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# SCIENTIFIC AND TECHNOLOGICAL INFORMATION: ANALYSIS OF PERIODIC PUBLICATIONS OF INFORMATION SCIENCE

INFORMAÇÃO CIENTÍFICA E TECNOLÓGICA: ANÁLISE DAS PUBLICAÇÕES PERIÓDICAS  
DA ÁREA DA CIÊNCIA DA INFORMAÇÃO

INFORMACIÓN CIENTÍFICA Y TECNOLÓGICA: ANÁLISIS DE LAS PUBLICACIONES  
PERIÓDICAS DEL ÁREA DE LA CIENCIA DE LA INFORMACIÓN

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**JITA:** HA. Periodicals, Newspapers.

**RESUMO:** A pesquisa analisa os artigos publicados em periódicos científicos nacionais da área da Ciência da Informação, classificados com Qualis A1, tendo como parâmetro o termo “informação científica e tecnológica”. Apresenta conceitos acerca da informação científica e tecnológica e dos processos que envolvem seus usos, bem como a comunicação científica, fluxos informacionais e fontes de informação. A metodologia empregada consiste em estudo descritivo com abordagem quanti-qualitativa, com utilização das técnicas da bibliometria para medição de índices e da análise de conteúdo de Bardin. Foram analisados trinta e seis artigos, enquanto do qualitativo foram vinte e um resumos. Os resultados mostram que o periódico que mais publicou sobre o termo pesquisado foi “Informação e Sociedade”, o ano com maior número de publicações foi 2016. A autoria múltipla foi uma tendência constatada nos artigos e as palavras-chave mais utilizadas foram: acesso livre, informação científica e tecnológica e preservação digital. Quanto ao conteúdo dos resumos foi possível identificá-los dentro de três categorias de análise, sendo elas: ciência da informação e processos que envolvem o uso da informação; produção, comunicação e avaliação da atividade científica e tecnológica; e desenvolvimento científico e tecnológico. Conclui-se que há uma tendência da literatura analisada em se voltar para o estudo da própria informação, de metodologias aplicadas em estudos e ainda de produtos e serviços da informação. Os resumos abordaram temas como repositório institucional, bibliometria, coautoria, gestão de revistas científicas e políticas de informação científica e tecnológica.

**PALAVRAS-CHAVE:** Informação científica. Informação tecnológica. Produção científica. Periódicos científicos. Comunicação científica.

**ABSTRACT:** The research analyzes the articles published in national scientific journals of the area of Information Science, classified with Qualis A1, having as parameter the term "scientific and technological information". It presents concepts about scientific and technological information and the processes that involve its uses, as well as scientific communication, information flows and sources of information. The methodology used is a descriptive study with a quantitative-qualitative approach, using bibliometrics techniques for index measurement and Bardin content analysis. Thirty - six papers were analyzed, while the qualitative ones were twenty - one abstracts. The results show that the most published journal about the term researched was "Information and Society", the year with the highest number of publications was 2016. Multiple authorship was a trend observed in the articles and the most used keywords were: free access , Scientific and technological information and digital preservation. As for the content of the abstracts, it was possible to identify them within three categories of analysis, namely: information science and processes involving the use of information; Production, communication and evaluation of scientific and technological activity; And scientific and technological development. It is concluded that there is a tendency of the literature analyzed to return to the study of the information itself, of methodologies applied in studies and also of information products and services. The abstracts addressed topics such as institutional repository, bibliometrics, coauthoring, management of scientific journals and scientific and technological information policies.

**KEYWORDS:** Scientific information. Technological information. Scientific production. Scientific journals. Scientific communication.

**RESUMEN:** La investigación analiza los artículos publicados en periódicos científicos nacionales del área de la Ciencia de la Información, clasificados con Qualis A1, teniendo como parámetro el término "información científica y tecnológica". Presenta conceptos acerca de la información científica y tecnológica y de los procesos que involucran sus usos, así como la comunicación científica, flujos informativos y fuentes de información. La metodología empleada consiste en un estudio descriptivo con abordaje cuantitativo, con la utilización de las técnicas de la bibliometría para medición de índices y del análisis de contenido de Bardin. Se analizaron treinta y seis artículos, mientras que el cualitativo fueron veintinueve resúmenes. Los resultados muestran que el periódico que más publicó sobre el término investigado fue "Información y Sociedad", el año con mayor número de publicaciones fue 2016. La autoría múltiple fue una tendencia constatada en los artículos y las palabras clave más utilizadas fueron: acceso libre, información científica y tecnológica y preservación digital. En cuanto al contenido de los resúmenes fue posible identificarlos dentro de tres categorías de análisis, siendo ellas: ciencia de la información y procesos que involucra el uso de la información; producción, comunicación y evaluación de la actividad científica y tecnológica; y desarrollo científico y tecnológico. Se concluye que hay una tendencia de la literatura analizada en volverse hacia el estudio de la propia información, de metodologías aplicadas en estudios y aún de productos y servicios de la información. Los resúmenes abordaron temas como repositório institucional, bibliometría, coautoria, gestión de revistas científicas y políticas de información científica y tecnológica.

**PALABRAS CLAVE:** Información científica. Información tecnológica. Producción científica. Periódicos científicos. Comunicación científica.

## 1 INTRODUCTION

Information occupies a prominent place in our society, both in personal and professional relationships. We are constantly using it to make decisions and solve everyday problems. Leaving to the scientific and technological field is even more expressive the relevance that the information presents for the social and economic development of a country, its insertion in the process of scientific communication propitiates the perception of relevant aspects about the scientific knowledge and the technological knowledge, as the basis for innovation. (MOURA; ROZADOS; CAREGNATO, 2006).

Its constitution, communication, transfer and use are studied by Information Science (CI) in order to better understand its influence in the process of economic and social development in Brazil. The issue of scientific and technological information (ICT) is essential for the development of the country from an economic and social perspective.

ICT communication takes place through two types of information sources: formal and informal. The former are represented by primary, secondary, tertiary publications and by services and the information environment. The dissemination of this information was established by the scientific communication system, which has been consolidating over time. The latter are represented by different modalities of interpersonal interchange, such as conversations, correspondence, phone calls and meetings of a restricted nature.

Not only are investments in this type of information important, as well as studies on their characteristics, production and availability. Analyzing scientific and technological production is therefore fundamental to the field of IC.

In view of the above observations, we have the interest of presenting the analysis performed in articles published in national scientific journals of the IC area classified with Qualis A1. Taking as starting point the appreciation regarding the expressiveness of the theme "scientific and technological information" in the CI as well as identify the authors who are publishing on this theme. For this we identify the national scientific journals classified in 2015 with classification A1; we identified the number of publications per year, type of authorship, authors in evidence, quantity of articles by institution and occurrence of keywords. And we analyze the content of the abstracts of the articles selected to identify the thematic approaches.

## 2 INFORMATION AND SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT

In the current social context we observe a growing increase in access and use of information, making it relevant in the process of decision making in several fields of knowledge. Information becomes a prominent place in human relations and is also used as a raw material in the scientific and technological field.

Information, therefore, has a strategic value in both fields and represents "[...] more than a means of economic development, information has a paradigmatic function in a world where nothing is produced randomly, from an idea that emerged without an external informational influence." (SOUZA, p. 35, 1991).

The treatment and availability of information is a crucial factor for the best use and consequently optimization of the processes involved in both scientific and technological development. Scientific information can be conceptualized as "[...] all knowledge that results - or is related to the result - of scientific research." (AGUIAR, p 10, 1991). The main stage of scientific research is the dissemination of results precisely because of the circulation of scientific information that will serve as a basis for other research and will provide the advancement of science, the disclosure also guarantees the authorship of the subject that has published. Corroborating with this thought Mueller states that,

To obtain reliability, besides the use of a rigorous scientific methodology for the generation of knowledge, it is important that the results obtained by the research of a scientist are divulged and submitted to the judgment of other scientists, their peers. (MUELLER, 2000a, p. 21)

This process of dissemination of results and consideration by other members of the scientific community guarantees the researcher recognition and validation of their research.

The functions of scientific information were listed by Aguiar (1991) and important for the dissemination of new knowledge obtained through scientific research, validate the right of intellectual priority, serve as input for a new scientific research and explain the methodology used in the project. scientific research. We can infer that scientific information is both the input and the product of research, it adds values to previous information and transforms them into something new:

Scientific information is therefore the knowledge that constituted, at a certain point in the evolution of science, an addition to the then universal understanding of some fact or phenomenon, and has become available as a result of scientific research, that is, of a research work conducted according to the scientific method. (AGUIAR, 1991, p.10).

According to Aguiar (1991, p.11), "technological information is all kind of knowledge related to the way of making a product or rendering a service, to put it on the market." as functions: serve as raw material for the development of technological research, guarantee

industrial property rights, disseminate technologies in the public domain, assist the technological management process, provide monitoring and evaluation of technological development trends, enable impact assessment economic, social and environmental impact of technologies. (AGUIAR, 1991). It also serves as a means of confronting previous information, "Technological information leads individuals to new theories, new theses; it brings experiences that were developed in environments other than what one experiences, so that one can evaluate, test, analyze, criticize, etc. " (VALENTIM, 1997, p.27).

Information technology is an essential input to maintain competitiveness in the industrial environment. The process of transforming technological information into consumer goods requires industry to pay special attention and constant monitoring,

Like Brazilian society, the Brazilian industrial sector must definitively awaken to the importance of information, especially the technological one, having a modern posture in relation to it and having the conviction that without information, mainly technological, there will be no competitiveness. (VALENTIM, 1997, p. 17)

Technology information plays a crucial role in the industry, especially when it comes to Research and Development (R&D). Roussel, Saad and Bohlin (1992) classify R&D into three types, incremental, radical and fundamental. The incremental has as characteristics the competent exploitation of the technical and scientific knowledge, the low risk and the modest reward. The radical allows the creation of new knowledge for the company with a characteristic commercial objective, besides possessing a greater risk and high reward. The fundamental one also allows the creation of new knowledge for the company with the intention to broaden and deepen the understanding of the same one has high risk and uncertain applicability to the commercial necessities.

With regard to the scientific field Le Coadic (2004, p. 26) elucidated, "information is the sap of science. without information, science can not develop and live. "This statement makes us reflect on information as a crucial factor for the continuity of scientific activities at all stages. In the technological field, the value of this information is perceptible, and technological information is increasingly important for the technological capacity of the industries and is necessary to support decision making, aiming at competitiveness and playing a fundamental role in the R D process. (VALENTIM, 1997; JANNUZZI, 2002).

Information is also an essential factor for economic performance and its communication process contributes to the efficiency of companies, "In economic terms, it is increasingly recognized that information (and its effective communication) is the most important resource for the efficiency of any industry, production process or trade. " (FREIRE, 1991, p.21). It is important to emphasize that the scientific and technological information are complementary, which corroborates with the thought of Le Coadic (2004) on the question of industrialization passing through science and science through industrialization.

### **3 INFORMATION SCIENCE, ORGANIZATION AND DISCLOSURE OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION**

Le Coadic (2004, p.25) states that Information Science is " a rigorous social science which relies on a strict technology" and "aims at the study of the general properties of information nature, genesis, effects), and the analysis of their construction, communication and use processes. "

The author discusses the three processes of scientific and technical information: construction, communication and use. In the first process, construction, the question of the relevance of scientific and technical activities is addressed, being "the source from which scientific and technical knowledge flows, which will become, after being registered, scientific and technical information."(LE COADIC, 2004, p.26). The broad growth of research activities triggered a process of information valorization where the system of knowledge construction was incorporated into economic and social development. This growth allowed the multiplication of the number of specialized journals and, consequently, the increase of the scientific literature, which in theory did not mean equal growth from the qualitative point of view.

As characteristics of the information growth, the author cites the expansion of the sectors where this knowledge is exercised; the movement of synthesis and the desire for unity; the emergence of new products, production processes, activities and companies; the introduction of new products on the market, the development of new production processes and the creation of new activities and new businesses. Faced with all this growth process, we have the actors of the construction of this information, the scientific community that in general terms "[is] the social group formed by individuals whose profession is scientific and technological research" (LE COADIC, 2004, 28), this community allows the scientist to share his results and as a return of this activity he gains the recognition of his peers.

Communication in scientific circles is strictly important for the development of research. According to Le Coadic (2004, p. 32), "The role of communication is to ensure the exchange of information on the work in progress, putting scientists in contact with each other." This communication can be classified as informal, when it is more personal in nature, it also covers unfinished research, ongoing research communication, etc., and formal, when it includes publications widely published as articles published in scientific journals and books. (Mueller, 2000a).

The evolution of the scientific field is intrinsically linked to its communication, since from this process the studies performed can be compared, refuted and perfected, allowing a continuous cycle of information. On the importance of communication systems Targino (2000, p.5) states,

Finally, whichever approach is adopted for the study of the development of science, the nature of communication systems is vital to science and is at the heart of the scientific method. There is no science without communication. There is no communication without information.

Scientific communication acts as a mediator in the process of information exchange, thus allowing the formation and continuity of information flows,

This allows the exchange of information, which concludes that while information is a product, a substance, a matter, communication is an act, a mechanism, is the process of intermediation that allows the exchange of ideas between individuals. Communication is a natural phenomenon intrinsic to man, varying according to the characteristics of the groups in which and between which it is effective. As such, the communication process presupposes a common stock of preexisting elements - language, expressions, codes, etc. - essential to facilitate the information flow. (TARGINO, 2000, p.10).

A famous model of scientific communication is what presents the process in a continuous way, where the activities carried out by the researcher generate documents such as preliminary reports, research communications in progress. At the end of the research there will be presentations at seminars, colloquiums, conferences that produce complete written papers or abstracts that will be widely disseminated and will serve as reference for other researchers. (GARVEY; GRIFFITH, 1972 apud MUELLER, 2000a).

Regarding the Mueller model (2000a, p. 30), "it is easy to see that information flows through many channels and that different types of documents are produced whose characteristics vary according to the research stage and type of the target audience and the objective of the communicator. ", it is interesting to note how information is changing along the flow according to the purpose defined by the producer of that information.

The information flows arose from the quantitative information explosion and the decrease in the communication time of the information. These flows have as characteristics the circulation of relevant quantities of information per unit of time that break national borders. The internationalization of the information market can be illustrated by the data flows, these flows also allow the understanding of the progressive increase in interest in knowledge according to demand, information monitoring, competitive intelligence and knowledge management. (LE COADIC, 2004).

Scientific communication and information flows make use of sources of information that are extremely important for the continuity and quality of scientific and technological processes. ICT sources contribute to successful research, development, innovation and science and technology-related activities,

Effective use of ICT helps avoid duplication of previously performed work. This action can result in saving time and material resources, human and financial. In addition, and perhaps most importantly, it can serve as a source of ideas or for the

development of an idea. ICT, therefore, can act as a valuable source of inspiration and serendipity for the student, teacher, professional or researcher. (CUNHA, 2016, p.ix.).

The sources of information can be classified into: primary, secondary and tertiary. Congresses and conferences, legislation, names and trademarks, technical standards, patents, periodicals, technical reports, theses and dissertations are some examples of primary sources. Databases and databases, bibliographies, biographies, library catalogs, dictionaries, encyclopedias, fairs and exhibitions, films and videos, images, books, manuals are examples of secondary sources. Bibliographies of bibliographies and directories are examples of tertiary sources. We want to highlight the journal here as a primary source of information, as it is one of the most efficient means when it comes to the registration and dissemination of research, original studies and other types of intellectual work, "It is the type of primary publication considered the most updated and important in science and technology. " (CUNHA, 2016, p.21.).

The first scientific journals appeared in France and England, respectively, and were well accepted by the scientific community, which encouraged the emergence of other journals in several European countries, with the main purpose of disseminating the researches being carried out by their members. "(MUELLER, 2000b, p. The functions of the scientific journals according to the Royal Society are listed by Mueller (2000b, pp. 75-76),

a The. formal communication of the results of the original research to the scientific community and other stakeholders This was one of the original functions of the journal, remaining practically unchanged until today; b. preservation of registered knowledge Together, the journals serve as a file of the ideas and reflections of the scientists, the results of their research and observations on the phenomena of nature; the preservation and organization of journals in libraries around the world guarantee the possibility of access to the knowledge recorded over time; has been one of the most important responsibilities of librarians; c. establishment of intellectual property In publishing his article, making public the results of his research, the author formally registers his authorship, requiring for himself the priority in scientific discovery; d. maintaining the quality standard of science Publication in journals that have a respected corps of reviewers gives an article authority and reliability, as the approval of the experts represents the approval of the scientific community; without it a researcher can not publish his article in respected journals; without publishing can not get recognition for his work.

With the evolution of technology, journals also occupied the electronic medium, being "an extremely versatile and fast medium of communication that allows the dissemination of research immediately after its completion, ignoring geographical barriers to access [...] , minimizing hierarchical barriers and enabling information retrieval in a variety of ways. " (MUELLER, 2000b, p. 85).



## 4 RESEARCH METHODOLOGY

The research is part of an approach of mixed methods since in addition to listing and describing precise data on scientific production, qualitative analysis sought to raise and answer questions about the subject, relating the theoretical reference to the behavior that the literature presented. Creswell (2007, p.35) points out that,

[...] a mixed-method technique is one in which the researcher tends to base the claims of knowledge on pragmatic (eg, problem-oriented, problem-centered and pluralistic) elements. This technique employs investigative strategies that involve simultaneous or sequential data collection to better address research problems. Data collection also involves obtaining both numerical information (for example, in instruments) and text information (for example, in interviews), so that the final database represents both quantitative and qualitative information.

The choice for this type of approach was mainly due to the accomplishment of the objectives of this research, which consists of listing quantitative data of the scientific production and also analyzing the content of the abstracts of the articles, the two types of research being complementary and important for the foundation results. In order to characterize the quantitative data we used Bibliometry, which consists of "[...] the application of statistical and mathematical techniques to describe aspects of literature and other means of communication (quantitative information analysis). (ARAÚJO, 2006, p.12). The technique used in the qualitative approach was the content analysis that includes the steps of pre-analysis, material exploration and treatment of results, inference and interpretation.

We selected three national journals, on the Sucupira platform, which were classified as scientific journals, available online with Qualis A1 classification. They are: Information and Society, Perspectives in Information Science and Transformation. Then we search the electronic address of each periodical, with the following search term "scientific and technological information" in the field "research" with all categories included by the need to delimit the corpus of the analysis.

We obtained 40 results, being excluded from the corpus of the analysis four of the results (Frame 1) because they did not fit as articles.

**FRAME 1.** Search result in all journals

Newspapers	Results
Information and Society	16
Perspectives in Information Science	12
Transformation	8
Totality	36

**Source:** search data (2017).

The journal that presented the most publications was "Information and Society" with a total of 16 articles, followed by "Perspectives in Information Science" with 12 articles and "TransInformation" with 8 articles.

## 5 PRESENTATION AND ANALYSIS OF RESULTS

The bibliometric analysis included thirty-six articles, sixteen from the periodical "Information and Society", twelve from the Periodical "Perspectives in Information Science" and eight from the journal "Transformation".

One of the variables listed in the specific objectives of this work is the number of articles published by the journals over the years, being the criterion used the first year in which an article with the subject was recovered and the most recent year to make the time cut, according to this criterion we analyze the period of 27 years (1989 a 2016).

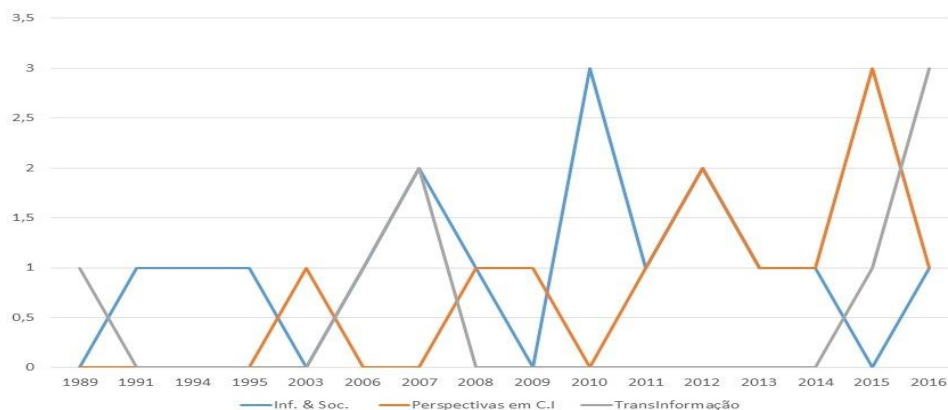
The results show that the first article retrieved with the term appears in 1989 in the periodical "TransInformação", no results were found in the years of 1990, 1992 and 1993. In the period of 1996 to 2002 the search also did not offer results, in 2003 an article was retrieved in the periodical "Perspectives in Information Science", already in 2004 and 2005 no publication was found. From 2006 to 2016 results were found, highlighting the years of 2007 with four publications, 2010 with three, 2012 with four, 2015 with four and 2016 with five.

**Table 1.** Year versus number of publications per periodical

Year	Information and society	Perspectives in information science	Transformation	totality	%
1989	0	0	1	1	2,8
1991	1	0	0	1	2,8
1994	1	0	0	1	2,8
1995	1	0	0	1	2,8
2003	0	1	0	1	2,8
2006	1	0	1	2	5,6
2007	2	0	2	4	11,1
2008	1	1	0	2	5,6
2009	0	1	0	1	2,8
2010	3	0	0	3	8,3
2011	1	1	0	2	5,6
2012	2	2	0	4	11,1
2013	1	1	0	2	5,6
2014	1	1	0	2	5,6
2015	0	3	1	4	11,1
2016	1	1	3	5	13,9
Total	16	12	8	36	100

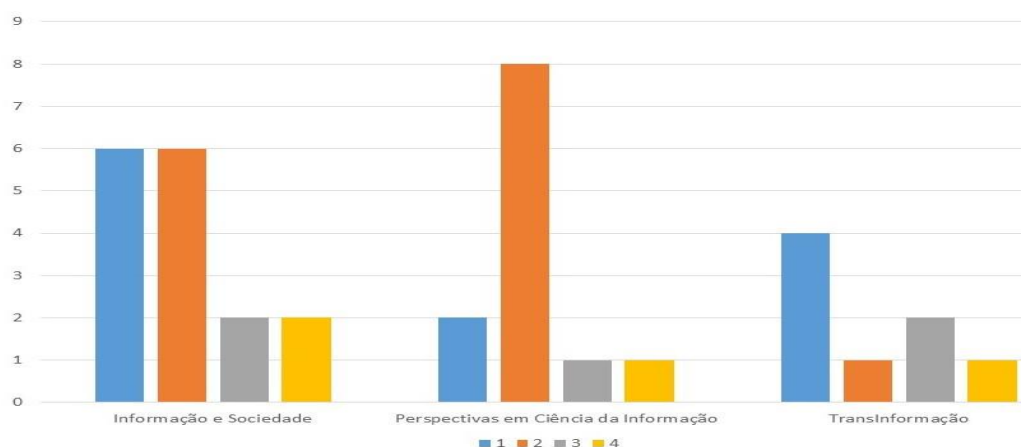
**Source:** Search Data (2017).

The following chart allows a better visualization of the evolution of the publications of the periodicals over the years, with the apex of the production of the journal "Information and Society" in 2010 with three articles from the periodical "Perspectives in Information Science" in 2015 with three articles and the "TransInformação" journal in 2016 also with three articles.



**Graphic 1.** Distribution of the number of periodical publications per year  
**Source:** Search Data (2017).

Another aspect analyzed was the type of authorship of the articles, the results showed that the type that prevailed was the multiple authorship of two authors with 15 results among the articles analyzed, secondly comes the single authorship with 12 results, in the third the multiple authorship of three authors with five results finally multiple authorship of four authors with four results. The number of articles per type of authorship of each journal can be visualized in the following graph,



**Graphic 2.** Number of publications per periodical x number of authors  
**Source:** Search Data (2017).

Os autores que mais obtiveram destaque foram elencados na tabela a seguir, o resultado engloba todos os tipos de autoria e foca no número de vezes em que cada autor

aparece por artigo. Como destaque temos um grupo formado por onze autores, sendo a autora que mais publicou artigos com o termo pesquisado Maria Cristina Soares Guimarães com cinco artigos e Alice Ferry de Moraes com três artigos.

**Table 2** - Authors in evidence

Authors	Number of articles	%
GUIMARÃES, Maria Cristina Soares	5	13,9
MORAES, Alice Ferry de	3	8,3
MOURA, Ana Maria Mielniczuk de	2	5,6
CENDÓN, Beatriz Valadares	2	5,6
SILVA, Cícera Henrique da	2	5,6
FLORES, Daniel	2	5,6
SILVA, Fábio Mascarenhas e	2	5,6
SANTOS, Henrique Machado dos	2	5,6
RODRIGUES, Jeorgina Gentil	2	5,6
TEIXEIRA, Robson da Silva	2	5,6
CAREGNATO, Sonia Elisa	2	5,6

**Source:** Search Data (2017).

From an analysis of the Lattes curriculum of the authors, we point out important considerations regarding the subject studied in this research. Maria Cristina Soares Guimarães holds a master's degree and a doctorate in Information Science with titles of the course completion papers respectively, "Evaluation in Science and Technology: a Prospective Study in Chemistry" and "Technology as Knowledge: Public and Private; the social and the economic, "is a researcher at the Oswaldo Cruz Foundation (Fiocruz), which justifies the fact that three of the articles analyzed are studies applied at the institution.

Another interesting point is that Maria Cristina is coordinator of the Specialization Course lato sensu Scientific and Technological Information in Health of the Institute of Communication and Scientific Information and Technology in Health (ICICT), her topics of interest include free access and scientific and technological health information , Evaluation in S&T and Socialization of information and social studies of science and technology which clarifies the author's emphasis on the study in question. Alice Ferry de Moraes has a Specialization in Information Management in S&T, a master 's degree and a doctorate in Information Science, her final papers being respectively "Journal - research source. The use of journalistic information by researchers to produce knowledge at the University "and" The use of strategies in the transfer of information in health videos ", is an inactive server of Fiocruz. It is notable that both have interest and produce in the area of S&T, being part of one of the institutions that most act in the dissemination of scientific and technological information.

Table 3 shows the institutions with the most publications in descending order. The survey takes into account the number of times that institution appears in the articles and involves all types of authorship. The most prominent institution was Fiocruz, with the appearance in nine articles, followed by UFRGS, UFMG, UFPB and UFRJ with three articles, UNIRIO, UNESP, UEL, UFSM and UFSCAR with two articles. , one of the articles could not identify the institution).

**Table 3.** Number of articles per institution

Instituições	Artigos	%
FIOCRUZ	9	25
UFRGS,UFMG,UFPB, UFRJ	3	8,3
UNIRIO,UNESP,UEL UFSM,UFSCAR	2	5,6
IFSP,USP,UESB IBICT,PUC CAMPINAS,UFPE		
UNICAMP,UFPR	1	2,8
UFSC,PUC MINAS, CIEB,UFPI,UNB CEFET/RJ,UFABC		
Sem identificação	1	2,8

**Source:** Search Data (2017).

The predominance of publications of the Oswaldo Cruz Foundation can be explained by the remarkable relevance of the institution in the country when it comes to the generation and diffusion of scientific and technological knowledge. This premise can be found in the mission of the foundation that consists of "Promoting health and development social, generate and disseminate scientific and technological knowledge, be an agent of citizenship. These are the concepts that guide the work of the Oswaldo Cruz Foundation (Fiocruz), linked to the Ministry of Health, the most prominent institution of science and technology in health in Latin America "(FIOCRUZ, 2016).

Another variable analyzed was the occurrence of keywords in articles, of articles retrieved four did not present keywords were: "National policy of scientific and technological information: need versus reality", "Information Science: a science for scientific information and technological? "" Education and technology: outcomes / (between) links in the adventure of (in) forming man - a possible discussion? "And" Unesco information and documentation policies and programs and sources for their study. " In total we obtained 120 keywords, we chose to include in the table those that were repeated at least once, the keyword that got the most attention was "Free access", followed by "Scientific and technological information", "Digital preservation", "Scientific production", "Scientific information", "Information

science", "Scientometry", "Co-authorship", "Digital archival documents", "S & T interaction", "Patent", "Platform lattes", "Information retrieval" "Institutional Repository" and "Information Representation".

**Table 4.** Occurrence of keywords

Keyword	Repetitions	%
Free access	4	3,3
Scientific and technological information	3	2,5
Digital preservation	3	2,5
scientific production	2	1,7
Scientific Information	2	1,7
information Science	2	1,7
Scientometrics	2	1,7
Co-author	2	1,7
Digital Archives	2	1,7
Interaction S&T	2	1,7
patent	2	1,7
Platform lattes	2	1,7
Information Retrieval	2	1,7
Institutional Repository	2	1,7
Information Representation	2	1,7

**Source:** Search Data (2017).

The keywords listed give us a dimension of the content of the articles. The predominance of the term "free access", for example, indicates a certain concern with the democratization of scientific and technological information in articles. As well as "Scientific production", "Scientometrics", "Co-authorship", "Information retrieval" and "Information representation" indicate studies on the use of this information. In order to better understand these relationships, it was necessary to analyze, in addition to the keywords, the content of the abstracts of the articles by classifying them into categories of analysis.

### *5.1 Representations of the content of articles*

For the analysis of content, at the time of pre-analysis, we opted for the exclusion of some articles because of the fact that their contents evade the topic addressed in this work. The result of this process was 21 article summaries for the content analysis corpus.

The categories of analysis were chosen from the content of the theoretical-conceptual framework and the reading of the abstracts and keywords of the articles, the following table shows the progression of the categories analyzed.

**Frame 2.** Progression of the categories of analysis

Progression of categories		
INITIALS	INTERMEDIARY	ENDINGS
1. Information representation	I. Treatment and management of information	I. Information science and processes involving the use of information
2. Information retrieval		
3. Information management		
4. Dissemination of information	II. Availability and monitoring of information	
5. Access to information		
6. Information monitoring		
7. Scientific and technological production	III. Production and scientific communication	II. Production, communication and evaluation of scientific and technological activity
8. Scientific Communication		
9. Evaluation of scientific production	IV. Methods of analysis of scientific production	
10. Bibliometrics		
11. Scientometrics		
12. Interaction between S&T	V. Information as input for technological and scientific development.	III. Scientific and technological development
13. Scientific and technological culture		
14. Scientific and technological innovation		
15. Information Programs	VI. Policies and programs for S&T	
16. Policies for scientific and technological information		

**Source:** Search Data (2017).

The first category of analysis "Information science and processes involving the use of information" aims to group articles that contain the processes of representation, retrieval, management, dissemination, access and monitoring of information in their summaries and keywords. For a better understanding in the body of the citation text extracted from the abstracts, we list the articles in ascending order. In this category seven articles were analyzed, which are enumerated from 1 to 7.

**Frame 3.** Category of analysis I

I. Information Science and processes involving the use of information	
Titles Two Articles	Scientific and technological information and information services (1)
	The contributions of information design to the democratization of access to information on package inserts in Brazil (2)
	Information monitoring in society at risk: the case of the avian influenza pandemic (3)
	Metadata standard for rare works on the web: an exploratory study at the Oswaldo Cruz Foundation (4)
	Use of Web Surveys for use studies (5)
	The use of electronic bulletin in the reference sector: a case study (6)
	Organization of information in open electronic systems of scientific and technological information: analysis of the Lattes Platform (7)

**Source:** Search Data (2017).

One of the articles focuses on the concepts of scientific, technological and business information and relates them to reference and information services, making a comparison

between Brazil and other countries, as highlighted in the excerpt, "Emphasizes aspects of the technological information service , both in developed countries and in Brazil. " (1). One aspect that is sufficiently addressed in the abstracts is free access to scientific and technological information, which is elucidated in some parts, "[...] present the area of Information Design to demonstrate how the contributions of this technoscience can contribute to the democratization of information , particularly in the access of the technical-scientific information of the health sector. "(2); "Discussion, evaluation and presentation of parameters for the organization of Brazilian scientific and technological information, focusing on the problems of access to information in open systems" (7).

The article on Information Design shows through the analysis of package inserts the importance of this area in the access to the technical-scientific information of the health sector. The article aims to present the area and elucidate its contribution to the democratization of information. The article on open systems emphasizes the problems faced in the access of scientific and technological information. Promotes discussion, evaluation and presentation of parameters for the organization of this information. The exploratory study was applied in the Lattes Platform and concluded that the open nature of the system affects the consistency of the data in the information retrieval, the article also presents suggestions to improve the system.

In one of the summaries, the scientific memory of Fiocruz is highlighted, presenting it as a source of information in the field of Information Science. The article presents a proposal of a metadata standard to describe rare works in the institutional repository. This demand arose from the difficulty in the management of analog and digital documents. The articles also address the application of methods and the creation of information services, one of the articles presents the Web Surveys method applied to a research on the use of the Capes journal portal. The research questionnaires were sent to approximately 15 thousand teachers distributed in 17 federal universities. It also presents the difficulties faced in applying the method and the preliminary results of the research. Another article presents a case study at a university in the reference sector of a library of the course of physics of a university, the elaboration of an electronic bulletin is presented as proposal for the dissemination of information in Brazilian public universities.

There is an emphasis on the processes of information representation and its subsequent retrieval, one of the articles highlights the document categorization process analyzing the difficulties and results in two processes, one based on the use of keywords and the other on the use of citations to represent documents . Two experiments were performed with algorithm of categorization based on other keywords with categories using artificial neural networks, also details the methodology used in the experiments, emphasizes the importance of the research for studies of representation of documents and information retrieval.

The second category of analysis, "Production, communication and evaluation of scientific and technological activity", aims to group the articles that presented in their



summaries topics such as scientific and technological production, scientific communication, evaluation of scientific production, bibliometry and scientometry. This category incorporated eight articles from the total corpus of the analysis listed from 8 to 15.

**Frame 4.** Category of analysis II

II. Produção, comunicação e avaliação da atividade científica e tecnológica	
Titles two articles	Co-classification between articles and patents: a study of the interaction between S & T in Brazilian Biotechnology (8)
	Experiences related to the collection of theses and dissertations (9)
	Institutional health repository: the experience of the Oswaldo Cruz Foundation (10)
	Bibliometry and "evaluation" of scientific activity: a study on the index (11)
	Co-authorship in articles and patents: a study of the interaction between scientific and technological production (12)
	Models of management of scientific journals: a necessary discussion (13)
	Exploration of the Lattes Platform by subject: methodology proposal (14)
	Terminology as a qualitative indicator (15)

**Source:** Research Data, (2017).

The summaries contained in category II highlight the scientific and technological production, the clear interaction between the two types of information and also the ways to evaluate this production through bibliometrics, this tendency presented in the summaries is clear in the following excerpts, "Analyze the interaction between science and technology (S & T) from a scientometric approach, using the co-classification technique. "(8); "It analyzes the interaction between the scientific and technological production of researchers who have filed patents in the area of Biotechnology" (12); "To complement the research, a research was carried out on the Lattes platform, considered as another alternative for surveying scientific and technological production" (9); "[...] with the aim of ensuring the preservation of the memory of the scientific and technical production of Ict and its extension with a view to promoting free and unrestricted access to Fiocruz's intellectual production." "The Lattes Platform in Brazil is a relevant curricular information system that allows the registration of the scientific and technological production of each researcher" (14).

The third category of analysis, "Scientific and Technological Development", aims to include articles that in their summaries presented topics such as interaction between S & T, scientific and technological culture, scientific and technological innovation, information programs, policies for scientific and technological information . Articles in this category were listed from 16 to 21.

**Frame 5.** Category of analysis III

III. Desenvolvimento científico e tecnológico	
Titles two articles	Information and innovation in the Manqueira plague vaccine (16)
	National policy on scientific and technological information: need versus reality (17)
	UNESCO information and documentation policies and programs and sources for their study (18)
	Environmental information in Brazil: for what and for whom (19)
	The obvious of scientific information: access and use (20)
Patent generates patent? (21)	

**Source:** Research Data (2017).

The abstracts of this category corroborate with Aguiar (1991) and Valentim (1997) who view scientific and technological information as part of processes that generate research in the scientific environment and products in the technological environment. We can highlight important points in the summaries that summarize the idea of information as the input of processes that lead to the advantage in the field of innovation and scientific and technological development, "[...] information as a strategic element for the process of scientific innovation and technological. "(16)," The text addresses the access and use of scientific information, from its design and function to the scientific and technological progress of the countries. "(20). The highlighted sections elucidate the crucial participation of information in scientific and technological activities, placing it at the center of these processes. The abstracts also address the issue of free access to scientific information and the information flow of this information.

Part of the abstracts focuses on the issue of policies and programs, and the question of the need for a national policy of scientific and technological information is highlighted in the following section: "It is tried to glimpse the current trend of ICT - Scientific and technological information in Brazil , based on their necessity as opposed to the implications of their conformation in reality. "(17). It is also made the indication of sources of information in activities of programs in the scientific and technological field. A specific type of information was addressed in one of the articles, Environmental Information. It addresses the issue of information diffusion, information professionals and self-sustaining development in Brazil. One of the summaries presents as a result of the research the contrast in our country in the use of the patent in the fields of innovation and technology, (21) "... the patent is not presented as necessary information for the production of technology and innovation," which leads the author to verify the need to carry out actions to transfer and transform knowledge into knowledge.

## 6 CONCLUSION

The study in question addressed pertinent subjects regarding the universe of scientific and technological information and scientific production. The description and analysis of the presented data allowed a greater understanding of the literature on the subject, although the research cut had only part of this environment. The objectives listed were reached, since we analyzed the literature on the term "scientific and technological information" in three (3) Qualis A1 journals that are included in the scope of Information Science. For the accomplishment of the objectives we carried out a bibliographical survey about the subject, bringing important concepts and facts for the comprehension of the general way. We describe quantitative aspects of the analysis corpus by means of tables and graphs and we find the variables: number of publications per year, having the years 2016, 2015, 2012, and 2007 as a highlight of production.

Multiple authorship as a trend. The authors Maria Cristina Soares and Alice Ferry de Moraes as a highlight in production, the institution with the most prominence within the production was the Oswaldo Cruz Foundation and the most used keywords were free access, scientific and technological information and digital preservation. We also analyzed the Lattes curriculum of the most productive authors, which allowed us to conclude that their formations and research are focused on the area of Science and Technology.

The summaries of articles selected for content analysis showed the tendency of the literature to turn to the study of information itself, methodologies applied in studies, and information products and services. The analysis of the production itself was also a factor verified in the abstracts that dealt with topics such as theses and dissertations, institutional repository, bibliometry, co-authorship and management of scientific journals. Also, we note the concern with the policies of scientific and technological information and its contributions to scientific and technological development.

The research sought, through a clipping in the literature, to understand the aspects of ICT presented in the content of the abstracts of articles that are transmitted in the main means of scientific communication. The quantitative data aided the understanding and were complementary and of fundamental importance for the conclusion of the study. We want to emphasize that the study did not intend to empty the discussions on the subject or to exhaustively raise contents and data. We hope that, like all scientific communication, this study will serve as an input for the launching of further research, thus contributing to the flow of information and the advancement of science.

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