Technology Transfer: A Bibliometric Analysis

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Abstract

In a global context of highly competitive, new technologies have become an indispensable element for companies, the tool normally used to gain such advantage is the transfer of technology. In order to provide an overview of how this issue has been studied by the academic community, this article presents a bibliometric analysis of published studies on the technology transfer in the Scielo and ScienceDirect bases between the years 1973 to 2016. It was concluded the year with more publications on the subject in both bases was in 2013, the journal with the highest number of articles in the Scielo base was the Journal of Technology Management & Innovation with concept Qualis B2, while the Innovation magazine with concept A1 had more items on the base ScienceDirect.

Keywords: technology; technology transfer; bibliometric analysis

1. Introduction

In a context with globalization of markets and rapid integration of economies, companies are forced to focus on their competitive priorities. However, for this objective to be achieved a continuous adaptation of business strategies is required and technology has been recognized as an indispensable element for support the global strategy of companies in their quest for survival in a highly competitive environment (LUCATO et al, 2015). The relevance of the technology in a modern world, the breakthroughs of market openings and the de-bureaucratization of international trade have brought a great deal of importance to the topic of technology transfer (LARK-SAAVEDRA et al., 2014)

Through a simplified vision, the transfer of technology can be understood as a movement of know-how, the exchange of technical or technological knowledge from one organizational environment to another. This concept brings the idea that, in any transfer of technology, there is a wide interaction environment that converges in several sources and users of technology (PEREZ; VARGAS, 2014). Currently, transfer technology is a central tendency of innovation processes, since innovation highlights the transference constituent interconnections, from learning among heterogeneous beneficiary organizations to users of the knowledge produced (PEREZ; VARGAS, 2014).

Despite the importance, data and theories about this subject are still sparse and this scope was rarely delineated or systematized (CLOSS, FERREIRA, 2012). In view of this, as important as publishing research in a particular area of science, it is necessary to systematically review the totality of this production. This process allows the strengthening of knowledge, indicates more efficient ways to solve problems as well as opens new avenues for research, among other advantages (CLOSS; FERREIRA, 2012).

Based on the need for a better understanding of the studies about technology transfer, this article aims to

present the result of a bibliometric analysis of the studies published on the subject in the Scielo and Sciencedirect Bases, it is worth mentioning that the two databases used in this research are some of the most important in terms of relevance and comprehensiveness of the publications available.

2. Literature Review

2.1 Transfer Technology

The transfer of technology is a process performed between two organizations in which certain knowledge is acquired, developed, used and improved in order to improve a methodology, process, product or element of that product (LUCATO et al, 2015). The movement of technology can take place in many ways, for example from one company to another company or from a research institution to a company.

According to Rogers, Takegami and Yin (2001, p.254) technology transfer is "the movement of technological innovation from an Research and Development (R&D) organization to a recipient organization". For a better explanation, universities are a kind of research institution and in this theoretical field, it is worth mentioning the triple helix model (ETZKOWITZ; LEYDESDORFF, 2000), one of the most referenced about the different agents of the innovation process and, consequently, the processes of technology transfer. This model characterizes the interrelationships between three major entities: the university, the government and the companies, with the aim of exploring ways of creating a favorable environment for innovation (CLOSS, FERREIRA, 2012).

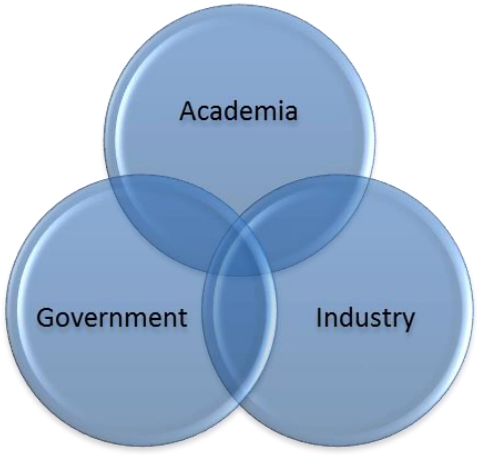

Figura 1. Triple Helix
Source: Adapted from ETZKOWITZ; LEYDESDORFF, 2000

Collaborations from the university-business relationship have become increasingly important (FABRIS et al, 2015). Based on the triple helix model, universities and companies have a kind of mutual dependence, since companies have the need for innovative products within their commercial environment while universities have the ability to develop such products through research. The third element of the propeller, on the other hand, the government has the duty to articulate, to stimulate and to support the relation between

the other elements of the propeller (CLOSS; FERREIRA, 2012).

Technology transfer can be achieved in different ways: directly, indirectly or in both ways. Transfer is direct when the technology is embedded next to equipment, facilities, instruments or components. The process is considered indirect when it is done through patents, drawings or other document, emphasizing the fact that the transfer can happen with the combination of the two forms (LUCATO *et al*, 2014).

It should be noted, however, that the process of technological development takes place in different ways in developing and developed countries (LUCATO *et al*, 2015). While in the first world economies the creation of technology starts with adaptation, absorption and negotiation. In turn, in the case of emerging countries, the technology is absorbed and adapted to the local conditions however, the generation of its technological capacity only begins when the negotiations regarding the new technology are carried out with the developers (TAKAHASHI, 2005 *apud* LUCATO, 2015).

The economic, market, product performance, the economic domain of the obtained or even the satisfaction with the new technology can be criteria to evaluate the success in the transfer process of technology. For success in the transfer process, the results are dependent on a set of internal and external factors, for example, infrastructure and experience in the process of technology transfer are (TAKAHASHI and SACOMANO, 2002; LUCATO et al, 2015).

3. Methodological Approach

This research is characterized as exploratory, since it aims to provide greater proximity to the topic addressed, in this case, technology transfer. Regarding the procedures, it is possible to classify it as a bibliographical research, since it is developed in material already elaborated, in this case scientific articles of index bases (GIL, 2002). It should also be noted that research can be concomitantly characterized as systematic, since the systematic review is a review model that uses rigorous and clear methods to identify, select, collect data, analyze and describe relevant contributions to its research (CORDEIRO et al, 2007).

The present research was carried out in two methodological stages, constituted as follows: initial data collection and bibliometric analysis. At the data collection stage, all articles published in Scielo (www.scielo.org) and Sciencedirect (www.sciencedirect.com) were searched for "Transferencia de Tecnologia" term in Portuguese and Spanish, since in both language the term is written in the same way, and “Technology Transfer” in English. Thus, the two terms were considered at the moment of the searches in the databases already mentioned, using the Boolean operator OR, the research was carried out following the form: "transferencia de tecnologia" OR "technology transfer". It should be clarified that searches for terms were carried out concomitantly in the title and abstract, restricted to articles in periodicals and only those in the English, Portuguese and Spanish languages.

During the second stage, a bibliometric analysis of the articles found was carried out with the objective of identifying the number of articles published in the two databases between 1973 and 2016, which periodicals had a greater number of publications with the theme technology transfer during the period quoted above and which was the Qualis concept of these journals. The results obtained with the present study are presented in the following sections.

4. Presentation and Analysis of the Results Obtained

In the searches carried out in the databases, 85 articles were found in the Scielo database and 58 articles in the Sciencedirect database, totaling 143 articles, with reference to the theme "Technology Transfer". The years of publications of the texts found are between 1973 and 2016. Figure 2 shows the evolution of publications per year, in the Scielo database, during the period studied.

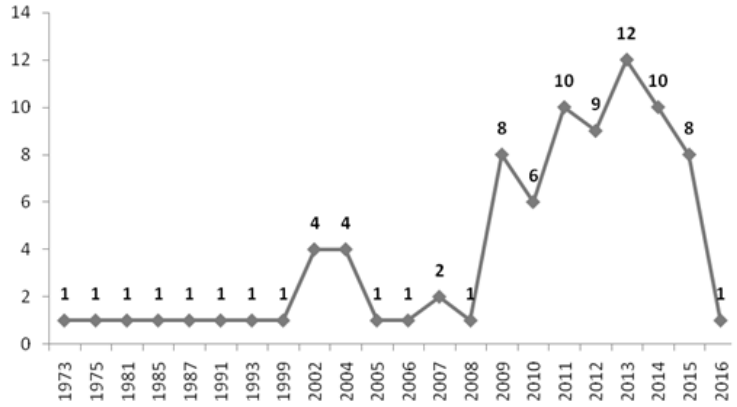

Figure 2. Publishing Articles at the Scielo Base
Source: Prepared by the Authors

It can be seen from Figure 2, the year of 2013 was published 12 articles related to the theme, which represents 14% of the data. Following the analysis, it is possible to see that in the interval from 1973 to 1999, 8 articles were published, totaling approximately 9%. Between 2002 and 2008, 13 articles were published, representing 15%. As of 2009 there was a growth of publications related to the theme compared to previous years. From 2009 to 2014 the publications presented oscillations, and ended up declining in 2015 and 2016.

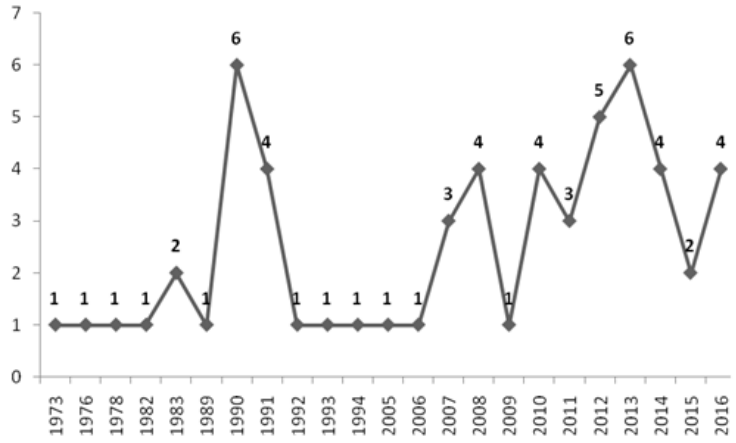

Figure 3. Publications Base Articles ScienceDirect
Source: Prepared by the Authors

Figure 3 deals with the publications on the subject found in the ScienceDirect database, showing that between 1973 and 1989, 7 articles were published, representing 12%. It should be noted that in 1990, 6 texts were published, representing 10%, only in that year, showing a growth in relation to previous years. In 1991 and 1992, there was a fall, where 4 (7%) texts were published in 1991 and 1 (2%) was published in 1992. In 1993, 1994, 2005 and 2006, there was one publication every year, adding 4, during this period, which is 7%. In 2007 and 2008, there was a growth of the publications, being added 7, which represents 7%. Returning to decrease in 2009, having a publication and thus oscillating in its growth until 2016.

Figure 4. Periodicals with the publication number of the Scielo database
Source: Prepared by the Authors

Figure 4 shows the number of journals publications that had more than one publication in the Scielo database, leaving out 38 journals that had only one publication that represent 45% of the articles published. The following journals were published in the journal SciELO Nova, Brazilian Journal of Seeds, Revista de Administração Pública, Revista Mexicana de Ciencias Agrícolas, Revista Panamericana de Salud Pública, and South African Journal of Industrial Engineering. 16% of searches. The journals Revista de Administração Contemporânea and Universidad, Ciencia y Tecnología each published three texts, adding up 7% of the searches. The periodical Gestão & Produção published 4 texts, representing 5%. The Journal of Business Administration released 7 articles, which returns us 8%. Finally the Journal of Technology Management & Innovation with 16 texts on the subject which represents 19%.

Figure 5. Periodicals with the publication quantitative of the ScienceDirect database
Source: Prepared by the Authors

Figure 5 presents the journals with more than one publication related to the theme found in the ScienceDirect database, journals with one publication represent 40% of the searches totaling 23 text. The magazines Cuadernos de Economía y Dirección de la Empresa, Gaceta Sanitaria, Investigaciones de Historia Económica - Economic History Research, Clinical Medicine and the European Journal of Management and Economy of the Company had every 2 publications, totaling 17%. The Solar Energy newspaper presents 3 publications, representing 5%. The journals Studies Management and European Investigations of Direction and Economy of the Company had 4 published texts each, that represent 14% of the searches. The World Patent Information published 5 texts on the subject, thus totaling 9%. Technovation presented the largest number of publications, with 9 published texts representing 16%.

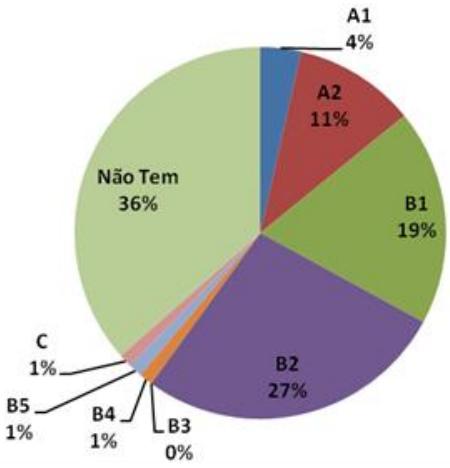

Figure 6. Qualis of Scielo Newspapers
Source: Prepared by the Authors

In relation to Qualis of the Scielo journals, as shown in Figure 6, it was found that 1% presents Qualis A1, which is equivalent to 3 publications. For the A2 concept, we have 11% that equals 9 texts. The journals

with B2 concepts, which represent 27% of the texts, were the ones that published the most, thus adding 23 texts. Nevertheless 36% of the texts, in their magazines did not have concept Qualis that in numbers are 31 publications.

The journals with Qualis A1 were Bulletin of the World Health Organization, Brazilian Journal of International Policy and Mental Health. With Qualis A2 were Revista de Administração Contemporânea, RAE Electrónica, Revista de Administração Pública, Cadernos de Saúde Pública and Revista Direito GV. The Journal of Technology Management & Innovation was the most published journal in which it presented Qualis B2, and had 16 publications representing 19% of the texts sought.

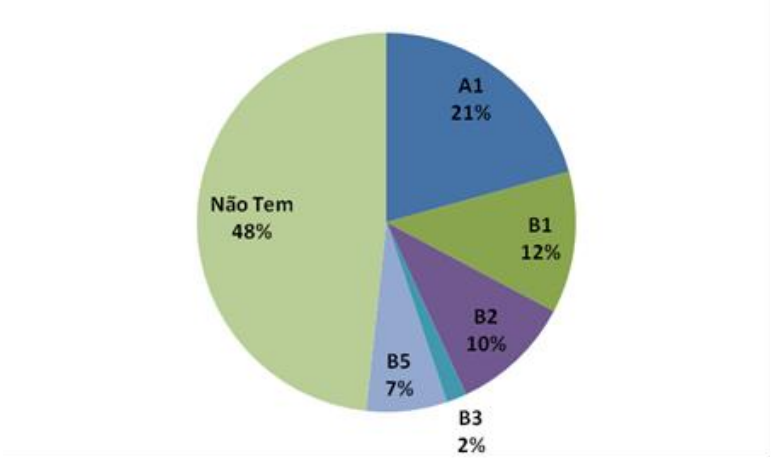

Figure 7. Qualis of ScienceDirect Newspapers
Source: Prepared by the Authors

Figure 7 shows the Qualis of the journals found in the ScienceDirect database, with 21% having A1 concept, which in numbers represent 12 search texts. With concept B1 it has 12%, which represents 7 texts. With concept B2 are 10% that add up to 6 texts. The journals that do not have Qualis concept express 48% of the texts of the search, which in number are 28 texts.

The periodicals with concept A1 are Technovation and Solar Energy, of which Technovation was the one that published more texts of the periodicals, totaling 9 texts found in the search of the subject in the base. The second periodical with the highest number of publications was the World Patent Information with Qualis B1 totaling 5 texts. The B1 concept journals are the World Patent Information and Health Gazette. With concept B2 are Clinical Medicine, Spanish Urological Records, Intensive Medicine (Portuguese and English version) and Iberoamerican Magazine of Automation and Industrial Informatics.

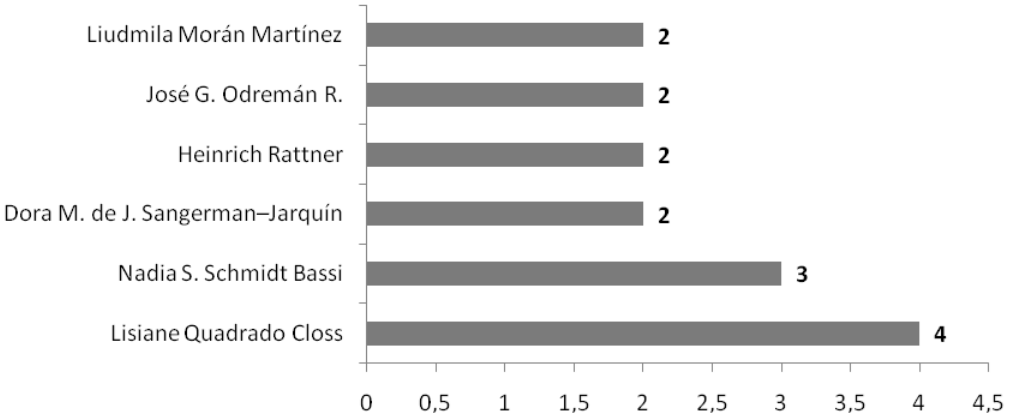

Figure 8. Authors with more articles published in Scielo
Source: Prepared by the Authors

Figure 8 presents the authors with more publications in the Scielo database according to the Lisiane Closs theme with 4 articles each, followed by Nadia Bassi with 3 articles, and authors Dora Sangerman-Jarquín, Heinrich Rattner, José Odremán and Liudmila Morán Martinéz with 2 articles each. The article of the research "Intervenentes in the transference of university-company technology: the case PUCRS" of the author Lisiane Closs was quoted 25 times.

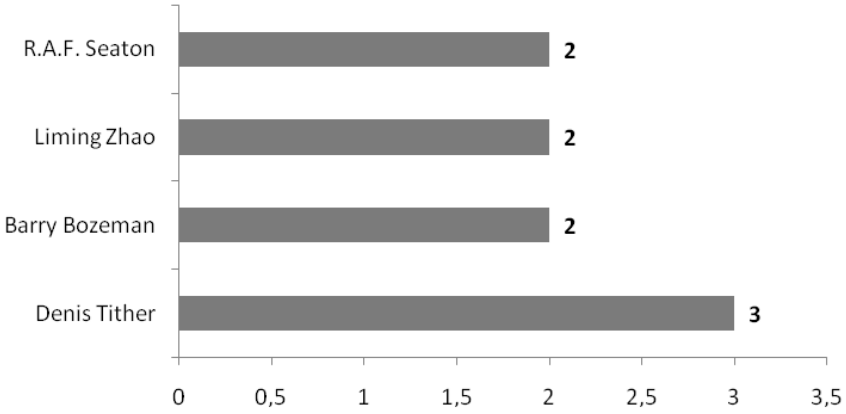

Figure 9. Authors with more articles published in ScienceDirect
Source: Prepared by the Authors

Figure 9 shows the authors with more publications in the ScienceDirect base according to the topic is Denis Tither with 3 articles, followed by authors Barry Bozeman, Liming Zhao and R.A.F. Seaton with 2 articles published each. Denis Tither's article "The case study of technology transfer and funding mechanisms in an industrially supported multi-centered research university" was quoted 10 times in other publications.

5. Conclusion

This article is based in a bibliometric analysis of the articles of the Scielo and Sciencedirect base that had as technology transfer theme. Being addressed the evolution of publication annually, periodicals and concept Qualis.

An analysis of the number of articles found between the years 1973 and 2016 was carried out, showing that the year that had the most publications in both bases was 2013 and in the base Science direct is added the year of 1990, in which the base had 6 publications in both 1990 and 2013. The journal with the largest number of articles in the Scielo database was the Journal of Technology Management & Innovation with concept B2, while in the ScienceDirect base the magazine Innovation with concept A1 had more articles in the base.

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