Bibliometric analysis of indicators system related to patentes

Análisis bibliométrico sobre sistema de indicadores relacionados con patentes

Análise bibliométrica em sistema de indicadores relacionados a patentes

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Abstract

The use of a system of indicators can aid in the decision-making process as well as the assessment of patent potential. The objective of this study is to present a bibliometric analysis of scientific publications on the system of indicators related to patents. In the study a bibliometric analysis was carried out by means of a search in the bases Scielo and Scopus, being found 319 publications; after the time cut from 2000 to 2017 and the exclusion of duplicate articles, 233 publications

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were analyzed, representing 73% of the publications found. The results indicate that there has been an increase in publications related to patent-oriented indicator systems; however, Brazil has few articles on the subject, with publications predominating by the United States and China. It was verified that the use of bibliometrics allows to consult publications on different subjects, allowing to help researchers in their future researches.

Keywords

Measurement, bibliometry; Scopus; Scielo; scientific publications.

Resumen

La utilización del sistema de indicadores puede ayudar en el proceso de toma de decisiones, así como la evaluación del potencial de las patentes. El objetivo de este estudio es presentar un análisis bibliométrico de publicaciones científicas sobre sistema de indicadores volcados a patentes. En el estudio se realizó un análisis bibliométrico por medio de una búsqueda en las bases Scielo y Scopus, siendo encontradas 319 publicaciones; después del corte temporal de 2000 a 2017 y la exclusión de los artículos duplicados se analizaron 233 publicaciones, representando el 73% de las publicaciones encontradas. Los resultados indican que hubo un crecimiento en las publicaciones relacionadas con sistemas de indicadores de patentes; sin embargo, Brasil tiene pocos artículos sobre el tema, habiendo predominio de publicaciones realizadas por Estados Unidos y China. Se verificó que la utilización de la bibliometría permite que se consulte publicaciones sobre diferentes temas, posibilitando auxiliar a investigadores en sus investigaciones futuras.

Palabras clave

Medición, bibliometría, Scopus, Scielo, publicaciones científicas.

Resumo

A utilização de sistema de indicadores pode auxiliar no processo de tomada de decisões, bem como a avaliação do potencial das patentes. O objetivo desse estudo é apresentar uma análise bibliométrica de publicações científicas sobre sistema de indicadores voltados a patentes. No estudo foi realizada uma análise bibliométrica por meio de uma busca nas bases Scielo e Scopus, sendo encontradas 319 publicações; após o corte temporal de 2000 a 2017 e a exclusão dos artigos duplicados foram analisadas 233 publicações, representando 73% das publicações encontradas. Os resultados indicam que houve um crescimento nas publicações relacionadas a sistemas de indicadores voltados a patentes; todavia, o Brasil possui poucos artigos sobre o tema, havendo predominância de publicações realizadas por Estados Unidos e China. Verificou-se que a utilização da bibliometria permite que se consulte publicações sobre diferentes temas, possibilitando auxiliar pesquisadores em suas pesquisas futuras.

Palavras-Chave

Medição, bibliometria, Scopus, Scielo, publicações científicas.

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Introduction

In recent years, the activities involving the production of quantitative indicators related to science, technology and innovation are being strengthened in Brazil, due to the recognition of the need for both federal and state governments and the national scientific community to have instruments that help to define guidelines and assess activities geared to scientific and technological development in the country. (Mugnaini, Jannuzzi, & Quoniam, 2004).

The indicators allow to define objectives and guide present and future trends, making possible the measurement of changes and the formulation of alternatives to reach the objectives of organizations and research institutions. (Mourão, 2006).

In this research, the use of scientific indicators allows analyzing the production of patent-oriented indicator systems. Bibliometrics allows the analysis of scientific production, identifying knowledge about a given topic, and assisting in future research.

It is important to emphasize that bibliometry involves a methodology that enables the census of scientific activities through data analysis. (Kobashi & Santos, 2008). This allows the production of relevant indicators for the treatment and management of information and knowledge, allowing the evaluation of scientific production. (Guedes, 2008).

Therefore, the research aims to present a bibliometric analysis of scientific publications on the system of indicators related to patents.

Literature Review

Indicators

The indicators are measurement tools, used to raise quantitative and/or qualitative aspects of a given phenomenon, seeking its evaluation, besides allowing to measure different types of activity and achieve different objectives. (Rozados, 2005). They also seek to identify or direct attention to results-oriented issues. (Bittar, 2001).

In addition, the indicators are a parameter that helps in measuring the difference between the desired situation and the current situation, allowing a problem to be identified, being an important

managerial tool that can be used in the organization management process. (Zucatto, Sartor, Beber, e Weber 2009).

The use of indicators helps to make decisions, by setting goals that allow the goals to be achieved. In addition, a challenge in using indicators is to select one among all possible indicators; however, to overcome this difficulty it is necessary to create criteria to select or construct adequate indicators. (Gao, Christensen, e Kørnøv, 2017; Miremadia, Saboohia & Jacobssonc, 2018).

However, it is important to point out that for constructing an indicator, it is necessary to choose which aspect of reality will be analyzed and define the concepts that will be used to explain the phenomenon researched. (Soligo, 2012).

Finally, the systems of indicators are tools that allow to measure the performance of organizations, enabling these companies to have information that helps in competitiveness. (Bezerra e Carvalho, 2011). In organizations, indicators are used to evaluate organizational performance. (Graça e Camarinha-Matos, 2017).

Thus, the use of indicators makes it possible not only to measure, but also to measure the performance of scientific production, favoring scientific and technological development, and assisting in the decision-making process. And it is through the bibliometric indicators that analyze the scientific productions, allowing to carry out future researches.

Bibliometrics

The bibliometrics was initially oriented towards the measurement of books, that is, focusing on the number of editions and copies, the number of words contained in the books, statistics related to the book industry, etc., but gradually it was applied to other formats of literature production, such as journal articles and other types of documents, and then to authors' productivity and the study of citations. (Araújo, 2006).

In addition, it is understood that the evaluation of academic production is important to assist in the measurement of the quality of scientific research, aand it is through the use of bibliometrics that a measurement is made to evaluate both science and information flows. (Resende, 2012).

The use of bibliometrics techniques allows understand the structure and characteristics of relationships between authors, institutions and between subjects through keywords (Francisco, 2011), favoring the analysis of scientific production. This has been a widely used tool in measurements. (Mueller, 2013).

In addition, bibliometric studies employ methodologies that help to identify editorial tendencies, awaken knowledge about a given topic, and present gaps for future research (Ribeiro e Silva, 2016), which may contribute to the development of a scientific study.

It is important to highlight that it has contributed to the exploration of techniques and results in order to analyze aspects of their own, that is, it is used to measure aspects of academic production contributing to the development of science. (Medeiros e Vitoriano, 2015).

Therefore, this technique allows to analyze the scientific production through indicators that are available in the databases, making possible the comparison of data and a more comprehensive evaluation of the scientific development on a certain theme.
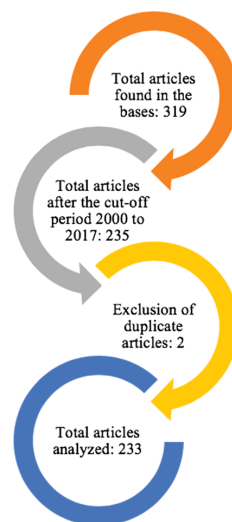
Methodology

The research consists of a bibliometric analysis of published articles, related to the system of indicators related to patents. Bibliometrics is an important element in the analysis of the scientific production of a country, since its indicators can represent the behavior and development of an area of knowledge, as well as to identify the quantity of works on a specific subject. (Araújo e Alvarenga, 2011; Kobashi e Santos, 2008).

A search was made in the online databases Scielo and Scopus, aiming to map the production on the analyzed subject. In the Scielo database, the keyword "system and indicators and patents" was used in the "all indices" field, with only 7 publications found between 2002 and 2015.

In the Scopus database, the keywords "system AND indicators AND patent" were used in the "Article Title, Abstract, Keywords" field, the filter being applied only to select the articles; were found 312 publications from 1965 to 2017. However, data were filtered from 2000 to 2017, reducing the search for the last 18 years, totaling 228 documents found.

The data found from the databases were exported to a spreadsheet and analyzed together, and duplicate articles were excluded, as can be seen in Figure 1.

Figure 1. Process of analyzing articles.

Total articles found in the bases: 319

Total articles after the cut-off period 2000 to 2017: 235

Exclusion of duplicate articles: 2

Total articles analyzed: 233

Source: Own elaboration (2018).

Results and Discussion

In the surveys carried out at the bases, 233 publications were analyzed, excluding the duplicates, giving a reference to the theme to the system of indicators for patents. These publications occurred between 2000 and 2017. Milbergs and Vonortas (2004) highlighted the generations of indicators of Science, Technology and Innovation, indicating that as of 2000 the process indicators appeared.

The Figure 2 shows the annual evolution of articles in the Scielo and Scopus databases, highlighting that since 2008 there has been an increase in the production of articles related to indicator systems.

**Figure 2. Distribution of articles per year.**
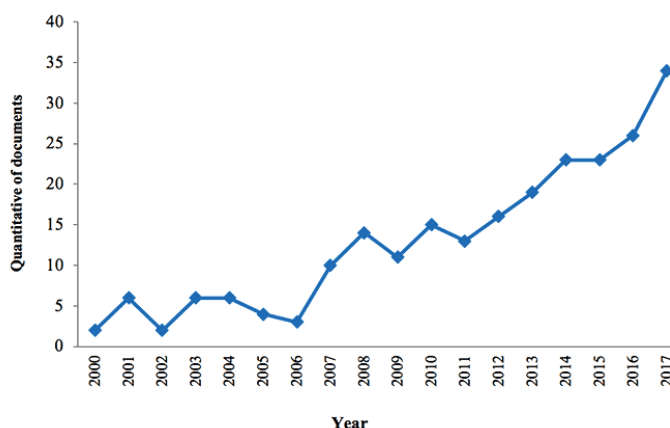
Still, it can be seen from Figure 2 that the year 2017 presented the largest number of articles on the subject, 34, representing 15% of the data found. Analyzing the period from 2007 to 2017, in which there was an increase in publications, it was observed that 204 articles were published, totaling 75% of publications, showing that production on this topic has been growing over the years.

The Figure 3 shows the journals with the highest frequency of publications, highlighting articles with 2 or more publications, having a total of 65 articles, which represented 28% of the total articles analyzed in this research. Scientometrics published the largest number of articles on the subject, 18 (8%), followed by Technological Forecasting and Social Change with 14 (6%) and Research Policy with 8 (3%).

**Figure 3. Periodicals with higher frequency of publications.**
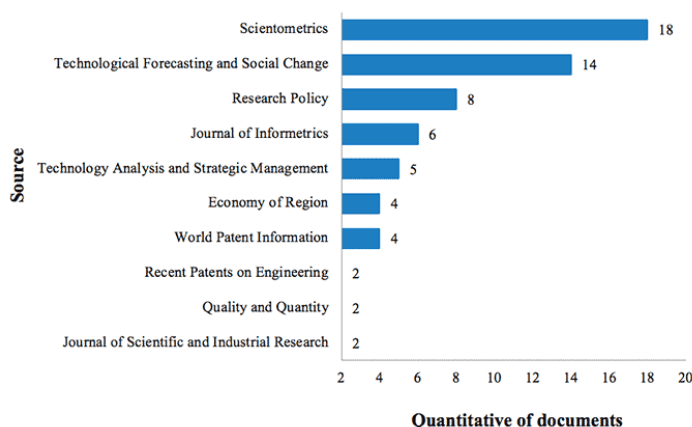
Scientometrics is a journal devoted to quantitative aspects of science, while Technological Forecasting and Social Change is a journal focused on the practice of forecasting and future studies.

Research Policy, on the other hand, is a journal that analyzes articles focused on innovation, technology and research. This shows that the journals with the greatest number of articles are focused on the analysis of studies focused on themes that interact with the theme system of indicators.

Figure 4. Periodicals with higher frequency of publications.
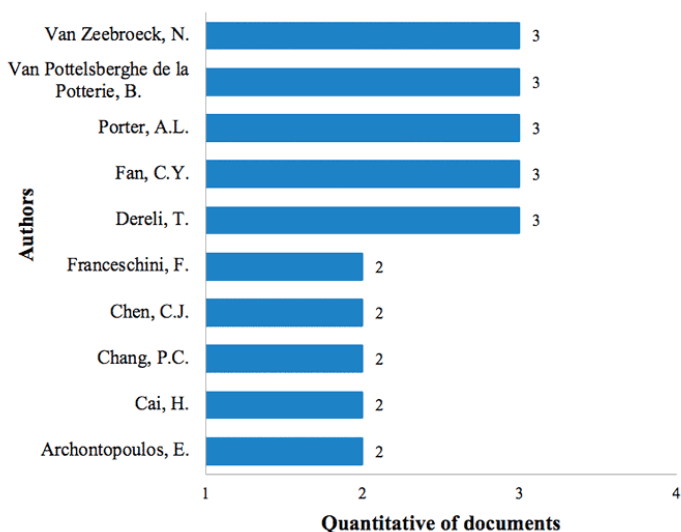
Source: Own elaboration through the Scielo and Scopus database (2018).

The Figure 4 presents the authors with the highest number of publications on the subject analyzed, being that Dereli, T.; Fan, C.Y.; Porter, A.L.; Van Pottelsberghe de la Potterie, B.; Van Zeebroeck, N. have 3 publications each. The Table 1 presents the authors with the highest number of publications, highlighting the affiliations of these researchers and the countries of origin.

Table 1. Authors with the largest number of publications and their affiliation

Author	Affiliation	Country
Dereli, T.	Iskenderun Technical University	Turkey
Fan, C.Y.	National Applied Research Laboratories Taiwan	Taiwan
Porter, A.L.	Search Technology Inc.	United States
Van Pottelsberghe de la Potterie, B.	Université libre de Bruxelles	Belgium
Van Zeebroeck, N.	Université libre de Bruxelles	Belgium
Archontopoulos, E.	European Patent Office	Netherlands
Cai, H.	Xi'an Jiaotong University	China
Chang, P. C.	Yuan Ze University	Taiwan
Chen, C.J.	National Taiwan University	Taiwan
Franceschini, F.	Politecnico di Torino	Italy

Source: Own elaboration through the Scielo and Scopus database (2018).

The Figure 5 highlights that there is a concentration of US publications, 34; representing 14.6%, followed by China with 21 (9.0%) and Germany with 20 (8.6%). It was noticed that Brazil is present among the 10 countries with more productions focused on indicators systems, presenting 12 publications, representing 5.2%.

Figure 5. Countries with more Publications.
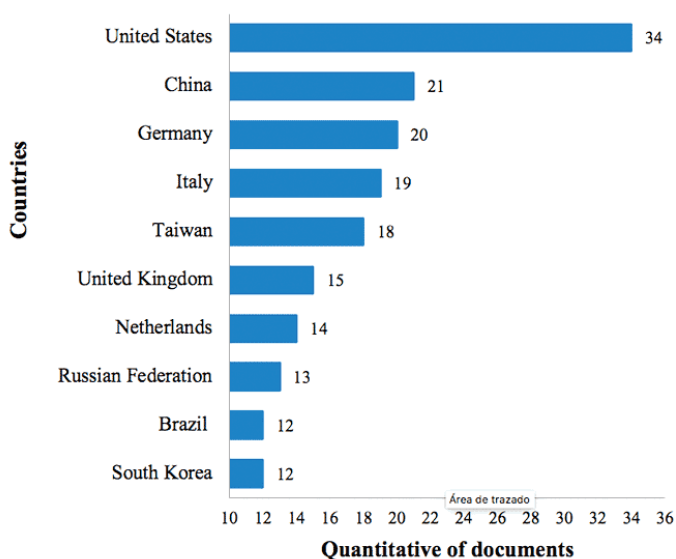
Source: Own elaboration through the Scielo and Scopus database (2018).

In turn, the Figure 6 shows the use of VOSViewer which is a computer program that has free access. This is used to create bibliometric maps, in the case of this research we tried to build a network of occurrences of keywords that were used by authors of the 233 articles found in the research.

He identified the frequency of the keywords, being found 86. Of this number, the words that do not fit the proposal of this research were removed, leaving 27 words that formed 6 clusters, represented by different colors. These colors mean the division of clusters between words, each of which constitutes a cluster.

Figure 6. Occurrence of keywords
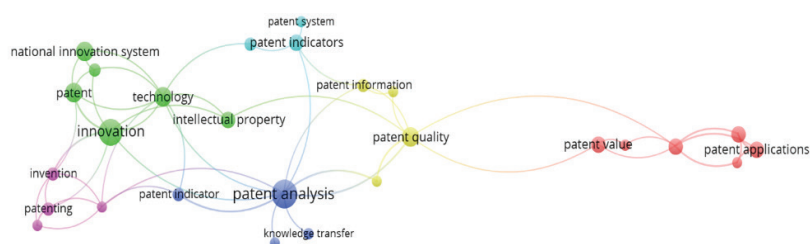
Source: VOSViewer (2018).

Still, it is understood that the more important an item (keyword), both its writing and its representative circle will have a larger size. These circles indicate the location of each item and its size represents the total number of co-occurrences of an item (Van Eck Waltman, Dekker, & Van Den Berg, 2010). The Table 2 highlights keywords found through VOSViewer.

Table 2. Terms found in VOSViewer

Cluster	Color	Number of terms	Found terms
1	Red	6	Patent applications, patent drafting, patent oppostion, patent statistics, patent systems, patent value
2	Green	6	Innovation, intelectual property, national innovation system, patent, tecnology, triple helix.
3	Dark blue	4	Knowledge transfer, patent analysis, patent indicator, technological innovation.
4	Yellow	4	Patent information, patent quality, patent quality classification, technology management.
5	Pink	4	Intellectual property (ip), invention, patent family, patenting.
6	Light blue	3	Patent indicators, patent portfolio, patent system.

Source: Own elaboration through the VOSViewer (2018).

Analyzing the terms, it was found that most of the words are related to patents and indicators, showing that the research of the publications has deepened to articles related to indicators and patents.

Conclusion

The research used bibliometrics to analyze the publications related to system of indicators oriented to patents; this type of methodology makes it possible to identify periodicals and articles on a particular topic, which favors the development of future works, such as scientific articles.

It was found that few publications were found in the Scielo database, different from the Scopus database that several productions have been identified related of indicator systems.

This analysis made it possible to identify an evolution in the number of publications on the subject, and 2017 was the year with the highest number of publications. However, it was noted that Brazil presented few articles on the subject, while the United States, China and Germany surpassed with productions on the system of indicators; even so, Brazil is among the 10 countries with the most productions focused on indicator systems.

In addition, when analyzing productions, it has been found that most publications address only an analysis of patents or innovation indicators, but it does not present a system that highlights patents or technologies developed by universities.

Also, when verifying the occurrence of keywords through the VOSViewer program, it was verified that most of the words are directed to patents and innovation, since the study involved articles related to system of indicators related to patents.

Thus, it is understood that the use of bibliometrics allows the identification of publications on different subjects, which can contribute to broaden the researches related to a system of indicators oriented to patents, allowing Brazil to improve its scientific production, since in the country still has little production on this subject.

As a suggestion for future work, one can analyze in addition to articles, theses and dissertations that deal with the system of indicators, seeking to broaden the type of research to be analyzed, as well as other databases that cover a larger number of journals.

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