

LEADERSHIP AND COMPLEXITY: A Bibliometric Study

Cristiano José Castro de Almeida Cunha

Affiliated to Universidade Federal de Santa Catarina

Address: Campus UFSC - Laboratório de Educação à Distância (LED), Florianópolis / Trindade – Santa Catarina. CEP: 88040-970 – Brazil.

E-mail: cunha@egc.ufsc.br

Helen Fischer Günther (Corresponding Author)

Affiliated to Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento / Universidade Federal de Santa Catarina

Address: Campus UFSC - Laboratório de Educação à Distância (LED), Florianópolis / Trindade – Santa Catarina. CEP: 88040-970 – Brazil.

E-mail: helen.fg@gmail.com

Fabiana Böhm Gramkow

Affiliated to Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento / Universidade Federal de Santa Catarina

Address: Campus UFSC - Laboratório de Educação à Distância (LED), Florianópolis / Trindade – Santa Catarina. CEP: 88040-970 – Brazil.

E-mail: fbgramkow@hotmail.com

Alessandra Casses Zoucas

Affiliated to Programa de Pós-Graduação em Engenharia e Gestão do Conhecimento / Universidade Federal de Santa Catarina

Address: Campus UFSC - Laboratório de Educação à Distância (LED), Florianópolis / Trindade – Santa Catarina. CEP: 88040-970 – Brazil.

E-mail: alessandrazoucas@gmail.com

Acknowledgements

FAPESC - Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina

IFSC - Instituto Federal de Santa Catarina

LGR – Laboratório Liderança e Gestão Responsável

We would also like to thank Meggie Fornazari (Programa de Pós-Graduação em Inglês, Universidade Federal de Santa Catarina) for the translation of this paper.

ABSTRACT

The objective of this paper is to present the developments made in the literature regarding leadership and complexity. A bibliometric analysis was thus performed on articles published on Web of Science, SCOPUS, and EBSCO between 1968 and 2013. A total of 126 articles have been selected, written by 345 authors affiliated to 135 institutions from 24 countries. It is important to highlight that no Brazilian articles have been found in the SCIELO database in relation to these topics. This study has also enabled the identification of a profile of studies performed on these issues through a broad retrospective panorama of publications. Results found portray a continuous interest by the international scientific community in studying leadership and complexity.

Keywords: *leadership; complexity; complexity leadership theory; bibliometric analysis.*

1. INTRODUCTION

Studies on leadership have been developed and improved according to organizational needs and challenges, as well as overlapping with other correlate issues and forming new theoretical discussion, as presented by Uhl-Bien (2011). One of these opportunities for theoretical partnerships is to connect leadership and complexity.

This article aims to observe the developments in the literature on the issues of leadership and complexity over time. To this end, it presents interesting features that may sharpen the edges of the explored theme, as well as open paths for future studies. It also introduces information on the topic for people initiating their studies on this field.

The features explored by this study are: chronological distribution of publications; amount of articles per field and/or area of knowledge; the top 10 countries in publication numbers, among the selected articles; article production by individual authors since the first year; chronological distribution of the researching population; amount of articles per number of authors; composition of author main affiliations; research networks; journals publishing the most cited authors; list of journals and frequency of articles; number of article citations; ratio between number of citations and journal impact factors.

2. THEORETICAL FOUNDATIONS

Ideas relating leadership and complexity dated earlier than 1968, when investigations concluded that groups of complex individuals change their leaders more frequently than groups of simple individuals (Streufert, Streufert & Castore, 1968). Please note that the content is related to individuals (leaders) rather than organizations.

The concepts composing the science of complexity derive from several disciplines, such as systemic thought, theoretical biology, non-linear dynamics and complex adaptive systems in which each brings forward a different aspect of complexity (Weberg, 2012). The theory of complexity, or the theory of complex systems arising from biological sciences starts to be used to interpret phenomena from other sciences, not unlike what occurred with social sciences and leadership.

Uhl-Bien and Marion (2008) defend that the dynamics of complexity represent a new form of rationale for the theory of leadership. They are based on hive theory or collective intelligence (biology) in order to explore the dynamic of complexity and leadership within the organizational context. They understand the science of complexity steering away the bureaucratic notions of control and predictability to approach a perception of leadership that is networked, complex, adaptive, and non-linear, as an interactive process emerging in the context of history.

The complexity leadership theory, according to Uhl-Bien and Marion (2008), started with the notion of complex adaptive systems that are the basic unit of analysis in the science of complexity. These are neural networks interacting among one another, working as interdependent agents connected within a cooperative dynamic of common objects. In this sense, they compare to mutable structures superimposing multiple hierarchies, in systems connected with one another in a dynamic and interactive network composed by people. The general structure is similar to the management of knowledge flows within organizations, being thus called "temporary constellations of people and units" by Uhl-Bien (2011). Complex adaptive systems emerge naturally, being able to solve problems creatively, as well as to quickly learn and adapt.

The complexity leadership theory describes 3 functions of leadership: adaptive, administrative, and promoting, as commented by Uhl-Bien and Marion (2008), in order to explain how leadership emerges and occurs. Adaptive leadership is an emerging and interactive dynamic producing results into a social system. It is a movement of collaborative change that emerges non-linearly from interactive exchanges, or more specifically of spaces between agents. Adaptive leadership occurs through asymmetrical interaction of two types: one related to authority that is referred to preferences (including differences of knowledge, competences, beliefs, etc.). This type of adaptive change is produced by clash of existing but incompatible ideas, knowledge, and technologies that take the form of new creative ideas, knowledge, learning, or adaptation. Another kind of adaptive leadership is the familial form, which occurs when 2 interdependent individuals debating over conflicting perceptions on a given topic that suddenly generate a novel understanding on the matter. In addition, it cannot be claimed by an individual, but as a function or product of interactions between individuals and complex adaptive systems.

The function of administrative leadership refers to individual actions in formal management functions, such as to plan and coordinate organization activities. Leaders in administrative tasks get involved with planning, construction of view, fundraising for goal achievements, crisis management, and organizational strategy. Administrative leadership is a *top-down* function based in authority and position. However, within the structure described by complexity, administrative leadership is advised to exert authority with a reflection upon the company needs for creativity, learning, and adaptability. For example, the decision to exert profitable efficiency in a volatile environment could deprive the company from a much needed adaptation capacity.

Another function of leadership is to promote conditions catalyzing adaptive leadership and allowing for its emergence. Results involve from aiding customers and executives to enhance their behavior to spreading innovative products through the formal management system. This is a function of integration and intertwining between the dynamics of complex adaptive systems and formal administrative systems. It involves the interaction of formal and informal systems within an organization.

The field of leadership currently opens room for development, notably in relation to facing three unsolved problems through the traditional leadership presuppositions: linear rationale, not familiarizing organization culture, and preparation for innovation (Weberg, 2012).

There is no indication of Brazilian research on the topic approached in this paper, according to analyses made in the national SCIELO data base. Thus, there is a fertile field of study to develop in leadership and complexity within the Brazilian scenario.

3. METHOD

This paper was developed with the application of bibliometric techniques (Spinak, 1996) (Santos & Kobashi, 2009) in order to investigate the organization of the scientific field on leadership and complexity exclusively from bibliographic sources. Therefore, the methodological path of this study counts with adopting statistical and mathematical methods in order to map information from bibliographic records of documents in scientific data bases (Santos & Kobashi, 2009).

The objective of this study is to identify publications on leadership and complexity in scientific data bases with national and international recognition, as well as to characterize the main scholars involved with the topic, their collaboration networks, and the tendencies of results in the analyzed studies.

The development of this study followed a process consisting of three stages: (a) data collection, (b) data analysis, and (c) data synthesis and representation. Scientific rigor was considered in the performance in each of these stages as a fundamental element for high quality analysis (Crossan & Apaydin, 2010). These three stages can be summarized into the following steps:

- a) Data base identification: due to its national and international scientific recognition and the ease of access to researchers, the data bases selected for the study were the ISI Web of Science; SCOPUS; and EBSCO.
- b) After identifying the scientific data bases, search criteria were established as well as in the performance of the study in the identified data bases. The search string utilized for this study was "Leadership" AND "Complex*" where the asterisk allowed the inclusion of the word *complex as well as its variations, such as Complexity and others with the same radical*.
- c) The aforementioned search string was applied on the search engines of the data bases selected by the study. Thus, the search string was used in the field named TOPIC, which comprises publication titles, keywords, or abstracts.
- d) The result of this search strategy generated 209 publications. Next, filters such as English language, accessible for analysis articles, and full articles filters were used, leading to 126 publications. This initial set was thus utilized as a base for all future analyses.
- e) Later, the set of data was imported to the EndNote® tool for processing.
- f) Data analysis was made from building charts, graphs, and figures for bibliographic representations, which allowed us to identify the main authors, countries, keywords, and the chronological distribution of publications studied on leadership and complexity.

In the following section, the most relevant results are presented on the point of view from abstraction and the high level of data aggregation.

4. RESULTS

4.1 General

According to the bibliometric analysis performed, 126 academic papers have been located within at least one of the researched data bases: SCOPUS, EBSCO, and Web of Science (WOS). These papers have been written by 345 authors affiliated to 135 institutions from 24 countries and published in 93 publication sources (journals or event annals). Table 1 presents the general research data.

4.1.1 Summary of the main results found

Table 1 presents a summary of the results found in the bibliometric survey.

Table 1: Summary of findings.

Aspects	Quantity
Publications	126
Different authors	345
Sources of publication	93
Institutions	135
Countries	24
Different keywords	599

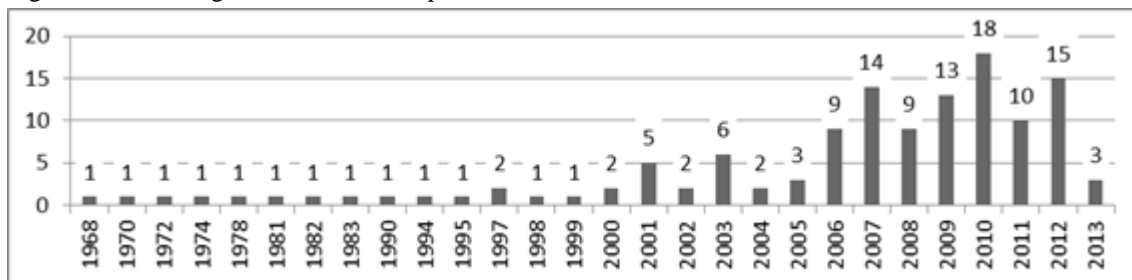
Source: Authors

In relation to distribution of publication types, a predominance of publication in articles in 85 occurrences (91.40% of publications) followed by 8 occurrences of articles published in scientific event annals (8.60% of publications).

4.1.2 Chronologic distribution of published articles

Figure 1 presents the distribution of publications throughout the last 45 years. The first publication found in both Web of Science and SCOPUS on Leadership and Complexity was in 1968, with a paper intitled *Leadership in negotiations and the complexity of conceptual structure* by Siegfried Streufert, Susan c. Streufert e Carl H. Castore. It is possible to observe that until 1995 the found publications are distributed with a frequency of 1 publication every two years. Only after 1997, publications start becoming annual, and after the year 2000 there is significant amount of frequency with a peak in 2010, with a total of 18 publications on the topic in the same year.

Figure 1: Chronological distribution of publications.



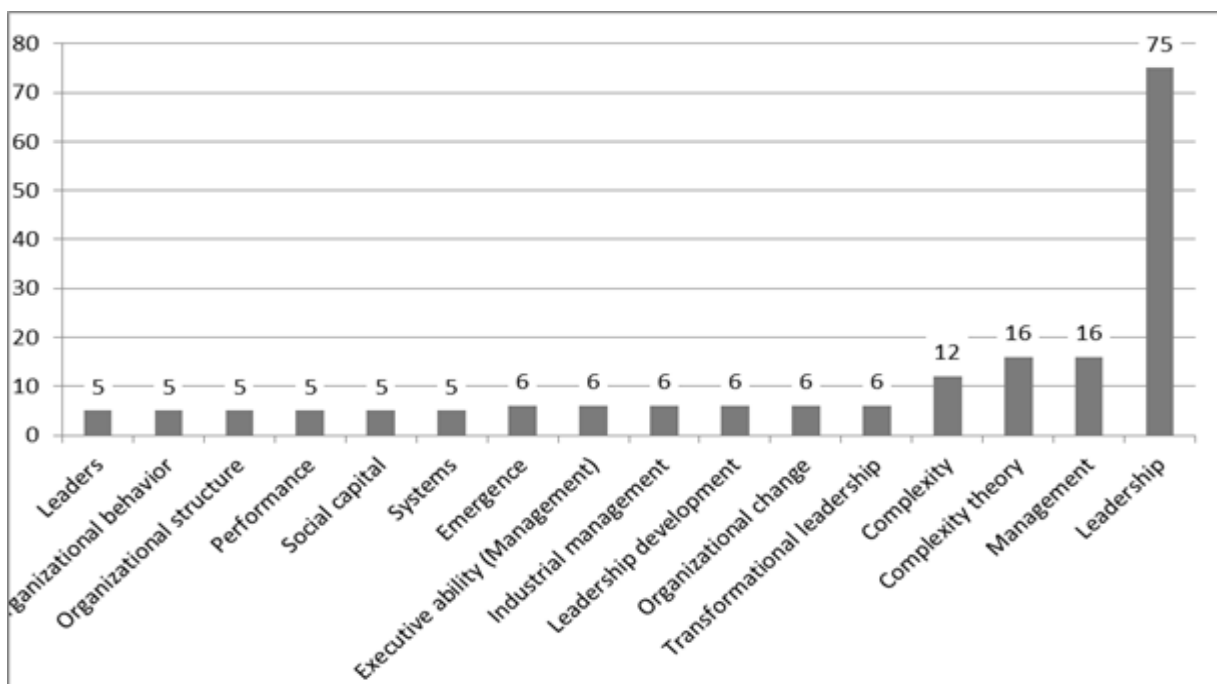
Source: Constructed by the authors.

Years with the greatest amount of publications on the issue started in 2006 (9 publications), 2007 (14), 2008 (9), 2009 (13), 2010 (18), 2011 (10), and 2012 (15). In 2013, the year this research was performed, 3 papers are indexed on the theme with a tendency for the numbers to be increased until the end of the year.

4.1.3 Amount of articles per field of knowledge

Figure 2 presents keywords with frequency of use 5 or greater in the total of 126 articles analyzed, including the keywords applied into search engines SCOPUS, EBSCO, and Web of Science: *leadership* and *complexity*. *Leadership* is the most used keywords on papers related to leadership and complexity, occurring 75 times (12.5% of the total of 599 keywords utilized). Both keywords *management* and *complexity theory* occur 16 times each, and *complexity* occurs 15 times.

Figure 2: Most frequently used keywords.



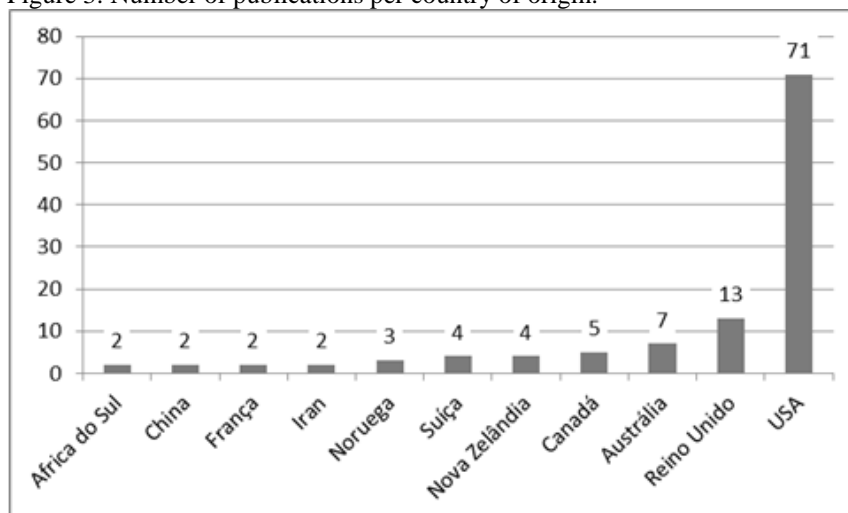
Source: Constructed by the authors.

4.2 Authorship

4.2.1 Countries with most publications

Figure 3 presents the countries of origin of publications. The researched data bases usually have articles indexed in English language. This is the point in common that could explain the linguistic similarity of the 5 countries with most publications in the period.

Figure 3: Number of publications per country of origin.



Source: Constructed by the authors.

All five continents appear within publications; however, there are no articles from South America.

4.2.2 Authorship patterns

The analysis of publication authorship allows a glimpse of their origins in relation to research groups, individual researchers, and also which authors usually publish in tandem. Table 2 presents the order of collaborating authors. The column "Authorship Order" displays the amount of publications that a given author is in a given position, shown in parenthesis. For example, Marion is an author in 7 of the selected publications; he is the first author in 4, the second in 2, and the third author in 1 paper.

Table 2: Authorship position among collaborating authors.

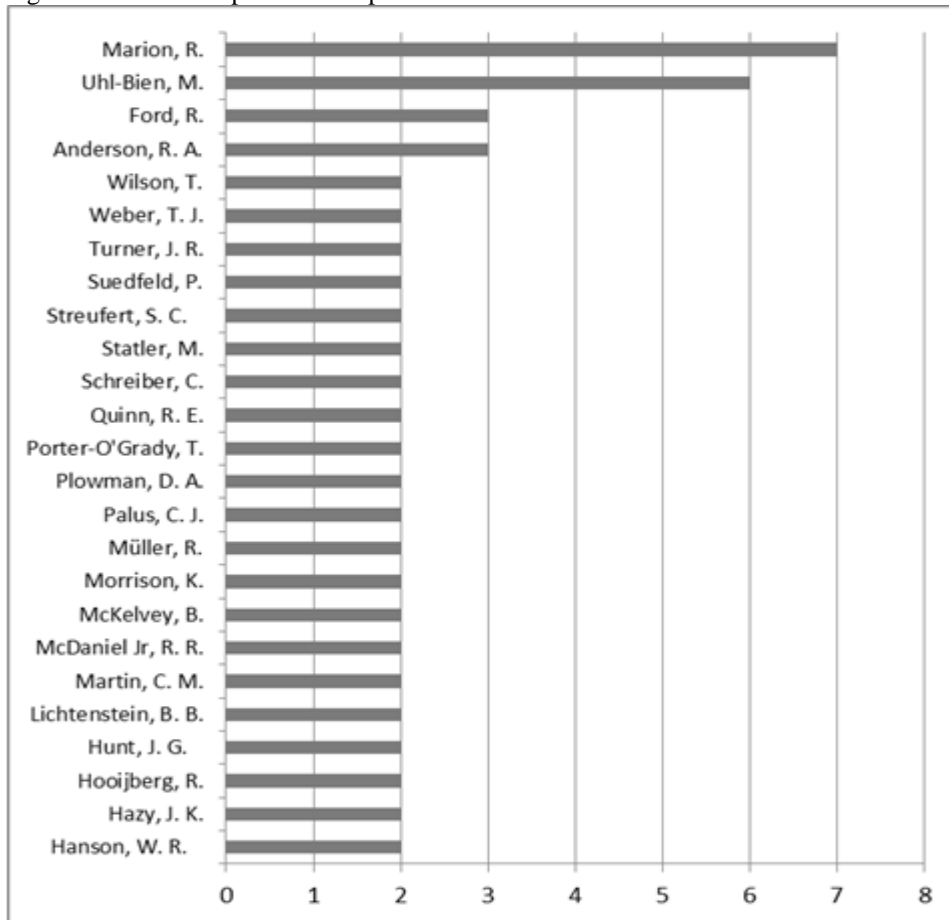
Most frequent author	Number of Publications	Authorship position
Marion	7	4(1) 2(2) 1(3)
Uhl-Bien	6	2(1) 4(2)
Anderson	3	2(1) 1(2)
Ford	3	1(1) 2(2)
Hanson	2	2(1)
Lichtenstein	2	2(1)
Müller	2	2(1)
Morrison	2	2(1)
Hooijberg	2	1(1) 1(2)
Plowman	2	1(1) 1(2)
McKelvey	2	1(1) 1(3)
Schreiber	2	1(1) 1(5)

Source: Constructed by the authors.

It can be noted that Russ Marion and Mary Uhl-Bien are the authors with the greatest number of publications, twice as many as Anderson and Ford, who appear in third and fourth place on the list.

Figure 4 displays the list of signing authors by number of publications among the selected papers. The authors signing only one publication have been omitted.

Figure 4: Amount of publications per author.



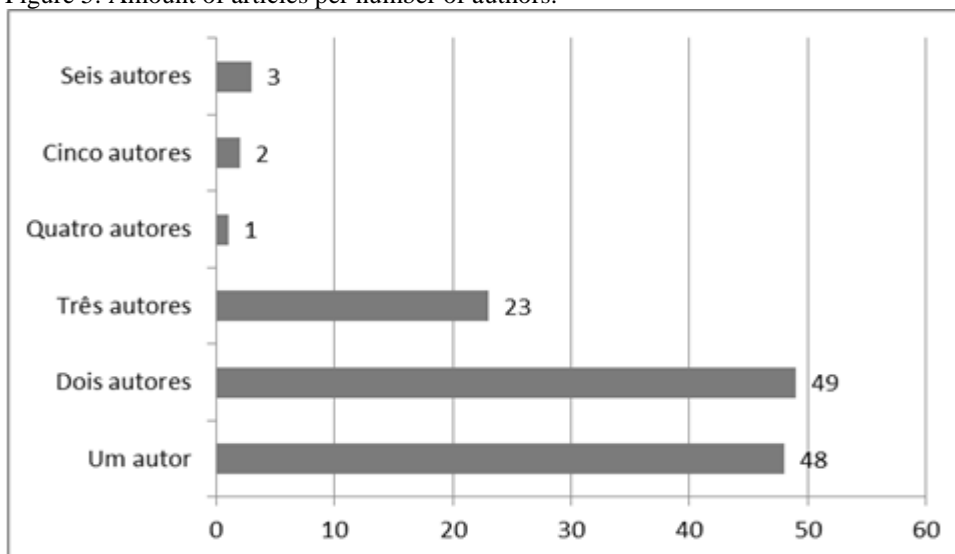
Source: Constructed by the authors.

The heterogeneous characteristic of authorship within the selected publications is displayed in Figure 4. From the set of publications, 21 authors signed 2 publications, and 4 have signed more than 2 publications.

4.2.3 Amount of articles by number of authors

This section presents how the 126 articles are distributed in terms of article quality by number of authors. This distribution is demonstrated in Figure 5.

Figure 5: Amount of articles per number of authors.



Source: Constructed by the authors.

From the total of 126 articles, 48 have been written by a single author; 49 have 2 authors; 23 have 3 authors per article; 1 article has four authors; 2 articles have 5 authors; and 3 articles have 6 publishing authors.

It is possible to observe that most articles have been written by 1 or 2 authors, with a total of 97 articles (76.98%). A concentration of 23 articles (18.25%) has been written by 3 authors and a minority of 6 articles (4.76%) have been produced by either 4, 5, or 6 authors.

4.2.4 Main author productivity per institution

Table 3 presents author affiliation with the greatest number of publications, as well as the productivity of those institutions.

Table 3: Productivity of institutions affiliating main authors.

Institution	Amount of Authors	Amount of Articles	Amount of Articles per author
University of Nebraska-Lincoln	2	8	4
Clemson University	1	7	7
Spartanburg Regional Health Care System	1	3	3
Duke University	1	3	3
University of Texas	1	3	3
University of Massachusetts	1	3	3
Anderson University	1	2	2

Source: Constructed by the authors.

Among the universities with the most cited and most relevant authors are the University of Nebraska - Lincoln and Clemson University, the respective institutions to which Uhl-Bien (6 articles) and Russ Marion (7 articles) are affiliated. It is important to highlight that the University of Nebraska - Lincoln also has Plowman as a contributing author of 2 articles, which makes it the second most productive institution with the highest number of citations.

Clemson University is the institution with the greatest productivity from a single author: Russ Marion. Other institutions have one author with varying productivity by participation in 3 articles (Spartanburg Regional Health Care System, Duke University, University of Texas, and University of Massachusetts) and 2 articles (Anderson University).

The authors with the greatest scientific production in the field of leadership and complexity are from institutions both linked to Management and to Health. This field gains highlight as although the topic seems to be connected to Management, it is peculiar that the topic is tackled by Health.

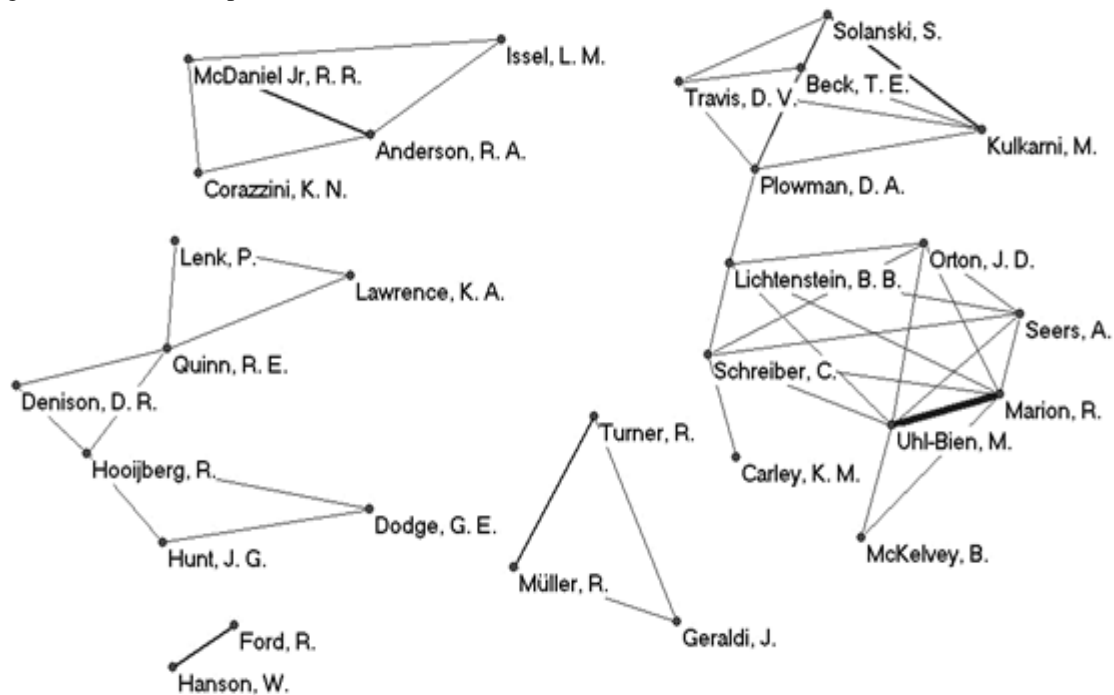
4.2.5 Researcher network (authorship and co-authorship)

A field of knowledge is developed by several authors, but there are some authors publishing more frequently on the topic, presenting a co-authorship pattern that is repeated and maintained through time.

By analyzing the researcher networks it is possible to identify which authors are closest, and which have never worked together. Additionally, it is possible to observe which authors build relations between different universities or research groups.

Figure 6 presents the co-authorship pattern between authors with 2 or more publications within the selected papers.

Figure 6: Co-authorship network.



Source: Constructed by the authors.

The thicker lines represent the number of publications between two authors. It is possible to note that Marion and Uhl-Bien are the team with the greatest number of co-authorship (6 articles), followed by 2 collaborating papers by: Müller & Turner, Anderson & McDaniel Jr., and Ford & Hanson (2 authorships). They demonstrate greater isolation in relation to other authors, as they neither establish connections with other groups nor other authors.

Some authors seem to act as connection agents, building relations between distinct groups. Such is the case of Plowman and Lichtenstien connecting groups A and B, Hoojberg connecting groups E and F, and Quinn connecting groups F to G.

Group B presents the greatest number of participating authors, followed by Group A. Groups E, F, and G present a trend towards greater approximation, perhaps tending to a similar setup as Group B.

4.3 Journals

4.3.1 Journals publishing the most cited articles

In the analysis of the most cited articles, it is possible to make two considerations: that of general citations, and that of citation per journal data base, as presented in Table 4.

Table 4: Journals publishing the most cited articles, with highlight given to 10 journals.

Code	Title	Journal	SCOPUS citations	EBSCO citations	WoS citations
2289	A typology of virtual teams - Implications for effective leadership	Group & Organization Management	258	229	137
2271	Leadership: Current Theories, Research, and Future Directions	Annual Review of Psychology	146	83	172
307	Complexity Leadership Theory: Shifting leadership from the industrial age to the knowledge era	Leadership Quarterly	126	184	79

2678	Complexity science - Complexity, leadership, and management in healthcare organisations	British Medical Journal	200	37	148
492	Paradox and Performance: Toward a Theory of Behavioral Complexity in Managerial Leadership	Organization Science	ND	321	53
195	Leadership in complex organizations	Leadership Quarterly	ND	257	59
1100	Nursing homes as complex adaptive systems: relationship between management practice and resident outcomes	Nursing Research	127	47	82
632	Leadership Complexity and Development of the Leaderplex Model	Journal of Management	81	89	37
2337	Let chaos reign, then rein in chaos- repeatedly: Managing strategic dynamics for corporate longevity	Strategic Management Journal	52	43	58
272	Organizations as complex adaptive systems: Implications of Complexity Theory for leadership research	Leadership Quarterly	47	64	42

Source: Constructed by the authors.

It is possible to observe that the most cited articles have been published on Leadership Quarterly:

- a) Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era
- b) Leadership in complex organizations
- c) Organizations as complex adaptive systems: Implications of complexity theory for leadership research

The second most cited journal is the Group & Organization Management with the article Organizations as complex adaptive systems: Implications of Complexity Theory for leadership research. In third place is the Annual Review of Psychology with the article Leadership: Current Theories, Research, and Future Directions.

In relation to the amount of citations per data base, both the 1st and 3rd most cited article is A typology of virtual teams - Implications for effective leadership in SCOPUS and EBSCO data bases with 258 and 229 citations each, respectively. Leadership in complex organizations is in second place in EBSCO with 257 citations.

The least cited articles have been published in Strategic Management Journal with 52 citations on SCOPUS, and in Leadership Quarterly with 42 citations in Web of Science.

It is possible to observe that some of the most cited articles do not have SCOPUS data base indexation, namely: Paradox and Performance: Toward a Theory of Behavioral Complexity in Managerial Leadership and Leadership in complex organizations.

4.3.2 List of journals and article frequency

The journal with the highest number of articles is Leadership Quarterly, holding more than twice as many articles as the second and third journals on the list (Consulting Psychology Journal e Emergence: Complexity & Organization).

The analysis of journals holding 2 or more articles in this selection confirms the predominance of Leadership Quarterly, holding 30% (39) of the articles in this extraction.

Table 5 presents the journals with the greatest number of articles and their respective impact factor in the studied selection.

Table 5: Journals with the highest number of selected articles and their respective impact factors.

Journal	Number of articles	JCR	SJR
Leadership Quarterly	12	2,705	2,339
Consulting Psychology Journal	5	ND	0.41
Emergence: Complexity & Organization	5	ND	0.289
Educational Management Administration and Leadership	4	ND	0.935
Journal of Business Ethics	4	0.963	0.712
Journal of Evaluation in Clinical Practice	3	1,229	0.551
Academy of Management Journal	2	5,608	6,284
Journal of Applied Psychology	2	4,308	4,572
Military Psychology	2	0.720	0.423

Source: Constructed by the authors.

It is possible to say that the journals with the highest impact factor are not those with the greatest participation in the number of selected articles (Academy of Management Journal and the Journal of Applied Psychology, with 2 articles each).

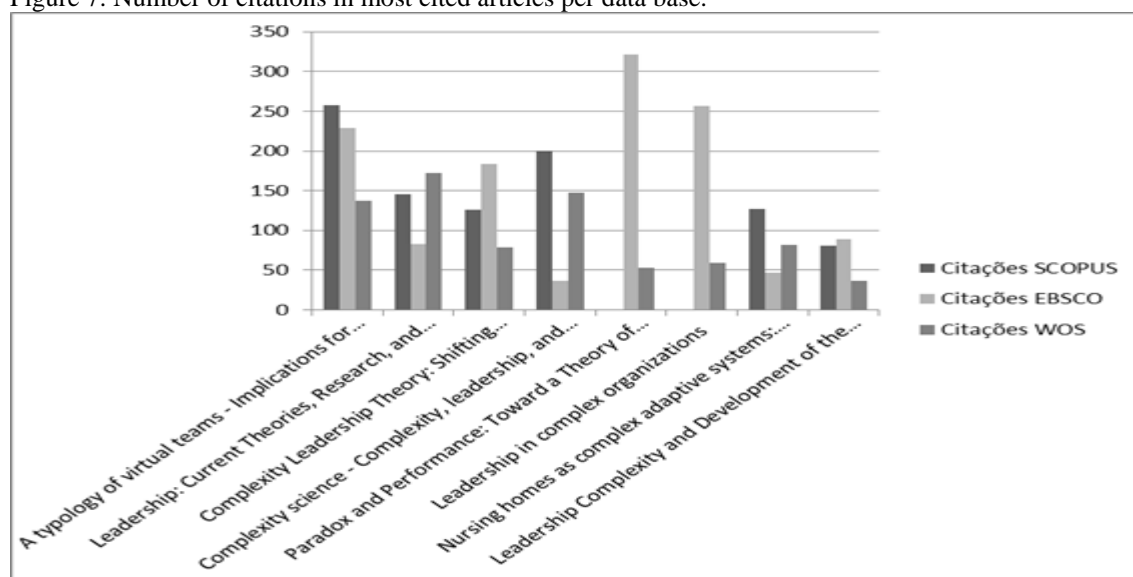
The variety in journals is also characteristic of this selection as approximately 70% articles are in single, not repeated journals.

4.4 Citations

4.4.1 Number of citations in articles

The number of citations in each article was collected in each data base and compiled into Figure 7.

Figure 7: Number of citations in most cited articles per data base.



Source: Constructed by the authors.

Among the 10 publications with the highest number of citations in SCOPUS, 2 have been published in Leadership Quarterly. The remaining articles have been published by 1 different journal each. The earliest article is in 1995, but it is not the most cited; additionally, the most cited article is only the 5th earliest article among the 10 most cited. Two articles are not indexed in SCOPUS and have not been counted in this observation.

The most cited articles in EBSCO are Paradox and Performance: Toward a Theory of Behavioral Complexity in Managerial Leadership and Leadership in complex organizations, placing 5th and 6th in Figure 9. In the Web of Science, the most cited are in 2nd and 4th paces in Table 4, namely Leadership: Current Theories, Research, and Future Directions and Complexity science - Complexity, leadership, and management in healthcare organisations.

4.4.2 Relation between number of citations and journal impact factor

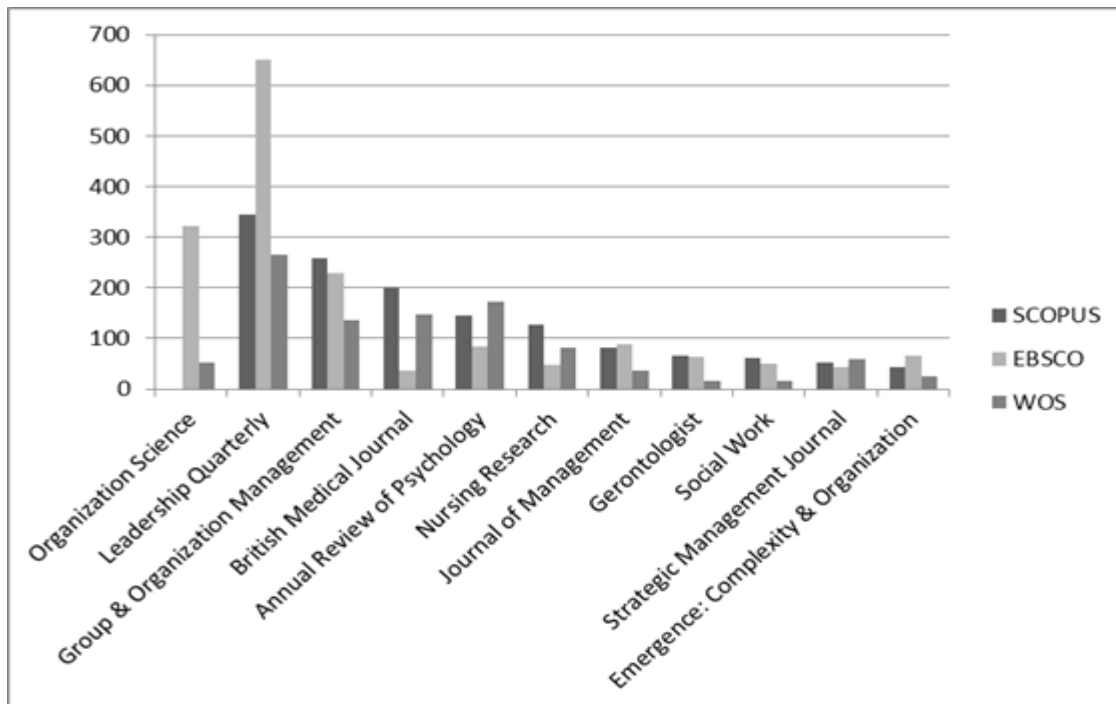
A natural trend of researchers is to consider that the greater the number of citations, the greater impact factor of the journal. Data analysis deriving from Table 4 shows that this is not true for the selected publications. It is possible to not that the highest impact factors are equivalent to the 3rd and 4th most cited journals (JCR), and the 3rd and 5th most cited journals (SJR).

Table 6: Number of journal citations and their respective impact factors.

Journal	Selected Articles	SCOPUS citations	EBSCO citations	WoS citations	JCR	SJR
Leadership Quarterly	13	345	650	265	2,711	2.339
Group and Organization Management	1	258	229	137	2,957	1.537
Annual Review of Psychology	1	146	83	172	15,265	8.137
British Medical Journal	1	200	37	148	17,215	1.4
Organization Science	1	ND	321	53	3,351	5.469
Nursing Research	1	127	47	82	1,556	0.583
Journal of Management	1	81	89	37	6,704	4.199
Strategic Management Journal	1	52	43	58	3,367	5.22
Gerontologist	1	65	63	17	2,283	1.208
Emergence: Complexity & Organization	5	44	66	26	ND	0.289
Social Work	1	61	51	17	0,867	0.581

Source: Constructed by the authors.

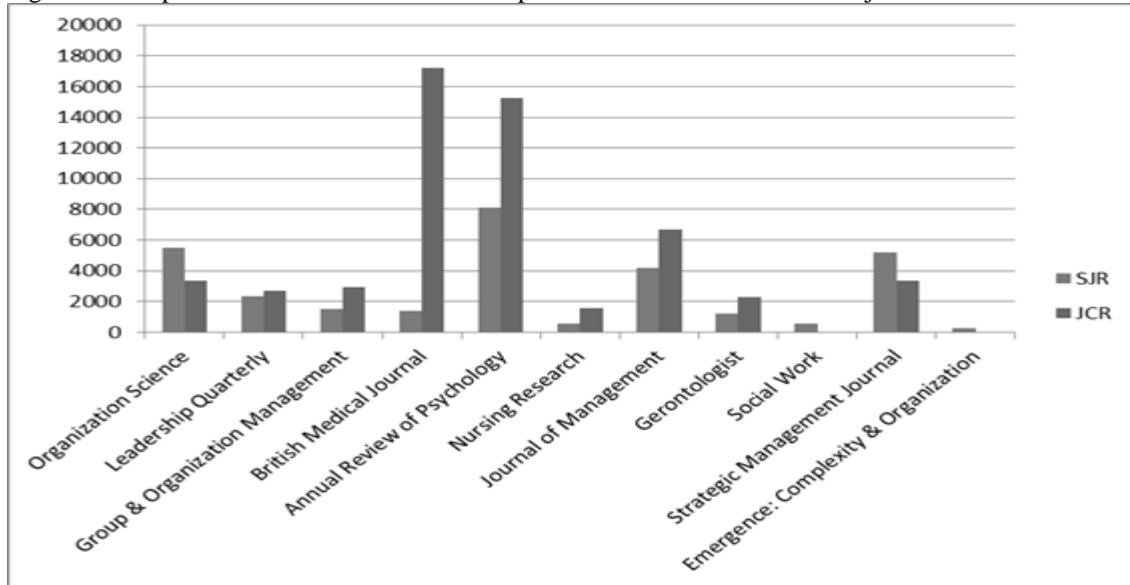
Figure 8: Comparison between citations of journals with over 50 citations per data base.



Source: Constructed by the authors.

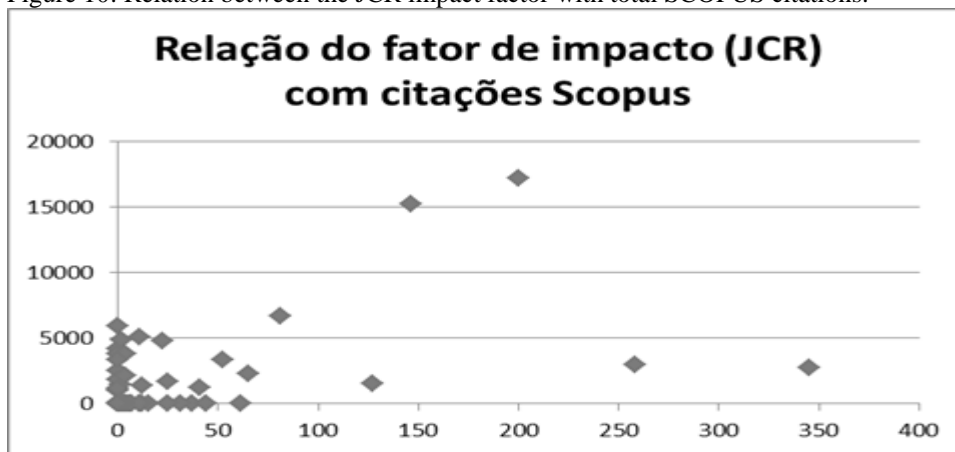
The relation between impact factor and number of citations in all selected journals reinforces such feature, as observed in Figures 9 and 10.

Figure 9: Comparison between SJR and JCR impact factors in the most relevant journals.



Source: Constructed by the authors.

Figure 10: Relation between the JCR impact factor with total SCOPUS citations.



Source: Constructed by the authors.

Figure 11 represents the relation of the JCR impact factor with total SCOPUS citations, as shown below.

Figure 11: Relation between the SJR impact factor with total SCOPUS citations.



Source: Constructed by the authors.

The relation between the impact factor measured by JCR and the total citations in each journal found in the researched data bases indicates that the concentration of journals is between 0 and 200 citations, and an impact factor of up to 6,000 which shows an inverse proportion.

The analysis of total citations in the data bases, as well as the impact factor of each journal on SJR shows a similar pattern, even though with greater data dispersion; there is a considerable amount of journals with average to high impact factors, with little to no citations.

5. FINAL REMARKS

The present study contributes to the understanding of the leadership and complexity field and its development, as it weaves a profile of studies performed on these topics, with a broad retrospective panorama of publications.

A total of 126 articles were selected from the query and bibliometric analyses performed in SCOPUS, Web of Science, and EBSCO; they were written by 345 authors from 135 institutions in 24 countries and had 599 keywords.

The development of the literature permeating the topics of leadership and complexity was accentuated after 2006, reaching 8 articles per year on the matter in periodicals indexed in the researched data bases. The keyword leadership is the most utilized by the set of publications, which leads to confirm that analyzed articles correspond to the objective of the study, with results and discussion related to the issue of leadership. The following keywords with highest frequency, management and complexity theory, allow room for interpretation that it is a topic related to these fields in connection with leadership.

English-speaking countries are among those originating the highest number of publications, with South America being the only continent lacking publications in our selection. Authors Russ Marion and Mary Uhl-Bien have the greatest participation in publications, having published twice as much as Anderson and Ford. It is possible to affirm that there is heterogeneity in authorship, as from 25 of the authors having published 2 or more articles, 21 people are responsible for 42 articles and almost thrice as many different authors remain within the total selected articles. Most articles have one or two researcher authors.

Authors are most often affiliated to the University of Nebraska - Lincoln and Clemson University, which also has Plowman as a contributing author in 2 articles, granting the institution with the highest number of citations and the largest productivity within the selected articles. This feature is reinforced through the researcher network analysis: there are 8 co-author groups in which Plowman and Lichtenstein are the connection between the 2 largest researcher groups.

Leadership Quarterly is the journal publishing most articles on the issues of leadership and complexity, as well as the most cited journal in the data bases observed; however, it is not the journal with the highest impact factor (JCR or SJR). The most cited articles differ among data bases. In SCOPUS, the most cited paper is entitled A typology of virtual teams - Implications for effective leadership.

Thus, to understand the development of content on leadership and complexity presents the relevance of the performed study, as the pattern of publications indicates a growing interest on the issue. Descriptive studies will allow for deeper relations to be made between the two topics, as well as for the identification of gaps resulting from this combination, thus encouraging the development of new talks on leadership and complexity.

REFERENCES

- Crossan, Mary M., & Apaydin, Marina. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Literature. *Journal of Management Studies*, v. 47, n. 6, p. 1154-1191. doi: 10.1111/j.1467-6486.2009.00880.x
- Kobashi, Nair Y., & Santos, Raimundo N. M. (2006). Institucionalização da pesquisa científica no Brasil: cartografia temática e de redes sociais por meio de técnicas bibliométricas. *TransInformação*, v. 18, n. 1, p. 27-36.
- Spinak, Ernesto. (1996). *Dicionário enciclopédico de bibliometria, cienciometria e informetria*. Caracas: UNESCO.
- Streufert, Siegfried, Streufert, Susan & Castore, Carl H. (1968). Leadership in negotiations and the complexity of conceptual structure. *Journal of Applied Psychology*, v.52, n. 3, p. 218-223. doi: <http://dx.doi.org/10.1037/h0025852>
- Uhl-Bien, Mary. (2011). Relational Leadership and Gender: From Hierarchy to Relationality , In Patricia Werhane; Mollie Painter-Morland (Eds.), *Leadership, gender and organization* (pp. 65-74). Springer.
- Uhl-Bien, Mary, & Marion, Russ. (2008). *Complexity Leadership – Part I: Conceptual Foundations*. Information Age Publishing.
- Weberg, Dan. (2012). Complexity Leadership: A Healthcare Imperative. *Nursing Forum*, v. 47, n. 4, 268-277. doi: 10.1111/j.1744-6198.2012.00276.x