *et al.* (2013) focus on identifying barriers to KT from the researcher's perspective. They found how the lack of awareness of the research groups capabilities, the bureaucratic hurdles and business' perception of scientific knowledge low transferability are the most common barriers.

One of the suggestions derived from our review is to create collaborative environments between universities and industry. In this sense, commitment and willingness of companies to ensure open communication flows can help (Rosli *et al.*, 2018). In addition, Fischer *et al.* (2020) suggests that universities should strengthen internal ties between members of the academic community for the joint generation and dissemination of useful knowledge for frugal innovations. They also pointed that reducing bureaucratic barriers with external agents, as well as setting up incentive schemes that reward involvement, are critical for success. Finally, it has been shown that international scientific mobility fosters the development of new relationships. As a consequence, supportive mobility programmes of researchers facilitate the exchange of knowledge between regions (Gibson and McKenzie, 2014; Murakami, 2014; Guo *et al.*, 2018). In this regard, the role of public institutions is important as is discussed in the following section.

3.2.3. The role of the institutional context

This literature emphasises the role played by the institutional context in the understanding of the KT drivers (Filatotchev *et al.*, 2009). Collaboration between public institutions and innovation system actors (i.e., big science centres and industry) is a key element that facilitates KT and the only way to enable the development of specific long-term initiatives (Carlisle *et al.*, 2013; Gerstlberger, 2004; Novelli *et al.*, 2006), especially in knowledge-based economies (Miller *et al.*, 2016). Public institutions, which can play the role of knowledge banks or knowledge brokers (von Malmberg, 2004), can influence

KT processes and thus the R&D capability of a firm or region (Zou and Ghauri, 2008). This influence depends, among other factors, on the contextual economic and political characteristics (Jandhyala and Phene, 2015). In this sense, there is evidence of a positive and direct relationship between countries with high levels of R&D expenditure and the capability to generate and transfer knowledge (Di Cagno *et al.*, 2014).

As economies develop and national institutional support is not enough, there is a necessity to generate cross-border networks to facilitate learning (Khan *et al.*, 2016). Governments' legal, economic and administrative commitment and support facilitate innovation through KT (Khan *et al.*, 2016; Millar and Choi, 2009; Novelli *et al.*, 2006). The creation of incentives, the implementation of measures to stimulate knowledge flows and to increase the absorptive and managerial capacity of business networks (Koschatzky, 2002), are some of the mechanisms that literature has identified as useful. It is also necessary to develop informal networks to share knowledge across national borders (Levin and Barnard, 2013; Ko and Liu, 2017). Thus, the creation of collaborative inter-organisational KT networks involving public institutions, research centres and industry can help to gain regional legitimacy and contribute to a sustainable territorial competitive advantage (Zou and Ghauri, 2008).

All this brings challenges. At the regional level, improving the regional image can allow harnessing social capital. Moreover, by creating attractive environments and generating local, national, and international linkages, the development of collaborative communities is encouraged (Smedlund, 2006). At the national level, the creation of a national knowledge agenda for strategy and policy development (Schneider, 2007) provides a clear roadmap to stimulate collaborative networks that will enhance the government innovation ecosystem (Di Cagno *et al.*, 2014).

4. Conclusions

Through a comprehensive review, this paper aimed to examine the current state of the literature on KT and collaborative networks. To this end, a systematic review was conducted over the last twenty years following the PRISMA method. Specifically, 190 articles from 53 journals were considered. This review has detected a growing interest in KT and collaborative networks research, especially from a quantitative and macro perspective.

After a thorough review, we conclude that previous literature has placed particular emphasis on the analysis of KT's determinants and collaborative networks. Different studies have identified how inherent properties of the actors involved in innovation systems, as well as contextual factors, influence knowledge diffusion. In addition, KT consequences have also been frequently analysed, with a particular focus on the variables of innovation propensity and business performance, concluding that effective KT through collaborative networks generates potential innovation capacity.

The study of the collaboration network's structure has probably been the central axis of this paper's findings. First, the literature has confirmed that the centrality position of a given agent in a collaboration ecosystem, whether it be a company or a business unit, represents an essential factor for achieving efficient and effective KT flows. Second, the absorption and integration of external knowledge depends, to a large extent, on the collaboration network structure in which they are located. In other words, a more central strategic position allows the generation of collaborative relationships and, consequently, potential avenues for KT.

Our findings have also been organised according to the types of agents that make up different KT relationships. Given their inherent characteristics, MNEs have been the organizations that have received more attention. Communication and leadership are highly relevant factors in this business modality. Other research has analysed KT between universities and industry. Universities and research centres, due to their role as knowledge generators, represent an essential agent in the innovation system. In this sense, literature has specially focused on the identification of barriers that difficult KT between knowledge generators and industry. The authors converge on one main idea: the need to create mechanisms to facilitate KT practices to address the difficulties detected. Finally, public institutions also play a vital intermediary role in the achievement of collaborative learning networks. Our review has also summarized some of the recommendations encouraging the development of KT processes and, in the long run, the creation of regional value. In this sense, incentives that stimulate knowledge flows as well as the creation of a knowledge agenda can provide a roadmap that enhance innovation ecosystems.

This paper has several implications. From a theoretical perspective, this study constitutes the first systematic review that brings together two fundamental concepts in the field of business management and innovation: KT and collaborative networks. The extensive period selected and the demanding criteria of inclusion allows us to analyse the contributions with the greatest impact and to identify the research agenda. This study allows the scientific community to know what the current state of the art is, which relationships are most and least studied and where the focus should be placed in the future.

Regarding managerial implications, there is a high agreement on the benefits that the creation and dissemination of knowledge brings to first, innovative behaviour and second,

economic performance. Practitioners should be aware of this. Throughout this paper, multiple arguments have been presented that defend the implementation of KT process in companies. Having a dynamic portfolio of stored business knowledge can help to detect firm weaknesses and strengths. This can allow the elaboration of strategic action plans around the construction of collaborative innovation networks. Some of the most important determinants of effective KT processes are related to social capital. In this sense, managers should implement integrated management models that take into consideration organizational aspects such as company size or location, but also intangible and human variables such as trust, leadership, culture or communication strategies.

From a macro perspective, public authorities should be aware of the innovation system landscape in their regions or countries. Making this information available to other agents in the ecosystem can enable the development of actions to improve KT processes and strengthen collaborative networks. In addition, this review has shown how the interaction between centres that generate knowledge (i.e. universities) and businesses is vital for the achievement of innovations and regional value. Public authorities must provide the necessary resources and flexible mechanisms for knowledge commercialization. Only in this way, strong and stable collaborative KT networks can be created. Finally, it has been evidenced that the creation of a collaborative culture of trust is fundamental. Public authorities can contribute to attract external agents by giving visibility to the knowledge created in a given region or sector. As a consequence, providing an innovative and transparent image can promote collaboration in KT among agents as well as attract external agents and also strengthen the culture of collaborative trust.

4.1. Limitations and future research agenda

This paper is not without limitations. An important proportion of the research analysed are case studies focusing on a single company. This research has been considered in our systematic review, but its generalization should be treated with caution. This, in turn, may constitute a future line of research. A meta-analysis that selects the quantitative articles that investigates this phenomenon may provide interesting results that complements ours. Due to the complexity of knowledge measurement, many of the selected papers could not empirically establish causal relationships. Furthermore, knowledge has been measured through different variables, i.e., patents, collaboration contracts, training courses, strategic alliances or spin-offs among others, which makes conclusions difficult to compare.

In any case, this systematic review has revealed how the study of KT and collaborative networks is a promising research field. The implications that derive from our review suggest that there are significant research gaps that may be subject of attention in the future. Table 2 synthetizes some of these future research paths.

From a conceptual perspective, current research has not empirically defined knowledge and, consequently, has not modelled KT. This is the main reason that makes generalisation and comparison of findings difficult. This constitutes a necessary but very complex research line. The intangibility of knowledge as a resource is also a challenge to be addressed and not an impediment of continuing researching in this trend. Future work may try to find out how to develop knowledge measurement scales to estimate KT indicators.

We have evidenced how the micro-perspective is the most commonly approach to analyse KT processes and collaborative networks. Although this micro approach is of

undoubted interest, we understand that the availability of macro analysis has huge potential in terms of policy implications. The identification of causal relationships in a globalised knowledge-based economy is vital to improve national competitiveness and innovation indexes. As the current Covid-19 pandemic is showing us, international collaboration is fundamental to exploit externalities and synergies with high strategic value.

Our review has also detected that the literature has paid limited attention to some business configurations such as family firms, franchises or joint ventures. Our findings are not necessarily exchangeable to these types of businesses, given their inherent characteristics. However, according to their frequency in the industrial sector, this could constitute a promising research niche.

All the papers reviewed in this study deal with the analysis of KT from the point of view of its advantages and benefits assuming that it is efficient. Nevertheless, this KT efficiency cannot be guaranteed. Taking into consideration possible inefficiencies in KT may derive in conclusions of interest regarding the consequences of the lack of collaboration. Widening the perspective may probably generate a greater awareness for those responsible for knowledge management and business innovation. We believe that these may constitute future lines of research of interest to all the groups involved. Finally, the generation of efficient innovation and knowledge systems represent the main interests to organisations and society. The development and implementation of integrated knowledge systems can (1) boost business competitiveness, (2) generate more employment, (3) improve social welfare, and (4) adapt regulatory frameworks to create strategic synergies.

In this sense, digital transformation can change the future dynamics of KT. The creation of digital systems that allow the integration of large volumes of data, as well as the implementation of mechanisms that manage internal knowledge, represents a promising field of research. It is important to efficiently manage learning processes, but without an adequate security and protection system, the availability of valuable knowledge sources does not guarantee the achievement of competitive advantages. Therefore, analysing the determinants, effects and consequences of the implementation of automatic KT process safety systems may be another enriching line of research in future studies.

Table 2. Future research avenues for KT and networks

Concept	Empirical knowledge definition	<ul style="list-style-type: none"> • Measurement of knowledge to ensure comparability of results between studies.
	KT modelling	<ul style="list-style-type: none"> • Alternatives to model KT. • Is there a way to capture knowledge exchange flows?
	Scale development	<ul style="list-style-type: none"> • Can the development of a KT measurement scale allow modelling of these flows? • Items that should contain.
Macro perspective	Identification of relationships in R&D networks	<ul style="list-style-type: none"> • Regions that should be consider creating formal and informal networks. • Areas of knowledge or industrial sectors to be consider.
	Current barriers and solutions	<ul style="list-style-type: none"> • Barriers that can be identified and how we can avoid them.
	Cultural variables identification	<ul style="list-style-type: none"> • Cultural variables that determine the achievement of efficient KT networks between regions.
	University-business-public institutions collaboration	<ul style="list-style-type: none"> • Specific protocols to encourage collaboration between actors. • Identification of other actors in regional innovation systems. • Action plans that allow to strengthen and maintain relationships.
Business modalities	Family firms	<ul style="list-style-type: none"> • Study of KT flows for these types of companies.
	Franchises	<ul style="list-style-type: none"> • Importance of belonging to a collaborative learning network.
	Join Ventures	<ul style="list-style-type: none"> • Effects on economic performance and innovation.
Inefficient KT	Consequences	<ul style="list-style-type: none"> • Consequences of poor management creation and KT.
	Agents to be avoided	<ul style="list-style-type: none"> • Agents that should not be considered in the creation of a collaborative KT network. • In what cases?
	Solutions and action protocols	<ul style="list-style-type: none"> • Alternatives to solve inefficient KT practices. • Design of standardized protocols.
Digital transformation	Digital systems to manage KT	<ul style="list-style-type: none"> • Digital systems to allow managing knowledge storage and record internal and external knowledge flows.

		<ul style="list-style-type: none"> • Specific cases in which its implementation is especially interesting and advantages and disadvantages. • Items that should be considered.
	Security systems	<ul style="list-style-type: none"> • Effects of incorporating knowledge protection systems in a company. • Effect's variation according to the context. • Implementation of this systems and its effect to obtain sustainable competitive advantages.
	Intelligent algorithms	<ul style="list-style-type: none"> • Implementation of intelligent digital systems that predict potential collaborative synergies. • Improvement of KT efficiency in performance and innovative capacity.

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