IT GOVERNANCE: THE EVOLUTION OF SCIENTIFIC PRODUCTION OVER THE PAST 20 YEARS

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ABSTRACT

IT provides services to all departments of the company, interacts with each of them and must have its processes and activities administered in a coordinated manner and according to the strategic planning of the company. For that, we have an IT governance to guide and control the operational, tactical and strategic processes. This article aims to show the importance of IT governance at the academy, through the 1995-2015 academic output, through a systematic review. Bibliometrics indicators have proved to be relevant for the analysis and evaluation of the science produced in different areas of knowledge at the regional, national and international levels. We are aware of the importance of the continuity of the appearance of articles in the period of the study (1995-2015) and stay to the present day, presenting an increase of the authors, the quotations and the works during the last twenty years.

Key words: IT Governance; bibliometric; systematic review; academic production;

INTRODUCTION

Information technology (IT) can no longer be managed as a simple administrative service, its complexity begins in the various heterogeneous areas that make up the system, from support to users to IT infrastructure, programs and systems.

IT provides services for all departments of the company, interact with them and need their processes and activities administered in a coordinated manner and according to the strategic planning company. For that, we have an IT governance to guide and control the operational, tactical and strategic processes.

According to Albertin and Albertin (2010), the organization directs and establishes the requirements for IT governance (ITG) because its activities depend on the emergence of informatics information to achieve business objectives.

Weill and Ross (2006) define IT Governance as the specification of decision-making rights and the framework of responsibilities to stimulate desirable behaviours in the use of IT.

This article aims to show the importance of IT Governance to the academy, through the academic production from 1995 to 2015, using bibliometric. The bibliometrics indicators have proven

relevant to the analysis and evaluation of the science produced in different areas of knowledge (GRÁCIO and OLIVEIRA, 2012).

2. CONCEPTUAL FRAMEWORK

2.1 IT GOVERNANCE

2.1.1 Definitions

Several authors define the IT Governance, we summarized the main contributions. IT Governance. Lunardi (2008) in his work states that the concepts and definitions are relatively new, yet the literature suggests different definitions for the term. Table 01 shows the concepts raised and listed by the author.

Table 1: ITG Definitions

Definition	Reference
1 - IT Governance is used to describe how IT media or governs business relationships through an IT-based system.	Venkatraman cited Loh 1993
2 - IT Governance addresses the implementation of IT-related structures and architecture (and authority standards) to successfully achieve activities in response to the environment and organizational strategy.	Sambamurthy; Zmud 1999
3 - IT governance focuses on the structure of relationships and processes to develop, direct, and control IT resources so as to achieve the organization's goals through contributions that add value, balance risk versus return on resources and processes from you.	Korak-Kakabadse Kakabadse, 2001
4 - IT governance is the organizational capacity exercised by the Board of Directors, senior management and the IT department to control the formulation and implementation of the IT strategy and thereby ensure the merger between IT and business.	Van Grembergen 2002
5 - IT governance is the structure of relationships and processes to direct and control the company in order to achieve corporate objectives, adding value through the balancing of the rich versus the return obtained by IT and its processes.	ISACA, 2002

6 - IT Governance is the responsibility of the Board of Directors and senior management. It is an integral part of corporate governance and consists of organizational and leadership structures and processes that ensure that IT supports and expands the organization's objectives and strategies.	ITGI, 2003
7 - IT governance is the organizational capacity to control the formulation and implementation of IT strategies, as well as guiding the proper direction in order to gain competitive advantage for the organization.	Turban; Mclean; Wetherbe, 2004
8 - IT Governance specifies the structure of responsibilities and decision rights to encourage desirable behaviours in the use of IT.	Weil; Ross, 2004
9 - IT Governance is defined as the distribution of responsibilities and rights among the organization's people for IT decisions, and the mechanisms and procedures for monitoring and making strategic decisions related to IT.	Peterson, 2004
10 - IT Governance refers to how the organization ensures that its strategy and IT practices have been used to support the organization's strategy and implement information practices.	Mcginnis et al., 2004

Source: LUNARDI, 2008

The IT Governance seeks to define a structure of relationships and processes to direct and control one organization to add value to the business through balanced risk management and return on investment (ALBERTIN, 2004).

According to Albertin and Albertin (2010) the organization directs and establishes the requirements for IT Governance (ITG) because its activities are dependent upon the arising of IT information to meet business goals.

Weill and Ross (2006) identify the six core assets of organizations that are key to achieving strategies and generating value for the business: human assets, financial assets, physical assets, intellectual property assets, information and IT assets and relationships assets. The information and IT asset, due to its importance and insertion in the organizational environment, needs to be increasingly aligned with the organization's strategies. Veras (2009) contributes by stating that the organization's business strategy is that it defines the governance model to be employed, which ultimately defines the IT governance model as well.

For this, IT governance needs to identify the principles of corporate governance and reflect on IT management.

According to Weill and Ross (2006), an effective IT governance must address three issues related to decision-making:

a) which decisions must be taken to ensure the management and effective use of IT?

b) who should make those decisions?

c) how theses decision will be taken and monitored?

Weill and Ross (2006) have implemented a matrix called the IT Governance Arrangement Matrix, which addresses the issues surrounding which decisions should be made and who should make them. The matrix allows the relation between five key decisions and that relate to a set of archetypes that allow to specify the decision rights in the IT.

With respect to key decisions about IT governance, the authors suggest that every organization needs to take five major decisions on IT; they are:

1 - Decisions about IT Principles that are high-level statements about how IT is used in business, which become part of the organizational environment and can be discussed, debated, supported, denied and improved. In addition to defining the desirable behaviour for both IT professionals and users of information technology;

2 - Decisions on IT Architecture, is the logical organization of data, applications and infrastructures, defined from a set of policies, relationships and technical options adopted to achieve the desired technical and business standardization and integration. Architecture decisions are very important for a will management and effective use of IT;

3 - IT Infrastructure Decisions are centrally coordinated and shared IT services that provide the foundation for the organization's IT capability. Possess adequate infrastructure means providing services with a good cost / benefit to allow the organization to adopt a faster new applications and business;

4 - Decisions on business application needs are the specifications of the need for IT applications business acquired in the market or developed internally;

5 - Decisions about Investments and IT prioritization are decisions about how much and where to invest in IT, including project approval and justification techniques. These decisions usually involve three dilemmas: how much to spend, what to spend, and how to reconcile the needs of different interest groups.

These five decisions relate to effective IT governance, each of which represents important aspects that must be observed within IT. At the headquarters of IT Governance arrangement decisions (columns) are crossed with archetypes (lines) that describe combinations of people who have decision-making rights or contribute to making IT decision.

Weill and Ross (2006) used political archetypes to describe groups of people, such as: monarchy, feudalism, federalism, duopoly, and anarchy. The archetypes were divided into 6 groups described below:

a) Business Monarchy: Represents senior business executives who make IT decisions that affect the entire organization. Usually business monarchies accept contributions from many sources for key decisions;

b) IT Monarchy: IT professionals, especially the CIO, make IT decisions. Organizations typically implement IT monarchies in a variety of ways; most often involve IT professionals from both corporate teams and business units;

c) Feudalism: each business unit makes decisions regarding IT. This model helps decision making organization as a whole;

d) Federalism: the boards, central bodies and business units are responsible for decisions about IT. The largest business units and more powerful often get more attention and have greater influence over decisions;

e) IT Duopoly: represents bilateral consensus between IT executives and other business executives. The Duopoly involves the core IT group and the senior management team, the executives and leaders of the business units;

f) Anarchy: decisions are made by individuals from small groups who make decisions about IT. The anarchy are considered the ruin of many IT groups, since they are expensive to sustain and preserve.

2.1.2 Objectives of IT Governance

According to Fernandes and Abreu (2008), the main goal of the GTI is to align IT to the business requirements. The alignment of the foundation is business continuity, care strategies and compliance with external regulatory milestones. Deployed the main objective, the authors identify IT Governance objectives:

a) to allow IT to have a clearer and more consistent position in relation to the other business areas of the company;

b) align and prioritize IT initiatives with business strategy;

c) provide the alignment of the IT architecture, its infrastructure and applications to the business needs, in terms of present and future;

d) provide IT with the necessary operational and management processes to meet IT services, according to standards that meet business needs;

e) provide IT with the structure of processes that allows the management of its risk for the operational continuity of the company;

f) Provide clear rules for responsibilities for decisions about IT principles, IT architecture, IT infrastructure, Application needs, investments, information security, vendor strategy and partnerships, and make a decision-making model work corresponding.

2.1.2 The use of IT governance models

Since the 1980s, various models and standards of good practice for managing IT resources have been developed. Some "are original and others are derived and / or evolved from other models" (FERNANDES and ABREU, 2008). Table 2 shows some of the key best practice models used in IT resource management.

Table 02 - Main models used

Model	Scope
COBIT	Control, auditory and IT Governance
ITIL	IT services Management
CMMI	Information System Development
BS7799, ISO17799	Information security
Prince2	Project Management
PMBOK	Project Management
Six Sigma	Process Quality
SAS70	Services auditory

Source FERNANDES and ABREU (2008)

Santos (2007) proposed a model for the IT Governance cycle, where they point out the possible applications of main models for IT management, distributed in four stages of an IT governance cycle (Figure 1).
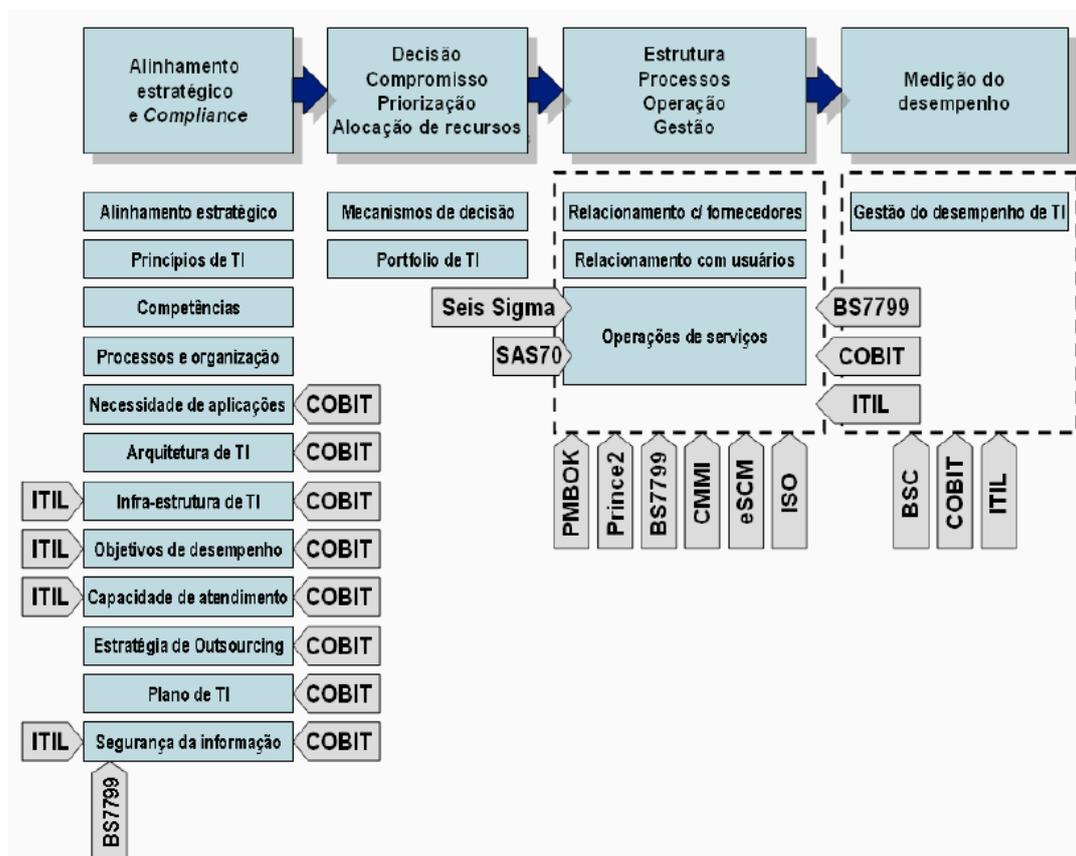

Figure 1 - The models of best practices in IT governance context

Source Santos, 2007

2 .2 Bibliometric

According to Lopes et al. (2012), bibliometric is a quantitative and statistical technique to measure knowledge production and dissemination indexes, as well as follow the development of several scientific areas and the patterns of authorship, publication and use of research results. The evaluation of the scientific production, important for the recognition of researchers in the scientific community, is made through the application of several bibliometrics indicators, which are divided into indicators of scientific quality, importance and impact.

Bibliometrics analyzes written communication, by counting words. It is currently related to the counting not only of textual elements present in the paper support, but mainly of information extracted from bibliographic databases (AMARAL et al, 2004).

Tarapanoff et al. (1995) define bibliometric as the study of quantitative aspects of the production, distribution and use of information registered, from mathematical models, for the decision-making process.

Some researchers have noted that the frequency distribution of the data in a text or in a set of bibliographic references follows certain standards. These observations gave rise to bibliometric laws: Lotka's Law that determines the contribution of each author to the advancement of Science; the Bradford Act which is a method for selecting the most representative periodicals for an area of science; and Zipf's Law, which found that if words occurring in a text are counted and sorted in descending order of number of occurrences, the multiplication of the number of occurrences by ranking in each word is a constant (AMARAL et al, 2004).

Among the various bibliometrics indicators formed from citation data, it is worth noting that the identification of the number of references made to a specific set of works that one wishes to qualify is possibly a relevant process of evaluation of the research activity, operationally difficult to apply to development agencies. These difficulties are mainly due to the large number of documents involved in these situations and the known inconsistencies of citation and bibliographical indexes.

In view of these limitations, the citation data categorized by journals and published as indicators in the Journal Citation Reports (JCR) of the Institute for Scientific Information (ISI) are now used as a benchmark for researchers and institutions. Three indicators are published annually in the JCR by periodical title: the immediacy index, the half-life of the quotations (cited Half-life) and, finally, the best known and used bibliometric index, the impact factor (Impact Factor) (STREHL, 2005).

3. Research Methodology

In this work a bibliometric research was carried out for a quantitative analysis of the written communication of articles published in periodicals. Citations and co-citations were analyzed. The citation analysis is based on the premise that authors cite articles that they consider important in the development of their research.

One of the most well-established methods for integrating research results and evaluating knowledge accumulated within a domain is a theoretical review of the literature (Oliver, 1987). This

method allows a researcher to analyze and evaluate both the quantitative survey and qualitative within a domain to draw conclusions about the state of the field (Petter, DeLone, & McLean, 2013).

A theoretical revision is based on existing conceptual and empirical studies to provide a context for identifying, describing and transforming into a higher order of theoretical structure and various concepts, constructs, or relationships. Its main objective is to develop a conceptual framework or model with a set of research propositions or hypotheses (Webster, Watson, 2002; Baumeister, Leary, 1997).

Revisions can be made to address an emerging issue that would benefit from the development of new theoretical foundations or a mature topic for which there is an accumulated body of inquiry but there is a lack of appropriate theories or current theories are insufficient to address the problems existing research (Paré et al., 2015).

A descriptive review focuses on revealing an interpretable pattern of the existing literature (Guzzo et al. 1987). It produces some quantification, often in the form of frequency analysis, such as publication time, research methodology and search results. This method of review usually has a systematic procedure, including search, filtering, and sorting.

According to Pare et al. (2015), descriptive reviews seek to determine the extent to which a set of empirical studies in a particular area of research supports or reveals interpretable patterns or tendencies in relation to pre-existing propositions, theories, methodologies, or findings. By accomplishing this goal and ensuring the generalization of its results, descriptive reviews collect, code and analyze numerical data that reflect the frequency of topics, authors or methods found in the existing literature.

Our objective is to portray an IT Governance landscape as an emerging area of academic research and provide a snapshot to guide future development. Given the birth of this area of research, we do not and cannot attempt to analyze any variables, correlations or theories. We found a descriptive review approach more appropriate to the current stage of this research.

3.1 Scope of Literature Research

The first step of a literature review study is to locate relevant literature through computer searches and manual. Traditionally, this is done by targeting some prominent magazines and conferences.

We conduct research of keywords and summary on the database Web of Science and for each year (up to September 7, 2016), used whether as search term "IT Governance" OR "Information Technology Governance" on the topic subfield and the 1995-2016 period.

The research aimed at peer-reviewed academic journal articles, therefore, filters were used if available. The initial search resulted in 193 hits.

 3.2 Filtering process

The 193 articles were imported directly into an EndNote database. There were no duplicates, and ten papers without authors' names or written by anonymous authors were also discarded. After a staged

selection process, the remaining 183 articles in the database were then digitized and filtered in three rounds.

The first round involved manually scanning titles for seemingly irrelevant articles. This round of filtering excluded articles that did not address the phenomenon of social business in business and technology. This first round of scanning also enabled the identification and deletion of additional duplicates not identified by EndNote due to the error of authors' first and last names. In total, 5 articles were discarded at the end of this round, which resulted in 177 articles being kept in the EndNote database.

The second round involved manual scanning of abstracts and full text reading if necessary. This round was to exclude the articles that did not address IT governance as a central topic of the discussion. This round was the most comprehensive and time-consuming phase, since in-depth reading of the articles was necessary to perform the filtering tasks. At the end of this round, 10 articles were dropped, resulting in 167 articles remaining in the EndNote database.

In this work a bibliometric research was carried out, or bibliometric, for a quantitative analysis of the written communication of articles published in periodicals. Citations and co-citations were analyzed. The citation analysis is based on the premise that authors cite articles that they consider important in the development of their research.

The analysis tools were:

i) Bibexcel

The Bibexcel, although it does not have an intuitive interface, allows the construction of an interesting timeline that shows the relationship between the level of citation between the authors and the respective year in which this occurred. This information, coupled with the work itself, of each author, makes it possible to map a work / idea / innovation made by one of these authors, from its first publication to the most recent days. It is also possible to know how important a work has been in order to become a reference for future work. An interesting measure is also to know how works of the same author are related to the references of other contemporary works. With summary information it is possible to relate how highly referenced works allow new ideas, totally divergent from each other, to emerge. A disadvantage of this program is that it is enough to make a mistake in one step so that it is closed without further information. One advantage is its flexibility of integration with other tools such as Pajek (Machado Jr. et al., 2014).

ii) Pajek

And a program focused only on the visualization of bibliometric data, that is, it is not possible to build any type of map with it, just to visualize it. This tool is widely used in the scientific community, so that in the vast majority of bibliometric analysis programs there is the option of the data to be used to export by Pajek (Machado Jr. et al., 2014).

The selection of Bibexcel as a processing program and Pajek as a visualization illustrates a research decision, which was based on the experiences gained from the tests in each software. Bibexcel and Pajek were also more cost-effective in terms of ease of operation and processing power for the chosen scope. Another important issue in the selection process was the compatibility between the processing

software (Bibexcel) and the visualization software (Pajek) and the repositories, because besides being free they were quite complete in the functionalities required to perform a mapping.

4. Results

The results of the bibliometric survey using the descriptive review showed that there has been a large increase in articles in journals in the last 20 years, from 2 articles in 1995 to 26 in 2013. We can note a significant increase from 2004. Academic researchers began to be involved in this trend at the end of 1999, but the periodicals were sporadic until 2004.

As shown in Graph 01, from 2004 to 2015, the number of peer-reviewed journals increased substantially. This explosive growth in newspaper publications reflects the growing acceptance by the IT Governance academy as a salient and legitimate research area. The evolution can be seen in graph 01. The number of citations also increased significantly, as shown in graph 02.
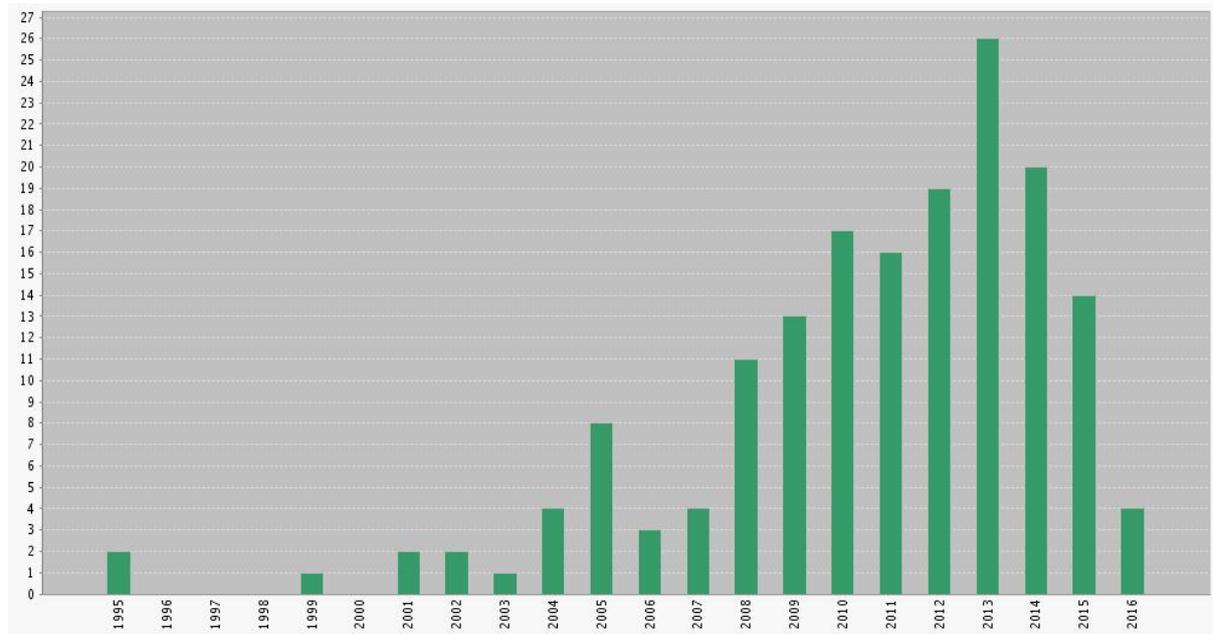
Graph 01 - Publications per year
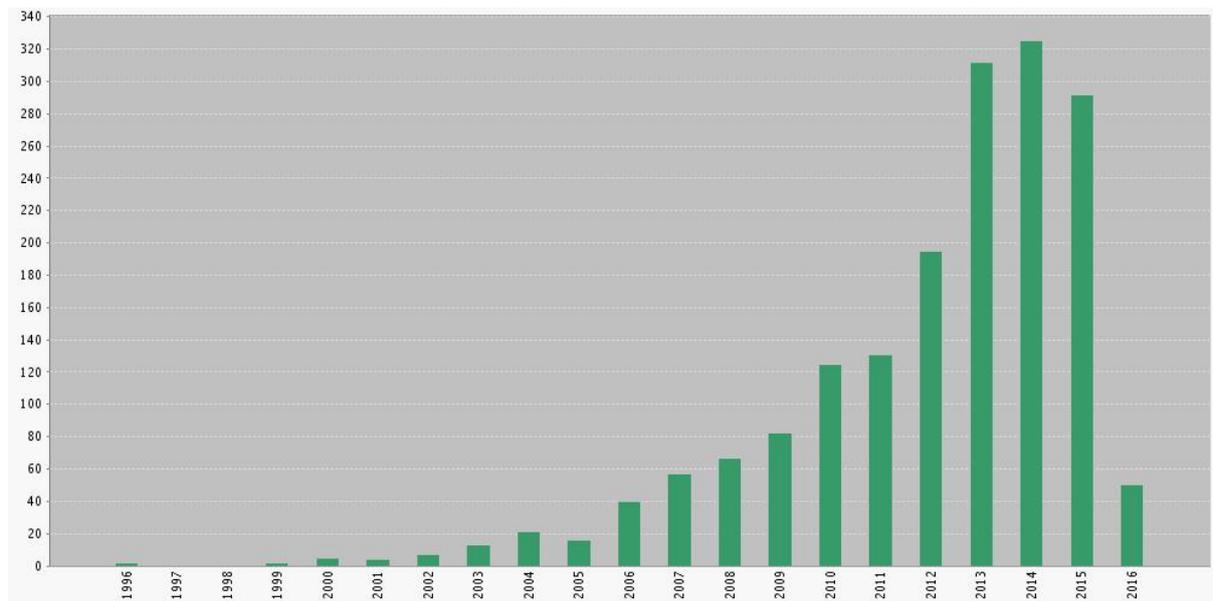
Graph 02 - Quotations per year.

The main countries producing the most articles were the United States with 59 publications, Australia with 19 publications and Germany with 16 publications. Brazil appears in 11 place with 5 publications.

Table 03 - Publications by countries

Country	Publications
USA	59
AUSTRALIA	19
GERMANY	16
NETHERLANDS	9
CANADA	8
ENGLAND	8
PEOPLES R CHINA	8
SOUTH AFRICA	7
SWEDEN	6
TAIWAN	6
BRAZIL	5
SOUTH KOREA	5
ITALY	4
AUSTRIA	3
BELGIUM	3
DENMARK	3
SPAIN	3
INDIA	2
INDONESIA	2
ISRAEL	2
JAPAN	2

LEBANON	2
NEW ZEALAND	2
NORWAY	2

American universities are the most developed articles on IT Governance, see Table 04, but the distribution and almost uniform between universities, ranging between 2 and 5 publications which shows that we have several institutions working with this theme.

Table 04 - Main universities according to publications

University	Publications
UNIV GEORGIA	5
UNIV QUEENSLAND	5
MONASH UNIV	4
QUEENSLAND UNIV TECHNOL	3
TEMPLE UNIV	3
UNIV JOHANNESBURG	3
UNIV MARYLAND	3
UNIV MUNSTER	3
UNIV N CAROLINA	3
UNIV OKLAHOMA	3
WASHINGTON STATE UNIV	3
UNIV BAMBERG	2
UNIV CARLOS III MADRID	2
UNIV DUISBURG ESSEN	2
UNIV MANCHESTER	2
UNIV MEMPHIS	2
UNIV MINNESOTA	2
UNIV NEW S WALES	2
UNIV RICHMOND	2
UNIV STELLENBOSCH	2
UNIV TASMANIA	2
UNIV TENNESSEE	2
UNIV WASHINGTON	2
VLERICK LEUVEN GENT MANAGEMENT SCH	2
UNIV AMSTERDAM VRIJE	2

The main areas of expertise are Computer Science and business economics. The publication points of articles were also analyzed. Most articles (104 articles, 62 percent) come from twenty journals (as shown in Table 5). Clearly, articles related to IT Governance have appeared in most leading theory-oriented IS journals, such as MISQ, ISR, and EJIS. Table 5 is a useful resource for researchers who wish to publish IT governance studies or for people looking for good IT Governance benchmarks.

Table 5 - Publications by Periodicals

Source Titles	records
INFORMATION SYSTEMS MANAGEMENT	15
JOURNAL OF INFORMATION TECHNOLOGY	10
MY QUARTERLY	9
INTERNATIONAL JOURNAL OF INFORMATION MANAGEMENT	7
EUROPEAN JOURNAL OF INFORMATION SYSTEMS	7
INTERNATIONAL JOURNAL OF ACCOUNTING INFORMATION SYSTEMS	6
WIRTSCHAFTSINFORMATIK	5
JOURNAL OF MANAGEMENT INFORMATION SYSTEMS	5
DECISION SUPPORT SYSTEMS	5
JOURNAL OF GLOBAL INFORMATION MANAGEMENT	4
INFORMATION SYSTEMS RESEARCH	4
INFORMATION MANAGEMENT	4
SOUTH AFRICAN JOURNAL OF BUSINESS MANAGEMENT	3
JOURNAL OF ORGANIZATIONAL AND END USER COMPUTING	3
INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT	3

INTERNATIONAL JOURNAL OF ADVANCED COMPUTER SCIENCE AND APPLICATIONS	3
INFORMATION SYSTEMS FRONTIERS	3
GOVERNMENT INFORMATION QUARTERLY	3
COMPUTERS SECURITY	3
SCIENCE OF COMPUTER PROGRAMMING	2
total	104

Table 06 shows the main authors in this period.

Table 06 – Main authors

Authors	Publications
GREEN P	5
ZMUD RW	3
XUE L	3
WILKIN CL	3
WEITZEL T	3
TIWANA A	3
PRASAD A	3
BEIMBORN D	3
WINKELMANN A	2
WEILL P	2
VON SOLMS R	2
VON SOLMS B	2
VERHOEF C	2
TAMM G	2

SHEET PP	2
STANTCHEV V	2
RUSU L	2
RICHARDSON VJ	2
PARENT M	2
NFUKA EN	2
LIN FY	2
KONSYNSKI B	2
HEALES J	2
BRADLEY RV	2
BERNROIDER EWN	2
ALI S	2

Table 07 presents the most cited works and their authors. To the citation analysis it was necessary to put a restriction to consider only the 12 most cited authors, to create the sociogram the relationship of the authors (Figure 02).

Table 07 - most cited works

Publication	Citations
Ross J, 2004 It Governance Top Pe	50
Sambamurthy V, 1999, V23, P261, Missouri Quart, doi 10.2307 / 249754	48
Weill P, 2005, V46, P26, Mit Sloan Manage Rev	25
C Brown 1997, V8, P69, Inform Syst Res DOI 10.1287 / Isre.8.1.69	22
Brown C 1994, V18, P371, Mis Quart, Doi 10.2307 / 249521	22
Peterson R, 2004, V21, P7, Inform Syst Manage, Doi 10.1201 / 1078 / 44705.21.4.20040901 / 84183.2	20

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Brown A, 2005, V15, P696, Communications Ass I	19
Weill P, 2004, V3, P1, Mis Q Exec	19
Xue Y, 2008, V32, P67, Mis Quart	18
Eisenhardt K 1989, V14, P532 Acad Manage Rev, doi 10.2307 / 258557	16
Bharadwaj A, 2000, V24, P169, Mis Quart, Doi 10.2307 / 3250983	15
Reich B, 2000, V24, P81, Mis Quart, Doi 10.2307 / 3250980	15
Bowen Paul L, 2007, V8, International Journal Of Accounting Information Systems, Doi 10.1016 / J.Accinf.2007.07.002	15

Source: Authors
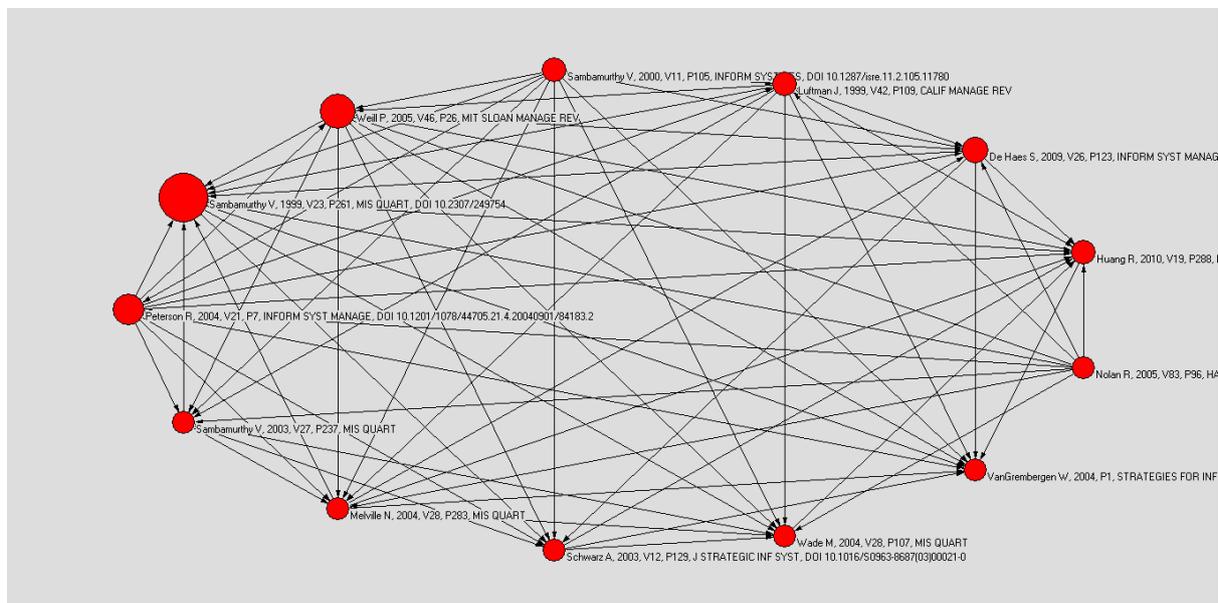
Figure 02 - Sociogram quotes - Source: Authors

5. CONCLUSION

In the corporate market the use and importance of IT Governance is undeniable, companies are increasingly using IT Governance. To analyse the same performance at the Academy, we used bibliometrics indicators to analyse and evaluate the articles in the WOS database. We obtained 167 articles in the period from 1995 to 2015, the highest production in the last ten years, showing the evolution of research in the field of IT Governance and highlighting the quantity in the years 2014 and 2015. This theme is of interest to several areas of knowledge, although the largest concentration is in computer science, the other areas have also contributed with articles, characterizing that this is a multidisciplinary subject. In the same way, this theme is researched in several countries and institutions of education and research of the world.

According to the distribution of publications, the US is the country with the largest number of publications, distributed in several universities, what we can realize is that IT Governance is researched in several institutions.

Their relevance for the continuity of the articles, during the period of this research (1995 to 2015) and remain until the present day, has increased in authors, citations and works in the last twenty years.

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