

<https://doi.org/10.23913/ride.v10i19.501>

*Artículos Científicos*

## **Transferencia de conocimiento e innovación tecnológica: Una revisión tradicional de la literatura**

***Knowledge Transfer and Technological Innovation: A Traditional Literature  
Review***

***Transferência de desenvolvimento e inovação tecnológica: Uma revisão  
tradicional da literatura***

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## Resumen

En este documento se revisaron 1099 artículos de investigación relativos a la relación entre la transferencia de conocimiento y la innovación tecnológica, desde los enfoques organizacional, clúster, intra-empresa, nacional, regional y sectorial, para identificar las áreas de oportunidad del tema. Dichos enfoques fueron clasificados en cinco orientaciones: análisis estadísticos, mapas conceptuales, análisis conceptuales, revisión de literatura y otros. Se encontró un amplio uso de métodos cualitativos, en especial modelos y análisis conceptuales, porque en su mayoría los estudios están centrados en saber cómo se transfiere el conocimiento al interior de las organizaciones. De igual forma, se halló que dentro del proceso de la transferencia se hace más hincapié en el receptor del conocimiento que en el emisor. Por ende, se sugiere que las futuras investigaciones consideren a ambos actores, se incremente el uso de técnicas cuantitativas con perspectiva sistémica y se considere a las micro, pequeñas y medianas empresas.

**Palabras clave:** innovación tecnológica, métodos cualitativos, micro, pequeñas y medianas empresas, modelos y análisis conceptuales, transferencia de conocimiento.

## Abstract

In this document 1099 research articles concerning the relationship between the transfer of knowledge and technological innovation were reviewed, from these approaches: national, regional, sectorial, organizational, cluster and intra-company in order to identify areas of opportunity of this topic. Also, these approaches were classified into five guidelines: statistical analysis, concept maps, conceptual analysis, literature review and others. Nowadays there is an extensive use of qualitative methods, especially models and conceptual analysis, because most studies are focused on knowing how knowledge within organizations is transferred. Similarly, it was found that within the transfer process more emphasis is placed on the receiver of knowledge rather on than the issuer. Therefore, it is suggested that future research consider both actors, the use of quantitative techniques with a systemic perspective and consider increasing micro, small and medium enterprises for studies.

**Keywords:** technological innovation, qualitative methods, micro, small and medium enterprises, models and conceptual analysis, knowledge transfer.

## Resumo

Neste documento, 1099 artigos de pesquisa sobre a relação entre a transferência de conhecimento e a inovação tecnológica foram revisados, a partir dessas abordagens: nacional, regional, setorial, organizacional, cluster e intra-empresa, a fim de identificar as áreas de oportunidade deste tópico. Além disso, essas abordagens foram classificadas em cinco diretrizes: análise estatística, mapas conceituais, análise conceitual, revisão de literatura e outras. Atualmente, há um uso extensivo de métodos qualitativos, especialmente modelos e análises conceituais, pois a maioria dos estudos está focada em saber como o conhecimento dentro das organizações é transferido. Da mesma forma, verificou-se que no processo de transferência é apenas enfatiza o receptor do conhecimento, em vez do emissor. Portanto, sugere-se que pesquisas futuras considerem os dois atores, o uso de técnicas quantitativas com perspectiva sistêmica e considerem o aumento de micro, pequenas e médias empresas para estudos.

**Palavras-chave:** inovação tecnológica, métodos cualitários, empresas micro, pequeñas y medianas, modelos e análises conceituais, transferência de conhecimento.

**Fecha Recepción:** Febrero 2019

**Fecha Aceptación:** Julio 2019

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## Introduction

One of the recent concerns of the world's economies lies in answering the following question: What is the key to achieving true sustainable economic development to ensure a high quality of life for its inhabitants? The first answer was given by Schumpeter (1934) in the early twentieth century in his book *The Theory of Economic Development*, which provides the basis of innovation as the engine of economies. Schumpeter (1934) portrays innovation as a dynamic force



that causes the continuous transformation of social, institutional and economic structures. However, almost 50 years later, Nelson and Winter (1982) explained that the way companies generate innovation is through knowledge.

The dominance of the knowledge-based economy, together with the rapid technological changes in the fields of science, information and communication and transport, have resulted in a change from the information age to the knowledge age ( Yigitcanlar, Velibeyoglu, Baum and Global, 2008). Within these new concepts of the era of knowledge, innovation and creativity have become primary factors of production and development (Scott, 2006).

The world economy is increasingly dependent on the production, distribution and use of knowledge (Chang and Chen, 2004). It has been estimated that more than 50% of the gross domestic product (GDP) of the economies of the main countries of the Organization for Economic Cooperation and Development (OECD) is now based on knowledge (Maskell, Eskelinen, Hannibalsson, Malmberg and Vatne, 1996). Therefore, the great challenge for developed and developing countries is to find a way to use knowledge to improve competitiveness.

The success of the innovation depends on the way in which knowledge is obtained and managed, in other words, it depends on efficient knowledge management (Alavi y Leidner, 2001; Du Plessis, 2007; Hurmelinna-Laukkanen, 2011; Malik, 2004; Popescul, 2011, 2012; White y Bruton, 2010).

It should be noted that since the publication of Schumpeter in 1911, Theory of economic development (Solow, 1956), the concept of complex economic cycles has a chaotic nature; So innovation is a non-linear dynamic (Goodwin, 1950, 1982, 1990). This means that it is more appropriate to study innovation, as a process and as a social system, from a nonlinear or systemic perspective.

Knowledge transfer (TC) forms an important part in this knowledge management for innovation, since it is a critical factor in an organization's ability to innovate (Cohen and Levinthal, 1990). However, organizations do not necessarily know all the knowledge they have. In general, this is due to internal knowledge transfers: instead of being fluid or systemic, they are often static or difficult to achieve (Szulanski, 1994; Von Hippel, 1994). In addition, the little systemic attention that this topic has received has caused the TC process to be ambiguous in different dimensions of scope (Szulanski, 2000), since the requirements are different in a company or at the level of a

nation. Therefore, the objective of this work is to detect what has happened in the field of TC from within organizations, between organizations, at sectoral, cluster, regional and national levels.

## Method

A traditional literature review process was performed (Jesson, Matheson, and Lacey, 2011). This process focused on the research of scientific articles published in the period from 1997 to 2017 in the Journal of Knowledge Management, as well as in Physics Review, Technovation and Technological Forecasting and Social Change. These articles were reviewed in English and indexed in the ISI Web of Knowledge.

From the articles obtained the following questions were asked:

- 1) What have been the different scopes of the CT study?
- 2) What methods were used to analyze such studies?
- 3) What have been the future investigations recommended by the studies carried out and which others have been detected as a lack of the reviews?

The inquiry process was as follows. First, all publications indexed in Web of Science (WoS) containing the keywords “knowledge transfer” were downloaded in the title. Derived from this first search, 1099 files were found in total. Next, the search was refined with respect to the categories of the field, and only articles that related to the following terms were searched: management, business, economics, multidisciplinary sciences, social sciences interdisciplinary and sociology.

To ensure that the review included all the articles of relevant journals, the highest rank of knowledge management journals was considered, that is, the criteria of Serenko and Bontis (2009) were included, so 207 articles were considered from the Journal of Knowledge Management.

Subsequently, an advanced PostScript source file viewer search tool was used to find, by keywords, transfer knowledge in any part of the documents in the databases. Then, according to the abstracts of the articles and the main objective, the most representative methodologies that were dedicated to understanding the ways in which knowledge is transferred were located.

Once the articles were located, they were extracted from the database and reviewed one by one to identify the objective of the article, authors and their country of origin, findings, methodology used, scope of study and future recommendations.

Next, these articles were selected and classified by the scope of geographical study in six categories: 1) National, 2) Regional, 3) Sectorial, 4) Cluster, 5) Organizations and 6) Intra-company. The definition of each of these categories is explained in table 1.

**Tabla 1.** Descripción de los alcances de la revisión

<b>Alcance</b>	<b>Descripción</b>	<b>Referencias</b>
<b>Nacional</b>	Los sistemas nacionales de innovación consideran actores como el Gobierno, dependencias de investigación y empresas, todos sumergidos en una dinámica de política pública nacional para el impulso de la innovación de un país.	(Dosi, Freeman, Nelson, Silverberg y Soete, 1988; Etzkowitz y Leydesdorff, 2000; Freeman, 1987, 1995; Lundvall, 1998; Nelson, 1993)
<b>Regional</b>	Las actividades y políticas de innovación aplicadas a nivel regional. El alcance regional puede ser señalado a una ciudad, entidad federativa, o cualquier comunidad específica que albergue y sea afectada por las organizaciones que se encuentren al interior.	(Casas, 2002; Cowan y Zinovyeva, 2013; Leydesdorff y Fritsch, 2006)
<b>Sectorial</b>	Las actividades aplicadas al impulso de la innovación a través de prácticas de TC en un sector determinado, por ejemplo, un sector industrial como el manufacturero, o el sector público, de turismo, de producción, pymes, etc.	(Amayah, 2013; Bekkers y Bodas, 2008; Schartinger, Rammer, Fischer y Fröhlich, 2002; Wong y Aspinwall, 2005)

<b>Cluster</b>	La TC en grupos bien definidos de empresas que trabajan en coordinación para generar ventajas como economías de escala.	(Arbonés y Moso, 2002; Baptista y Swann, 1998; Connell, Kriz y Thorpe, 2013; Dahl y Pedersen, 2004; Lai, Hsu, Lin, Chen y Lin, 2013; Lindsay, 2005; Scheel, 2002; Tan, 2006)
<b>Organizaciones</b>	Actividades aplicadas al impulso de la innovación entre organizaciones de todo tipo como empresas, gubernamentales, universidades, fundaciones, etc., que realizan transferencia de tecnología o conocimiento entre organizaciones.	(Bekkers y Bodas, 2008; Edquist, 1997; Fang, Yang y Hsu, 2013; Kumar y Ganesh, 2009; Marouf, 2007; Siegel, Waldman, Atwater y Link, 2003; Watson y Hewett, 2006; Wilkesmann, Fischer y Wilkesmann, 2009)
<b>Intra-empresas</b>	La TC entre los miembros al interior de una empresa u organización. Esta puede ser entre personas o grupo de personas que interactúan dentro y pertenecen a la organización en cuestión.	(Spraggon y Bodolica, 2012; Szulanski, 1994; Van Wijk, Jansen y Lyles, 2008; Vuori y Okkonen, 2012)

Fuente: Elaboración propia

## Results

The scopes identified in Table 1 are a reference framework to classify the dimensions of study in which the literature for CT has been developed.

Subsequently, due to the heterogeneity of the research methods with which the CT was addressed, a classification of these methods was carried out in five fields: 1) Statistical methods, 2) Conceptual analyzes, 3) Conceptual models, 4) Review of the literature and 5) Others.

Statistical methods refers to the use of statistics tools applied to a set of data that could be obtained through surveys, interviews, and data mining to apply correlations, regressions and linear data smoothing. Conceptual analysis refers to the deepening of the concepts in vogue for analysis, interpretation and exemplification for greater understanding. The conceptual model schematizes the conceptual analysis to visualize it graphically. The literature review focuses on systematic methods applied to the historical, contextual and conceptual review of the subject under review; and, finally, the category Others refers to other methods such as mathematical models, simulations, networks, clusters and other techniques that are different from the previous four and, in addition, involve a deeper mathematical analysis, whether linear or nonlinear . The following paragraphs



summarize the review of the literature described in accordance with the authors who have worked on these issues (National, Organizations, Intra-companies, Regional, Sectorial and Cluster).

Regarding the National, five classification strata were detected. Statistical analysis (Bekkers y Bodas, 2008; Bruneel, d'Este y Salter, 2010; Delgado, Navas, Cruz y Amores, 2011; Jiménez, García y Molina, 2011; Wilkesmann *et al.*, 2009; Linares, 2008; Teo y Bhattacharjee, 2014; Khan, Lew y Sinkovics, 2015); Conceptual analysis (Cowan y Zinovyeva, 2013; Cummings y Teng, 2003; Floysand y Jakobsen, 2011; Ahammad, Tarba, Liu y Glaister, 2016; Frishammar, Ericsson y Patel, 2015); Conceptual model (Beesley, 2004; Dang y Umamoto, 2009; De Fuentes y Dutrénit, 2012; Etzkowitz y Leydesdorff, 2000; Levén, Holmstrom y Mathiassen, 2014; Perkmann *et al.*, 2013; Rodriguez, 2014; Sharma, Samuel y Ng, 2009; Siegel *et al.*, 2003); Literature Review (Clifton, Keast, Pickernell y Senior, 2010; Chang y Chen, 2004; Jackson, Brooks, Greaves y Alexander, 2013; Jensen, Johnson, Lorenz y Lundvall, 2007), and Others, mathematical modeling, regression, simulation, dynamic systems and networks (Acs, Anselin y Varga, 2002; Alcacer y Gittelman, 2006; Leydesdorff y Fritsch, 2006; März, Friedrich y Grupp, 2006; Papavassiliou y Mentzas, 2003; Schartinger *et al.*, 2002; Tang, Mu y MacLachlan, 2010; Zeng y Wu, 2009; Zhang, 2012).

As for Organizations, five basic classifications were also found. Statistic analysis (Boh, Nguyen y Xu, 2013; Casal y Fontela, 2007; Herschel, Nemati y Steiger, 2001; Miao, Choe y Song, 2011; Yun, Shin, Kim y Lee, 2011; Olmos, Castro y D'Este, 2014; Harzing, Pudelko y Reiche, 2016; Szulanski, Ringov y Jensen, 2016; Ranucci y Souder, 2015; Segarra, Roca y Bou, 2014); Conceptual analysis (Argote e Ingram, 2000; Assudani, 2005; Bender y Fish, 2000; Crowne, 2009; Christensen, 2007; Du Plessis, 2007; Iske y Boersma, 2005; Kumar y Ganesh, 2009; Shariq, 1999; Uit Beijerse, 2000; Ensign, Lin, Chreim y Persaud, 2014; Inkpen y Tsang, 2005; Filieri y Algezauai, 2014; Argote y Fahrenkopf, 2016); Conceptual model (Abou Zeid, 2002; Guzman y Wilson, 2005; Husted, Michailova, Minbaeva y Pedersen, 2012; Kakabadse, Kakabadse y Kouzmin, 2003; Kumar, 2013; Liyanage, Elhag, Ballal y Li, 2009; McElroy, 2000; Mentzas, Apostolou, Young y Abecker, 2001; Narteh, 2008; Reagans y McEvily, 2003; Robert, 2009; Schlegelmilch y Chini, 2003; Seufert, Von Krogh y Bach, 1999; Wiig, 2003; Zboralski, 2009; Abou Zeid, 2002; Recruitment, Peltokorpi y Vaara, 2014; Werner, Dickson y Hyde, 2015; Krylova, Vera y Crossan, 2016; Ko, 2014; Kang y Sauk Hau, 2014); Literature Review (Agrawal, 2001; Augier y Vendelá, 1999; Gao, Li y Nakamori, 2002; Mort, 2001; Quintane, Casselman, Reiche y



Nylund, 2011; Swan, Newell, Scarbrough y Hislop, 1999; Van Wijk *et al.*, 2008; Witherspoon, Bergner, Cockrell y Stone, 2013; Zellner y Fornahl, 2002), and Others, such as the Delphi method, dynamic systems, Markov, networks, decision tree (Chua y Banerjee, 2013; Guechtouli, Rouchier y Orillard, 2013; Huosong, Kuanqi y Shuqin, 2003; Powell y Swart, 2005; Sun y Scott, 2005; Xuan, Xia y Du, 2011; Zhao y Chen, 2013; Aalbers, Dolfsma y Koppius, 2014; Jasimuddin, Connell y Klein, 2014).

At the Intra-company level there are five items. Statistic analysis (Al Alawi, Al Marzooqi y Mohammed, 2007; Ardichvili, Maurer, Li, Wentling y Stuedemann, 2006; Casimir, Lee y Loon, 2012; Durmusoglu, Jacobs, Nayir, Khilji y Wang, 2013; Holste y Fields, 2010; Husted *et al.*, 2012; Lucas, 2005; Madsen, Mosakowski y Zaheer, 2002; Marouf, 2007; Mason y Pauleen, 2003; Paroutis y Al Saleh, 2009; Riege, 2007; Styhre, Ollila, Roth, Williamson y Berg, 2008; Teigland y Wasko, 2009; Van den Hooff, Schouten y Simonovski, 2012; Villasalero, 2013; Vuori y Okkonen, 2012; Yang, 2004; Minbaeva, Björkman, Fey y Park, 2000; Lai, Lui y Tsang, 2016; Lai *et al.*, 2016; Chan, Li y Pierce, 2011); Conceptual analysis (Ardichvili, Page y Wentling, 2003; Bontis, Fearon y Hishon, 2003; Campos y Sánchez, 2003; Carneiro, 2000; Casimir, Ng y Cheng, 2012; Crane, 2012; Ordóñez, 2004; Foos, Schum y Rothenberg, 2006; Gilbert y Cordey-Hayes, 1996; Goh, 2002; Jasimuddin, 2007; Lam y Lambermont-Ford, 2010; Mueller, 2012; Rangachari, 2009; Riege, 2005; Spraggon y Bodolica, 2012); Conceptual model (Brachos, Kostopoulos, Soderquist y Prastacos, 2007; Burns, Acar y Datta 2011; Crane, 2012; Diakoulakis, Georgopoulos, Koulouriotis y Emiris, 2004; Fang *et al.*, 2013; Ghobadi y D'Ambra, 2012; Harvey, 2012; Jasimuddin *et al.*, 2014; Mura, Lettieri, Radaelli y Spiller, 2013; Pandey y Dutta, 2013; Preiss, 1999; Snowden, 2002; Yoo, Suh y Kim, 2007; Andersson, Gaur, Mudambi y Persson, 2015), Literature Review (Echeverri-Carroll, 1999; Nissen, Kamel y Sengupta, 2000; Panahi, Watson y Partridge, 2013; Wang y Noe, 2010; Minbaeva, 2013; Li, Chang, Lin y Ma, 2014), and Others, such as simulation, correlation, regression, genetic algorithms (Behrend y Erwee, 2009; Huang y Chen, 2009; Kang y Kim, 2013; Meng, Lin y Li, 2011; Nan, 2008; Sackmann y Friesl, 2007; Wang, 2013; Watson y Hewett, 2006; Van Burg, Berends y Van Raaij, 2014; Van Burg *et al.*, 2014; Van Burg *et al.*, 2014).

At the Sector level five strata were found. Statistic analysis (Amayah, 2013; Barachini, 2009; Blomkvist, 2012; Brachos *et al.*, 2007; Cantú, Criado y Criado, 2009; Huang, Chiu y Lu, 2013; Kim, Newby y

Song, 2012; Li, 2010; Martín, Martín y Estrada, 2012; Matschke, Moskaliuk y Cress, 2012; Nakano, Muniz Jr y Batista Jr, 2013; Oerlemans y Knobens, 2010; Rhodes, Hung, Lok, Lien y Wu, 2008; Seba, Rowley y Delbridge, 2012; Van den Hooff y De Ridder, 2004; Wong y Aspinwall, 2005; Yang, 2007; Kalar y Antoncic, 2015; OECD, 2010; Cassia, De Massis, Meoli y Minola, 2014); Conceptual analysis (Chua y Banerjee, 2013; Kwok y Gao, 2004); Conceptual model (Appleyard y Kalsow, 1999; Kim, Suh y Hwang, 2003; Sáenz, Aramburu y Blanco, 2012; Syed-Ikhsan y Rowland, 2004; Wagner, 2003; Yakhlef, 2007; Westera, Nadolski, Hummel y Wopereis, 2008); Literature Review (Graham *et al.*, 2006; Malik, 2004; Mitton, Adair, McKenzie, Patten y Perry, 2007; Thompson, Estabrooks y Degner, 2006), and Others, integrated by networks, mathematical models, simulation (Kim, Hau, Song y Ghim, 2013; Valdés y Sánchez, 2012; Mudambi, Piscitello y Rabbiosi, 2014; Baggio y Del, 2013; Ziegler, Perry, Jacobs y Braun, 2001; Schomaker y Zaheer, 2014; Ungar, Whitman, Hart y Phipps, 2015).

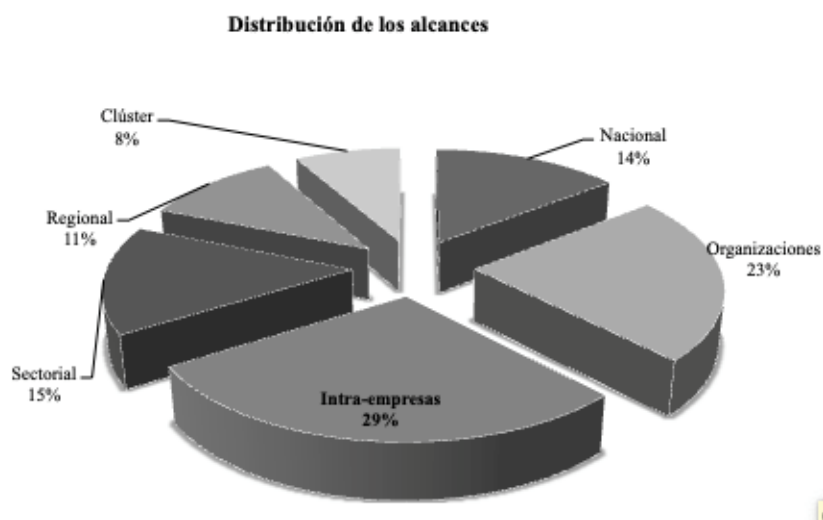
Another is the Regional, which also has five points. Statistic analysis (Cruz, Pérez y Cantero, 2009; Darroch, 2003; Ding, Liu y Song, 2013; Fang *et al.*, 2013; Fullwood, Rowley y Delbridge, 2013; Goh y Hooper, 2009; Jeon, Kim y Koh, 2011; McAdam, Moffett y Peng, 2012; Pangil y Chan, 2013; Peng, 2013; Rivera, Ortiz y Flores, 2009; Voelpel y Han, 2005; Schulze, Brojerdi y Von Krogh, 2014; Lunnan y Zhao, 2014; Reus, Lamont y Ellis, 2016; Ahammad *et al.*, 2016; Mudambi *et al.*, 2014; Osabutey y Jin, 2016); Conceptual analysis (Hutchings y Michailova, 2004; Schleimer y Riege, 2009; Testa, 2013); Conceptual model (Endres, Endres, Chowdhury y Alam, 2007; Strach y Everett, 2006; Taminiau, Smit y De Lange, 2009; Uotila y Melkas, 2008; Ahammad *et al.*, 2016; Miller, Mcadam, Moffett, Alexander y Puthusserry, 2016; Gil y Carrillo, 2016); Literature Review (Casas, 2002; Clark, 1999); Sectorial analysis (Deeds y Decarolis, 1999); Lunnan y Zhao, 2014; Zhao, Zuo y Deng, 2015), and Others, with mathematical modeling, regression, simulation, dynamic systems and networks (Chen, Hsiao y Chu, 2014).

The last classification is that of Cluster, which, like the previous ones, is made up of five classifications. Statistic analysis (Bodas y Marques, 2013; Connell *et al.*, 2013; Dahl y Pedersen, 2004; Hoffmann, Lopes y Medeiros, 2013); Conceptual analysis (Fromhold y Werker, 2013; Guo y Guo, 2011; Tan, 2006); Conceptual model (Scheel, 2002; Weidenfeld, Williams y Butler, 2010); Literature Review (Arbonés y Moso, 2002; Manning, 2013), and others: clustering, SOM (Self-Organizing Maps), econometric regression, mathematical models (Baptista y Swann, 1998; Chen,

Chen y Wu, 2012; Chyi, Lai y Liu, 2012; Giuliani, 2013; Lai *et al.*, 2013; Lin y Li, 2010; Mortazavi y Bahrami, 2012; Leszczynska y Pruchnicki, 2017).

According to the above, the scope that has been studied the most in recent years (29%) is that of Intra-companies, that is, within the organizations, various concepts have been generated and the organizations (23%) have been the starting point for students of CT (see figure 1). It should be noted that the organizations studied are generally large companies.

**Figura 1.** Distribución de los alcances para la TC



Fuente: Elaboración propia

One reason why studies within organizations is the majority can be attributed to the fact that since the 40s pioneers such as Hayeck (1945), Machlup (1962), Simon (1979, 1991), Fiol and Lyles (1985), Kogut and Zander (1996) and Nonaka and Konno (1998) have focused on the study of knowledge individually within the people who interact and work in organizations due to technology transfers.

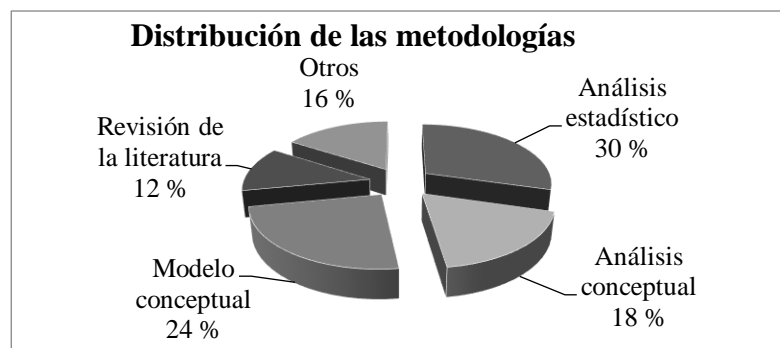
On the other hand, the most used methodology in the scope of intra-companies is that of statistical analysis, since most of its results are based on surveys, interviews and questionnaires for a given concept, which reflects the internal structures of organizations ; however, sometimes the forcefulness of the results is usually subjective.

The main sources of information for these studies are managers, specialists and leaders of high-responsibility working groups. These studies have mainly been carried out in the United Kingdom, Germany, Austria and Italy.

At the national level, there is a tendency more focused on the use of conceptual models and those belonging to the category Others, that is, there is a greater concern for finding more systematized models that imply, on the one hand, the discussion of the concepts that affect the development of a country and, on the other hand, the inclusion of variables that can measure or model socio-economic dynamics within a global framework. Countries such as China, the Netherlands, the United States, Australia, Greece and Mexico have made some approximations with linear correlation methods to find indicators of technological innovation. In the Sector and Regional level scopes, statistical analyzes predominate for the study of innovative capacities and TC between different companies within a productive sector or region, where countries such as Spain and China influence.

The Cluster level is being studied by mathematical models for the analysis of CT among organizations in a cluster. Countries such as China, Japan, Taiwan, Germany and Spain have focused efforts on studying their national conglomerates through strategies for the analysis of public policies for innovation. On the other hand, it should be noted that 30% of the techniques used are statistical analyzes, 24% conceptual models (see figure 2) and 16% use quantitative techniques, of which 91% are methods that use deterministic models despite the fact that innovation It is a nonlinear process.

**Figura 2.** Distribución de las metodologías para la TC

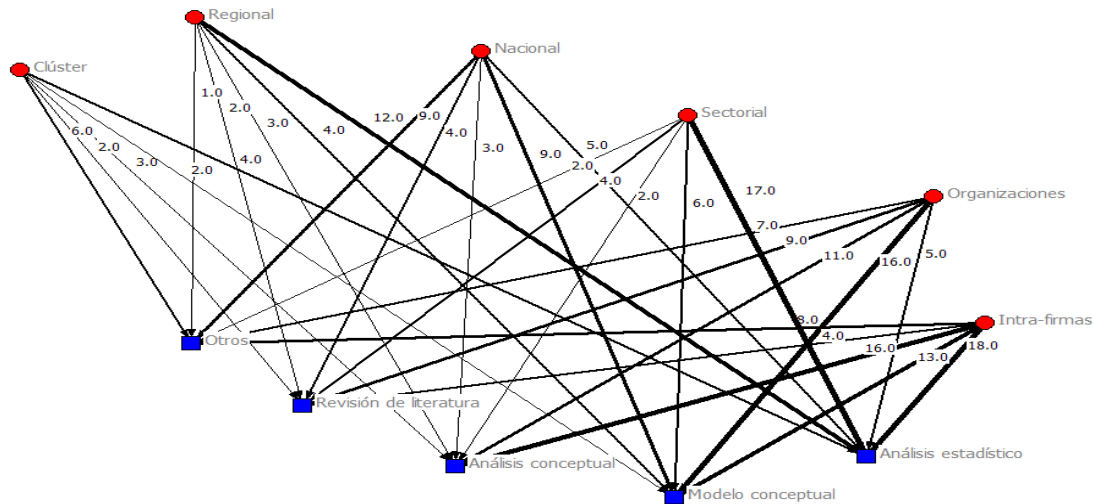


Fuente: Elaboración propia

A graphic version of these findings is shown in Figure 3, which is a sociotechnical network that associates the scope of the CT scan with the methods with which they were explored.

The circle-shaped nodes at the top of the network represent the scopes and the box-like nodes at the bottom represent the methods.

**Figura 3.** Red de asociación para los métodos y alcances



Fuente: Elaboración propia

The lines that connect these nodes represent the relationships that associate them and, as can be seen, these vary depending on the degree of cohesion (number of articles) between the nodes. The orientation of the network, as well as the thickness of the relationships, are a function of the degree of cohesion of the network. This is why the nodes at the lowest level have a high degree of cohesion (Statistical Analysis and Intra-firms or Intra-companies) and as the network rises the cohesion between the nodes decreases (Cluster and Others).

Figure 3 also represents a summary of the central revision of this document. However, it should be noted that authors such as Carayannis and Campbell (2012), Chang and Chen (2004), Choi, Kim and Lee (2010), Fleming and Sorenson (2001), Floy sand and Jakobsen (2011), Freeman (1996), Galanakis (2006), Goodwin (1950, 1982, 1990), Hanusch and Pyka (2007), Hirooka (2006), Jensen, Johnson, Lorenz and Lundvall (2007), Kash and Rycroft (2002), Kok (2009), Leydesdorff (2000) and Nonaka, Kodama, Hirose and Kohlbacher (2014) suggest studying

innovation from the perspective of systems dynamics and complexity theory, since the diffusion of innovation is of a non-linear logistic nature (Griliches, 1957; Goodwin, 1950, 1982, 1990).

Given the above, a second review was carried out to find methodologies that consider systemic, integral approaches and complexity.

The results obtained show that 96% of the articles consider innovation as a linear process and use the systemic from the conceptual perspective rather than quantitative.

The scope of these articles is diversified and publications range from 2000 to 2014, indicating their recent application. Finally, future research found is shown in Tables 2, 3, 4 and 5.

Tables 2, 3, 4 and 5 concentrate the future investigations of the reviewed articles, which highlight the need to deepen the role of the actors involved, type of organization, sociocultural elements, new forms of informal learning and motivational factors. It also highlights the consideration of the use of other methodologies, such as econometric models, interdisciplinary approaches, the use of networks, evolutionary approaches and multilevel techniques.

**Tabla 2.** Futuras investigaciones para la TC

<p><b>Campos de acción</b></p>	<ul style="list-style-type: none"> <li>• Estudiar cómo la TC afecta la eficiencia, efectividad y calidad en los procesos.</li> <li>• Generar una mayor comprensión de la administración del conocimiento; puede darse a través de la creación de redes.</li> <li>• Incluir mecanismos de innovación en el proceso de TC.</li> <li>• Crear redes de conocimiento para conocimiento tácito.</li> <li>• Analizar cómo las organizaciones pueden adquirir y transferir conocimiento exitosamente y generar importantes recursos de ventajas competitivas.</li> <li>• Investigar las perspectivas de la industria para entender mejor las motivaciones que propician la colaboración con las universidades.</li> <li>• Investigar el impacto de otras dimensiones de la TC (interna/externa, lateral/vertical, <i>marketing</i>/tecnológica/administrativa).</li> <li>• Integrar el trabajo de los psicólogos sociales con los socioeconomistas en los incentivos y motivación.</li> <li>• Examinar si las estructuras de TC están asociadas con la mejora del desempeño de las organizaciones profesionales.</li> <li>• Estudiar las relaciones entre capacidades de infraestructura, resultados y medidas específicas de desempeño organizacional.</li> <li>• Analizar la dinámica entre flujo de dinero, bienes, servicios y conocimiento.</li> <li>• Identificar las relaciones de interdependencia entre los diferentes alcances de los sistemas de innovación.</li> <li>• Tomar en cuenta las implicaciones para la construcción institucional en una economía de aprendizaje.</li> <li>• Examinar el impacto de las barreras sobre los resultados de colaboración.</li> <li>• Diseñar una política de investigación y tecnología, barreras para las interacciones industria-universidad en otras áreas más que la cooperación directa de investigación.</li> <li>• Mejorar el entendimiento de las relaciones entre conocimiento organizacional y el desempeño empresarial.</li> <li>• Generalizar las prácticas del intercambio del conocimiento individual al organizacional.</li> <li>• Explorar los procesos de conversión de modos de conocimiento en redes de innovación.</li> <li>• Examinar moderadores como la propiedad psicológica basada en equipos, conciencia y clima de intercambio de conocimiento.</li> <li>• Estudiar relaciones inter e intracorporativas dentro de un distrito industrial.</li> </ul>
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	<ul style="list-style-type: none"> <li>• Examinar las consecuencias de las diferentes configuraciones de las relaciones interorganizacionales para los diferentes tipos de innovación.</li> <li>• Entender los factores críticos de éxito para la gestión del conocimiento adoptada en las pequeñas y medianas empresas (pymes).</li> <li>• Estudiar si las empresas con una gestión de conocimiento integral maximizan su desempeño a uno más extenso.</li> <li>• Revisar la dependencia de los estudios desde la perspectiva académica sobre TC y culturas de conocimiento.</li> <li>• Investigar el efecto de interacción entre la capacidad de absorción de los receptores y el conocimiento.</li> <li>• Investigar la relación entre configuraciones de capital social estructural, conocimiento transferencia e innovación.</li> <li>• Explorar el papel de la improvisación en combinación con la experiencia individual, poder individual, información en tiempo real y memoria organizacional y cómo afectan la transferencia y la protección del conocimiento.</li> <li>• Explorar condiciones de frontera para el impacto positivo de improvisación en <i>KIOs</i> (organizaciones intensivas en conocimiento).</li> <li>• Examinar los mecanismos de TC desde un nivel micro a un nivel macro.</li> <li>• Explorar las relaciones entre creatividad, innovación y conocimiento.</li> </ul>
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Fuente: Elaboración propia

**Tabla 3.** Futuras investigaciones para la TC



<p><b>Muestra/Contexto</b></p>	<ul style="list-style-type: none"> <li>• Muestras más grandes de organizaciones para un análisis estadístico más robusto.</li> <li>• Examinar los flujos de conocimiento en las diferentes regiones del mundo.</li> <li>• Examinar las empresas innovadoras con redes no locales en zonas rezagadas.</li> <li>• Examinar a detalle las diferencias culturales, propósitos y duración de la TC según el contexto donde sea analizado.</li> <li>• Considerar los contextos estructurales, habilidad de aprendizaje, experiencias y su importancia para el estudio de la TC.</li> <li>• Crear un enfoque en el entendimiento del aprendizaje y la generación del conocimiento en comunidades de práctica.</li> <li>• Explorar y examinar las similitudes y diferencias entre los diferentes contextos de clústeres industriales, así como en los países en vías de desarrollo.</li> <li>• Estudiar las contingencias globales para entender la emergencia de nuevos cambios en una economía globalizada.</li> <li>• Aumentar el tamaño de muestra para la validación de modelos.</li> <li>• Aplicar los modelos micro y macro (como nivel clúster) para validación.</li> <li>• Examinar si la cultura organizacional afecta la TC.</li> <li>• Trasladar modelos micro a nivel macro, tales como los mecanismos para la gobernanza en la TC.</li> <li>• Examinar qué determina la “confianza” y “cultura” en el contexto de la implementación de la TC.</li> <li>• Examinar las prácticas de TC con un amplio rango de aspectos sociales y emocionales positivos y negativos.</li> <li>• Examinar el rol de la localización geográfica en el desempeño empresarial.</li> <li>• Explorar el intercambio de conocimiento entre universidades en otros países para entender el impacto de la tendencia y regímenes de promoción.</li> <li>• Revisar procesos de transferencia, adaptación e, incluso, apropiación social de los conocimientos y las tecnologías en beneficio del desarrollo económico y social de las regiones y localidades.</li> <li>• Desarrollar medidas de parentesco semántico y pragmático, así como comparar los efectos de la relación lingüística y cultural en otros procesos vinculados a la comunicación.</li> </ul>
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Fuente: Elaboración propia

**Tabla 4.** Futuras investigaciones para la TC

<p><b>Agentes</b></p>	<ul style="list-style-type: none"> <li>• Estudiar compañías que producen TC.</li> <li>• Mapeo del conocimiento a partir de las organizaciones que realizan proyectos.</li> <li>• Considerar los contextos estructurales, habilidad de aprendizaje, experiencias y su importancia para el estudio de la TC.</li> <li>• Conducir análisis de TC entre clientes y vendedores.</li> <li>• Estudiar la TC en otras dimensiones como persona-organización, equipo inter-firmas, etc.</li> <li>• Estudiar la TC entre la relación clúster-clúster.</li> <li>• Medir la recepción del conocimiento y su uso entre los usuarios.</li> <li>• Estudiar las nuevas formas de aprendizaje informal y generación de conocimiento en comunidades de práctica virtuales.</li> <li>• Medir la importancia relativa de los factores que afectan las características personales y desarrollo de conocimiento.</li> <li>• Construir sistemas de innovación usando a las firmas como actores centrales.</li> <li>• Estudiar el papel de los medios de comunicación social en apoyo a la gestión del conocimiento para el cliente.</li> <li>• Establecer medidas para extender el intercambio de conocimiento en una universidad e investigar el vínculo entre este y medidas de éxito organizacional tales como crecimiento, innovación, investigación de resultados y reputación.</li> <li>• Probar las relaciones entre las diferencias entre académicos, sus percepciones y la aceptación de una orientación empresarial dentro de su universidad y la participación de académicos en diversas actividades.</li> </ul>
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Fuente: Elaboración propia

**Tabla 5.** Futuras investigaciones para la TC

**Consideraciones metodológicas**

- Los análisis deben usar menos interpretación subjetiva y metodologías filosóficas.
- Considerar otros factores críticos diferentes de los reflejados en las entrevistas.
- Proveer más trabajo teórico y empírico a las dimensiones involucradas en la TC.
- Usar metodologías sistémicas para analizar el flujo de conocimiento.
- Usar dinámica de redes y estructura de redes para establecer las relaciones entre las conexiones de la TC.
- El análisis de redes sociales (ARS) debe ser combinado con métodos matemáticos para mejores resultados.
- Enfoque en la coevolución entre innovación institucional y tecnológica.
- Los resultados obtenidos con análisis estadístico deben ser reforzados con métodos matemáticos para validarlos.
- Utilización de métodos econométricos para encontrar patrones espaciales en los canales de colaboración.
- Estudiar la TC en clústeres con metodologías cuantitativas y casos de estudio.
- Desarrollar métodos para una representación empírica del conocimiento.
- Buscar una validación empírica de los modelos de TC.
- Examinar la TC desde la perspectiva de las ciencias cognitivas.
- Probar la importancia de las emociones como un mediador en TC con diferentes metodologías.
- Considerar más variables, reglas interactivas y agentes en modelos de simulación.
- Caracterizar los diversos patrones de las interacciones universidad-sociedad en varios ajustes.
- Construcción de un marco teórico para combinar las dimensiones de calidad dentro de las diferentes etapas del proceso de conversión de conocimiento.
- Utilizar un enfoque interdisciplinario.
- Diferenciar el conocimiento tácito del explícito.
- Desarrollar una mejor medida para la captura de la adopción y uso del conocimiento transferido.
- Modelación dinámica multicriterio.
- Usar técnicas multinivel (por ejemplo, modelos jerárquicos lineales) para probar marcos teóricos multinivel.
- Los estudios longitudinales podrían ofrecer ideas más significativas.

Fuente: Elaboración propia

## Conclusions



In a globalized economy driven by knowledge it is a challenge to achieve effective knowledge management, since diversification is amplified in each study context and the number of variables grows indefinitely. Then, placing each context in its frame of reference facilitates the definition of the variables. In this way, it is that in the scopes of study for CT the variables studied correspond mostly to patterns of action of knowledge; This is why statistical analysis predominates in methodologies.

The importance that has been given to the study within and between organizations has become more relevant, although the amount of studies in micro and small companies is limited, which is an area of opportunity in this field. At the same time, all the staff of an organization should be considered, since not only senior managers have the responsibility of disseminating knowledge.

The inclusion of methodologies such as quantitative and systemic order could be a useful tool for social variables. This will allow more robust research to provide increasingly strong results. Examples of these tools are the dynamics of systems, networks, soft systems and viable systems.

It is also important to note that investigations for CT are more focused on the study of the issuer of knowledge than on the recipient. Thus, it is equally important to consider both to be able to evaluate the quality of the resource they are absorbing, since knowledge is a complicated abstract element to measure.

Other areas of opportunity are focused on systematically analyzing how the CT process is organized in each actor involved and how that process can be measured.

It is significant that Asian countries are making great efforts to understand cognitive processes related to knowledge, using methodologies based on logical-mathematical analysis to find results with a greater attachment to reality.

Finally, future research could aim to answer what kind of knowledge is transferred and what kind of knowledge is absorbed during the CT process, as well as try to measure the rate of absorption and transfer through network analysis, especially in organizations, or the use of systemic tools to obtain information at the national level.

## **Acknowledgment**

We appreciate the facilities granted for the realization of this work to the National Polytechnic Institute, through the Secretariat of Research and Postgraduate with the projects SIP 20180023 and SIP 20180688. To the Interdisciplinary Unit of Engineering and Social and Administrative Sciences (Upiicsa) and the Center of Research and Development of Digital Technology (Citedi). Likewise, to the Program of Stimulus to the Performance of the Researchers (EDI), to the Program of Stimulus to the Teaching Performance (EDD) and to the Commission of Operation and Promotion of Academic Activities (Cofaa).

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<i>Rol de Contribución</i>	<i>Autor (es)</i>
Conceptualización	Brenda & Mario «grado de contribución» «igual»
Metodología	Brenda & Mario «grado de contribución» «igual»
Software	No aplica
Validación	Jesús, Teodoro & Raúl «grado de contribución» «igual»
Análisis Formal	Jesús, Teodoro & Raúl «grado de contribución» «igual»
Investigación	Brenda & Mario «grado de contribución» «igual»
Recursos	No aplica
Curación de datos	No aplica
Escritura - Preparación del borrador original	Jesús, Teodoro & Raúl «grado de contribución» «igual»
Escritura - Revisión y edición	Brenda & Mario «grado de contribución» «igual»
Visualización	Brenda & Mario «grado de contribución» «igual»
Supervisión	Brenda & Mario «grado de contribución» «igual»
Administración de Proyectos	Jesús, Teodoro & Raúl «grado de contribución» «igual»
Adquisición de fondos	Brenda, Mario, Jesús, Teodoro & Raúl «grado de contribución» «igual»