META-ANALYSIS AS A RESEARCH TOOL: A SYSTEMATIC REVIEW OF BIBLIOMETRIC STUDIES IN ADMINISTRATION

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ABSTRACT

Purpose: To present the meta-analysis technique as a strategy applied to bibliometric research, in order to unveil the state of the art of the international scientific production, its interactions as areas of knowledge, the collaboration among authors and institutions in the Business Administration area, based in the period from 1998 and 2017.

Originality/value: In the initially applied exploratory research, it was observed a gap in the debate of using meta-analysis as a state of the art investigation resource in the Business Administration area. The meta-analysis used as a research instrument makes possible a strict association of several studies.

Design/methodology/approach: It is a qual-quant research approach, of exploratory character, outlined through bibliographic research. As for the investigation mechanism, it was used meta-analysis as a systematic investigation. The development of the research was divided into two phases. The first, called macro-analysis, and the second, micro-analysis.

Findings: Research results showed that the number of bibliometric studies published in the second decade of the studied period was significantly higher. The publication areas, within the scope of Administration, were also affected by important changes, comparing the analyzed periods, evidencing a growth in publications between 2008 and 2018 in the areas of planning and management. As practical applications, it is possible, from this study, to use the publications and analyses to better understand how, when and by whom the bibliometrics was made, that is, denser and deeper bibliometric studies, which can highlight trends in a certain study area.

KEYWORDS

Meta-analysis. Microanalysis. Bibliometry. Administration. Search.

1. INTRODUCTION

Academic literature offers a wide communication system among communities from several knowledge areas from different countries, collaborating for spreading advances of science and of the history of humanity. The conjunction among knowledge areas, the different theoretical approaches, and axes provide input for building bibliometric indexes that, in turn, allow for refinement and understanding of scientific production focused on its applicability. In this sense, bibliometry can be understood as a strategy that intends to gauge scientific activity on specific themes and, with this, to anticipate trends detected through study and analysis of literature more representative of the state of the art, in the scientific means. Such understanding expands the application of this strategy when evaluating occurrences of research in different circumstances or, yet, the exchange of knowledge among governments, education and research institutes, and cultures of several countries (Sanz-Casado, Suarez-Balseiro, García-Zorita, Martín-Moreno, & Lascurain-Sánchez, 2002).

Scientific research is a reliable and necessary means for understanding the genesis and evolution of subjects and multidisciplinarity, not only in relation to theoretical questions but also to their applicability. The development of scientific investigation in universities triggered several fields of knowledge. Since the advent of organized academic activities, research has become individual and collective spheres in science, technology, humanities, and social sciences. Societies, specialized research institutes, university departments, scientific conferences, and journals have emerged, attesting for the continuous social formation of research (Paterson, 2001). Thus, in order to provide a consistent theoretical framework in the search for knowledge, it is imperative to place a structured process for selecting works of academic prestige in the studied context (Valmorbida, Ensslin, & Ensslin, 2013).

The bibliometric techniques, which were initially limited to the library sciences area, had their use expanded to other areas of knowledge, such as Business Administration, with new applications and purposes, among them, to allow information mapping and assessing the quality of the scientific knowledge produced (Machado, Souza, Parisotto, & Palmisano, 2016). This improvement in the construction of scientific knowledge, from academic literature, is influenced by the interest and rate of growth of studies in bibliometry (Ribeiro, 2017). Such methods are applied to evaluate national and international academic production, to identify articles, authors and

themes that are most relevant and current; to investigate trends of thematic and methodological approaches in journals of higher relevance, establishing greater alignment among the researched themes and the available academic productivity (Xavier, Silva, Gomes, & Costa, 2012).

Bibliometric studies are essential to formulate syntheses on a wider and varied range of authors, contexts, and reflections that, as a whole, form research findings through the combination of results from several sources. This combination, named meta-analysis, makes possible a methodological application based on a new approach, grouping and connecting results and findings from other approaches (Reynaud & Todescat, 2017).

The term "meta-analysis" emerged in 1976, by Gene Glass, to report the statistical combination of independent research findings, applied to a quantitative approach. However, it was only in 1985 that Stern and Harris presented the qualitative perspective of meta-analysis (Glass, 1976; Beaucher & Jutras, 2007). In view of this and with the intention of discussing the bibliometric analysis technique as a research instrument in the Administration area, the following research question was formulated:

- What is the research profile and development of bibliometric studies in the Administration area, in articles published in international journals, between 1998 and 2017?

In order to define the range of this study, for 20 years of publications about bibliometric research in the Administration area, the following criterion was adopted: to investigate international publications related to the Administration area, of high impact, according to the JCR index, adopted by the Web of Science database; and to separate the analysis in two decades – from 1998 to 2007 and from 2008 to 2017, following the practice observed by the authors to compare the evolution of the use of the bibliometric technique.

The general objective of this work is to present the meta-analysis technique as a strategy applied to bibliometric research, in order to unveil the state of the art of the international scientific production, its interactions with the areas of knowledge, and the collaboration among authors and institutions, within the administration area, from 1998 to 2017.

This work is organized in five sections, besides this introduction. In the second section, it is presented the development of the meta-analysis technique for research and the importance of bibliometric studies. The third section presents the methodological procedures adopted in this study: data collection, analysis, and treatment. The fourth section presents the research findings, the analysis, and discussion for them. In the final considerations,

presented in the fifth section, the main conclusions are summed up, together with the research limitations and suggestions for future studies.

2. DEVELOPMENT OF THE META-ANALYSIS TECHNIQUE IN RESEARCH

A meta-analysis, according to Schmidt and Hunter (2014), is an evidence crossing technique (terms, variables, names, keywords, arguments, and others) that makes possible a strict association of previous studies over a specific theme, allowing an evaluation of the global effect of the research made. This technique has become useful in the development of knowledge about organized sciences, producing an important contribution to future research agendas (Kepes, McDaniel, Brannick, & Banks, 2013).

Historically, the use of systematic review was introduced at the beginning of the 20th century, growing in popularity and amount at the end of the same century. In 1904, it was published the first systematic review, summing up the results of two studies in the Medical area, even though the term "meta--analysis" was only used for the first time in 1976 (Pinto, 2013). From the 1950s on, researchers of the Medical, Psychology and Sociology areas started developing new methods, with the objective of integrating information about primary studies through the use of statistical techniques.

The application of this technique makes it possible to systematically synthesize existing empirical findings, according to a research approach based on evidence. Thus, meta-analysis provides directions and the direct effects among the studied variables. It allows researchers to assess the heterogeneity of primary studies. Therefore, it integrates several primary studies, generating more statistical power and, at the same time, avoiding the influence and potential statistical inadequacies from isolated studies (Frese, Rousseau, & Wiklund, 2014).

Meta-analysis makes two types of analysis possible: qualitative and quantitative. The approach of this work has the prerogative of elevating the objectivity of literature reviews, mitigating the occurrence of possible biases, besides enhancing the number of assessed studies (Figueiredo, Paranhos, Silva, Rocha, & Alves, 2014). Thus, it is not only about an analysis technique that makes viable and possible reviewing literature using a strict methodology, but also an approach that operationalizes and integrates new areas of knowledge in a way which would not be possible individually through research, besides proposing and answering questions never posted before,

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in any of the studies separately (Brei, Vieira, & Matos, 2014).

In turn, qualitative meta-analysis emerges as secondary and originates from the quantitative meta-analysis, with the main objective of grouping a big amount of primary studies to combine the findings and outline a broader portrait of a given phenomenon (Beaucher & Jutras, 2007; Galvão & Steiner, 2013). According to Paterson (2001), qualitative meta-analysis can also be referred to as a qualitative research meta-study. The first one consists in developing a research question and selecting a theoretical structure. The second process refers to developing inclusion and exclusion criteria for qualitative studies, assessing their quality and data management strategies. The third one includes metadata analysis, involving a "multifaceted" system to group data based on criteria such as method, sample, publication date and specific problems (Paterson, 2001; Bicudo, 2014).

The qualitative meta-analysis objectives are the development of theories, high-level abstraction, and generalization, in order to make qualitative results more viable for practical application (Estabrooks, Field, & Morse, 1994; Jensen & Allen, 1996; Galvão & Steiner, 2013). According to Schreiber, Crooks, and Stern (1997), there are three purposes related to meta-analysis theory. The first one is the theory construction, in which the findings from different sources can be used for the highest deepening of the theory level, using data from only one sample. The second purpose is to explain a theory, a parallel, a deductive and analytical process in which an abstract concept in a study is filled through the synthesis of other studies' findings. The theoretical development is the third one, and it refers to summarizing the results into a product that is densely descriptive and comprehensive and, therefore, more complete than any of its constituting studies. These authors also suggest that any of these three purposes can be complementary (Schreiber et al., 1997).

According to Lovatto, Lehnen, Andretta, Caravalho, and Hauschild (2007), meta-analysis evidences the effect of studies in a way which would not be possible individually, for it gathers all studies and makes a combined analysis. Thus, it develops the analytical potential of the research, expanding the opportunities to show the differences among the methodologies used.

2.1 The importance of bibliometric studies

The bibliometric tools allow exploring the influential analytical contributions of academic studies and connections. Thus, the technique has supported the conceptual development of scientific fields (Di Stefano, Peteraf, & Verona, 2010). The main advantages of the bibliometric method are neutrality, objectivity and opportunity to implement reviews applying

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methods to explore studies on a variety of questions (Nerur, Rasheed, & Natarajan, 2008).

The importance of the bibliometric analysis was recognized as a study source that applies specific procedures through which it is possible to identify the scope of themes not very well explored in the literature yet (Ribeiro, 2017). Therefore, it is seen as the elementary basis of research and source of meticulous investigative commitment in order to gather knowledge (Pizzani, Silva, Bello, & Hayashi, 2012; Ribeiro, 2017).

The bibliometric analysis provides information about growth in the literature and the flow of knowledge within a specific field during a period of time, analyzing gathered information based on data, such as citations, authors, keywords, or the variety of the consulted journals (Raan, 2005). Bibliometry includes different methods, such as citation analysis, co-citation analysis, and bibliographic coupling, using citations and keyword analysis (De Bellis, 2009; Zou, Yue, & Vu, 2018).

Thus, it has become a more and more common means of determining the status and degree of progress of the subjects, and it serves as a basis for establishing theoretical foundations of these same subjects (Durisin, Calabretta, & Parmeggiani, 2010). Bibliometric studies are used to identify the objective and range of different publications, the researchers' trends, the collaboration patterns among them and the coverage of the publications. Besides that, they serve to study growth in the literature on a specific topic, throughout a specific period of time (Kumar & Naqvi, 2010; Teodoroski, Santos, & Steil, 2015), and this contributes in the scientific inference process.

As an assertion mechanism, bibliometry reflects the effort in revealing what is produced in a certain area of knowledge, being responsible for stimulating learning and advancements, and pointing out trends in many different areas of knowledge (Pizzani et al., 2012; Zupic & Čater, 2015). Bibliometric research is frequently combined with scientific mapping techniques, in order to visualize the conceptual structure of a certain research area (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011), uniting multiple analysis methods, depending on the different types of information used (Raan, 2005; Zou et al., 2018).

More recent studies have been used to analyze the multiple relations established among researchers, publications, subjects or research topics. These investigations led to the development of new bibliometric indexes, the multidimensional indicators, from which maps are made to graphically represent the connections among the many scientific activity characteristics (Small, 1973).

Among the most meaningful authors who allowed the development of

this new model of indicators, Small (1973) stands out, who represented graphically, through cluster analysis, the relations among scientific documents that had been co-cited. Later, Small and Garfield's (1985) works allowed the mapping of existing interrelations among a great number of scientific specialties from a great global map in which each subject is placed next to the one with which it holds a greater number of common links, typical of social networks studies.

If associated to the use of indicators, the bibliometric analysis represents an objectively assessed outline, in order to know how a certain theme is approached in the national and international literature (Valmorbida et al., 2013). National and international studies benefit from the theoretical structure through co-authorship network analysis, for example, when applied to bibliometric studies (Ribeiro, 2017). The development of theories and hypotheses testing is another applicability of bibliometry, once it can reveal unknown patterns in a certain field of study when associated to evaluation and predictive methods (Koseoglu, Rahimi, Okumus, & Liu 2016).

Besides identifying gaps in the literature and academic practice, bibliometric studies enlighten the relation among subjects of areas of knowledge. In another aspect, the results from bibliometric studies may serve as a basis for formulating policies and allocating resources in government agencies, organizations that foster research and education institutes managers (Koseoglu et al., 2016).

3. METHODOLOGY

The methodology adopted in this study was bibliographic, of descriptive-exploratory character. As for the investigation mechanism, it was used the quantitative and qualitative meta-analysis approach (mixed method) as a systematic investigation, realizing comparisons and research data analyses (Zimmer, 2006; Aguirre & Bolton, 2014; Creswell & Clark, 2013; Rossetto, Bernardes, Borini, & Gattaz, 2018). The technique has as its purpose to develop theoretical knowledge that utters the level of abstraction, hoping for a greater perspective of applications in practical situations. Besides that, it can regroup a great amount of research to associate results and reach the representativeness of the phenomenon data (Beaucher & Jutras, 2007; Servantie, Cabrol, Guieu, & Boissin, 2016).

The development of the research presented here was made in two steps. The first, called macro-analysis, had as a goal to obtain a general view of the structure of the Administration area. The main goal was to analyze the aca-

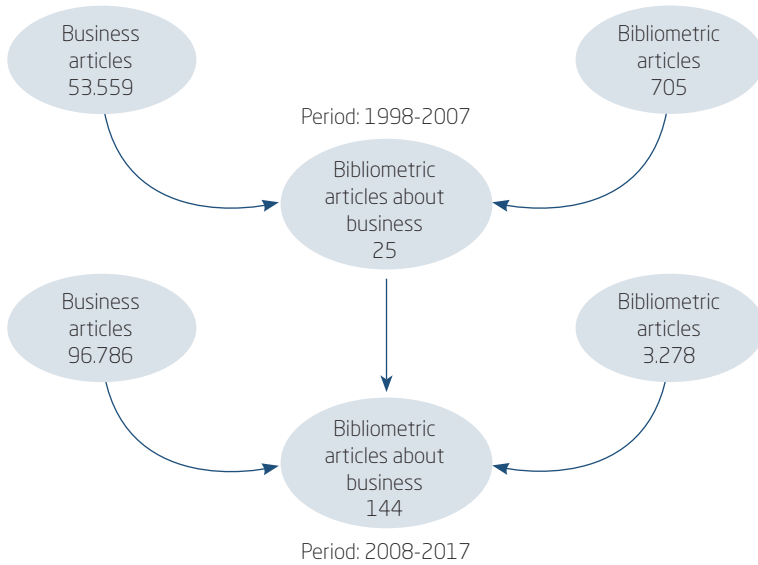demic production profile of bibliometric studies in the Administration area.

Two temporal scopes were made in this first step, the first one between 1998 and 2007, and the second one between 2008 and 2017, which allowed a more detailed examination of the investigated area structure. Besides that, it was determined that the research would involve only scientific production of articles published in English, being excluded other types of documents. For such, it was made a bibliometric analysis through the multidisciplinary database Web of Science (previously known as Web of Knowledge), produced by the Institute for Scientific Information (ISI), currently maintained by Clarivate Analytics. The scope is the core of the "Web of Science™ Main Collection", which comprehends the "Social Sciences Citation Index (SSCI) 1956-to present", containing scientific production in social sciences.

The first step was defining the search keywords, which associated the terms "bibliometry" and "administration" or "business", in order to limit the range of results in this work. In the two periods analyzed, the initial parameter for searches was "bibliometr*" associated with research in the area of "business". In the first period (1998-2007), it was obtained 25 publications, while in the second period (2008-2017) 144 publications were identified, totalizing 169 articles, presented in Figure 3.1.

The Web of Science database has a large range of areas of knowledge and scientific production with international relevance, and also provides a set of metadata necessary to bibliometric analysis and mappings. The database provides complete information about publications, journals, authors, the number of citations, the cited references, the institutions, countries, foster agencies, among others (Carvalho, Fleury, & Lopes, 2013).

The purpose of the second step, called "micro-analysis" was to obtain a more specific view on research in the Administration area, that is, to find changes or certain trends in both analyzed periods. This step was carried out in three phases, according to what Déry and Toulose (1996) proposed. In the first one, all the 169 articles were classified in groups, according to the year of publication. In the second phase, the content was explored through relationship indicators, such as citation, co-citation, and co-authorship. The third phase was the analysis of the research metadata, which contributed to the relations mapping (links) among the source articles of this study. To develop the metadata creation, the input came from the articles, as well as the keywords, bibliographic references, and citations. The data grouping was made with the tool ISI Web of Science, bringing an output of all information related to previously made research.

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(Figure 3.1)

DATA GATHERING

Business
articles
53.559

Bibliometric
articles
705

Period: 1998-2007

Bibliometric
articles about
business
25

Business
articles
96.786

Bibliometric
articles
3.278

Bibliometric
articles about
business
144

Period: 2008-2017

Source: Elaborated by the authors.

The metadata analysis made possible the generation of tables, graphics and illustrated maps. The tables and graphics were produced with the Microsoft Excel software. The production of the networks was created with the VOSviewer software, version 1.6.7, which allows for the original ISI Web of Science research metadata to be imported to the database, for, then, being processed and the estimations elaborated. The following analyses were generated:

1. relationship of articles for references;
2. relationship of keywords;
3. relationship of co-citation among authors;
4. relationship of co-citation among countries;
5. relationship of co-authorship.

Once different bibliometric analyses methods have strengths and weaknesses, combining several methods to explore research trajectories in a certain subject has become a trend in bibliometry. Previous studies using a combination of co-citation and co-word analysis indicated complementary

roles of both analyses (Braam, Moed, & Raan, 1991; Chang, Huang, & Lin, 2015). After applying the co-citation analysis and the co-word analysis in a literature review study, Åström (2002) pointed out that overlapping the two methods was relatively small and the combination of the two methods provided better results.

In the same way, Chang et al. (2015) suggested that the combination of co-citation analysis with the keyword analysis made possible not only to create a comprehensive map of the conceptual structure of a given subject but also to facilitate a deeper understanding in the development of this knowledge.

4. RESULTS

It was identified and analyzed 169 bibliometric articles, being 25 during the first period and 144 during the second period, in the Administration area. This analysis involved studies realized between two periods, from 1998 to 2007 and from 2008 to 2017. For such, the analysis of the results was divided into six topics: 1. publications frequency in chronological order; 2. impact factor of relevant journals; 3. co-citation of authors with highest productions on this theme; 4. co-citation analysis of the country; 5. co-authorship network; and 6. keywords analysis.

4.1 Publications frequency in chronological order

Figure 4.1.1 presents the publication period of the articles (1998-2007), indicating scientific production in the Administration area throughout time. It is noted that the number of publications started growing only after 2004, nevertheless, it is a small sample, therefore, the variations are not very meaningful.

(Figure 4.1.1)

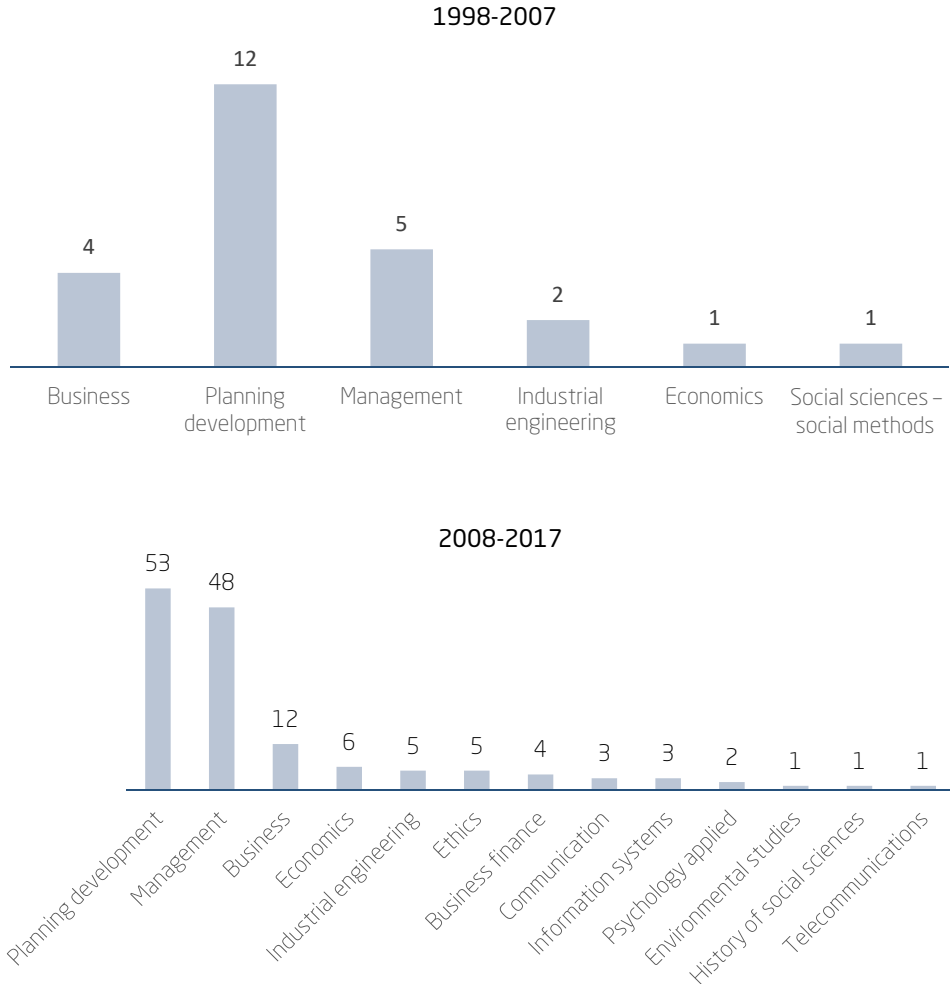### DISTRIBUTION OF THE ANALYZED PUBLICATIONS
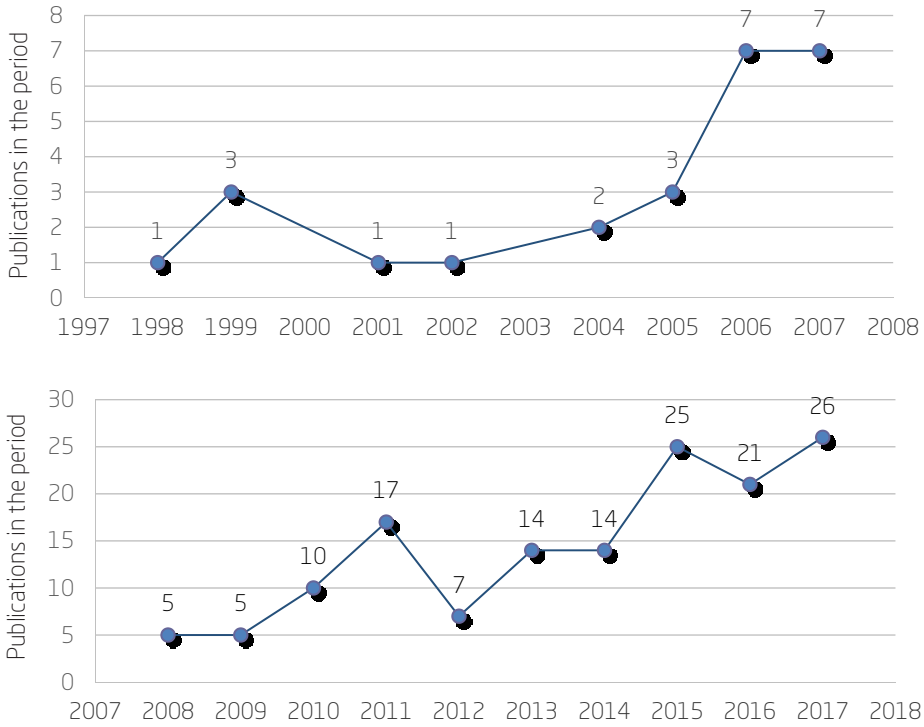
Source: Elaborated by the authors.

In the second analyzed period (2008-2017), as it is seen in Figure 4.1.2, there is growth in publications yearly, although in 2012 there is a drop in productions.

(Figure 4.1.2)

EVOLUTION OF THEMATIC AREAS WHEN APPLYING THE BIBLIOMETRIC AREAS

1998-2007

2008-2017

Source: Elaborated by the authors.

In the first analyzed period, only six categories present scientific production. Business and planning categories are more representatives, with 12 articles, respectively. The second analyzed period shows a higher diversity of categories. The research flow in planning and management are more productive, besides the emergence of seven new categories within the study area.

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Complementarily, the research identified that from 1998 to 2007, the 25 articles analyzed produced 1,719 citations from 1,391 articles. Between 2007 and 2017, the 144 found articles produced 2,214 citations coming from 1,824 articles, besides a growth from 3.47% in 2008 to 18.05% in 2017. When exploring these pieces of information, it can be concluded that, although the number of articles from 1998 to 2007 is smaller, their scientific production impact in the Administration area is higher, for the average of citations per article is 69.2, while from 2008 to 2017, this average drops to 15.37.

4.2 Impact factor of relevant journals

The impact factor is the bibliometric indicator used by the ISI, calculated by dividing the total number of citations of specific articles from specific journals in a given year, published during two years before that, in a specific set of scientific journals by the number of scientific articles published by that same journal during the same period (Tahai & Meyer, 1999; Saha, Saint, & Christakis, 2003).

Figure 4.2.1 presents the ten journals with the highest number of published articles that approach the scope of this study. The analysis was made through the ISI Web of Science database, in April 2018.

(Figure 4.2.1)

MAIN INTERNATIONAL ANALYZED JOURNALS

| Journal	Impact factor	Publications	% of publications
Technological Forecasting and Social Change	2.625	65	38.46%
Journal of Business Research	3.354	11	6.50%
African Journal of Business Management	1.105	5	2.96%
R&D Management	2.444	5	2.96%
Industrial Marketing Management	3.166	4	2.37%
Journal of Business Ethics	2.354	4	2.37%
Strategic Management Journal	4.461	4	2.37%
Entrepreneurship Theory and Practice	4.916	3	1.77%
International Business Review	2.476	3	1.77%
RBGN Revista Brasileira de Gestão de Negócios	0.153	3	1.77%
Others	-	62	36.70%
Total	-	169	100%

Source: Elaborated by the authors.

It can be seen that 50.88% of the published articles are concentrated in the four first journals: *Technological Forecasting and Social Change* (38.46%), *Journal of Business Research* (6.50%), *African Journal of Business Management* (2.96%), and *R&D Management* (2.96%). The other investigation factor is the relation between the number of publications and the impact factor (IF), in which it can be seen that the journals with the highest impact are: *Entrepreneurship Theory and Practice* and *Strategic Management Journal*, nevertheless, these present only four articles and the articles about the theme, respectively. The impact factor reflects the general estimation of the journal.

4.3 Co-citation of most relevant authors and their methodologies

To analyze authors and articles, it was chosen the use of graphics known as network maps. These maps use links and colors to emphasize authors or concepts that are interconnected.

Two analyses were applied, as show figures 4.3.1 and 4.3.2, from 1998 to 2007 and from 2008 to 2017, respectively. The analysis shows authors who quote other authors and, as they appear together, a similarity among their studies emerges. The size of the node presents the normed number of citations received by the articles and the thickness of the node represents the strength of the co-citation links. The link and proximity between two authors identify the co-citation relation between them. The color of the node indicates the cluster to which the author is associated.

Figure 4.3.1 presents the analysis from 1998 to 2007 and, from this analysis, the author Kostoff stands out for his nine published articles. According to the Web of Science, his publications are in planning development, industrial engineering, and management areas. Right next to him, there is an author who has links with the remaining authors belonging to the red and green clusters.

(Figure 4.3.1)

CO-CITATION MAP (1998-2007)
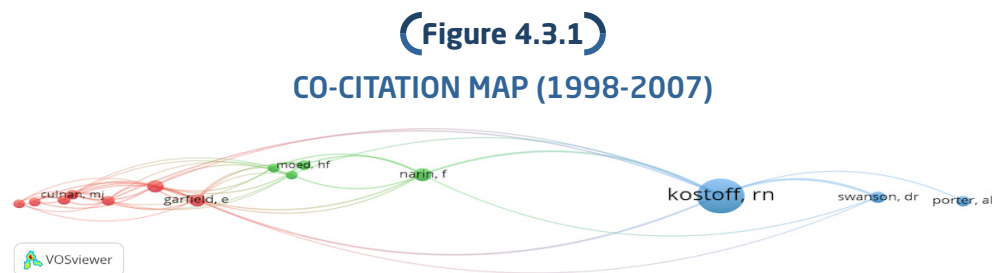
Source: Elaborated by the authors with VOSviewer.

In the first decennium, Pieters, Baumgartner, Vermut, and Bijmiolt (1999) developed a study about the citation network of the *International Journal of Research in Marketing*, from 1981 to 1995. According to the study's objectives, citation concepts were used. For the authors in the citation networks, they participate in making interactions in order to exchange valuable resources. Citation networks are specific social networks in which the actors are journals, articles or authors, valuable resources are ideas and knowledge, and interactions are citations from an author to other authors.

Luwel, Noyons, and Moed (1999) developed research with the objective of illustrating the use of bibliometric tools in evaluating scientific research made in Flemish universities and research organizations funded by public funds, and in evaluating the scientific-technological performance in the field of Information Technology. Phillips, Baumgartner, and Pieters (1999) published a bibliometric study made throughout 27 journals with which the *Journal of Consumer Research* had meaningful communication connections from 1982 to 1993. Issues not taken into consideration in studies of previous citations in Marketing were approached in this paper, such as: how influential are the journals and how their influence grows throughout time? The analysis of the results points out that a small set of marketing and psychology journals carry out disproportional influence, nevertheless, marketing journals are almost entirely limited to the marketing field.

The second analysis period is from 2008 to 2017 and, as seen in Figure 4.3.2, the co-citation network formed six clusters. The clusters were produced based on references belonging to the main authors.

(Figure 4.3.2)

CO-CITATION MAP (2008-2017)
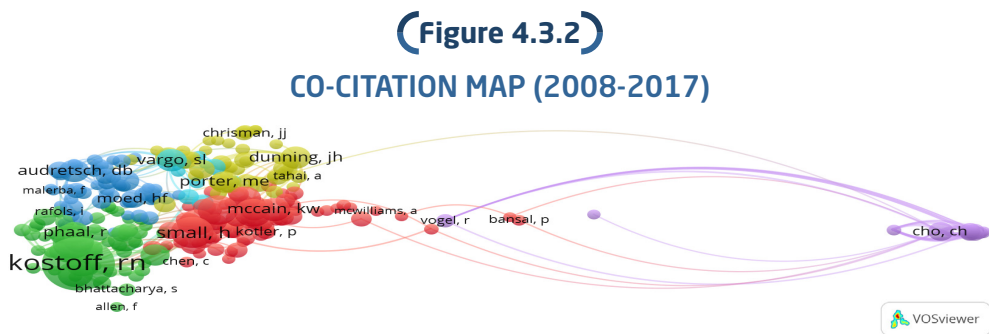
Source: Elaborated by the authors with VOSviewer.

In order to know more about the most cited authors, a minimum number of five citations was established, thus, in the red cluster, the authors who stand out are Garfield, Small, and Pilkington. The studies developed by

Garfield (2009) are focused to highlight the importance of bibliometry and the use of software, such as HistCite, to visualize the impact, as well as the growth of the area of study.

Pilkington (2008, 2009) used in his research bibliometric analysis techniques (co-citation) and social networks to investigate the intellectual pillars of the technology management literature, as well as to investigate the central themes of services research, analyzing citations in specialized journals, discussing changes in subfields and identifying emerging topics. The author uses bibliometry to expose differences among groups with different profiles or functions in different situations and networks, with the purpose of improving the efficiency of innovation activities in the corporate, industrial and national levels.

Figure 4.3.3

CO-CITATION MAP (2008-2017)
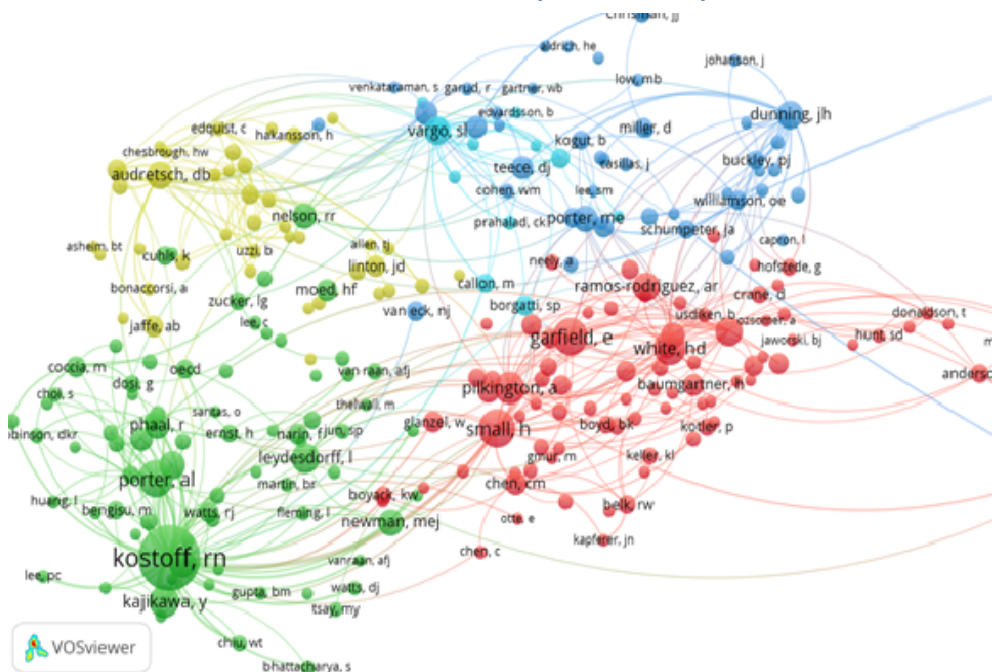
Source: Elaborated by the authors with VOSviewer.

Small (2008) explored the possibility of using co-citation clusters throughout three periods of time in order to track the emergence and growth of research areas and forecast short-term changes. For this research, he used co-citation grouping, mapping and cluster formation methodologies.

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In the blue cluster, Vargo (2011, 2008, 2007) stands out as the most cited author, his research is in the marketing area, mainly about value creation. It is highlighted that the traditional models of value creation focus on company production and price. However, it was presented an alternative perspective, one representing the intersection of two growing chains of the service science and the service-dominant logic (S-D).

The authors Kostoff and Kajikawa, in the green cluster, are the most cited. In the period of 2008-2017, the author who stands out by the number of published articles is Kajikawa, with nine published articles. His productions, according to the Web of Science, are classified in the Public Administration and Engineering areas. It can be seen that, in this period, scientific production in Administration generated higher participation of scholars from several countries, and proximity between Kostoff and Kajikawa.

This proximity is observed through Kajikawa's publications about themes and arguments that were developed by Kostoff. It is possible to notice in the figures that the evolution of bibliometric studies happens from one period to the other. Thus, authors who were adjacent to the theme in the first period reached their own cluster, as it happens with the author Garfield.

As for the main Kostoff and Schaller's works, it was observed that the article called "Science and technology roadmaps", published in 2001, had 283 citations and was published in the *IEEE Transaction on Engineering Management* journal. The research had as an objective to define science and technology routes (C&T) used in the industry, government and scientific production. These routes are employed as decision helpers to improve the coordination of activities and resources in more and more complex and uncertain environments. Specific uses include strategy, planning, execution, review and transition management, besides the improvement of communication among researchers, technicians, product managers, providers, users, and other interested parts.

In turn, Kajikawa published his first bibliometric study in 2008, "Tracking emerging technologies in energy research: toward a roadmap for sustainable energy", in the same journal, *Technological Forecasting and Social Change*, receiving 105 citations. This bibliometric research was developed, as well as Kostoff and Schaller's (2001), about routes within the field of science and technology for renewable and sustainable energy, essential for managing the several segments of society and economy.

4.4 Co-citation analysis related to the countries

The co-authorship analysis of countries reflects the communication degree among them, as well as their influence in this area. The co-authorship

network map of the publishing country shows many colors, demonstrating diversifications in research directions. The biggest "nodes" represent the most influential countries as the *locus* of the publication origin, due to the number of citations. The connections among these "nodes" are collaboration networks among the institutes, as shown in Figure 4.4.1.

Figure 4.4.1

CO-CITATION MAP OF THE COUNTRIES (1998-2017)
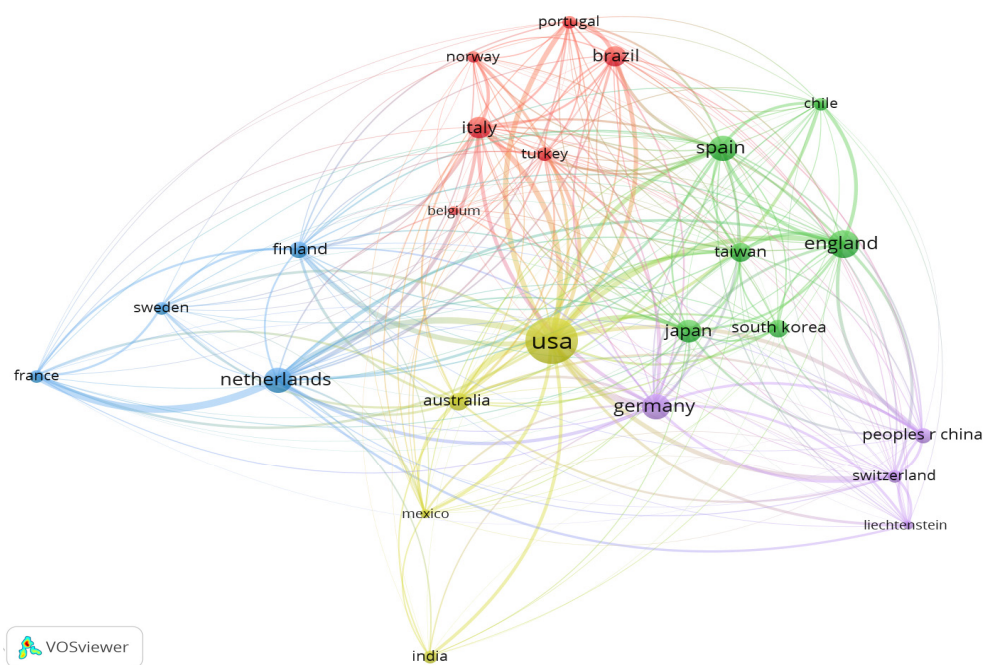
Source: Elaborated by the authors with VOSviewer.

The investigation of the origin of the countries shows the contribution of each region for international research in the Administration area. Figure 4.4.1 shows the countries which stand out in published articles from 1998 to 2017. Among the 41 countries that stand out, the United States is the most representative, with 31.36% of the total published articles about the theme, which also explains the reason why this research is carried out with scientific articles in English. The other influential countries are England (10.65%), Germany, Holland, and Spain (9.46%) and Japan (7.1%).

This way, it can be seen the presence of five clusters, the first one is yellow and the countries are: the United States, Australia, Mexico, and India.

This cluster is the main one, for its function is to connect the others. The purple cluster (Germany, China, Switzerland, and Liechtenstein) is the closest to the yellow cluster, that is, its scientific production has stronger relations.

The green cluster is represented by Japan, Taiwan, England, Spain, Chile, and South Korea. It is noted that, in spite of the distance from Holland node, there is a strong connection link with the United States. Holland belongs to the blue cluster, also composed by France, Finland, and Sweden. The red cluster has more representativeness from Brazil and Italy, followed by Norway, Turkey, Belgium, and Portugal.

Figures 4.4.2 and 4.4.3 present the co-citation network of Kostoff and Kajikawa, from the United States and Japan, by other authors from several countries, expressing the influence of these authors in other studies.

(Figure 4.4.2)

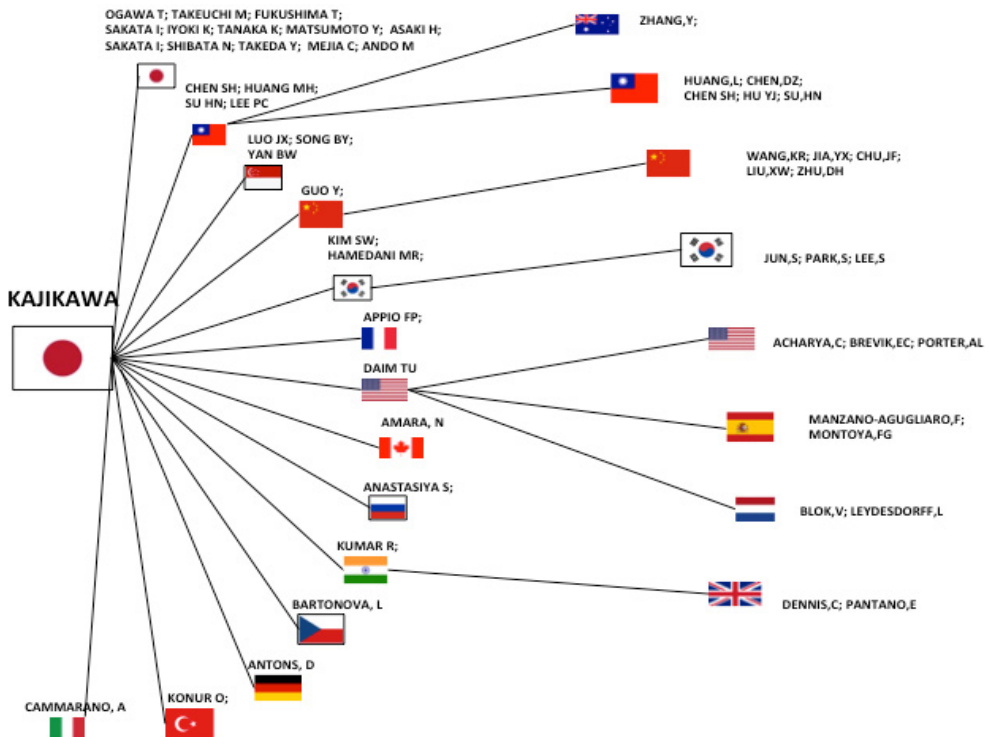**KOSTOFF'S CO-CITATION NETWORK AND CORRELATED COUNTRIES**
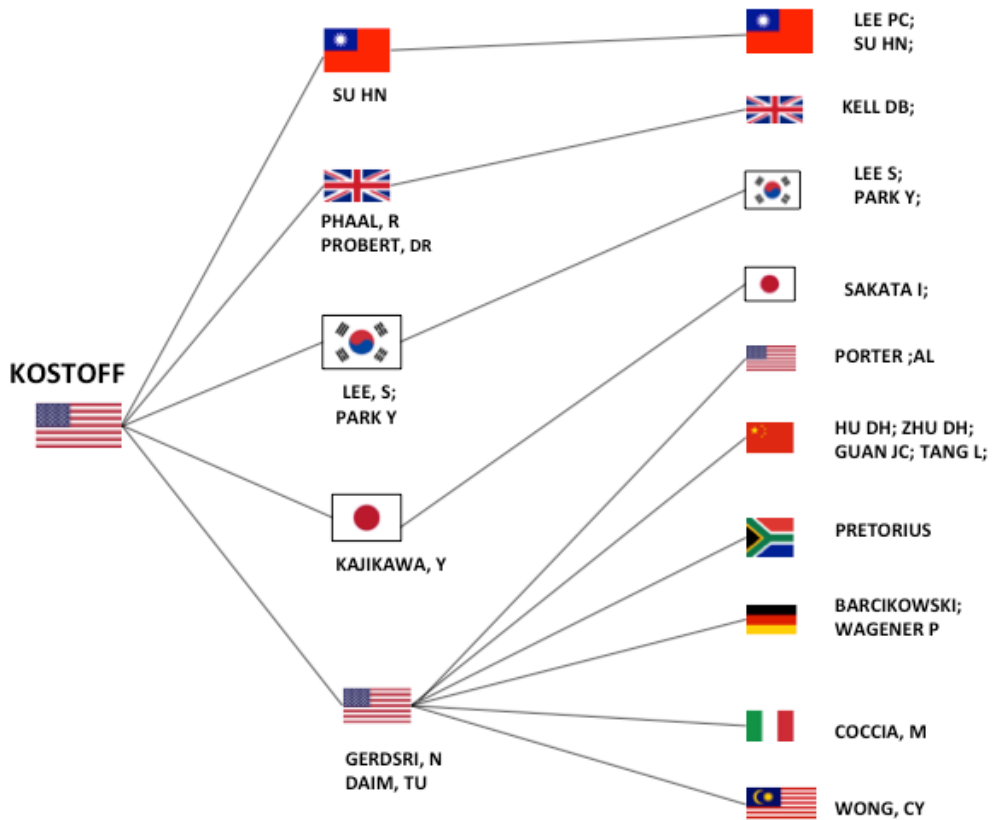
Source: Elaborated by the authors with Web of Science.

In turn, Figure 4.4.3 represents Kajikawa's co-citation network, from the sample of analyzed articles.

(Figure 4.4.3)

KAJIKAWA'S CO-CITATION NETWORK AND CORRELATED COUNTRIES

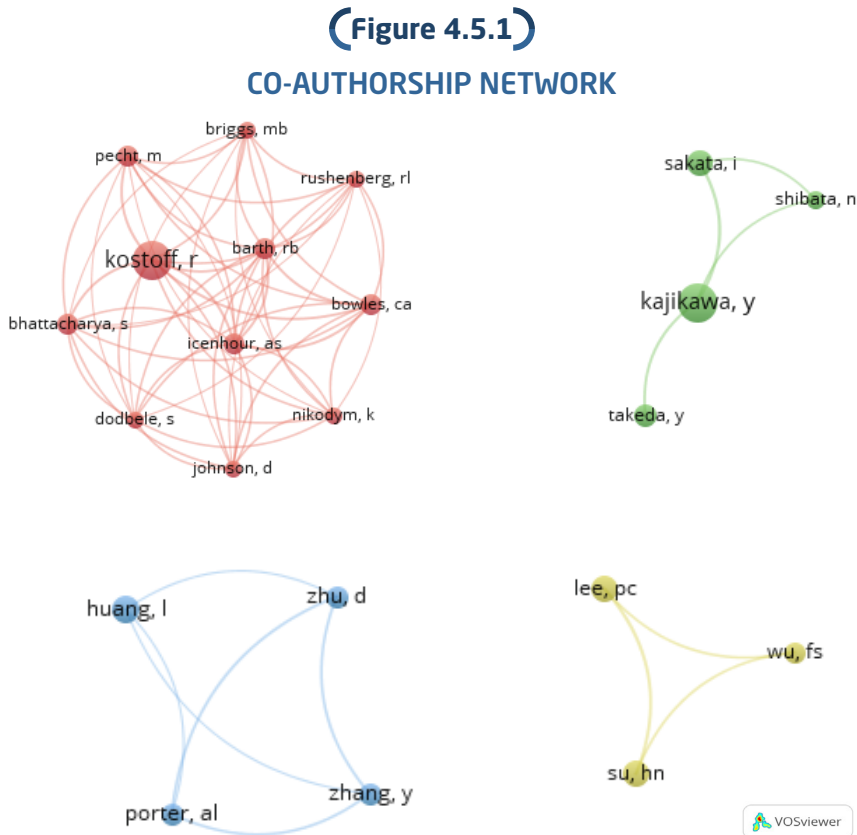Source: Elaborated by the authors with Web of Science.

The co-citation approach of an author allows examination of which countries the same theme, or object of study, holds relation with the scientific production. Hence the idea that holds the co-citation network as a relationship network, even though indirect, among authors.

4.5 Co-authorship network

The co-authorship analysis is an important content in bibliometric research and the collaboration level among authors is an indicator used to evaluate the current status in a specific area. For this analysis, it was used the total period (from 1998 to 2017), once it was considered the secondary

temporal space for this analysis, four co-authorship networks stand out. The co-authorship networks are made of researchers based on the number of publications made together (Figure 4.5.1).

Due to the highly interdisciplinary nature of the studies in the Administration area, the researchers come from different subareas, constructing different networks. Creating and analyzing knowledge maps of the co-authorship network of productive authors provides important information on the researchers and their contribution for the Administration area in cooperation groups, what reinforces the advantages for individual researchers to search cooperation opportunities. In the VOSviewer, the co-authorship analysis was used to generate the knowledge domain maps of the main research groups, as shown in Figure 4.5.1.

(Figure 4.5.1)

CO-AUTHORSHIP NETWORK

Source: Elaborated by the authors with VOSviewer.

Each node represents an author and the size of the nodes indicate the number of published articles. The link which connects two nodes represents

the cooperation relation between two authors, and the thickness of the link represents the strength of the cooperation. The red co-authorship network is composed by Kostoff, Rushenberg, Briggs, Barth, Bowles, Johnson, Dodbele, Pecht, Bhattacharya, Icenhour, and Nikodym. In this network, Kostoff is considered the central researcher for having the biggest node in the co-authorship cluster. The authors of this network are affiliated in different organizations: in the United States, the Naval Research Center Laboratory, in Maryland University; and in India, the National Institute of Science, Technology and Development Studies.

The green network is made by the researchers Ichiro Sakata, Naoki Shibata, Yuya Kajikawa, and Yoshiyuki Takeda. The node of this network is concentrated on Yuya Kajikawa. Different from the red network, the researchers are Japanese, belonging to the Innovation Policy Research Center, the Institute of Innovative Research, the School of Engineering, and the University of Tokyo.

The researchers Zhu, Huang, Porter, and Zhang are part of the blue cluster. It is noticed that, in this collaboration network, all the nodes have a very similar size, that is, there is not a central researcher. They are affiliated to institutions in different countries, such as the Decision System and e-Service Intelligence Lab of the University of Technology Sydney, in Australia, The School of Management and Economics of Beijing Institute of Technology, in China, and Georgia Institute of Technology, in the United States.

The smallest co-authorship network is the yellow cluster, composed by only three authors, them being: Lee, Wu, and Su. However, the authors are affiliated to the same educational institution, The National Chengchi University, in Taiwan.

The co-authorship publications are critical in promoting research innovation and sharing knowledge, as well as in improving the quality of research. However, according to the analyses results, few groups were identified, understanding that, in the studied sample, most of the productive authors are, in fact, independent authors.
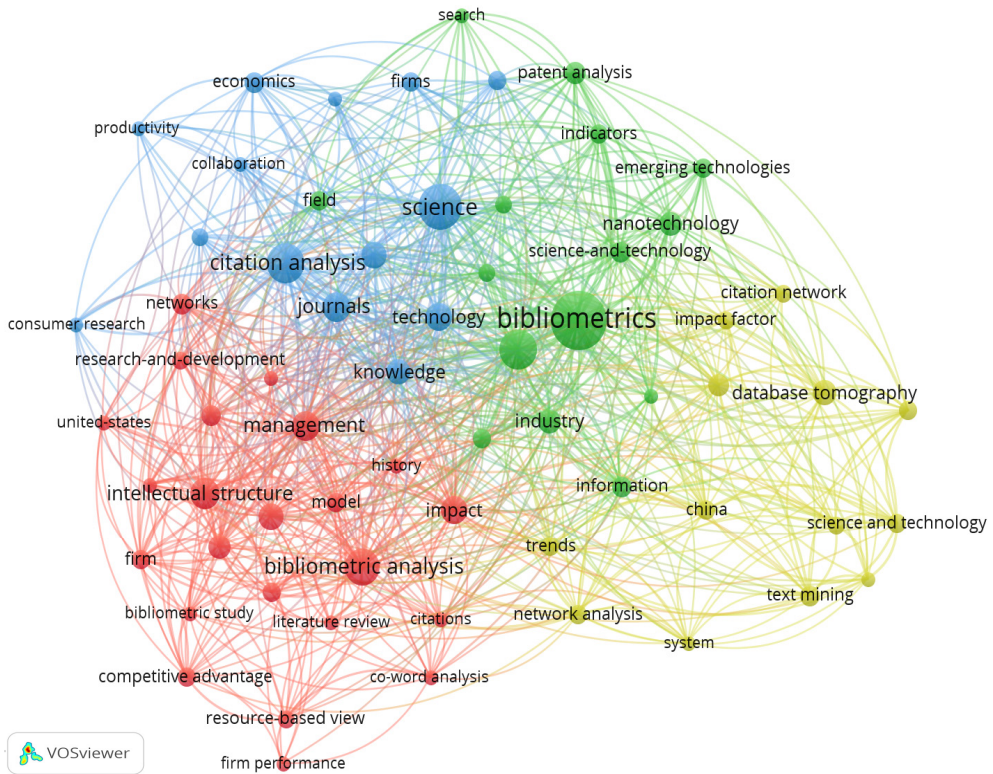
4.6 Keyword analysis

With the purpose of exploring changes in the themes, it was made a keywords frequency analysis of articles from 1998 to 2017 of the Web of Science database in order to confirm the main lines of study of the last 20 years.

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(**Figure 4.6.1**)

CO-OCCURRENCE KEYWORD NETWORK FROM 1998 TO 2017

Source: Elaborated by the authors with VOSviewer.

Figure 4.6.1 reveals the existence of four clusters related to bibliometric research in Administration:

- the red one has themes related to management, bibliometric analysis, firm, model, competitive advantage, networks, bibliometric study, impact, citation, and intellectual structure;
- the yellow one has as its central theme citation network, impact factor, trends, system, and science and technology;
- the green cluster, with the subjects bibliometric, industry, information, emerging technologies, search, and field;
- the blue cluster concentrated on the term science and related to themes, such as knowledge, productivity, collaboration, economic, and journals.

Thus, it was noted that researches involving bibliometry in the Administration areas are studied and published in the scientific productions with authentic results in different contexts.

5. FINAL CONSIDERATIONS

This study sought to answer the following guiding question:

- What is the research profile and development of bibliometric studies in the Administration area, in articles published in international journals, between 1998 and 2017?

For analytical purposes, the investigated period was divided into two blocks, being the first one from 1998 to 2007, and the second one from 2008 to 2017.

In the first period (from 1998 to 2007), it was identified 25 bibliometric studies, produced by foreign authors, whose countries and journals were also identified, as well as the emphasis to the themes of publications concentrated on the subareas of management, entrepreneurship, and innovation of Administration. The journals which published most were the *Technological Forecasting and the Social Change* and the *Entrepreneurship Theory and Practice*.

In the second studied period (from 2008 to 2017), there was significant growth in the number of publications based on bibliometric studies, jumping from 24 to 144 studies until the end of the second studies period. In this period, there were changes in the thematic focus, being planning and management the most explored themes in the published studies. Most of the published articles are concentrated in four journals: *Technological Forecasting and Social Change*, *Journal of Business Research*, *African Journal of Business Management*, and *R&D Management*.

The use of meta-analysis technique contributed to identifying which are the most influential authors in using bibliometric studies. In the period comprehended in this work, Kostoff and Kajikawa stand out for producing more published articles, being the number of citations in their publications used in several countries, showing the relation among their research with other authors. Another contribution of this work was to allow highlighting the emergence of co-citation, co-authorship and keyword clusters, and the variety of growth trends among the clusters and their demonstration of it through relationship maps.

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With this, it is possible to conclude that most of the authors who produced most about "management", "technology" and "innovation" concentrate in countries such as the United States, England, Germany, Holland, Spain, and Japan. With the meta-analytical focus, it was possible to identify the most relevant research in Administration, considering the impact factor of the journals, and four co-authorship networks, highlighting that most of the authors write independently.

As a contribution of this work for future studies, the bibliometric study is suggested as an applicable approach to analyze the scientific production of collaborative character. The association of the bibliometric study, the meta--analysis, and a powerful database, as it is the case of the Web of Science, allows for the identification of trends in scientific production and discussion related to the Administration field and, also, to examine the origin of the productions, what may enlighten how the scientific production of a country influences authors from other countries, generating a virtuous cycle of new scientific knowledge.

METANÁLISE COMO INSTRUMENTO DE PESQUISA: UMA REVISÃO SISTEMÁTICA DOS ESTUDOS BIBLIOMÉTRICOS EM ADMINISTRAÇÃO

RESUMO

Objetivo: Apresentar a técnica de metanálise como uma estratégia aplicada à pesquisa bibliométrica para desvelar o estado da arte da produção científica internacional, suas interações com as áreas de conhecimento, a colaboração entre autores e instituições, na área da Administração, com base no período entre 1998 e 2017.

Originalidade/valor: Na pesquisa exploratória inicialmente aplicada, observou-se uma lacuna no debate sobre o uso metanálise como um recurso de investigação do estado da arte na área da Administração. A metanálise utilizada como instrumento de pesquisa proporciona uma associação rigorosa de diversos estudos.

Design/metodologia/abordagem: Trata-se uma abordagem pesquisa quali-quantitativa, de caráter exploratório-descritivo, delineada por pesquisa bibliográfica. Quanto ao mecanismo de investigação, foi usada a

metanálise como uma investigação sistemática. O desenvolvimento da pesquisa foi realizado em duas etapas: macroanálise e microanálise.

Resultados: Os resultados da pesquisa mostraram que o número de estudos bibliométricos publicados na segunda década estudada foi significantemente maior. As áreas de publicações, dentro do escopo da Administração também sofreram mudanças importantes quando se compararam os períodos analisados, evidenciando um crescimento de publicações entre 2008 e 2017 nas áreas de planejamento e gestão. Como aplicações práticas, podem-se, a partir deste estudo, utilizar as publicações e análises para melhor compreender como, quando, onde e por quem foram realizadas as bibliometrias, de forma que possam ser usadas para a realização de metanálises, ou seja, estudos bibliométricos mais densos e profundos, que possam evidenciar tendências em determinada área de estudo.

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