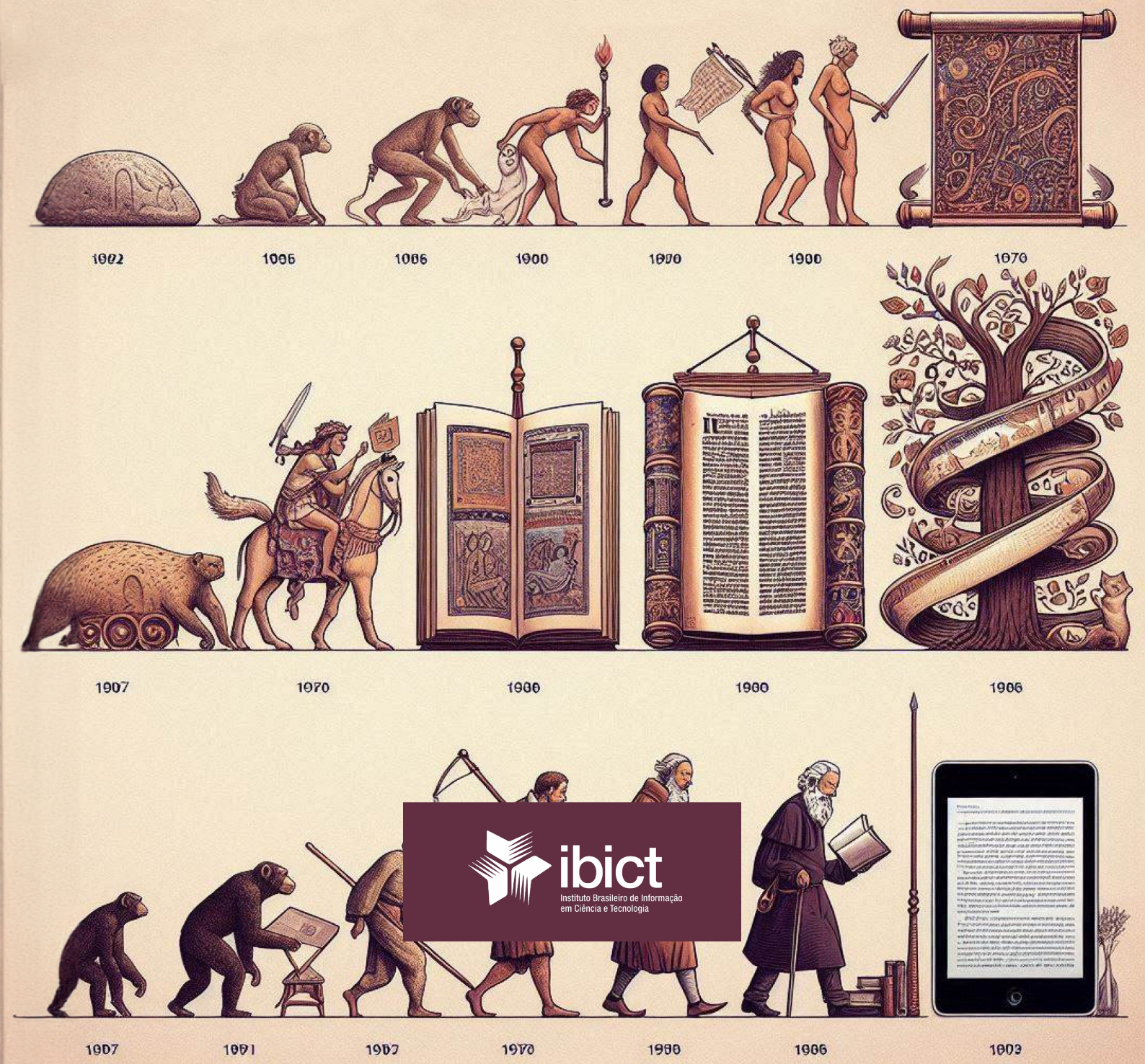
CIÊNCIA DA INFORMAÇÃO

v.52 n.2 maio/ago. de 2023 • ISSN Eletrônico: 1518-8353 • ISSN Impresso: 0100-1965



ibict
Instituto Brasileiro de Informação em Ciência e Tecnologia

NOTAS DO EDITOR

Para baixar o PDF de cada artigo da revista Ciência da Informação a partir do seu smartphone ou tablet, escaneie o QR Code publicado em cada artigo da versão impressa. Mais informações pelo telefone: (61) 3217-6231

Ciência da Informação [recurso eletrônico]. – v. 52 (1972). – Brasília, DF: Instituto Brasileiro de Informação em Ciência e Tecnologia, 2024
1 recurso *online*: il.

Quadrimestral
ISSN: 0100-1965
e-ISSN: 1518-8353.
Acesso: https://revista.ibict.br/ciinf
Título abreviado: Ci.Inf.
Título, resumos e textos em português, inglês e espanhol.
Preservada digitalmente na Rede de Serviços de Preservação Digital – Cariniana (Ibict).

1. Ciência da Informação – Periódico Científico. I. Instituto Brasileiro de Informação em Ciência e Tecnologia.

Instituto Brasileiro de Informação em Ciência e Tecnologia (Ibict)

Setor de Autarquias Sul (SAUS)
Quadra 05, Lote 06, Bloco H – 5º Andar
Cep: 70070-912 – Brasília, DF

Telefones: 55 (61) 3217-6360
55 (61) 3217-6350
www.ibict.br

Rua Lauro Muller, 455 - 4º Andar - Botafogo
Cep: 22290-160 – Rio de Janeiro, RJ

Telefones: 55 (21) 2275-0321
Fax: 55 (21) 2275-3590
http://www.ibict.br/capacitacao-e-ensino/pos-graduacao-em-ciencia-da-informacao
http://www.ppgci.ufrj.br

Editada em maio de 2023.

Última edição em maio de 2024.

Publicada em junho de 2024.

EQUIPE TÉCNICA

Editor Científico
Tiago Emmanuel Nunes Braga

Editor Científico Emérito
Cecília Leite Oliveira

Editores Científicos Convidados
Marta Ligia Pomim Valentim
Rita de Cassia Maia da Silva
Shirley Carvalhêdo Franco

Editores Responsáveis
Polyana Gentil Penna
Ramón Martins Sodoma da Fonseca

Editor Executivo
Joana Gentil Penna

Bibliotecários – Normalizadores
Fernanda Percia França
Julia Rodrigues da Silva
Pedro Henrique Sousa Ferreira

Revisão gramatical
Fernanda Olivetto
Daniela de Souto Inocêncio
Sarah Lindalva de França Heleno Pereira

Tradutores Inglês
Clemente Gentil Penna
Elisa da Silva Perfeito

Tradutores Espanhol
Mónica Patricia Ramírez Rivas
Sarah Lindalva de França Heleno Pereira

Diagramação
Dayane Jacob de Oliveira
Miranda Almeida Guimarães Duarte

Suporte Tecnológico
Alexandre Ribeiro da Silva
Mathews Lima de Alencar Filho

Projeto Gráfico
SEDIT

Capa
Rodrigo Azevedo Moreira

Ciência da Informação
v.52 n.2 maio/ago. 2023

ISSN 0100-1965 e ISSN 1518-8353

Periódico da Ciência da Informação Trilíngue - PT / EN / ES

Trilingual journal of Ciência da Informação - PT / EN / ES

Revista Ciência da Informação trilingüe - PT / EN / ES

CONSELHO EDITORIAL (MARÇO DE 2021 A MARÇO DE 2023)

Marcello Peixoto Bax
Pós-Doutorado pela Rensselaer Polytechnic Institute (RPI) – Estados Unidos. Doutor em Informática, Anal. Sistemas e Tratamento de Sinal pela Université Montpellier 2 – Sciences et Techniques (UM2) – França. Professor da Universidade Federal de Minas Gerais (UFMG) – MG – Brasil.
http://lattes.cnpq.br/1864473087690223
Email: bax@eci.ufmg.br

Márcia Feijão de Figueiredo
Doutora em Ciência da Informação pelo Programa de Pós-Graduação em Ciência da Informação do Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT) e Universidade Federal do Rio de Janeiro (UFRJ) – Rio de Janeiro, RJ – Brasil. Professora da Universidade Federal do Estado do Rio de Janeiro (Unirio) – RJ – Brasil.
http://lattes.cnpq.br/6986762652734445
https://orcid.org/0000-0002-2341-6637
Email: marciaffigueiredo@gmail.com

Maria Cláudia Cabrini Grácio
Livre-docência pela Universidade Estadual Paulista (Unesp) – SP – Brasil. Doutora em Filosofia pela Universidade Estadual de Campinas (Unicamp) – Campinas – SP – Brasil. Professora da Universidade Estadual Paulista Júlio de Mesquita Filho (Unesp) – Marília, SP – Brasil.
http://lattes.cnpq.br/5170688300970006
https://orcid.org/0000-0002-8003-0386
Email: cabrini@marilia.unesp.br

Maria Manuel Borges
Doutora Ciências Documentais, especialidade em Tecnologias de Informação e Comunicação pela Universidade de Coimbra, Faculdade de Letras – Portugal. Professora da Universidade de Coimbra (UC) – Coimbra – Portugal.
https://orcid.org/0000-0002-7755-6168
https://mariamanuelborges.weebly.com/
https://www.cienciavitae.pt/portal/pt/821F-CED0-75EA
http://mariamanuelborges.weebly.com
Email: mmmb@fl.uc.pt, mmborges@gmail.com

Mariângela Spotti Lopes Fujita
Livre-docência pela Universidade Estadual Paulista Júlio de Mesquita Filho (Unesp) – SP – Brasil. Pós-Doutorado pela Universidad de Murcia (UM) - Espanha. Doutora em Ciências da Comunicação pela Universidade de São Paulo (USP) – SP – Brasil. Professora Voluntária, na condição de docente permanente da Universidade Estadual Paulista Júlio de Mesquita Filho (Unesp) – Marília, SP – Brasil.
http://lattes.cnpq.br/6530346906709462
https://orcid.org/0000-0002-8239-7114
Email: goldstar@flash.tv.br

Naira Christofoletti Silveira
Doutora em Ciência da Informação pela Universidade de São Paulo (USP) – SP – Brasil. Professora da Universidade Federal do Estado do Rio de Janeiro (Unirio) – RJ – Brasil.
http://lattes.cnpq.br/3661612581538948
https://orcid.org/0000-0002-0490-0052
Email: naira.silveira@unirio.br

Raimundo Nonato Macedo dos Santos
Pós-Doutorado pela Universidad Carlos III de Madrid (UC3M) – Espanha. Doutor em Information Stratégique Et Critique Veille Technol pela Université Paul Cézanne Aix Marseille III (AixMarseille III) – França. Professor da Universidade Federal de

Pernambuco (UFPE) – Recife, PE – Brasil.
http://lattes.cnpq.br/2595121603577953
https://orcid.org/0000-0002-9208-3266
Email: rnmacedo@uol.com.br

Tatiana de Almeida
Doutora em Ciência da Informação pelo Programa de Pós-Graduação em Ciência da Informação do Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT) e Universidade Federal do Rio de Janeiro (UFRJ) - Rio de Janeiro, RJ – Brasil. Professora da Universidade Federal do Estado do Rio de Janeiro (Unirio) – RJ – Brasil.
http://lattes.cnpq.br/8454243785833187
Email: tatiana.almeida@unirio.br

AVALIADORES DESTE NÚMERO

Adilson Luiz Pinto
Pós-Doutorado. Universidad Carlos III de Madrid, UC3M, Espanha. Servidor Público – Coordenador Observatório de Informação da UFS – Brasil.
http://lattes.cnpq.br/4767432940301118
https://orcid.org/0000-0002-4142-2061

Adriane Maria Arantes de Carvalho
Doutora em Ciência da Informação pela pela Universidade Federal de Minas Gerais, Brasil. Professora Adjunta da Pontifícia Universidade Católica de Minas Gerais – Brasil.
http://lattes.cnpq.br/7121724013827539
https://orcid.org/0000-0001-6754-8116

Cátia Rodrigues Barbosa
Pós-doutorado em Museologia pela Universidade de Québec em Montréal (UQÀM- 2014) – Bolsista CAPES. Membro da Associação Nacional de Pesquisa e Pós-Graduação em Ciência da Informação (ANCIB) – Brasil.
http://lattes.cnpq.br/6519048390622308

Clarissa Moreira dos Santos Schmidt
Doutora em Ciência da Informação (2012) pelo Programa de Pós-graduação em Ciência da Informação da Escola de Comunicações e Artes da Universidade de São Paulo (ECA-USP) – Brasil. Professora do Departamento de Ciência da Informação da Universidade Federal Fluminense – Brasil.
http://lattes.cnpq.br/939814999644338

Edgar Bisset Alvarez
Doutor em Ciência da Informação pelo Programa de Pós-Graduação em Ciência da Informação da Universidade Estadual Paulista (UNESP), com período sanduíche na Universidad de Murcia/Espanha. Professor nos cursos de Graduação e Pós-Graduação, do Departamento de Ciência da Informação no Centro de Ciências da Educação, Universidade Federal de Santa Catarina (UFSC) – Brasil.
http://lattes.cnpq.br/625948789739207

Isa Maria Freire
Pós-Doutora. Universidade de São Paulo, Escola de Comunicações e Artes, USP ECA, Brasil. Professora aposentada do Departamento de Ciência da Informação da Universidade Federal da Paraíba – Brasil.
http://lattes.cnpq.br/8430720903326399
https://orcid.org/0000-0001-7603-1872

Jaqueline Santos Barradas
Doutora em Ciência da Informação pelo IBICT/UFRJ (2015) na área da Comunicação Científica, Rio de Janeiro – Brasil. Professora Adjunta da Universidade Federal do Estado do Rio de Janeiro (UNIRIO) – Brasil.
http://lattes.cnpq.br/5206195266468729

Joana Coeli Ribeiro Garcia
Doutorado em Ciência da Informação.
Universidade Federal do Rio de Janeiro, UFRJ, Rio de Janeiro – Brasil. Professora Titular do Departamento de Ciência da Informação com atuação no Programa de Pós Graduação em Ciência da Informação, da Universidade Federal da Paraíba – Brasil.
http://lattes.cnpq.br/0920934902479266

Marcelo Fornazin
Doutor em Administração pela Fundação Getúlia Vargas, FGV, Brasil. Professor

Ciência da Informação

Volume 52 – Número 2 – maio/ago. 2023

Summary

Editorial

Polyana Gentil Penna
Editor-in-Chief
Ciência da Informação journal

We are pleased to present the latest edition of *Ciência da Informação*, volume 52, number 2, featuring submissions in the Articles and Literature Review sections from May to August 2023. This edition brings together a diverse collection of papers that explore crucial and contemporary themes such as governmental transparency, information organization, interdisciplinarity, and technological advancements in the field of Information Science. The documents published here are the result of detailed research and offer enriching reading for both academics and professionals in the field. The diversity of topics addressed from the perspective of Information Science is fundamentally important as it allows for an interdisciplinary and comprehensive approach, providing a deeper and integrated understanding of the informational complexities that permeate contemporary society.

The paper **Transparency of COVID-19 information: a comparison of open data transparency dashboards**, by Hironobu Sano, Ricardo Matheus, and José Carlos Vaz looks into the transparency features of COVID-19 control panels created by the governments of Brazil, Germany, the Netherlands, and the United Kingdom. The article concludes that the data are presented in different formats and functionalities, helping people track the disease's progression and make policy decisions. However, there is room for improvement in transparency and interoperability with legacy systems.

Studies on the organization and representation of information in a museological context, by Josefa Xavier de Paula and Eva Cristina Leite da Silva investigates the need to organize information for later retrieval in museological contexts. Using Bardin's Content Analysis, the study addresses the dialogue between Information Organization and Information Representation in museums, improving public access to information and assisting professionals in the field.

Interdisciplinary relations between Information Science and Law: a study based on publications on the IBICT journal, by Gillian Leandro de Queiroga and Iago Mendes Macedo analyzes themes in Information Science correlated with Law. Through Social Network Analysis, the study reveals a higher frequency of themes such as "Copyright," "Ethics," "Internet," and "Intellectual Property," highlighting the interdisciplinary potential between the two fields.

The paper **EICIDR: method for ergonomic inspection checklist in institutional digital repositories**, by Wilma Honorio dos Santos, Luciano Gamez, and Felipe Mancini proposes a checklist of ergonomic specifications and recommendations to evaluate the usability of institutional digital repositories. The integrative literature review showed that ergonomic tests improve the usability of these repositories, addressing existing gaps in ergonomic and usability evaluation.

Analysis of knowledge production in Applied Social Sciences in Scientific Initiation, by Andreza Pereira Batista and Gabriela Belmont de Farias investigates the

scientific production of projects from the Institutional Scientific Initiation Scholarship Program of the Universidade Federal do Ceará. The study shows that journal articles and conference proceedings are the most adopted means for disseminating research findings, highlighting their relevance for the training of students in the program.

In **E-Health technology acceptance: a meta-analysis**, by Luiz Philipi Calegari and Diego de Castro Fettermann, the authors synthesize the factors that explain the acceptance of e-health technologies using the UTAUT model. The study finds significance in the effects of constructs “Performance Expectancy,” “Effort Expectancy,” and “Social Influence” on “Behavioral Intention,” offering guidance for the development of health technologies.

Semi-automatic assessment of ICT Master Plan contents with Natural Language Processing technologies, by Ethel Airton Capuano presents an analysis on text search and semi-automatic content evaluation of Information and Communication Technology Master Plans of public agencies. Using natural language processing technologies, the study reveals that the plans comply with official standards but lack approaches to some important practices.

Perspectives of open educational resources for the library-information field: insights from Ranganathan, by Jessika Palmeira Alves and Alberto Calil Elias Junior provides an overview of scientific production related to Open Educational Resources in librarianship. The article highlights libraries’ adaptability to virtual environments, promoting democratic access to knowledge.

Disaster Victim Identification in the Context of Information Science, by Rodrigo Goncalves Teixeira and Adilson Luiz Pinto explores Disaster Victim Identification and the importance of effective protocols for transmitting critical information. The analysis of the Brumadinho disaster illustrates the relevance of Information Science concepts in the identification process.

Brazilian scientific publications in Information Science indexed in the Web of Science, by João Paulo Pastana Neves and Roberto Lopes dos Santos Júnior canvasses Brazilian scientific production in Information Science over 50 years using the Web of Science. The bibliometric analysis shows predominant international collaboration, especially with European institutions.

The article **Digital transformation in the public sphere: a bibliometric analysis**, by Wanderson Aparecido da Silva Alves, Eduardo Amadeu Dutra Moresi, Ana Paula Bernardi da Silva, and Helga Cristina Hedler details the importance of electronic governance for effective digital transformation in organizations. Using a literature review and bibliometric analysis, the study identifies emerging themes and the importance of maturity in electronic governance.

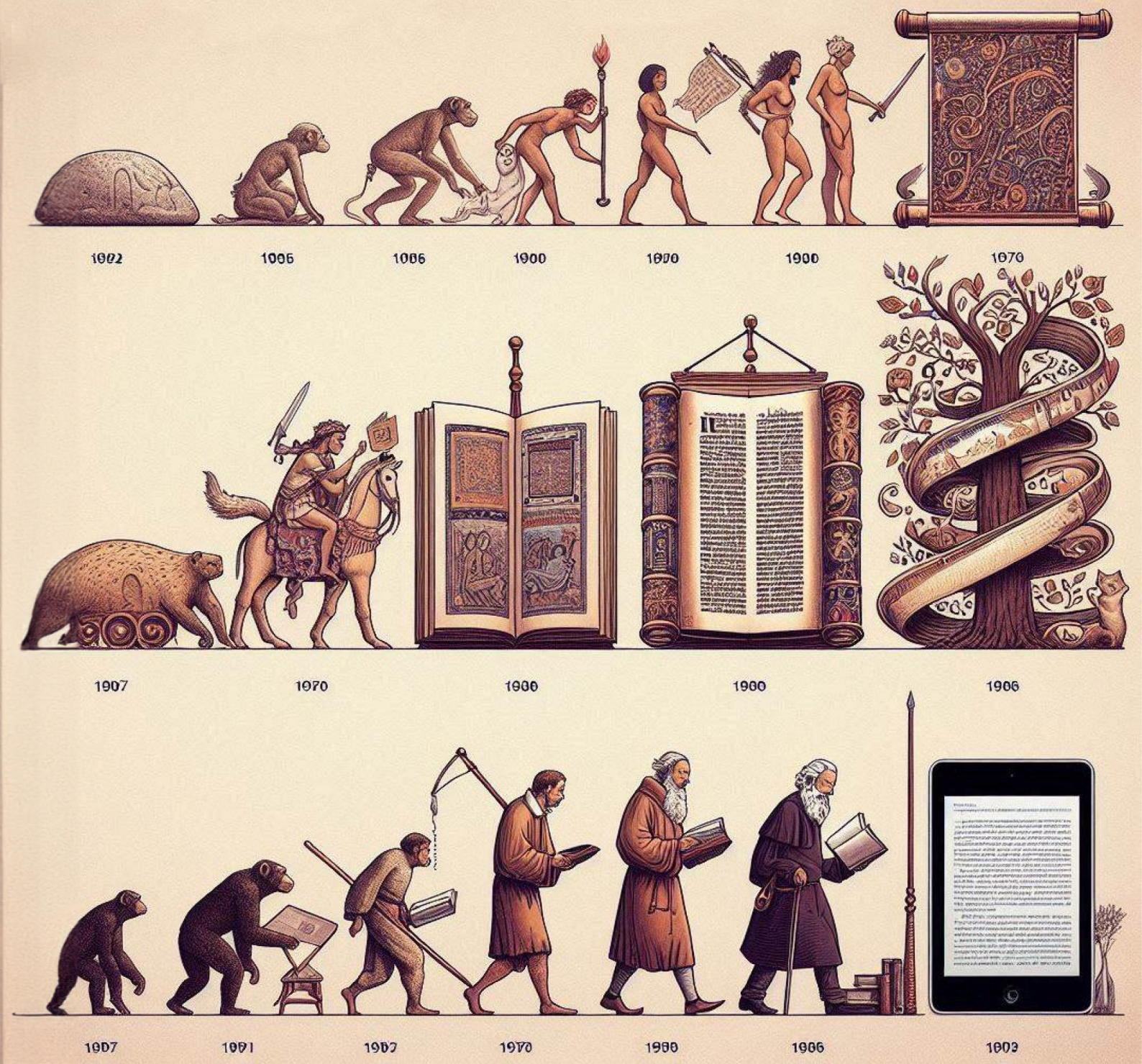
Correlations between representation theory and intentionality theory: contributions to information findability, by Fernanda Alves Sanchez, Fabiano Ferreira de Castro, Fernando Luiz Vechiato, and Silvana Aparecida Borsetti Gregorio Vidott seeks to identify correlations between Representation Theory and Intentionality Theory in the context of Information Science, highlighting their importance for information findability in digital environments.

The flow of information in the creation of a microlearning on circular economy, by Felipe Lopes, Roberto Maria do Carmo Duarte Freitas, and Antonio Hélio Junqueira maps the stages of information flow in creating online courses on Circular Economy. The research emphasizes the importance of Information Management to structure and present educational content optimally, improving the user experience.

The topics addressed in this edition are indispensable for the field of Information Science, involving governmental transparency, the organization and representation of information, interdisciplinarity, technological advancements, and information management in critical situations. These themes enrich the field, providing valuable perspectives for practice and theoretical development, aiding in promoting a broader and integrated understanding of informational complexities in contemporary society. We hope readers enjoy the content as much as we, the editorial team of the journal, enjoyed preparing this edition.

Have a good reading!

Articles



Transparency of COVID-19 information: a comparison of open data transparency dashboards

Hironobu Sano
PhD in Public Administration and Government, São Paulo School of Business Administration at Fundação Getulio Vargas (EAESP-FGV), São Paulo, SP, Brazil
Associate Professor, Universidade Federal do Rio Grande do Norte (UFRN), Natal, RN, Brazil.
http://lattes.cnpq.br/6037766951080411

Ricardo Matheus
Master in Administration, Universidade de São Paulo (USP), São Paulo, São Paulo, Brazil.
Assistant Professor, Delft Technical University, Delft, South Holland, Netherlands.
https://scholar.google.com/citations?user=kV0f5YcAAAAJ&hl=en

José Carlos Vaz
PhD in Business Administration, São Paulo School of Business Administration at Fundação Getulio Vargas (EAESP-FGV), São Paulo, SP, Brazil.
Professor at the School of Arts, Sciences and Humanities at the Universidade de São Paulo (EACH-USP), São Paulo, SP, Brazil.
http://lattes.cnpq.br/0053168971489438

Submitted on: 08/01/2020. Approved on: 11/20/2023. Published on: 06/21/2024.

ABSTRACT

This paper aims to analyze the transparency features of COVID-19 dashboard created by Brazil, Germany, The Netherlands, and, United Kingdom governments. These dashboards are webpages that present data in different format, such as text, maps, graphs and tables, and can reduce information asymmetry between the government and people. This paper relies on a combination of varied literature to build a Dashboard Transparency Evaluation Framework: Open Government Data, websites transparency assessment, dashboard functionalities and information flowchart, and collaborative stakeholder participation in open government processes. Based on an exploratory approach this paper adopted the structured search and evaluation method to investigate and evaluate the dashboards portals. This paper concludes that data are shown in different formats in all countries and with different functionalities and thus can help people follow the evolution of the disease and also the policy decision. However there is room to improve transparency, such as the integration of dashboards with open data policies and access to information or the interoperability with legacy systems. Future research can advance in the analysis of the users demand, articulation between stakeholders, state technological capacity among others.

Keywords: dashboards; transparency; open government data (OGD); COVID-19.

INTRODUCTION

The Severe Acute Respiratory Syndrome coronavirus 2 SARS-CoV-2 or COVID-19 has already taken on pandemic proportions in 2020, affecting over 213 countries in a matter of weeks. Remuzzi and Remuzzi (2020) recommended a global response to prepare health systems worldwide to deal with the virus outbreak. Analysis and dissemination of information is an essential front in facing health emergencies like this.

The creation of the health system is heavily connected with Information Systems (IS) that can gather information from private and/or public hospitals. Apparently, in a major part of the countries the governments centralizes data collection, storage, processing and publication.

After statistical processing, such as anonymization of the patient (e.g. name, address, social security number), the data from this governmental centralized health system is published aiming for transparency (Freitas; Dacorso, 2014). The active transparency of this data is commonly labeled as Open Government Data (OGD) (Diniz, 2010; Gregório Filho; Agune; Bolliger, 2010). The passive transparency is commonly associated with Freedom of Information Act – FOIA (Pedroso; Tanaka; Cappelli, 2013), out of the scope of this paper.

The OGD allows the government, people and enterprises to use the disclosed data (Albano; Reinhard, 2015). Data can be used by the government to design and justify public policies and also promote transparency and accountability. Currently, since the need for transparency of COVID-19, governments have been creating webpages with updated data in text, maps, graphs and tables formats about COVID-19. These webpages were defined by this paper as "*dashboards*", since the dashboards combine all these formats to reduce information asymmetry between the government and people.

However, these dashboards do not have technical features and data needed by all stakeholders to properly account COVID-19, reducing the level of transparency of these dashboards. Taking into consideration these issues, this paper aims to analyze the transparency features of COVID-19 dashboard created by Brazil, Germany, The Netherlands, and, United Kingdom governments.

This paper is structured as follows: Section 2 discuss transparency dashboards evaluation methods, section 3 describes the research method, section 4 presents the findings and the international comparison between countries dashboards, and, last, section 5 gives the conclusions of this research. Section 6 contains all references used in this paper.

Transparency dashboards evaluation methods

The disclosure of governmental data gained strength in the last decade associated with the Open Government Data initiative that defined 15 key principles to ensure free data usage, reuse and redistribution and since then has been used as guidelines for data publishing practices and its evaluation (Correa; Souza; Silva, 2019).

In addition to making data available, a subsequent movement revealed an increase in the number of Open Data Portals (ODP), which are web based sites designed to contain data and with features that allow its selection, manipulation and also data crossing (Matheus; Janssen; Maheshwari, 2018).

In recent years, governments have made more use of dashboards that can be defined as "[…] *the visualization of a consolidated set data for a certain purpose, which enables to see what is happening and to initiate actions*" (Matheus; Vaz; Ribeiro, 2018, p. 2). The recent outbreak of the COVID-19 has made dashboards even more popular among governments all over the world in an effort to make available information about the disease.

To evaluate the transparency of COVID-19 dashboards, this paper initially adopts a slightly modified dashboard information flowchart proposed by Matheus, Janssen and Maheshwari (2018) that consist of four stages: (A) data collection, (B) data processing, (C) dashboard structuring, and (D) dashboard publishing. The inclusion of stage C represents an adaptation made in the original version, and other flows that are not part of this research were removed (**Figure 1**).

Matheus and Janssen (2013) proposed a two folded model for websites transparency assessment: interpretation and accessibility of data. The first dimension is related to data collection and the analysis that is possible to do, thus regarding characteristics such as easy of interpretation, information quality, data completeness and update frequency. The dimension of accessibility affects interpretation of data and involves aspects such as simplicity in language, data in an overload format, adherence to standards. In the collection topic, it is also important to considerer the data source to ensure its accuracy and integrity. However, this paper cannot point out if governments have high or low accuracy since there is no accountability of data provided, specially due to the urgency of processing basic statistics from data to publicize numbers of cases and deaths.

Dashboard structuring (Stage C) and Dashboard publishing (Stage D) are interconnected once decisions made about the structure – and its functionalities – will have direct effects on the next phase of data publication. Matheus and Janssen (2013) highlighted the relevance of adhesion to standards as well as a unified use of technology. So, it is relevant to consider the types of technologies used in the platforms, particularly the programming language.

In terms of dashboards functionalities, Matheus, Janssen and Maheshwari (2018) proposed some design principles: customize views, support different views – such as static texts, tables, graphs, and, maps –, clear presentation, interaction support – such as instruction manual, FAQ and any other related documentation –, provide overview and details in the supported views, and ensure institutional support.

Matheus *et al*., (2018) identified nine critical success factors for OGD publication, and three of them are relevant to dashboard transparency evaluation: (i) licensing, (ii) platforms, tools, and services for opening data, and (iii) accessibility, interoperability and standards. In their analysis of communication information in public and private organizations, Moreira, Riccio and Sakata (2007) identified a lack of pattern for information publication and a prevalence of

the formats PDF, HTML and doc, which limits data comparison by the general public. Some type of standardization is important not only to foster communication and data analysis, but also in language programing in order to promote interoperability. The 5 Star Linked Data Model proposes a deployment scale scheme to analyze the maturity of open data, which starts with a single star for PDF documents and that grows with unitary increment: XLS, CSV, RDF, and LOD (Segundo, 2015).

Viana and Toledo (2011) proposed a process flowchart to evaluate transparency portals and emphasized the limitation of written language in developing countries due to functional illiteracy, and also recommended analyzing portals accessibility based on W3C standard. These W3C standards could be easily tested using automatic web based technologies such as International accessibility checker[1].

Abreu and Gomes (2017) highlighted the importance of stakeholders and their collaborative participation in open government processes. For that to happen, government need to adopt an open innovation paradigm, in which stakeholders are called upon to contribute not only in the implementation or evaluation stage, but in the whole policy process (Freitas; Cardoso, 2014).

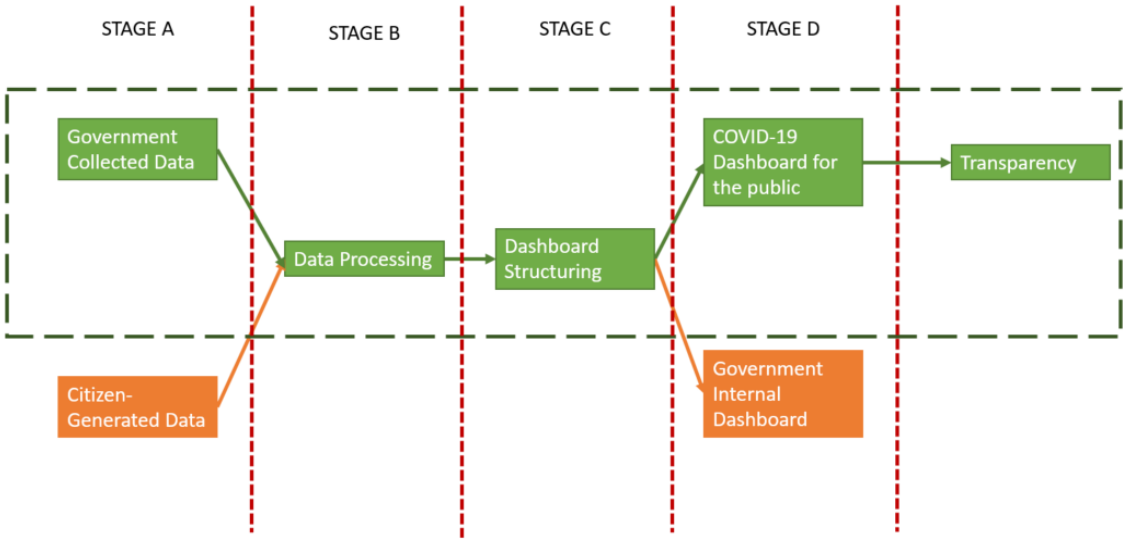
RESEARCH METHOD

This paper uses an exploratory approach (Stebbins, 2001) and the structured search and evaluation method (Matheus; Janssen; Maheshwari, 2018) to analyze the COVID-19 OGD transparency dashboards in Brazil, Germany, The Netherlands, and, United Kingdom. The criteria for these countries' selection are first the contextual relevance, since authors are Brazilian and Brazil can be compared with other countries that have been leading the electronic government transparency. All of them are fighting COVID-19, nevertheless, the pandemic arrived earlier in Europe than South America. Besides that, these countries represent different scenarios: Germany has been recognized for its hard policy to fight against the COVID-19, The Netherlands is one of the top ranked in the e-gov ranks, and the United Kingdom is one of the founders of Open Government movement (OGP).

The search and evaluation is based in the investigation of electronic portals (websites, dashboards, etc.) and its features aiming provide transparency to people. **Figure 1** describes the stages of evaluation proposed by Matheus *et al*., (2018). This paper selected the stages with green boxes, leaving out of the scope the orange boxes as they are related to data produced by citizens using web and mobile application. All the COVID-19 is highly regulated by governments and we considered all this data are governmental data.

1 https://achecker.ca/checker/index.php.

FIGURE 1 - Information Flow and Stages



Source: Adapted from Matheus et al., 2018.

After that, an evaluation is performed, being possible to compare similar transparency initiatives, for instance, different cities or international countries dashboards. All the green boxes contain dimensions of analysis. As an example, the stage C and D are influenced by features of a category called “Accessibility” that can be used to categorize the natural language of dashboards (Portuguese, English, etc.) and the level of accessibility recommended by W3C. This evaluation was created taking into consideration the base of Matheus *et al*., (2018) and other experts in the area, described in the section 2 and **TABLE 1** in the next section summarizes the selected attributes to evaluate the dashboards.

Proposed Dashboard Transparency Evaluation Framework

Table 1- Dashboard Transparency Evaluation Framework

Category	Description/Objective	Flow Stage Related	Source
A- Licensing	1- Identify types of license for the disclosed data .	Stage D- Publishing Dashboard	Matheus, R., Janssen, M., & Maheshwari, D. (2018). Matheus, R., Ribeiro, M. M., & Vaz, J. C. (2018).
B- Interoperability and OGD standards	This category aims to search and evaluate: 1- The level of OGD access based on the Linked Data 5-Stars 2- The level of OGD standards compliance based on the 15 Principles of Open Data	Stage A- Collecting Data Stage B- Data Processing	Alwan et al. (2020). Lourenço, R. P. (2015) Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011) Moreira, O., Riccio, E. L., & Sakata, M. C. G. (2007). Abreu, W. M. D., & Gomes, R. C. (2018).
C- Platforms and programming languages used	This category aims to search and evaluate: 1- The types of technologies used to create the transparency dashboards, such as programming languages (HTML, Javascript).	Stage C - Dashboard structuring	Matheus, R., & Janssen, M. (2013)
D- Functionalities to promote transparency	This category aims to search and evaluate: 1- The functionalities of the transparency dashboards, such as static texts, tables, graphs, and, maps. 2- Customized views 3- Support to different views 4- Interaction support (Manual, FAQ, Documentation) 5- Provide overview and details 6- Ensure institutional support	Stage B - Dashboard structuring Stage D- Publishing Dashboard	Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011) Moreira, O., Riccio, E. L., & Sakata, M. C. G. (2007). Abreu, W. M. D., & Gomes, R. C. (2018). Corrêa et al., (2019)
E- Accessibility	This category aims to search and evaluate: 1- The natural languages of the transparency dashboards, for instance, the mother language (Portuguese, German) and English for international audiences. 2- The level of accessibility recommended by W3C.	Stage C - Dashboard structuring Stage D- Publishing Dashboard	Matheus, R., & Janssen, M. (2013) Viana, G. B., & de Toledo, M. B. F. (2011)

Source: elaborated by the authors (2020).

Findings from international comparison of COVID-19 transparency dashboards

The findings present the analysis of the COVID-19 transparency dashboards using the framework created (see **Table 1**) for selected countries and are summarized in **Table 2**.

Table 2 – Categories and Attributes of COVID-19 Transparency Dashboards

Category	Brazil	Germany	The Netherlands	United Kingdom
URL Dashboard	https://covid.saude.gov.br/	https://npgeo-corona-npgeo-de.hub.arcgis.com/	https://www.rivm.nl/en/novel-coronavirus-covid-19/current-information-about-novel-coronavirus-covid-19	https://coronavirus.data.gov.uk/?_ga=2.86816410.343590268.1587809501-1956150173.1587809501
A- Licensing	1- Licensing: None	1- Licensing: None	1- Licensing: None	1- Licensing: Open Government Licence v3.0
B- Interoperability and OGD standards	1- Level OGD access: 3 stars, CSV format. 2- OGD standards: CSV used has no metadata, however, it is structured and objective	1- Level of OGD access: 0 stars, no data to download. 2- OGD standards: N/A	1- Level of OGD access: 3 stars, XLS and CSV format. 2- OGD standards: CSV used has no metadata, however, it is structured and objective	1- Level of OGD access: 4 stars, CSV and JSON format. 2- OGD standards: There is no metadata, however, structured and objective.
C- Programming languages	1- Technology for dashboard: HTML and Javascript	1- Technology for dashboard: ARCGIS web	1- Technology for dashboard: Drupal, HTML and Javascript	1- Technology for dashboard: HTML and Javascript
D- Functionalities to promote transparency	1- Functionalities: Tables, Graphs, Maps 2- Customize views No customization. Static website, no filters or slices, no SQL query 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for regional state level. Aggregated data. 6- Ensure institutional support: Not in the dashboard, but via mobile app.	1- Functionalities: Tables, Graphs, Maps 2- Customize views Interactive table selecting a region and changing all other features (maps/graphs), without filters or slices, with no SQL query. Maps pop-up of data from selected regions 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for regional state level. Aggregated data. 6- Ensure institutional support: No institutional support.	1- Functionalities: Static Text, Tables, Graphs, Maps 2- Customize views Static with few links to sources. Low level of interaction, showing only the current number of hospitalized people 3- Support different views: No other types of views. 4- Interaction Support No manual or any type of support. 5- Provide overview and details: Only for local level (city). Aggregated data. 6- Ensure institutional support: No institutional support	1- Functionalities: Static Text, Tables, Graphs, Maps 2- Customize views Static text with summary of data. Static Tables with low level of interactivity. No filters or slices, or SQL query. Static Graphs. 3- Support different views: No other types of views.4- Interaction Support No manual or any type of support. 5- Provide overview and details: Yes, for country, regional, and city level. 6- Ensure institutional support: No institutional support
E- Accessibility	1- Language: Portuguese 2- W3C standards (WCAG 2.0): No problems (zero)	1- Language: German 2- W3C standards (WCAG 2.0): No problems (zero)	1- Languages: Dutch and English 2- W3C standards (WCAG 2.0): 7 problems, 598 potential problems.	1- Languages:English 2- W3C standards (WCAG 2.0): No problems (zero)

Source: Created by the authors (2020).

Dashboards inspection according to the categories provides basic information about the initiatives. It also allows raising some relevant questions about implementing transparency dashboards in health emergency situations.

Only the UK provides licensing information. The absence of this information in other cases may mean that more structured data opening policies lack enforcing capacity or those responsible did not take this category into account when developing the dashboards.

Except in the German case, which does not bring data for download, the others take into account OGD standards, even if they do not publish metadata. It is possible to raise the hypothesis that the dashboards publication was an extraordinary and quick action, which caused the publication of metadata to be sacrificed either those metadata are available or not. Support services were not detected and this absence seems to be explained by the same factors as the lack of metadata.

Technological choices were based on widely used solutions, which demonstrate their suitability for dashboards of this nature and the presence of state capacity to mobilize these technologies quickly. Perhaps the use of other resources (e.g.) required technological capacities or time not available, given the context of urgency. Except for The Netherlands, the others had no problems with accessibility inspection.

The features adopted contribute to a certain extent to transparency, but with significant gaps. All have geolocation features, but only UK dashboard offers greater overview and details. It was not possible to identify whether these gaps are due to problems with availability or access to disaggregated data (e.g. data from legacy systems) or are just a design dashboard choice. In any case, this gap directly affects dashboards ability to promote transparency.

The four cases have low or medium degree of customization, not presenting, for example, features of SQL query. The dashboards do not have Linked Data features or APIs that allow users to customize queries and slices merging robust databases, like COVID-19 incidence and prevalence and government expenditures data.

Much of the content, except in the case of Germany, is presented in a static manner. Low interactivity is directly related to this characteristic, and German dashboard presents more powerful interactivity features, which can also be explained by the main technology adopted, once (ARCGIS) guarantees greater resources for data geolocation and consequent interaction capacity.

CONCLUSIONS AND FUTURE RESEARCH

Based in the four countries dashboards analysis, this paper identifies some limits and possibilities for the use of this tool in promoting transparency in emergency health situations.

Dashboards are simple and have room for development. They use technologies already widely used that are capable of offering reasonable solutions within the reach of governments. The use of more powerful resources, such as interoperability with legacy systems, may encounter technical difficulties or these related to data governance, reducing its availability.

Relevant obstacles may arise from aspects related to the integration of dashboards with open data policies and access to information, such as the publication of metadata and the offer of support.

Dashboards design suggests that, apparently, transparency is not emphasized or given as *pro-forma*. Many possibilities for increasing the level of transparency could be raised, in

addition to those presented above. However, the trade-off between quality and pressures for speed of response is a strong issue in health emergencies, which can influence the design of dashboards, forcing managers to make more modest and faster choices.

For the same reason, this paper did not propose a fully comprehensive analysis of the use of dashboards for transparency in the case of COVID-19. Otherwise can be a start of an international comparison and provide help to developers to create more transparent websites. Several new research questions and possibilities for future studies can be identified:

a) Dashboards features and usage

For learning how improve dashboards to make them more effective for COVID-19 and new pandemic events, is needed to know if the dashboards offer the most necessary information. Analyzing the dashboards from the point of view of supply, deepening this work, can be complemented with research from the point of view of demand, as transparency level evaluation analyzing data from dashboard usage by different types of users. These studies can offer answers that help design dashboards that meet the multiple needs of users regarding access to epidemiological, managerial and budgetary information.

Another category of questions concerns the context: it is important to know how features and usage of dashboards are influenced by country-specific contexts.

b) Technical issues

Decision makers can benefit from answers to several questions about technology choices, such as: What are the technologies that can enhance current dashboards and are not applied yet (e.g. Artificial Intelligence)? Legacy systems are a relevant source of data for dashboards? If yes, how their limits impact dashboards performance and design?

Interoperability is also a major issue and is related to both technology selection and data formats.

c) Management issues

Data governance is a decisive aspect for the success of dashboards. It will be important to analyze methodologies and policies for data collection, data workflow, metadata and data validation.

The approach of state technological capabilities can support studies in this field, identifying the demands and mechanisms for mobilizing capacities for the process of building dashboards. Analyzes can include decision making in the assembly and feeding of dashboards and interorganizational collaboration mechanisms.

d) Social and political issues

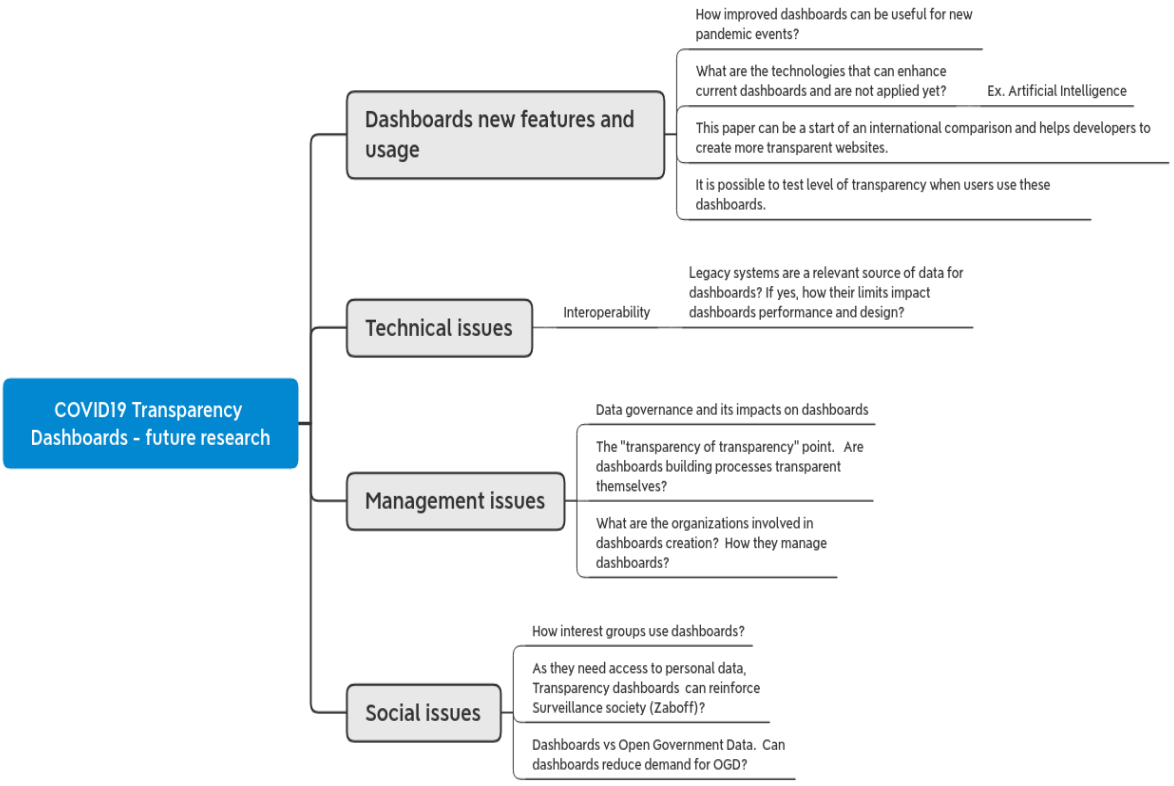
Assessing the impact of dashboards on promoting transparency can contribute to the applicability of this tool in contexts of health emergencies. Studies on impacts on specific groups and social actors can assist in the formulation of strategies by the government.

The relationship between dashboards and Open Government Data deserves further reflection. Is there an overlap between initiatives? What is the level of articulation between them? Can dashboards reduce demand for OGD?

Another issue is the “transparency of transparency”: are dashboards building processes transparent themselves? How do they take care of data protection? Once dashboards adopt Artificial Intelligence to provide more elaborated information, it will raise new questions about algorithmic transparency.

Finally, applied research is needed to explore new ways to increase the level of transparency of health emergency dashboards. As demonstrated in this article, this improvement in transparency depends on interventions in the various dimensions mentioned above and summarized in **Figure 2**.

Figure 2 – Future research about COVID-19 and transparency dashboards



Source: Created by the authors (2020).

Future research should bring us new resources for increasing impact of dashboards like these. Dashboards features and usages research should be useful to understand their relevance and help government and developers to enhance their impact on crisis management and provide more transparency. More research on technical issues, like interoperability also can contribute to create new dashboard technologies.

Management issues can help to create new techniques either for dashboards governance (transparency, decisions) or dashboard building and operation (team management, organizational structure).

There are many social issues related to dashboards which can receive research attention to foster conditions to better dashboard usage. Stakeholders and other relevant groups influence decisions and have their own needs and interests. Privacy and personal data protection is another important issue. We can ask if dashboards will contribute to right uses of personal data in our societies in order to prevent reinforcing surveillance paradigm.

REFERENCES

ABREU, W. M. D.; GOMES, R. C. Medindo o nível da influência colaborativa dos stakeholders e das ações de orçamento aberto. **Revista de Administração Pública**, Rio de Janeiro, v. 52, n. 4, p. 593-609, 2018.

ALBANO, C. S.; REINHARD, N. Desafios para governos e sociedade no ecossistema brasileiro de dados governamentais abertos (DGA). **Cadernos Gestão Pública e Cidadania**, São Paulo, v. 20, n. 67, p. 214-234, jul./dez. 2015. DOI: 10.12660/cgpc.v20n67.41150. Disponible en: https://periodicos.fgv.br/cgpc/article/view/41150. Acceso en: 23 nov. 2023.

CORREA, A. S.; SOUZA, R. M.; SILVA, F. S. C. Towards an automated method to assess data portals in the deep web. **Government Information Quarterly**, [*s. l.*], v. 36, n. 3, p. 412-426, 2019.

DINIZ, V. Como conseguir dados governamentais abertos. *In*: CONGRESSO CONSAD DE GESTÃO PÚBLICA, 3., 2010, Brasília. **Anais** [...]. Brasília: Consad, 2010. p. 4-18.

FREITAS, R. K. V. D.; CARDOSO, A. L. R. Inovação aberta na gestão pública: análise do plano de ação brasileiro para a Open Government Partnership. **Revista de Administração Pública**, [*s. l.*], v. 48, n. 4, p. 869-888, 2014.

GREGÓRIO FILHO, A. S.; AGUNE, R. M.; BOLLIGER, S. P. Governo Aberto SP: disponibilização de bases de dados e informações em formato aberto. *In*: CONGRESSO CONSAD DE GESTÃO PÚBLICA, 3., 2010, Brasília. **Anais** [...]. Brasília: Consad, 2010. p. 4-35.

MATHEUS, R.; JANSSEN, M. Transparency of civil society websites*:* towards a model for evaluation websites transparency. *In*: Proceedings of the 7th International Conference on Theory and Practice of Electronic Governance, 7., 2013, Seoul. **Anais** […]. Coreia: ICEGOV, 2013.

MATHEUS, R.; JANSSEN, M.; MAHESHWARI, D. Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. Government Information Quarterly. **Government Information Quarterly**, [*s. l.*], v. 37, n. 101284, p. 1-9, 2018.

MATHEUS, R.; RIBEIRO, M. M.; VAZ, J. C. Strategies and instruments for the dissemination and promotion of open government data use in Brazil: case study of Rio de Janeiro city hall. **Tecnologia e Sociedade**, Curitiba, v. 14, n. 33, p. 172-189, jul./set. 2018.

MOREIRA, O.; RICCIO, E. L.; SAKATA, M. C. G. A comunicação de informações nas instituições públicas e privadas: o caso XBRL-eXtensible Business Reporting Language no Brasil. **Revista de Administração Pública**, Rio de Janeiro, v. 41, n. 4, p. 769-784, jul./ago. 2007.

PEDROSO, L.; TANAKA, A.; CAPPELLI, C. A Lei de Acesso à Informação brasileira e os desafios tecnológicos dos dados abertos governamentais. *In*: SIMPÓSIO BRASILEIRO DE SISTEMAS DE INFORMAÇÃO (SBSI), 9., 2013, João Pessoa. ***Anais*** [...]. Porto Alegre: Sociedade Brasileira de Computação, 2013. p. 523-528. DOI: https://doi.org/10.5753/sbsi.2013.5718.

REMUZZI, A.; REMUZZI, G. COVID-19 and Italy: what next? **The Lancet**, [*s. l.*], v. 395, n. 10231, p. 1225-1228, abr. 2020.

SEGUNDO, J. E. S. Web semântica, dados ligados e dados abertos: uma visão dos desafios do Brasil frente às iniciativas internacionais. *In*: ENCONTRO NACIONAL DE PESQUISA EM PÓS-GRADUAÇÃO EM CIÊNCIA DA INFORMAÇÃO (ENANCIB), 16., 2015, João Pessoa. **Anais** […]. João Pessoa: UFPB, 2015.

STEBBINS, R. A. **Exploratory research in the social sciences**. California: Sage Publications, 2001. 80 p.

VIANA, G. B.; TOLEDO. M. B. F. An evaluation of Brazilian Transparency Portal and how to improve it. *In:* International Conference on Information Society *(i-Society)*, 2011, London. **Conferência** […]. London: IEEE, 2011. p. 366-372. DOI: 10.1109/i-Society18435.2011.5978471.

Studies on the organization and representation of information in a museological context

Josefa Xavier de Paula
Doctoral candidate in History at the Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brasil. Holder of a master's degree in Information Science, Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brasil.
https://lattes.cnpq.br/4619177534302662

Eva Cristina Leite da Silva
Holder of a PhD in Education from the School of Education, at the State Universidade Estadual de Campinas (Unicamp), in the city of Campinas, São Paulo, Brasil.
Associate Professor at the Universidade Federal de Santa Catarina (UFSC), Center for Educational Sciences (CED), Department of Information Science (CIN), in the Archival Science undergraduate course, and in the Postgraduate Program in Information Science (PGCIN), Florianópolis, Santa Catarina, Brazil.
http://lattes.cnpq.br/5163191593965425

Submitted on: 02/16/2021. Approved on: 11/06/2023. Published on: 06/21/2024.

ABSTRACT

Recording information today has been one of the biggest challenges, as the mass of information increases over time. To use these information records it is necessary that they are recoverable. The need to organize information for later retrieval has been the object of studies, which make possible dialogues between fields of knowledge that have information as an instrument, namely, Museology and Information Science; The present work presents a bibliographic survey about studies of Information Organization (IO) and Information Representation (IR) in a museological context, with the objective of deepening the understanding of this theme, both IO and IR in these spaces; To do so, Bardin's Content Analysis was adopted as a methodology, it was developed in the search of a set of Annals of events and Databases that constitute the largest indexers of scientific content about the theme of this work; Dealing with a possible dialogue of the Organization and Representation of Information in Museums, shows the concern in exploring a subject that is not very expressive in the databases of events and research, if related to other more recurrent themes. The dialogue between OI and RI for access to information in museological institutions facilitates access to information both for the public that accesses these places and for professionals who have direct contact with museological documentation. And yet, it corroborates the development of practices of professionals working in the field of Museology, Information Science and the like, through the dissemination of information.

Keywords: information science; museology; content analysis; Bardin.

INTRODUCTION

Information is one of the greatest inputs in society today, as the amount of information generated every day is ever increasing. However, for information to be used, it must be recoverable, therefore, recorded/fixed on a material or digital medium, organized and made available. On the other hand, unrecorded information may have objections to its socialization (accessibility) since its access is limited to spatial and temporal variables. In this context, Smith (2012, p. 85)[1] understands that, "[...] informação registrada equivale ao conceito de documento, embora o mesmo tenha sido investido de valores diferenciados ao longo do tempo".

With respect to recorded information, for Bates (1987, p. 6)[2], Information Science studies recorded information that "[...] seres humanos, produzem, procuram, utilizam, recuperam e utilizam", o universo da Ciência da Informação é aquele referente ao "mundo da informação registrada, produzida pela ação humana". According to the author, this recorded information can be found in "[...] livros, artigos, banco de dados, arquivos de dados, etc [...]"[3].

Recording information on a physical support (document) represents materializing such information. One example of said materialization is developing museum collections, which are determined by the processes of entry of objects into these collections, such as the documentation of a piece, from the registration process to an exhibition. When referring to museums which are research centers, in general, developing these collections is directly linked to the institution's research and area(s) of interest. However, regardless of collection development policies and/or processing strategies, contemporary information units, faced with socioeconomic, political and cultural circumstances, demand organization and access to information, and these as the main axes. In this sense, Macedo and Ortega (2019) state that access to information requires the organization of specific environments that enable the qualified use of information.

The search to ensure public access, together with the need to preserve museum heritage, brings reflection on the organization and representation of the multiple information of the museological object. For Lima and Alvares (2012), Organization and Representation of Information is the emphasis given to organization processes using representations of information and knowledge contained in the museological object, thus, these institutions have specific ways of representing information.

From the perspective of the organization of information, it is necessary to organize information and represent it so that it can later be retrieved (Pinho; Nascimento; Melo, 2015). Therefore, it is essential to look at the instruments that represent the information. For Moraes and Arcello (2000), representations are instruments for arranging and hierarchizing the social

1 Translation: "[...] recorded information is equivalent to the concept of document, although it has been given different values over time" (Smith, 2012, p. 85, editorial translation).

2 Translation: "[...] human beings, produce, seek, use, recover and use", the universe of Information Science is that referring to the "world of recorded information, produced by human action". According to the author, this recorded information can be found in "books, articles, databases, data files, etc" (Bates, 1987, p. 6, editorial translation).

3 Translation: "[...] books, articles, databases, data files, etc [...]" (Bates,1987, p. 6, editorial translation).

structure, and they identify the group or environment that produced or consumes them. Thus, it is possible to state that representing is creating structures to retrieve information in an efficient manner.

The representation of information is part of an essential process for its access and dissemination. In museums, the representation of information can be found in different sectors, such as exhibitions and museum documentation, which address objects, preservation instruments and access to information. For institutions to fulfill their preservation role, instruments play an indispensable part in the representation process.

In this context, a bibliographical survey on studies of the Organization of Information (OI) and Representation of Information (RI) in a museological context is presented, with the aim of deepening the understanding of this subject, both OI and RI in these spaces. How is the relationship between the organization of knowledge and information and the Representation of information being discussed in the museological context?

Information science: possible dialogues

The outlining of Information Science (IS) has been permeated by certain characteristics and concerns such as the circulation of documents and their dissemination in a more practical manner. There is concern for the relationship between man and knowledge, determined between those who provide and those who seek information (centered on human beings and society as a whole) (Shera, 1977). The storage and retrieval of information, or facts, no matter how well-done and how precise these mechanisms are, have no value if they are not used for the good of humanity, and it is this use that man dares not relinquish (Shera, 1977, p. 11).

Following the same logical reasoning, IS is a social science, based on doing things for society. According to Wersig and Neveling (1975), the social responsibility of Information Science is to ensure that people who need knowledge for their work/activity can receive it, regardless of whether they sought it or not. This is particularly the importance of IS, which plays a relevant role in investigating the processing of data and its conversion into useful information for those who seek/need it.

For Shera (1971), all communication focuses on content and a certain context. For the author, one fails to understand the informational context when they do not seek to understand how knowledge is communicated and its impact on society. Based on this understanding, organizing and representing is necessary for information to be made available to those who need it.

In IS, the representation of information and knowledge is directly linked to the ways of re-signifying it. From this perspective, dialogues are essential. One of them has been with the Organization and Representation of Knowledge, which addresses the organization and representation of information. In this sense, Burke (2003) distinguishes the two terms information and knowledge, attributing the following characteristics to information: what is relatively “raw”, specific and practical. The author denotes knowledge

as that which represents what has been “cooked”, processed or systematized by thought. Another concept is that of Capurro and Hjorland (2003) who state that the concept of information is directly related to what is desired to be answered, that is, to the problem or question that the information must satisfy.

This way, information depends on the context and limitations of reality. Thus, Bräscher and Café (2008) conclude that information is associated with views on knowledge while it influences and modifies them. In this sense, information is seen as a possibility of transforming knowledge structures and, therefore, knowledge can be seen as something that is provisional and in permanent review.

The Organization of Information also includes the organization of a set of informational objects to systematically arrange them into collections, in this case, we have the organization of information in libraries, museums, archives, both traditional and electronic. According to Bräscher and Café (2008). Therefore, two processes consequently produce two distinct types of representation: the representation of information, understood as the set of attributes that represents a given informational object and which is obtained by the processes of physical and content description, and the representation of knowledge, which constitutes a conceptual structure that represents models of the world, which, according to Le Moigne (*apud* Campos, 2004, p. 23), allow us to describe and provide explanations about the phenomena we observe.

In the definition of Smiraglia (2001), OK is the construction of tools for the storage and retrieval of documentary entities; he also highlights that the object of study is the document, in the case of museums, the museological object. OI is a process of arranging/classifying collections carried out by means of the description of the subject of their informational objects.

In the museological context, it is observed that the greatest uniformity with what is understood as RI in IS is the development of museological documentation (Lemos, 2018). This is because it is by means of this technical procedure of museology that information about objects is researched and described. This process can be a way to represent the most similar information both in IS, and in Library and Archival Science, provided that the specificities of each are considered.

The relationship between RI and museological documentation is characterized as one of the fundamental procedures in the processing of information in museums, being both extrinsic and intrinsic. According to Mensch (1992), the representation of objects can be configured in three dimensions: physical properties of the object (material, technical and morphological); function and meaning (interpretation); and History (genesis, use, deterioration and restoration factors). For Padilha (2014), this documentation essentially has the aim of organizing and enabling the recovery of the information contained in its collection. Once these actions are performed, the objects and/or museum collections become a source of information (for curation, scientific research, cultural and educational actions, various publications, among others) that can produce new knowledge. According to Ferrez (1994),

museological documentation is an ordered set of information on museum objects, where they are represented by means of writing and images, also being an information retrieval system for research and information sources.

In this context, the Organization of Information is established through processes that focus on the identification, collection and systematization of information about documents, from this process that constitutes the representation of information. In this context, Rowley (2002) highlights that information is only valuable to the extent that it is structured. If the information is not properly organized, it may not reach the user, becoming useless.

Two demands gain emphasis in today's information society, the organization and retrieval of recorded information. However, an issue persists, the loss of information/documents resulting especially from the lack of organization (physical and intellectual) of the information. In this regard, Martins (1992, p. 25)[4] asserts that "[...] quando os documentos existem e são localizados, carecem de organização que facilite o acesso [...]", thus, it is understood that, normally, when something is organized by extension, its access is facilitated.

In this sense, for Bräscher and Café (2008) RI is a product of OI, being a process that seeks to describe informational elements that represent a document. To promote discussions between Information Science and Museology, Araújo (2014) considers the Representation of Information to be a link between these two areas. In the same context, the author considers that, both in the general context of Information Science and in the specific context of museums, it is through RI that the possibility of retrieving and accessing information is conceived, contributing to the communication of the object/document with the user.

For this object/document to occupy a significant role in the museum space, it undergoes several processes to become part of a collection. For Ceravolo and Tálamo (2000), over the years, documentation assumes a significant status within museums, both as support for administrative activities and as a support element for the scientific research that is conducted in them.

In this context, organization and recovery involve: the existence of organization policies, categorization, classification, indexing procedures, representation instruments, etc., all permeated by socioeconomic, political and cultural aspects. Souza (2017) confirms this idea, highlighting that the commitment to describing a record of knowledge relating it to the social context, and internal policies of the information unit, in which its message will circulate is a recurring concern among professionals who organize the information.

Specifically on the organization of information, in the view of Bräscher and Café (2008), this process involves physical and content description of informational objects. In this descriptive process, there is a product, the representation of information (RI), that is understood as a set of descriptive elements that represent the attributes of a specific informational object. This product becomes fundamental for the recovery and access to information.

4 Translation: "[...] when documents exist and are located, they lack organization that facilitates access [...]" (Martins, 1992, p. 25, editorial translation).

METHODS

In research, the method is materialized as a set of different stages or steps that must be followed for it to be implemented (Cervo; Bervian; Silva, 2007). The research was developed based on the choice of Annals of events and Databases that constitute the largest indexers of scientific content on the subject of this work, which are: Annals of the International Society for Knowledge Organization - ISKO/Brazil, and the Annals of the National Meeting of Research in Information Science – ENANCIB. In addition, searches were conducted on the CAPES Periodicals Portal, in the following databases: Lista, Scielo Brasil and Web of Science, the Brazilian Digital Library of Theses and Dissertations – BDTD; and the Reference Database of Journal Articles in Information Science – BRAPCI. These scientific communication channels were chosen because they are sources of greater scientific production at the national level, and with international bases that could reveal productivity both within the scope of IS, in an attempt to encompass the main publications regarding the Organization of Information in the museological context.

Thus, this work adopted Bardin's (2003) Content Analysis as its methods, since its procedures allow an analysis be made based on inferences drawn from document contents - based on an interpretation controlled by means of variables or indicators, which provide greater freedom for the analyst, without losing the objectivity of the research, and because it is an analysis based on definitions designed by authors/researchers, that is, textually-recorded arguments.

The stages of the technique, according to Bardin (2006), consist of processing information based on a specific roadmap. Thus, divided into three stages: 1) pre-analysis, 2) exploration of the material and 3) processing of results (inference and interpretation).

Therefore, in 1) Pre-analysis, the first stage consists of i) skim reading, ii) choice of documents, iii) Formulation of hypotheses and objective iv) preparation of the material. It was based on a complete survey of the databases and complete collections of the aforementioned annals, using terms "Knowledge organization" and "Information Representation" and "Museum Collections" or "Museum" (and variations of the term in Portuguese and Spanish). The communications that identified dialogues on the Representation of Information in museum collections were read, selecting communications using keywords, titles and summary, as the works explore characteristics, concepts, and instruments regarding the Organization and Representation of information in museums.

When selecting documents, that is, delimiting the corpus, four basic rules are followed according to Bardin (2003): exhaustiveness - to the extent that all definitions found, when collecting information, were considered useful materials for analysis, selecting the content regarding ORI speeches in a museological context; representativeness - ensured by the choice of databases, as the works published in these channels are representative with regard to scientific production in Information Science; homogeneity - because the definitions

analyzed are related to the same field of study, they are homogeneous both in their textual structure and in their subject; and relevance of the material - the sources are the genuine ideas presented by the authors/researchers in their definitions.

The stage (2) of exploration of the material, according to Bardin (2003), consists of "coding, discounting or enumeration operations, depending on previously formulated rules". The search terms were defined; later with the databases already determined, we had quantitative results for each of them according to the previously defined strategies: Annals of ISKO – 9 papers, Annals of ENANCIB – 10 papers, BDTD – 7 papers, BRAPCI – 3 papers, SCIELO BR– 3 papers, WoS – 8 papers, Lista – 4 papers.

According to the above, a total of 44 publications were retrieved in the seven media initially proposed, such as annals and database. Thus, after searching this channel, the retrieved publications were exported to *Mendeley Desktop*, the references underwent a duplication process and the duplicates were excluded, as were the publications without titles. After this exclusion procedure, the total number of publications for analysis was 41.

Stage (3) covers session 4 – discussion of results, as it is defined as the processing of the results obtained; their interpretation connects the results obtained with the theoretical scope, and allows one to draw conclusions that lead to the advancement of the research (Ramos; Salvi, 2009). Based on these observations, it becomes possible to build concepts referenced by the consensus of the research community on the subject.

RESULT ANALYSIS AND DISCUSSION

The purpose of this section is to promote further approximation between studies on the Organization and Representation of Information in Museums. It is important to emphasize that this work does not intend to seek standards for concepts in the museological context regarding the organization of information, it does not seek unanimity, however, it highlights conceptions regarding the topic.

The scope for constituting the corpus of analysis was established by the texts retrieved from the databases previously mentioned. Only those texts that at some point refer to aspects related to discussions on the topic of this work were definitively included in the analysis presented below, which totaled 41 works.

For the purpose of this work, the first proposal was to observe how the authors portray OI and RI in dialogues with museum collections. The analyses revealed that there were 41 works in total, as shown in **Table 1**.

Table 1 – Authors and retrieved Annals and databases

Database and Annals	Authors of retrieved works
BRAPCI	LEMOS, KARPINSKI (2018); BRITTO, LARA (2017); MAIMONE (2018)
BDTD	SILVA (2011); SAMPAIO (2011); BARBANTI (2015); HIGASHI (2018); MAIMONE (2013); PADILHA (2018); YASSUDA (2009)
BENANCIB	PIQUET, COUTO, PIRES (2015); MORAES (2015); PADILHA, CAFÉ (2016); BALLESTÉ, ALMEIDA (2014); MURGUIA, GRIGOLETO (2013) ROCHA, MOURA (2014); PADILHA, CAFÉ, (2017)
ISKO BR	MARTINS, AZEVEDO NETTO (2012); MAIMONE, TÁLAMO (2013); SOUZA, (2015); NININ, SIMIONATO (2017); SILVA (2017); LIMA, COSTA, GUIMARÃES (2017); LIMA, VITORIANO, BARBANTI (2017) GUIMARÃES, SANTOS, SALES, MATOS (2015) SALES (2015)
LISTA	MARTY (2007) DUARTE, BELARDE-LEWIS (2015) RIBES, BOWKER (2009); SAMPAIO (2012)
WoS	MARTY (2007) BASSIER, VINCKE, HERNANDEZ (2018) CHEN, HUANG, BART JR (2006) MAIMONE, TALAMO, (2009); ALWI (2012) BOGOMAZOVA, MALEVANOV (2000) KAUR (2018) KOZUN, YALOVITSYNA, VOLOKHOVA (2018)
SCIELO BR	TEIXEIRA (2014); SANTOS NETTO, *et. al.* (2013); MAIMONE (2017)

Source: Prepared by the author (2020).

To classify the data collected, Bardin (2003) suggests the categorization process, which consists of grouping elements that converge in their characteristics into classes. The categories defined were: 1) Those in which OI and RI interact; 2) Those in which Museums, or museum collections interact; 3) Interactions between OI and RI in a museological context. The first category was defined with works that focus on processes in which OI and IR interact, applying titles, abstracts and keywords to the selection of this research. The second category was defined for the publications with terms that could highlight museums, or even museum collection interactions. Finally, the last group was defined based on work in which there were possible interactions between OI and RI in a museological context.

The table below shows the breakdown according to the categories previously presented.

Table 2 – Number of works with specified category.

Category	Quantity
OI AND RI INTERACT	16
MUSEUMS, COLLECTIONS AND MUSEOLOGY INTERACT	14
INTERACTIONS BETWEEN OI AND RI IN MUSEOLOGICAL CONTEXTS	11

Source: Prepared by the author (2020).

Since this is the object of this paper, the works that discuss this topic are shown in the table below following their title and corresponding authors.

Table 3 – Works that discuss OI and IR in the museological context

Title	Authors
Coleção Paranaguá: documentação museológica como acesso ao conhecimento	ROCHA, L. M. G. M.; MOURA, P. (2017)
Curadoria e ação interdisciplinar em museus: a dimensão comunicacional e informacional de exposições	MORAES, J. N. L. (2011)
Museu Bauru e informação: trajetória histórica e musealização sob o foco da documentação museológica.	LIMA, D. F. C.; NOVAES, R. S. (2013)
O documento e seu valor patrimonial. Os processos de tombamento do Museu Histórico e Pedagógico "Prudente de Moraes"	GRIGOLETO, M. C.; MURGUIA, E. I. (2013)
CI e Museologia: Análise das comunicações orais do ENANCIB sobre RI	LEMOS, L. H.; KARPINSKI, C. (2018)
A representação do objeto museológico na época de sua reprodutibilidade digital.	PADILHA, R. C. (2018)
Representação da informação e preservação da memória: Mapeamento conceitual do patrimônio imaterial brasileiro	MARTINS, G. K.; AZEVEDO NETTO, C. X. (2012)
Organização da informação em acervo de museu: a fotografia histórica	PADILHA, R. C.; CAFÉ, L. M. A. (2017)
Reflexões sobre museologia: documentação em museus ou museológicas?	CARVALHO, L. C.; SCHEINER, T. (2014)
Vozes do silêncio: memória, representações e identidades no Museu do Ceará.	SAMPAIO, D. A. (2012)

Source: Prepared by the author (2020)

After identifying the texts that focus more specifically on the interaction of the Organization and the representation of information in museums, it was possible to infer which subtopics are being most discussed in these texts, given that some papers manage to explore two topics or more. As shown in the table below:

Table 4 – Most evident subtopics in the papers.

Subtopic	Quantity
Organization of Information	3
Representation of Information	2
Museological Documentation	3
Cultural Heritage	2
Exhibitions	1

Source: Prepared by the author (2020)

According to the categories defined above, it was observed that there are papers that establish interactions between OI and IR in a museological context. Throughout this research, it was also possible to identify the possibility of further exploring the topic, because even if there are papers addressing this topic, according to Lemos and Karpinski (2018), it is essential to conduct future research to understand how RI is present in museums, and how IS helps Museology in OI. In other words, interdisciplinary dialogue is fundamental; when cooperating with each other with a horizontal dialogue, there is improvement in common aspects. However, some papers, even if they address the topic, do not explore it as much, or even do not name the representation of information as an integral part of information processing, they only mention it in other contexts.

It is observed that the works analyzed, such as those that show interaction between OI and RI in museums, address the observations made regarding RI in an elementary manner, or treat the RI process as if it were the museological documentation itself, which is how it is mainly treated in museums.

Works related to exhibitions deal specifically with the retrieval of information, and the processes developed to present this information, that is, communication with the public, considering what the object will communicate, and how the public will receive it. With regard to heritage, the line of research considers, according to Higashi (2018), cultural heritage as various elements categorized into material and immaterial, that is, everything that is related to people's way of doing things, techniques and skills, and the products of human creation, such as artifacts, objects and buildings. One of the purposes of heritage preservation is to keep memory alive, where the representation of information becomes fundamental to ensure access.

Works having museological documentation as their main topic are mainly focused on its importance for museum work, and for the development of any activity within the museum. In this context, it also highlights that one of the main objectives of museum documentation is the organization and representation of knowledge and information from the museum collection in order to process and facilitate their recovery by the public, specialized researchers and museum employees (Padilha, 2018). According to data from IBRAM (2011), only 21.3% of

museums had a record of cultural heritage. This premise reveals that more than 75% of museums do not know the exact number of objects they hold in their institutions; this situation would be different if museological documentation had been established in museums.

Dealing with a possible dialogue on the Organization and Representation of Information in Museums, shows concern for exploring a topic that is not very significant in event annals and databases, if related to other more recurring themes.

FINAL CONSIDERATIONS

According to the proposal of this work, the publications highlighted interactions between OI and RI focused on museum collections. Seven were analyzed, including event annals and databases: The annals of ENANCIB and ISKO-BR, LISTA, WoS, Scielo BR, BRAPCI, and BDTD were selected because they include a considerable part of the research conducted in this area and are relevant to the topic of this paper. Based on the titles, abstracts and keywords, it was possible to identify which publications addressed OI in museums. As a result, 41 papers were found to consider or mention forms of RI, part of the museological process.

Of the 41 works, 11 discuss OI and RI in the museological context. Although this can be considered a relevant number, compared to the search result, the expansion of research in IS and Museology can add experiences to understand and improve RI instruments in museums, mainly highlighting the ways in which information is organized in museums.

It was possible to observe discussions that suggest an analysis of the construction and relationship of the concepts of memory, the representation of information and cultural identity, and the interdisciplinarity between Museology and Information Science, based on their epistemological assumptions and paradigms.

The dialogue between OK and RI for access to information in museums facilitates both access to information for the public who access these places, and for professionals who have direct contact with museum documentation. And as a result, it corroborates the development of this activity, which is one of the ways in which information is disseminated. So that more and more documentary collections are organized, identified/represented, disseminated and accessed.

It should be noted that access to information is one of the ways of democratizing knowledge, as it makes research possible, showing the potential of museums as spaces that promote the development and transformation of heritage into cultural heritage, providing more concise and accurate information, saving time and communicating appropriately to their public.

It is also important to highlight that the exploration of RI as part of the process of museological documentation processing is still an elementary discussion in the publications researched that address museological documentation, therefore, it highlights the possibility of more effective exploration of RI instruments in museums. There is a need to further explore the

fields of Museology and IS in order to encourage research that highlights this topic, resulting in improvements both for museological processes and for researcher access to content. Thus, it contributes to the development of both fields, and mainly of social and cultural aspects.

The results of this research show that the dialogue between Museology and Information Science is contributory to both, a beneficial scenario for the processing of information, and thus facilitates access and communication in these fields, in order to enable greater production of knowledge in different contexts.

REFERENCES

ARAÚJO, C. A. Fundamentos da Ciência da Informação: correntes teóricas e o conceito de informação. **Perspectivas em Gestão e Conhecimento**, João Pessoa, v. 4, n. 1, p. 57-79, jan./jun. 2014.

BARDIN, L. **Análise de conteúdo**. Lisboa: Edições 70, 2003.

BARDIN, L. **Análise de conteúdo**. Lisboa: Edições 70, 2006. 225 p.

BATES, M. Information: the last variable. *In*: Proceedings of the 50th ASIS Annual Meeting, 50., 1987, Boston. Massachusetts. **Anais** […]. Boston. Massachusetts: American Society for Information Science, 1987, p. 6-10.

BRÄSCHER, M.; CAFÉ, L. Organização da informação ou organização do conhecimento? *In*: ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 9., 2008, São Paulo. **Anais** [...]. São Paulo: ANCIB, 2008. Disponible en: http://enancib.ibict.br/index.php/enancib/ixenancib/paper/viewFile/3016/2142. Acceso en: 20 jan. 2020.

BURKE, P. **Uma história social do conhecimento**: de Gutemberg a Diderot. Rio de Janeiro: Zahar, 2003. 241 p.

CAMPOS, M. L. A. Modelização de domínios de conhecimento: uma investigação de princípios fundamentais. **Ciência da Informação**, Brasília, v. 33, n. 1, p. 22-32, jan./abr. 2004.

CAPURRO, R.; HJORLAND, B. The concept of information. **Annual Review of Information Science & Tecnology**, v. 37, n. 1, p. 343-411, 2003.

CERAVOLO, S. M.; TÁLAMO, M. F. G. M. Tratamento e organização de informações documentárias em museus. **Revista do Museu de Arqueologia e Etnologia**, [*s. l.*], n. 10, p. 241-253, 2000.

CERVO, A. L.; BERVIAN, P. A.; SILVA, R. **Metodologia científica**. 6. ed. São Paulo: Pearson Universidades, 2006. 162 p.

FERREZ, H. D.; Documentação museológica: teoria para uma boa prática. *In*: **Cadernos de Ensaio**. Estudos de Museologia. n. 2, Rio de Janeiro: Minc/IPHAN, p. 65-74, 1994.

HIGASHI, A. K. **Acervo de fotógrafos como patrimônio cultural**: organização de documentos de Luiz Germano Gieseler no Museu Antropológico Diretor Pestana. 2018. Dissertação – Programa de Pós-graduação em patrimônio cultural. Universidade Federal de Santa Maria. Santa Maria, 2018.

INSTITUTO BRASILEIRO DE MUSEUS. **Museus em números**. Brasília: Instituto Brasileiro de Museus, 2011. p. 80

LEMOS, L. H.; KARPINSKI, C. CI e museologia: análise das comunicações orais do ENANCIB sobre RI *In*: ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 19., 2018, Paraná. **Anais** [...]. Londrina: ENANCIB, 2018. p. 5583-5597. Disponible en: http://hdl.handle.net/20.500.11959/brapci/102440. Acceso en: 20 out. 2020.

LEMOS, L. H.; **A representação da Informação em Ecomuseus**. Orientador: Cezar Karpinski. 2018. 99 f. Dissertação (Mestrado em Ciência da Informação) – Departamento de Ciência da Informação, Universidade Federal de Santa Catarina, Florianópolis, 2018.

LIMA, J. L. O.; ALVARES, L. Organização e representação da informação e do conhecimento. *In*: ALVARES, L. (org.). **Organização da informação e do conhecimento**: conceitos, subsídios interdisciplinares e aplicações. São Paulo: B4 Editores, 2012. p. 21-34.

MACEDO, S. M. S.; ORTEGA, C. D. Unidades de informação: termos e características para uma diversidade de ambientes de informação. **Em Questão**, Porto Alegre, v. 25, n. 2, p. 326-347, 2019. DOI: 10.19132/1808-5245252.326-347.

MARTINS, R. A. O sistema de arquivos da universidade e a memória científica. *In*: Anais do I Seminário Nacional de Arquivos Universitários, 1., 1992, São Paulo. **Anais** [...] Campinas: UNICAMP, 1992. p. 27-48.

MENSCH, P. Museology and the object as data carrier. *In*: MENSCH, P. **Object, museum, Museology, an eternal triangle**. Leiden: Reinwardt Academy. Reinwardt Cahiers, 1992.

MORAES, A. F. de; ARCELLO, E. N. O conhecimento e sua representação. **Informação & Sociedade***:* estudos, [*s. l.*], v. 10, n. 2, 2000. Disponible en: https://periodicos.ufpb.br/ojs/index.php/ies/article/view/328. Acceso en: 14 jan. 2021

PADILHA, R. C. **A representação do objeto museológico na época de sua reprodutibilidade digital**. Orientador: Lígia Maria Arruda Café. 2018. Tese (Doutorado em Ciência da Informação) – Universidade Federal de Santa Catarina, Centro de Ciências da Educação, Programa de Pós-Graduação em Ciência da Informação, Florianópolis, 2018. 256 p.

PADILHA, R. C.; CAFÉ, L.; SILVA, E. L. O papel das instituições museológicas na sociedade da informação/conhecimento. **Perspectivas em Ciência da Informação**, v. 19, n. 2, p. 68-82, abr./jun. 2014

PINHO, F. A.; NASCIMENTO, B. L. C.; MELO, W. L. As dimensões ôntica, epistêmia e documental na representação da informação e do conhecimento. **Revista ACB**, [*s. l.*], v. 20, n. 1, p. 112–123, 2015. Disponible en: https://revista.acbsc.org.br/racb/article/view/995. Acceso en: 15 jan. 2021.

RAMOS, R. C. S. S.; SALVI, R. F. Analise de conteúdo e analise do discurso em educação matemática – um olhar sobre a produção em periódicos qualis A1 e A2. *In*: SEMINÁRIO INTERNACIONAL DE PESQUISA EM EDUCAÇÃO, 4., 2009, **Anais** [...] Brasília, Sociedade Brasileira de Educação Matemática, 2009, p. 1-20.

ROWLEY, J. **A biblioteca eletrônica**. 2. ed. Brasília: Briquet de Lemos, 2002. 399 p. ISBN: 85-85637-20-X.

ROWLEY, J. **A biblioteca eletrônica**. São Paulo: Briquet de Lemos, 2002.

SOUZA, E. G. As teorias documentarias e a Organização da Informação: a centralidade das categorias obra e usuário. *In*: PINHO, F. A.; GUIMARÃES, J. A. C. (org.). **Memória, tecnologia e cultura na organização do conhecimento**. Recife: EdUFPE, 2017. p. 26-33.

SHERA, J. Epistemologia social, semântica geral e biblioteconomia. **Ciência da Informação**, [*s. l.*], v. 6, n. 1, p. 9-12, 1977.

SHERA, J. H. The sociological relationships of information science. **Journal of the American Society for Information Science**, [*s. l.*], v. 22, n. 2, p. 76-80, mar. 1971.

SMIRAGLIA, R. P. Musical Works as information retrieval entities: epistemological perspectives. **Proceedings of the Second International Conference on Music Information Retrieval**. Indiana: Bloomington, 2001.

SMIT, J. W. A informação na Ciência da Informação. **In CID**: revista de Ciência da Informação e Documentação, v. 3, n. 2, p. 84-101, 2012.

WERSIG, G.; NEVELING, U. The phenomena of interest to information science. **The information scientist**, v. 9, n. 4, p. 127-140, dec. 1975.

Interdisciplinary relations between Information Science and Law: a study based on publications on the IBICT journal

Iago Mendes Macedo
Law, Universidade Federal da Bahia (UFBA), Salvador, Bahia, Brasil.
Undergraduate research fellow, Institute of Information Science (ICI), Salvador, Bahia, Brasil.
http://lattes.cnpq.br/9903089324011061

Gillian Leandro de Queiroga Lima
Archival Science, Universidade Federal da Bahia (UFBA), Salvador, Bahia, Brasil.
Associate Professor, Institute of Information Science (ICI/UFBA), Salvador, Bahia, Brasil.
http://lattes.cnpq.br/5842800916317000

Submitted on: 03/29/2023. Approved on: 11/21/2023. Published on: 06/21/2024.

ABSTRACT

The present work aims to analyze themes, addressed in the area of Information Science, which are correlated with the area of Law. It is characterized, in terms of its approach, in qualitative and quantitative research. As for its objectives, it is characterized as exploratory field research, using an exploratory-descriptive procedure. To read and characterize the data, Social Network Analysis (ARS) is used. The results indicate that the works in the area of Information Science that maintain a thematic relationship with the area of Law, in the sample analyzed in this article, have more frequently addressed aspects related to “Copyright”, “Ethics”, “Internet”, “Intellectual Property” and “Open Access”. Finally, there is evidence of the potential of Information Science, as a field of knowledge, in maintaining interdisciplinary relationships with Law.

Keywords: law; information science; interdisciplinarity; knowledge areas; semantic networks.

INTRODUCTION

The aim of this paper is to analyze topics covered in Information Science that correlate with Law, in order to recognize the interdisciplinary relationships between these two areas of knowledge. It is based on a perspective of interdisciplinarity as an ongoing movement, representing a model of knowledge that is antagonistic to the process of fragmentation of knowledge, characteristic of the analytical proposal of contemporary science.

To this end, the keywords of works published in journal Information Science, of the Brazilian Institute of Information in Science and Technology (Ibict) were analyzed. These are considered to represent reference points from which the global meanings and central themes of a text are synthesized, and, from a methodological perspective, they offer the possibility of building networks as a way of presenting and representing results.

This research proposal emerged from the reading of article Mutations in Information Science and reflections in interdisciplinary mandalas (Pinheiro, 2018), which presents an epistemological and interdisciplinary perspective on the evolution and transformations of the scientific configuration of Information Science, in which the first epistemic configuration of the area, published in 1995, was entitled Diagram of the Interdisciplinarity of Information Science (Pinheiro; Lourenço, 1995); the second, Basic Core of disciplines, trends and interdisciplinary traits, in 2007 (Pinheiro, 2007); and the third Information Science, subareas and interdisciplinary areas (Pinheiro, 2018), in 2018.

A methodological approach to qualitative and quantitative research is adopted, characterized, in terms of its objectives, as an exploratory field research, using an exploratory-descriptive procedure. Descriptive statistics and social network analysis (SNA) are used as analysis techniques.

This paper, in addition to the introduction, is divided into four sections. In the second session, the relationships between Information Science and Law are addressed, in addition to the concept of interdisciplinarity. In the third session, the methodological procedures adopted are presented. In the fourth session, the research results are presented. At last, the final considerations and references that supported this study are presented.

The classification of Information Science and Law according to the CNPq Knowledge Area Table (KAT)

In the present study, the use of terms “Information Science” and “Law”, as areas of knowledge, is based on the classification proposed by the National Council for Scientific and Technological Development (CNPq), and adopted by the Coordination for the Improvement of Higher Education Personnel (CAPES), by means of the Knowledge Area Table (KAT),

as a political device of governmentality and from which government agencies organize and classify, "[...] em níveis hierárquicos, as possíveis *áreas* de conhecimento no país para fins de gestão e avaliação" (Sales; Murguia, 2015, p. 31-32)[1].

There are four classification levels presented in the KAT, the 1st level, called the Large Area, encompasses eight areas of knowledge due to the affinity of its objects, cognitive methods and instrumental resources; the 2nd level, called Area, brings together a set of 76 areas of knowledge, according to the nature of the object of research, "[...] com finalidades de ensino, pesquisa e aplicações práticas" (Sales; Murguia, 2015, p. 32)[2]. The 3rd level, called Subarea, which comprises 340 subareas and refers to a "[...] segmentação da área do conhecimento estabelecida em função do objeto de estudo e de procedimentos metodológicos [...]" (Sales; Murguia, 2015, p. 32)[3]; and, finally, the 4th level, called Specialty, which can be classified into different levels and is responsible for the "[...] caracterização temática da atividade de pesquisa e ensino" (Ministério da Educação, 2020; Sales; Murguia, 2015, p. 32)[4].

Despite there being no consensus within the scientific community as to whether the divisions presented in the KAT reflect the reality of the areas of knowledge from the perspective of tradition, which, for some, causes political interference in the scientific fields[5], this is considered, although not perfect, a relevant management tool, the development of which represents a major step forward in terms of agency and the promotion of national scientific knowledge.

Therefore, it is from the perspective of the CNPq and CAPES that, for the purposes of this study, Information Science and Law are considered areas of knowledge, linked to the broad area of Applied Social Sciences, and constituted by a set of inter-related and systematized knowledge, which can maintain some type of interdisciplinary relationship among themselves by means of the sharing of objects of research, in the sense of a convergence of perspectives (Pombo, 2008, p. 14).

A meaning for interdisciplinarity

With regard to establishing the meaning of the concept of "interdisciplinarity", the definition of which is frequently addressed in the context of epistemological discussions, it appears that there is no single proposal in the literature, or no higher standard that favors the adoption of one to the detriment of others (Japiassu, 1976; Pombo, 2008).

In fact, the main point of convergence between those who approach theme interdisciplinarity lies precisely within the wide variety of definitions proposed by various

1 Translation: "[...] at hierarchical levels, the possible areas of knowledge in the country for management and evaluation purposes" (Sales; Murguia, 2015, p. 31-32, editorial translation).
2 Translation: "[...] for the purposes of teaching, research and practical applications" (Sales; Murguia, 2015, p. 32, editorial translation).
3 Translation: "[...] segmentation of the area of knowledge established according to the object of study and methodological procedures [...]" (Sales; Murguia, 2015, p. 32, editorial translation).
4 Translation: "[...] thematic characterization of the research and teaching activity" (Ministério da Educação, 2020; Sales; Murguia, 2015, p. 32, editorial translation).
5 For further details on this discussion: Sales and Murguia, 2015, p. 32-33.

scholars, in the frequent instability of the contexts in which the term is used and in the insufficiency of concepts necessary to express what is referred to as “interdisciplinarity” (Japiassu, 1976, p. 71-72; Pombo, 2008, p. 10).

Below is a synthesis of the definition proposals expressed by Japiassu (1976) and Pombo (2008), although, as already mentioned, they are not the only ones available in the literature. The choice is justified by the fact that it is considered that the perspectives presented in the aforementioned texts are sufficient to achieve the purposes proposed by this study.

Japiassu (1976)[6] starts, first, from an attempt to define radical “disciplinarity”, which makes up term “interdisciplinarity”. According to him, “discipline” has the same meaning as “science”. “Disciplinarity”, therefore, corresponds to a “[…] conjunto sistemático e organizado de conhecimentos que apresentam características próprias nos planos do ensino, da formação, dos métodos e das matérias”[7].

Japiassu (1976, p. 73)[8] proposes a departure from terms “interdisciplinary” and “pluridisciplinary”, which, according to him, “[…] realizam apenas um agrupamento, intencional ou não, [de] certos ‘módulos disciplinares’, sem relação entre as disciplinas (o primeiro) ou com algumas relações (o segundo)”, with term “interdisciplinarity”, the main particularity of which lies in its epistemological horizon, that “can be nothing but the unitary field of knowledge”, in order

> [...] a religar as fronteiras que haviam sido estabelecidas anteriormente entre as disciplinas com o objetivo preciso de assegurar a cada uma seu caráter propriamente positivo, segundo modos particulares e com resultados específicos (Japiassu, 1976, p. 75)[9].

In short, from this perspective, the distinctive principle is always the intensity of exchanges between experts and the degree of real interaction between disciplines within the scope of specific research projects.

Pombo (2008, p. 13)[10], on the other hand, although his perspective converges with the thought of Japiassu (1976), considers that the attempt to define the common radical, that is, the word “discipline”, makes the work even more difficult and complex, given the variety of contexts in which such word is used. It can be used to refer to a branch of knowledge, a curricular component or a “[...] conjunto de normas ou leis que regulam uma determinada atividade ou o comportamento de um determinado grupo [...]”.

6 Translation: “[…] systematic and organized set of knowledge that presents its own characteristics in terms of teaching, training, methods and subjects” (Japiassu, 1976, editorial translation).

7 Translation: “[...] “ ‘disciplinarity’ means the specialized scientific exploration of a certain homogeneous domain of study [...]” (Japiassu, 1976, p. 72).

8 Translation: “[…] they only group, intentionally or not, certain ‘disciplinary modules’, of no relationship between the disciplines (the first) or some relationship (the second)” (Japiassu,1976, p. 73, editorial translation).

9 Translation: “[...] to reconnect the boundaries that had previously been established between disciplines with the precise aim of ensuring each one has its properly positive character, in particular ways and with specific results” (Japiassu, 1976, p. 75, editorial translation).

10 Translation: “[...] set of rules or laws that regulate a certain activity or the behavior of a certain group [...]”. (Pombo, 2008, p. 13, editorial translation).

Pombo (2008, p. 13)[11] then proposes a definition based on the etymology of the prefixes that precede the word “discipline”. This way, “pluri” or “multi” disciplinarity presupposes “[...] o pôr em conjunto, o estabelecer algum tipo de coordenação, numa perspectiva de mero paralelismo de pontos de vista”.

In turn, “interdisciplinarity” is achieved as one goes beyond the dimension of pure parallelism and mere coordination, “[...] e se avança no sentido de uma combinação, de uma convergência, de uma complementaridade [...]”[12] of perspectives. Therefore, this paper adopts an interdisciplinarity perspective as an ongoing movement, which seeks to establish a model of epistemological configuration of knowledge that allows the development of a point of view, regarding a given object, based on technical elements and conceptual aspects of different specialties, thus seeking to build a unitary field of knowledge and expand perspectives.

This proposal, therefore, presents itself as antagonistic to the model of modern analytical science, where knowledge is increasingly fragmented, in which relationships between different disciplines, when established, take place only in the sense of coordination.

Epistemological configurations between Information Science and Law

According to Pinheiro (2018), the first representation of the epistemological configuration of Information Science was outlined within the scope of the Postgraduate Program in Information Science (PPGCI/IBICT-UFRJ), in 1995 and, subsequently, improved and published, under title *Diagram of the Interdisciplinarity of Information Science* (Pinheiro, 1995).

In this epistemological configuration proposed by Pinheiro (2018), the existence of relationships between Information Science and Law was not found. Only after a second study on the topic, conducted years later, the results of which gave rise to the second epistemological configuration, published in 2007, was this relationship confirmed.

The second proposal for an epistemological configuration, published under title *Basic core of disciplines, trends and interdisciplinary traits* (Pinheiro, 2007), was the result of an analysis of the themes of 481 review articles published in *Annual Review for Information Science and Technology* between 1996 and 2004. In it, Law appears, along with Administration, Political Science, Economics, Statistics, Education and Ethics, correlated to Information Science by means of the following topics: “Information Policy” and “Training and Professional Aspects”, both, at the time, considered by Pinheiro (2018) disciplines undergoing consolidation.

One of the findings also presented was that the disciplinary core of Information Science at that time was predominantly concentrated in Information Systems, with 43 published articles in total, and in Information Technology, the second largest in absolute numbers, which amounted to 28 articles published.

11 Translation: “[...] bringing together, establishing some kind of coordination, from a perspective of mere parallelism of points of view” (Pombo, 2008, p. 13, editorial translation).

12 Translation: “[...] and moves towards a combination, a convergence, a complementarity [...]” (Pombo, 2008, p. 13, editorial translation).

Regarding the content of disciplines Information Policies and Professional Aspects, Pinheiro (2007, p. 85-86)[13] notes that, in the first "[...] tanto os programas e projetos nacionais quanto internacionais, aspectos jurídicos como copyright, questões de democracia e privacidade da informação"; appeared; while, in the second, "[…] estão incluídas questões profissionais, englobando ética, além de educação e treinamentos"[14].

Silva and Pinheiro (2011, p. 1631)[15] note that information policies are the result of sociocultural phenomena, neither spontaneous nor free, the definition of which, within the scope of Information Science, varies according to social and historical phenomena of power, and propose a definition of the concept as the "[...] conjunto de ações e/ou regras para obtenção e/ou direção/ produção/ divulgação e fluxo de informação em um determinado contexto".

From the perspective of public information policies, a subject that derives from debates on information policies, Jardim (2008, p. 7)[16] considers that this concept is related to the

> [...] conjunto de premissas, decisões e ações, – produzidas pelo Estado e inseridas nas agendas governamentais em nome do interesse social – que contemplam os diversos aspectos [...] relativos à produção, uso e preservação da informação arquivística de natureza pública e privada.

According to Jardim (2008, p. 4)[17], the topic is fundamentally addressed in Information Science due to its contribution "sobre a informação enquanto fenômeno social", although it relies on collaborations from areas such as Archival Science, Administration, Law, History, Sociology, IT, Political Science, among others.

Professional aspects, in turn, are often related to discussions about information professionals. The debates address issues such as the training, paradigms, profile and skills of this professional, as well as changes in the market.

Almeida Júnior (2017, p. 421)[18], in this sense, presents a perspective on the composition of the set called "profissionais da Informação", especially to librarians, archivists and museologists, a topic that generates controversy among researchers. In this regard, the author proposes a comprehensive understanding of information professionals as all those "que se interessam e trabalham com a informação, independentemente de sua formação básica"[19] and, after analyzing the profile of higher education courses in Library Science, Archival Science and Museology, he considers that information professionals have as ultimate goal the appropriation of information.

---

13 Translation: "[...] both national and international programs and projects, legal aspects such as copyright, issues of democracy and information privacy [...]" (Pinheiro, 2007, p. 85-86, editorial translation).

14 Translation: "[...] professional issues are included, encompassing ethics, as well as education and training[...] " (Pinheiro, 2007, p. 85-86, editorial translation).

15 Translation: "[...] set of actions and/or rules for obtaining and/or directing/ producing/ disseminating and the flow of information in a given context" (Silva e Pinheiro, 2011, p. 1631, editorial translation).

16 Translation: [...] set of premises, decisions and actions,–produced by the State and inserted into government agendas in the name of social interest–that contemplate the various aspects [...] relating to the production, use and preservation of archival information of a public and private nature. (Jardim, 2008, p. 7, editorial translation).

17 Translation: "about information as a social phenomenon" (Jardim, 2008, p. 4, editorial translation).

18 Translation: "Information professionals" (Almeida Júnior, 2017, p. 421, editorial translation).

19 Translation: "who are interested in and work with information, regardless of their basic training" (Almeida Júnior, 2017, p. 421, editorial translation).

From this perspective, Rubi and collaborators (2006, p. 82)[20] consider that in the context of the so-called Information Society, in which information becomes an indispensable input for any activity, as well as in view of the large amount of information made available, the role of this professional becomes indispensable, as such professional is a "[...] profissional capacitado a filtrar informação, organizar, analisar e disseminar [...]".

The most recent epistemological configuration, which sought to represent the epistemological configuration of Information Science, was published in 2018. The main source of the study was a research developed by Pinheiro (2018), published in Ibict Information Science journal, from which it was possible to have a view of the epistemic panorama of the area, as well as the research developed by the author for the Brazilian Science Thesaurus of Information, which was based on a classification of the area, with a theoretical approach, the result of almost 40 years of studies.

In this third epistemological configuration, called Information Science, subareas and interdisciplinary areas, Information Science appears related to Law, together with other areas, such as Economics, Communication, Library Science, Sociology, Computer Science, Political Science, Philosophy of Science and Philosophy, through open access to scientific information; Information policies; Open Science and research data, and Information ethics.

Pinheiro (2018) notes the emergence of new subareas in the field of Information Science, such as: Open access to scientific information and Open Science and research data, which "[...] são decorrentes das mudanças de paradigmas na Ciência, sobretudo na relação com a sociedade, e dos avanços e disponibilidade das tecnologias da informação e comunicação [...]" (Pinheiro, 2018, p. 127)[21].

METHODS

In terms of its approach, this research is a qualitative and quantitative research. Regarding its objectives, it is an exploratory field research, using an exploratory-descriptive procedure to collect and analyze information.

Field research, according to Marconi and Lakatos (2003, p. 186)[22], corresponds to that with the objective of obtaining information "[...] acerca de um problema para o qual se procura [...] descobrir novos fenômenos ou as relações entre eles". The aim is, therefore, to analyze these facts and phenomena, "[...] tal como ocorrem espontaneamente, na coleta de dados a eles referentes e no registro de variáveis que se presume relevantes [...]"[23].

This way, exploratory-descriptive studies combine the objectives of exploratory research, which seeks "[...] proporcionar maior familiaridade com o problema, com vistas a

20 Translation: "[...] professional trained to filter information, organize, analyze and disseminate [...]".(Rubi e colaboradores, 2006, p. 82, editorial translation).

21 Translation: "[...] result from changes in paradigms in Science, especially in the relationship with society, and the advances and availability of information and communication technologies [...]" (Pinheiro, 2018, p. 127, p. 82, editorial translation).

22 Translation: "[...] about a problem for which one seeks [...] to discover new phenomena or the relationships between them". (Marconi e Lakatos, 2003, p. 186, editorial translation).

23 Translation: "[...] as they occur spontaneously, in the collection of data relating to them and in the recording of variables that are presumed relevant [...]". (Marconi e Lakatos, 2003, p. 186, editorial translation).

torná-lo mais explícito ou a constituir hipóteses" (Gerhardt; Silveira, 2009, p. 37)[24], with those referring to descriptive research, which "[...] pretende descrever os fatos e fenômenos de determinada realidade [...]" (Triviños, 1987 *apud* Gerhardt; Silveira, 2009, p. 35)[25].

The adoption of such methodological procedures is mainly due to their ability to accommodate "[...] tanto descrições quantitativas e/ou qualitativas quanto a acumulação de informações detalhadas como as obtidas por intermédio da observação participante", as well as the possibility of adopting flexible sampling procedures of an eminently representative and systematic nature (Marconi; Lakatos, 2003, p. 188)[26].

Therefore, the research universe is defined as scientific articles in Information Science the themes of which are related to Law. The presence of the term "law" is considered a relationship criterion, whether in the titles, abstracts or in the keywords of the corresponding works. The articles published in journal Information Science of the Brazilian Institute of Information in Science and Technology (Ibict) were adopted as an analysis sample, in which works published from 1993 to 2020 were collected.

Data was collected from October 13th to 20th, 2021. The term "law" was used as a search criterion, by means of the search tool available on the journal's website. Fifty-five articles were identified, from which the following information was collected: title, author(s), keywords, year of publication and abstract, being that the abstracts and keywords of four articles were not found, thus, these were not considered in the result analysis.

For this research, we chose to consider the keywords of the chosen articles as an analysis criterion, considering that these represent, in addition to the possibility of building networks, an important point of reference for the exposure of themes, and key relevant ideas within a given study, as, from these, the global meanings and central themes of a text are synthesized.

In order to present the data collected in the field research, we chose to build a semantic network of keywords, so as to represent the relationships or inter-relationships existing between the keywords and the concepts found. To this end, software *Gephi*was used, which processes the information through a spreadsheet with text format data.

Therefore, to create the semantic network, in order to correct variations caused by linguistic factors, a manual data formatting procedure was first used, using a controlled vocabulary to standardize keywords through general rules.

Thus, the graphic accents were removed. Words presented in a language other than Portuguese were kept as found, as were those presented in the plural. The letters were placed in lowercase format and the words of proper nouns composed of more than one term were joined, forming a single word – "information science", for example, is represented in the chart as "informationscience".

---

24 Translation: "[...] provide greater familiarity with the problem, with a view to making it more explicit or constituting hypotheses" (Gerhardt; Silveira, 2009, p. 37, editorial translation).

25 Translation: "[...] intends to describe the facts and phenomena of a given reality [...]" (Triviños, 1987 *apud* Gerhardt; Silveira, 2009, p. 35, editorial translation).

26 Translation: "[...] both quantitative and/or qualitative descriptions and the accumulation of detailed information such as that obtained by means of participant observation." (Marconi; Lakatos, 2003, p. 188, editorial translation).

Semantic networks refer to a form of graphical representation composed of a set of nodes or vertices connected through edges or arcs. They are generally used to represent the relationships between a set of elements through a network of concepts. Thus, each node or vertex represents an object and the edges or arcs represent the relationships between them.

A social network analysis (SNA) approach was adopted as a theoretical framework for the interpretation and characterization of the results, defined by Wasserman and Faust (1994) and Grácio (2018) as the study that measures, describes and analyzes relational variables of a set of actors in order to represent the structure of a group.

In this approach, certain definitions and indices are used to characterize and express the meanings of networks. The indices used to analyze the results were: average degree, diameter, agglomeration coefficient, average minimum path and centrality, from which it was possible to infer considerations on the importance of concepts in networks, as well as the connections between them.

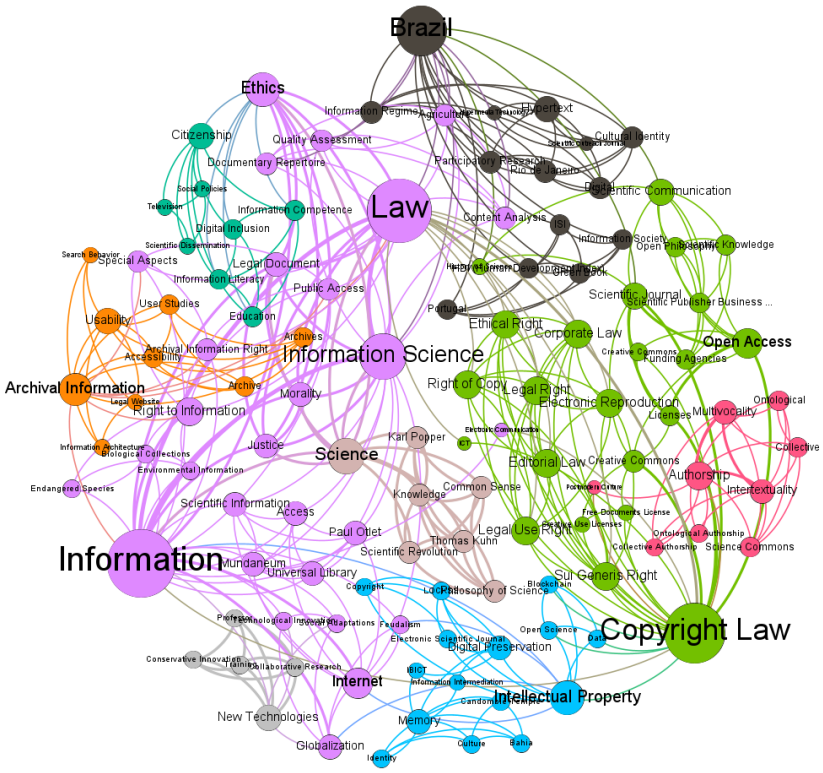
RESULT ANALYSIS AND DISCUSSION

Figure 1 shows the chart of the network of titles composed of the keywords of the works selected through field research. In order to build the network chart, the tool establishes links between words in the same article, linking them together.

If the words are found in both articles, the link between them is established. The size of the vertices is defined by the number of times the word it represents is repeated in the network, that is, by its degree. Therefore, the most frequent words are those whose vertices are larger in relation to the others.

Thus, it is noted that the largest vertices of the network, those that concentrate the highest degree, are: “law”; “information”; “science”; “informationscience”; “copyright”; “Brazil”; “intellectualproperty”; “ethics”; “archivalinformation” and “internet”.

Figure 1 – Semantic network of keywords



Source: Prepared by the authors (2022).

The modularity algorithm (*modularity class*) was used to identify what we call network communities, identified by colors and divided according to the degree of interaction between words.

It was found that the network is composed of nine communities, which were named according to the topics that compose them, resulting in the following titles: Intellectual Property, Identity, Memory, Preservation, Culture and Society (Blue color); Ethical Studies, Information, Law and Information Science (Lilac color); Copyright, Open Access and Scientific Knowledge (Green color); Information Society, Cultural Identity and Information Regime (Black color); Citizenship, Digital Inclusion, Education and Social Policies (Jade green color); Archival Information, Information Architecture, Accessibility and Archival Science (Orange color); Authorship, Intertextuality and Multivocality (Pink color); Collaboration, Training and Technologies (Gray color) and, finally, Scientific Knowledge and Scientific Revolution (Brown color).

The semantic network was built from keywords collected from 51 articles and is composed of 119 vertices and 385 edges. It has a density of 0.055. The density index measures the percentage of existing relationships in the chart, considering its maximum capacity, that is, it is the quotient between the existing relationships and the possible relationships[27] multiplied by 100: [D= ER / PR x 100].

27 The number of possible relationships is obtained by multiplying the total number of nodes by itself minus one: [PR = TNN x (TNN–1)].

The average degree of the network corresponds to 6.471. This can be understood as the arithmetic mean of the number of connections in each node, given that the result is obtained by dividing the number of connections existing in the network by the number of nodes. It has an agglomeration coefficient of 0.884. The agglomeration coefficient represents the tendency for two neighboring nodes of the same node to also be connected to each other. In other words, it measures the probability that two neighboring nodes that are related to a third node are also related to each other.

Furthermore, the network has average minimum path values of 3.435 and eight in diameter. The average shortest path corresponds to the arithmetic mean of the average shortest paths of each of its nodes. The path means the number of nodes that a given node relates to until it reaches another specific node. The minimum or shortest path, therefore, is the minimum number of nodes that an *X* node relates to until reaching a *Y*node. The diameter corresponds to the maximum distance, that is, the maximum number of nodes existing between two nodes. **Table 1** presents the keywords in the network with the highest percentages of centrality. This index corresponds to the percentage of direct connections between a keyword and others, revealing its ability to centralize information, which means that, for certain nodes to connect to others, they must go through the most central one that acts as an information intermediary.

Table 1 – Centrality of the highest degree vertices

Nodes/Vertices (concepts)	Node/vertex centrality (%)
information	0,874473
law	1
copyright	0,693819
brazil	0,423588
informationscience	0,667657
science	0,448322
intellectualproperty	0,282669
ethics	0,43001
openaccess	0,17399
internet	0,339237

Source: Prepared by the authors (2022).

The centrality index allows us to identify the main nodes in the network, which are not necessarily the most frequent–which have the highest degree, but rather those that establish the highest percentages of connections with their neighbors. When calculating the centrality of nodes, the degree is also taken into account, but it is now qualified by the number of connections it establishes with others, revealing its capacity as an information intermediary.

The term “law”, as it was used as a search criterion on the journal page, is that which concentrates the greatest centrality in the network, reaching the maximum centrality coefficient in the network. Likewise, terms such as “science”, “information”, “informationscience” and “brazil” also appear as central as they refer to the editorial line of the analyzed journal.

On the other hand, while analyzing the other terms, it is noted that, in the sample studied, works in Information Science that maintain a thematic relationship with Law more frequently address topics related to “copyright”, “ ethics”, the “internet”, “intellectualproperty” and “openaccess”.

Open access is part of the context of the open science movement, which refers to national and international social movements that propose changes in the forms of circulation, sharing and conditions of production of scientific knowledge, the aim of which is to allow free access to “[...] literatura científica, disponibilizada por periódicos científicos e repositórios digitais [...]” (Bandeira, 2017, p. 30)[28], under the argument that research funded with public resources must be accessible to the society that made its development possible by means of tax payment (Silva; Alcará, 2009).

Albagli (2015) presents a perspective of Open Science as something that is under construction, that is, as a process, mobilizing different interests and points of view, which allows multiple interpretations, and proposes a classification of this movement into two main aspects.

The first aspect refers to the regime of intellectual property rights protection, which is related to debates around the socialization or privatization of knowledge, information and culture, enhanced “[...] pelo desenvolvimento de sistemas eletrônicos e das plataformas digitais” (Albagli, 2015, p. 12)[29].

The second corresponds

> [...] à abrangência do próprio significado da ciência aberta”, que alcança a “[...] interlocução da ciência com outros tipos de saberes [...]”, provocando o “abalo de hierarquias, de fontes estabelecidas de autoridade e reputação”, ao propor a superação da “[...] perspectiva de pensar a ciência a partir da sua produtividade intrínseca”., evidenciando as relações entre “saber e poder (Albagli, 2015, p. 9-10)[30].

This demonstrates a characteristic of Information Science, as area of knowledge, responsible for thinking about the collection, production, organization, dissemination and access to information in the field of science and technology.

Regarding *ethics*, it appears that, related to information, it is responsible for investigating

> [...] se as mudanças e a deflação normativa dos ciclos da informação desestabilizam ou ameaçam a legitimidade e as práticas de justificação de algumas das principais

28 Translation: “[...] scientific literature, made available by scientific journals and digital repositories [...]” (Bandeira, 2017, p. 30, editorial translation).

29 Translation: “[...] by the development of electronic systems and digital platforms” (Albagli, 2015, p. 12, editorial translation).

30 Translation: “[...] the scope of the very meaning of open science”, which achieves “[...] dialogue between science and other types of knowledge [...]”, causing the “shock of hierarchies, from established sources of authority and reputation”, by proposing the overcoming of the “[...] perspective of thinking about science from its intrinsic productivity”., highlighting the relationships between “knowledge and power” (Albagli, 2015, p. 9-10, editorial translation).

> expressões dos discursos públicos contemporâneos, como a comunicação científica, a comunicação política e as principais formas de comunicação social, podendo afetar a credibilidade, a confiabilidade e a tomada de decisão em toda e qualquer manifestação da atividade social, inclusive as cotidianas (Gomez, 2020, p. 24)[31].

This information ethics dialogues with other areas of knowledge, such as "[...] a Comunicação, a Administração, a Biblioteconomia, a Arquivologia, a Museologia, a Antropologia e o Direito [...]" (Gomez, 2020, p. 20)[32].

Still on this topic, Gomez (2020, p. 25)[33] considers that "[...] os problemas éticos que têm recebido a atenção dos estudos da informação [...]" arise from "[...] mudanças nos modos de produção do conhecimento"[34], involving main issues such as "integridade da pesquisa [...]; o processo de institucionalização de uma ética pública [...] e o complexo sistema de publicação científica [...][35]".

At last, it can also be considered that these topics are, in a way, related to the advent of the global communication network, the *Internet*, which has frequently been at the core of discussions related to copyright and intellectual property rights, which take place, above all, within the scope of the Open Science movement, in which debates are established on the socialization and privatization of scientific knowledge.

CONCLUSIONS

The analysis developed throughout this study sought to analyze topics covered in Information Science that have a correlation with Law, with the purpose of understanding how such areas have behaved in the face of the increasing process of fragmentation of knowledge resulting from the analytical model of contemporary science, which has as its antagonistic pole an interdisciplinary perspective of organization and configuration of knowledge, still little explored, but which has increasingly gained space in scientific, technological and academic discourses.

The results highlight the potential of Information Science, as a field of knowledge, in maintaining interdisciplinary relationships with Law, mainly in aspects relating to scientific communication, production and access to information.

It should also be noted that the methodological approach presented can still be improved and become an auxiliary model for the investigation of interdisciplinary themes and potential among other areas of knowledge, which, in a way, justifies the development of this work.

31 Translation: "[...] whether changes and normative deflation of information cycles destabilize or threaten the legitimacy and justification practices of some of the main expressions of contemporary public discourses, such as scientific communication, political communication and main forms of social communication, which can affect credibility, reliability and decision-making in any and all manifestations of social activity, including everyday manifestations" (Gomez, 2020, p. 24, editorial translation).

32 Translation: "[...] Communication, Administration, Library Science, Archival Science, Museology, Anthropology and Law [...]" (Gomez, 2020, p. 20, editorial translation).

33 Translation: "[...] the ethical problems that have received the attention of information studies [...]" (Gomez, 2020, p. 25, editorial translation).

34 Translation: "[...] changes in the knowledge production methods" (Gomez, 2020, p. 25, editorial translation).

35 Translation: "[...] research integrity [...]; the process of institutionalizing public ethics [...] and the complex system of scientific publication [...]" (Gomez, 2020, p. 25, editorial translation).

At last, it is considered that the analysis developed can be expanded both concerning the number of articles to be analyzed and the terms to be collected, such as: article titles, periodicals, among others.

REFERENCES

ALBAGLI, S. Ciência Aberta em questão. *In*: ALBAGLI, Sarita; MACIEL, Maria Lucia; ABDO, Alexandre Hannud (org.). **Ciência aberta, questões abertas**, Brasília: Ibict; Rio de Janeiro: UNIRIO, 2015. Available at: http://www.cienciaaberta.net/encontro2014/. Access on: 21 nov. 2023.

ALMEIDA JUNIOR, O. F. Formação do profissional da informação: técnicas, tecnologias e mediações. **Revista ACB**, Florianópolis, v. 22, n. 2, ESPECIAL, p. 421–431, 2017.

BANDEIRA, P. M. **Movimento de acesso aberto no Brasil**: contribuição do Instituto Brasileiro de Informação em Ciência e Tecnologia a partir da implementação do Sistema Eletrônico de Editoração de Revistas. Orientador: Isa Maria Freire. 2017. Dissertação (Mestrado em Ciência da Informação) – Universidade Federal da Paraíba, João Pessoa, 2017.

BRASIL. Ministério da Educação, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). **Tabela de Áreas de Conhecimento/Avaliação**, 2020. Available at: https://www.gov.br/capes/pt-br/acesso-a-informacao/acoes-e-programas/avaliacao/instrumentos/documentos-de-apoio-1/tabela-de-areas-de-conhecimento-avaliacao. Access on: 21 nov. 2023.

GERHARDT, T. E.; SILVEIRA, D. T. **Métodos de Pesquisa**. 1. ed. Porto Alegre: UFRGS Editora, 2009.

GOMEZ, M. N. G. Reflexões sobre ética da informação: panorama contemporâneo. *In*: NELIDA, M.; CIANCONI, R. (org.). **Ética da informação**: perspectivas e desafios. Niterói: PPGCI/UFF, 2017. 260 p.

GRÁCIO, M. C. C. Colaboração científica: indicadores relacionais de coautoria. **Brazilian Journal of Information Science**: research trends, [*s. l.*], v. 12, n. 2, 2018. DOI: 10.36311/1981-1640.2018.v12n2.04.p24. Available at: https://revistas.marilia.unesp.br/index.php/bjis/article/view/7976. Access on: 21 nov. 2023.

JAPIASSU, H. **Interdisciplinaridade e patologia do saber**. Rio de Janeiro: Imago Editora, 1976. 220 p.

JARDIM, J. M. Políticas públicas de informação: a (não) construção da política nacional de arquivos públicos e privados (1994-2006). *In*: IX Encontro Nacional de Pesquisa em Ciência da Informação (ENANCIB), 9, 2008, São Paulo. **Anais** [...] São Paulo: USP, 2008.

JUNIOR, O. A. Formação do profissional da informação: técnicas, tecnologias e mediações. **Revista ACB**: Biblioteconomia em Santa Catarina, v. 22, n. 2, p. 421-431, abr./ jul., 2017.

MARCONI, M. A.; LAKATOS, E. M. **Fundamentos de metodologia científica**. 5. ed. São Paulo: Atlas, 2003.

PINHEIRO, L. V. R. Mutações na Ciência da Informação e reflexos nas mandalas interdisciplinares. **Inf. & Soc.**: Est., João Pessoa, v. 28, n. 3, p. 115-134, set./dez. 2018.

PINHEIRO, L. V. R. Pilares conceituais para mapeamento do território epistemológico da ciência da informação: disciplinaridade, interdisciplinaridade e aplicações. *In*: PINO, V.; CAVALCANTE, L.; NETO, C. (org.). **Ciência da Informação**: abordagens transdisciplinares gêneses e aplicações. Fortaleza: Edições UFC, 2007. 261 p.

POMBO, O. Epistemologia da interdisciplinaridade. **Ideação**, Campus de Foz do Iguaçu, v. 10, n. 1, p. 9-40, 2010. DOI: 10.48075/ri.v10i1.4141. Available at: https://e-revista.unioeste.br/index.php/ideacao/article/view/4141. Access on: 22 nov. 2023.

RUBI, M. P.; EUCLIDES, M.; SANTOS, J. Profissional da informação: aspectos de formação, atuação profissional e marketing para o mercado de trabalho. **Inf. & Soc.**: Est. João Pessoa, v. 16, n. 1, p. 79-89, jan./jun. 2006.

SALES, R.; MURGUIA, E. I. Determinações políticas na produção científica da Ciência da Informação do Brasil: impactos da Tabela de Áreas do Conhecimento (TAC) do CNPq. **Scire**, [*s. l.*], v. 21, n. 1, p. 27-34, 2015.

SILVA, T. E.; ALCARÁ, A. R. Acesso aberto à informação científica: políticas e iniciativas governamentais. **Inf. Inf.**, Londrina, v. 14, n. 2, p. 100-116, jul./dez. 2009.

SILVA, T. E.; PINHEIRO, M. M. K. Políticas de Informação no âmbito do ENANCIB. *In*: XII ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO (ENANCIB), 9., 2011, Brasília, **Anais** [...]. Brasília, 2011. p. 1627-1642.

TRIVIÑOS, A. N. S. **Introdução à pesquisa em ciências sociais**: a pesquisa qualitativa em educação. São Paulo: Atlas, 1987. 175 p.

WASSERMAN, S.; FAUST, K. **Social network**: methods and applications (Structural Analysis in the Social Sciences). Cambridge: Cambridge University Press, 1994. 868 p.

EICIDR: method for ergonomic inspection checklist in institutional digital repositories

Wilma Honorio dos Santos
Mestre em Ciências, Universidade Federal de São Paulo (Unifesp), São Paulo, SP, Brasil.
Analista em Saúde: Farmácia, Unidade de Vigilância em Saúde Freguesia/Brasilândia (Uvis FO/Bras), São Paulo, SP, Brasil.
http://lattes.cnpq.br/1152171822124225

Luciano Gamez
Pós-doutorado, Universidade do Porto, Porto, PO, Portugal.
Professor associado, Reitoria, Universidade Federal de São Paulo (Unifesp), São Paulo, SP, Brasil.
http://lattes.cnpq.br/5525481700316599

Felipe Mancini
Doutor em Ciências, Universidade Federal de São Paulo (Unifesp), São Paulo, SP, Brasil.
Professor associado, Reitoria, Universidade Federal de São Paulo (Unifesp), São Paulo, SP, Brasil.
http://lattes.cnpq.br/4433119488921195

Submitted on: 03/28/2022. Approved on: 12/20/2023. Published on: 06/21/2024.

ABSTRACT

Context: digital repositories are informational environments for managing and controlling the scientific and academic production of institutions and/or communities; Gap: however, they can present gaps such as navigation flaws, low usability and accessibility, limited searches, little disclosure of the environment and little or no use of customizable services; Purpose: from this context, an ergonomic evaluation of institutional digital repositories becomes necessary; Methodology – an integrative review of the literature was carried out to evaluate the state of the art of usability techniques applied to the ergonomics of institutional digital repositories and to support the methods applied in this work, the file of the included articles helped in the choice of the usability evaluation method, selection of a set of requirements for usability inspection in institutional digital repositories; Final considerations: the integrative literature review strategy in the databases used and used descriptors showed that the tests applied improve the usability of digital repositories. During this study, it was observed the lack of a checklist focused on ergonomic specifications and recommendations to evaluate the ergonomics and usability of institutional digital repositories. To fill this gap, an ergonomic inspection checklist was proposed for these digital repositories.

Keywords: ergonomics; cognitive ergonomics; mental workload; usability.

INTRODUCTION

Institutional Digital Repositories (IDRs) are informational tools applied to the management of scientific knowledge, to enhance the conduct of processes, create, share and disseminate knowledge (Fachin *et al*., 2009; Leite; Costa, 2006).

Academic institutions use IDRs to support and manage scientific information, mainly from research and teaching activities. They improve the institution's internal and external communication; maximize accessibility, the visibility and impact of its scientific production; feed back into the research activity and support teaching and learning processes; they ensure free access and reduced publication costs (Camargo; Vidotti, 2008).

Ergonomics seeks to reduce or eliminate occupational health risks and also improve working conditions in order to avoid increased fatigue for users caused by the high overall workload in its various dimensions: physical, psychological and cognitive loads. (Cybis; Betiol; Faust, 2010).

Cognitive ergonomics emerged from the expansion of the study of ergonomics, as a result of the widespread use of computers, to analyze the mental capacity that enables people to produce, retrieve and understand information generated by digital information and communication technologies (DICT), (Cybis; Betiol; Faust, 2010; Soares, 2015).

User interaction with the system is made through the interface, which allows its use in different tasks, and its usability is considered a critical factor in the success and acceptance of the product by its users (Coleti, 2014; Gamez, 2004).

The usability of an interface is linked to the system's ability to interact with users, meeting their needs (Lima; Souza; Dias, 2012). It is considered a quality requirement for software, necessary and required to achieve the quality of a computational system and allows it to be usable and easy to learn (Nielsen, 1994).

An interface with good usability ensures that devices and systems are adapted to the way users think, behave and work (Cybis; Betiol; Faust, 2010; Freire, 2022; Gamez, 2004; Lima, 2021; Moraes; Gonçalves, 2021; Souza, 2022).

For Nielsen and Loranger (2006), usability is related to five system attributes: being easy to learn, efficient to use, easy to remember and pleasant to use, in addition to being subject to few errors and linked to the system's capacity of interacting with users, meeting their needs, and is related to: ease of learning, effectiveness, attitude, flexibility, perceived usefulness of the product, suitability for the task, task characteristics and user characteristics.

Thus, an interface with good usability prevents users from having to learn complex procedures, helps them memorize activities in the system, guides the exploration of its content, protects against errors and facilitates procedures, and reduces the physical and mental burden on users, in addition to reducing the time spent to perform a task (Cybis; Betiol; Faust, 2010; Freire, 2022; Lima, 2021; Moraes; Gonçalves, 2021; Souza, 2022).

To build an IDR, navigation, architecture, content creation, page production, accessibility, usability and ergonomic requirements must be taken into account (Camargo; Vidotti, 2008; Ferreira, 2007; Rodrigues *et al*., 2004; Rogers; Preece; Sharp, 2013; Santos; Flores, 2015; Sayão, 2011; Scapin; Bastien, 1997; Soares, 2015; Winckler; Pimenta, 2002).

It is considered that: a high degree of usability of an interface is reflected in users performing tasks with ease, speed and satisfaction (Afonso; Lima; Cota, 2012; Cybis; Betiol; Faust, 2010; Freire, 2022; Gamez, 2004; Lima, 2021; Moraes; Gonçalves, 2021; Nielsen, 1994; Scapin; Bastien, 1997; Souza, 2022).

Studies conducted in IDRs show that they can present gaps, such as navigation flaws, low usability, limited searches, little disclosure of the environment and little or no use of customizable services (Bohmerwald, 2005; Camargo; Vidotti, 2008; Ferreira, 2007; Sales; Bezerra; Pereira, 2013; Santos; Flores, 2015; Sayão, 2011; Veiga *et al*., 2013).

In this context, these must be assessed regarding ergonomics and usability to provide effective interaction between users, available material and its interface (Afonso; Lima; Cota, 2012; Santos, 2018, Santos; Gamez; Mancini, 2015, 2016a, 2016b, 2016c, 2017, 2019; Soares, 2015).

Over the course of this study, the existence of a checklist focused on ergonomic specifications and recommendations to assess the ergonomics and usability of IDRs was not observed in the consulted literature. Only questionnaires were found focusing on users' degree of acceptance or not of the interface (Bohmerwald, 2005; Camargo; Vidotti, 2008; Ferreira, 2007; Freire, 2022; Lima, 2021; Moraes; Gonçalves, 2021; Oliveira, 2001; Rodrigues *et al.*, 2004; Sales; Bezerra; Pereira, 2013; Santos, 2018; Santos; Flores, 2015; Santos; Gamez; Mancini, 2015, 2016a, 2016b, 2016c, 2017, 2019; Sayão, 2011; Souza, 2022; Veiga *et al*., 2013).

To fill this gap, the aim of this work was to propose a Checklist for Ergonomic Inspection of Institutional Digital Repositories (CEIIDR), composed of a set of requirements, heuristics, guidelines and severity ratings based on the heuristics of Nielsen and his collaborators, as well as their guidelines for Content Creation, Page Production, Navigational Design, Architectural Design and Interface Design (Carvalho; Anacleto, 2002; Nielsen, 1994; Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

MATERIAL AND METHODS

To achieve the aim of this work, the following steps were followed: Integrative Literature Review (ILR) to investigate the state of the art of usability techniques applied to the ergonomics of IDRs; choice of the usability evaluation method and the selection of a set of requirements for inspection of its usability, the classification of the set of requirements for usability inspection of IDRs, the assignment of the expected response, the respective heuristics, guideline and severity rating for each requirement and, compiled, gave rise to the CEIIDR: checklist of ergonomic inspection in IDRs.

1) ILR

ILR was chosen because this type of review provides a broad analysis of the literature, contributes to discussions about research methods and results, as well as reflections on conducting future studies. The initial purpose of this research method is to obtain a deep understanding of a given phenomenon based on previous studies, it allows the combination of data from empirical and theoretical literature that can be directed to defining concepts, identifying gaps in the areas of study, review of theories and methodological analysis of studies on a given subject (Mendes; Silveira; Galvão, 2008).

Search string

The *ILR search string* was based on the terms in the research question: usability, cognitive ergonomics and IDRs. The research process consisted of an automatic search, *via the CAPES/MEC Journals Portal*[1] using *the* Virtual Private Network *(VPN) of* Unifesp*,* on Web of Science as this database indexes more than 12,000 high-profile journals worldwide, including journals such as those of the Association for Computing Machinery (ACM) Digital Library or those of the Institute of Electrical and Electronics Engineers(IEEE). The research was conducted on 09/26/2016 (Santos, 2018).

The searches were carried out based on pre-defined criteria (**Table 1** and **Table 2**).

Table 1 – Databases and search string

Database	Search String
CAPES/MEC Journals Portal	#1 USABILIDADE OR USABILITY OR (ERGONOMIA COGNITIVA) OR (COGNITIVE ERGONOMICS) OR (AVALIAÇÃO ERGONÔMICA) OR (ERGONOMIC EVALUATION) #2 (MÉTODOS DE AVALIAÇÃO) OR (EVALUATION METHODS) OR (EVALUATION) OR (METHOD*) OR (MÉTODO) #3 (REPOSIT* DIGITA*) OR (REPOSIT* INSTITUTIONAL*) OR (REPOSIT* DIGIT* INSTITUTIONAL*) OR (REPOSIT*) #4 #1 AND #2 AND #3
Association for Computing Machinery (ACM)	
Institute of Electrical and Electronics Engineers (IEEE).	

Source: Prepared by the authors using Software Zotero[2] (2022).

1 http://www.periodicos.capes.gov.br/

2 Free software *Zotero* was used to manage references resulting from the search in the Indexed Databases.

Table 2 – Eligibility Criteria

Inclusion Criteria	Exclusion Criteria
(1) articles containing techniques and/or methods for ergonomic evaluation of the usability of IDRs; **(2) descriptive articles relating usability evaluation with applications in DRs and/or IDRs.**	(1) articles that are not written in Portuguese or English; (2) similar articles with duplicate results in different databases; (3) incomplete articles (summary only, tutorials, whitepapers or keynotes); (4) book chapters; (5) articles not containing any application related to the context of usability in DRs and IDRs.

Source: Prepared by the authors using Software Zotero (2022).

2) Creation of CEIIDR

Literature used in the creation of CEIIDR

The literature used in the creation of CEIIDR was: Nielsen (1994), Nielsen and Loranger (2006), Nielsen and Tahir (2012) and the Nielsen (1994) guidelines for systems development, compiled by Carvalho and Anacleto (2002) as ILR cited these authors as experts on subject usability.

Choice of the usability evaluation method

Usability inspection using a checklist was chosen because it can be applied by any interface user without the need for expertise on the subject (Nielsen, 1994; Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Creation of requirements for evaluating the usability of IDRs

The creation of requirements for evaluating the usability of IDRs arose from the selection of the Nielsen (1994) guidelines for systems development, compiled by Carvalho and Anacleto (2002). Guidelines related to e-commerce websites were excluded. These requirements were structured in a table containing questions about usability in IDRs (Carvalho; Anacleto, 2002; Nielsen, 1994).

Expected response

Based on the literature of Nielsen (1994), Nielsen and Loranger (2006), Nielsen and Tahir (2012) and the Nielsen (1994) guidelines for systems development, compiled by Carvalho and Anacleto (2002), each requirement was assigned an expected answer (Yes/No).

Assignment of heuristics

For each requirement, the respective heuristic was assigned based on the 10 heuristics refined by Nielsen (1994) and studies on usability problems carried out together with Carvalho and Anacleto (2002), and they are:

1. Visibility of system status.
2. Correspondence between the system and the real world.
3. User control and freedom.
4. Consistency and standards.
5. Error prevention.
6. Helps users recognize, diagnose, and recover from errors.
7. Recognition rather than recall.
8. Flexibility and efficiency of use.
9. Aesthetic and minimalist design.
10. Help and documentation.

Guidelines

Each usability requirement was classified according to the guidelines for Content Creation, Page Production, Navigational Design, Architectural Design and Interface Design (Carvalho; Anacleto, 2002; Nielsen, 1994).

Severity rating

According to Nielsen (1994), severity ratings are classified on a scale of 0 to 4, and are:

0. I don't agree that this is a usability problem at all.
1. Cosmetic problem only: need not be fixed unless extra time is available on project.
2. Minor usability problem: fixing this should be given low priority.
3. Major usability problem: important to fix, so should be given high priority.
4. Usability catastrophe: imperative to fix this before product can be released.

Each requirement was classified according to the severity rating from 0 to 4 which, in ascending order, represented an increase in the compromise of usability in IDR, as well as in the speed of resolving the breach of the requirement in CEIIDR. We can say that severity rating zero (0) means that the problem encountered is not related to usability. For severity

rating one (1), the issue concerns the appearance of the page(s), which means it needs to be fixed only if extra time is available. Severity rating two (2) corresponds to a minor usability problem and should be given low priority to be resolved. Severity rating three (3) means that there is a major usability problem, it is important to solve it as should be given high priority. Severity rating four (4) represents a serious compromise in usability and it is imperative to fix this before the website is launched, or as quickly as possible because its compromise is critical for both the IDR and the user when referring to the expected and obtained results.

Compilation of data and requirements

CEIIDR – *Checklist* for Ergonomic Inspection of Institutional Digital Repositories was then created for the usability inspection test, composed of a set of requirements, heuristics, guidelines, their severity rating and expected response (Carvalho; Anacleto, 2002; Nielsen, 1994; Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

CEIIDR is presented in Appendix A.

RESULT ANALYSIS AND DISCUSSION

IRL showed that the models, methods and techniques used for usability evaluation are: testing interaction scenarios with tasks and inspection testing using a checklist.

The registration of all articles included in the ILR was decisive for choosing the usability evaluation method and selecting a set of requirements for usability inspection in IDRs based on the heuristics of Nielsen and his collaborators, as well as their guidelines for Content Creation, Page Production, Navigational Design, Architectural Design and Interface Design (Santos, 2018).

The authors, books and articles identified in reading the articles proved to be relevant for choosing the selected usability evaluation method and a set of requirements for usability inspection in IDRs (Carvalho; Anacleto, 2002; Nielsen, 1994; Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

According to Nielsen (1994), when opening a page on the Web , users first look at the main area, looking for titles and other indications of the page's content (Nielsen, 1994). This can be justified by the fact that reading on a screen is tiring for the eyes and slower (studies show that reading on a screen is 25% slower than reading printed texts (Anacleto; Villena, 2009).

Therefore, one must be cautious when creating content that will be presented, which needs to be easily viewed and understood by users (Anacleto; Villena, 2009).

Below are some guidelines that help create content: be succinct, avoid redundant content and long paragraphs, excessive itemization, exclamation points, spaces and punctuation for emphasis. Subheadings and lists should be used, as well as hypertext to divide long

information, pay attention to spelling, be careful with humor, do not use icons that show users gestures that could be offensive in their culture, nor use visual wordplay. A figure can contain different meanings in different cultures (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Furthermore, information from the repository, such as “About Us”, “Presentation”, “Policy”, “Privacy Policy” should not be grouped into a single reserved area, nor should it include internal information that must remain on the intranet. It is recommended that label sections and categories be used with user-centered language, according to the importance of these sections and categories to the user (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Capital letters should rarely be used together and never as a formatting style. Studies show that text in all capital letters is less readable than text in mixed case letters. Also, use month full names or their abbreviations, but not numbers (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

After having decided what information the page should include, one must plan how to present it; thus, the Page Production Guidelines direct the arrangement of information on the page (Anacleto; Villena, 2009; Nielsen, 1994).

The way information is organized on a page can make a difference between it communicating an appropriate message or demanding a high mental load from users (Nielsen; Tahir, 2012).

Users read a page on the Web in the same way as they read other types of information, that is, by grouping it spatially. For this reason, it is important that the layout conditions be respected. In Western countries, this means left to right and top to bottom. The most important information should be located in the top left corner of the page (Nielsen, 1994).

The layout is the way in which information items are arranged in a composition; they need to be consistent throughout all the pages on the website. In general, they should clearly define functional zones; they must be balanced in how the clear areas of the screens are used and must not have any object alignment issues. Layout plays an important role on a webpage, influencing the way users feel and understand information (Oliveira, 2001).

Therefore, it is recommended, among the Page Production guidelines, that the institution’s logo is located on the top left corner of the homepage and appears on all pages, and that the external logos are small and as discreet as possible in relation to the core content of the homepage and to the institutional logo (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Hypertexts must be productive, respect paragraphing, contain a reduced number of graphic elements, avoid watermark graphics, not use animation for the sole purpose of drawing attention to an item on the homepage (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Critical page elements, such as logos, taglines or the main title, should not be animated (Nielsen; Tahir, 2012).

Cybis (2010) recommends some caution when using background colors and textures in texts, in order to ensure readability: the search for textures with elements on very small scales; the search for textures in which the contrast between the colors and tones of its elements is reduced; not using reliefs with too many colors and tones. The use of neutral

colors for page backgrounds increases the readability of informative text and speeds up data transmission. Dark colors and textures can be used to direct user attention on a webpage. However, they should only be used in small areas, as using them across the entire length of the page increases visual fatigue (Cybis; Betiol; Faust, 2010).

Literature recommendations are for contrast in using colors, chromatic colors (blue, green, red, etc.) on an achromatic background (white, black and gray) or vice versa (Cybis; Betiol; Faust, 2010; Nielsen; Tahir, 2012).

The webpage must include a scroll bar with up and down arrows, a scroll indicator, avoiding horizontal scrolling at 800x600. The main elements of the webpage must be visible "above the fold" (on the first screen of the content, with no need for scrolling), the size of the most predominant window (Nielsen; Tahir, 2012).

Navigation is what allows users to carry out their tasks, not delaying or even preventing the execution of the tasks intended by the user (Anacleto; Villena, 2009; Nielsen, 1994).

Nielsen and Loranger (2006) say that navigation will be fully resolved when users can answer three basic questions: Where am I? Where have I been? Where can I go? Considering the IDR user, navigation must then show them their location, the path taken and the route responsibilities to the desired content (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Thus, a website must provide a dynamic site map, which indicates the page accessed and has ways to highlight information of interest to specific user populations, it must have a "Statistics" option, work equally in browsers Explorer, Mozilla , Opera and Google, use the browser's "back" arrow instead of a link for this purpose. However, these authors further state that, in most tests conducted with users, they frequently use the browser's "back" button, although there is a direct link to the location they wish to return to. The "back" button is always available, it is always in the same location and it always works the same way, retracing one step at a time. The strong consistency of the interface means that people don't need to look for a link on the page: they immediately know where to go. Finally, it is understood that the browser's "back" button is used more than a common link (Nielsen, 1994).

Nielsen and Loranger (2006) consider that opening new windows has bad effects: it interrupts the experience expected by the user; pollutes the user's screen with unwanted objects (sometimes causing crashes or memory errors); prevents the user's ability to return to visited pages and covers the window on which the user is currently working (Nielsen; Loranger, 2006). However, there is an exception, and it regards Adobe PDFfiles. In these types of documents, users often go directly to the window close box. Therefore, if the file opens in the same window and the user uses the close box, the webpage will consequently close. They state that the best guidelines for creating links to non- Web documents are: open non- Web documents in a new browser window; alert users in advance that a new window will appear; remove browser tools (such as the "back" button) from the new window; above all, the browser must be prevented from opening the document (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

The page must not make the same link available in different locations on the website , or have different links, but with the same function. The link of the title selected must be highlighted and underlined. Nielsen and Loranger (2006, p. 61)[3] add: “Não alterar as cores dos *link*s cria confusão navegacional”. It is understood that this requirement has the purpose of showing users the items they have already searched for and so that they do not select them again by mistake (Nielsen; Loranger, 2006).

Furthermore, the homepage must include an input box to enter search queries, instead of only providing a link to a search page, which must be color white, positioned in the same location on all pages, on the left side or center, taking advantage of the user experience on other websites. The area needs to be clear, leading the eye to this field and include the magnifying glass symbol to the right of the box, enabling spell checks, both for the search input data and for terms in the consulted documents (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

Nielsen and Loranger (2006, p. 54) mention that “Uma caixa de busca simples e padrão deve ser posicionada em um lugar padrão em todas as páginas [...]”[4]. The authors clarify that larger search boxes are better for two reasons. First, they encourage users to type longer queries, which typically leads to more accurate and useful results. Second, there are fewer typos and other errors when users can see everything they type (Nielsen; Loranger, 2006).

Nielsen and Tahir (2012, p. 75)[5] emphasize that “Além do texto colorido, o sublinhado é a segunda mais importante indicação para os usuários de que o texto é clicável [...]”. With regard to text and background colors, the authors found in their research that the white background is the most recommended and should be followed by most projects as it achieves the highest contrast and greatest readability. They also mention that texts in black are the most recommended, and the color blue is widely used in links (Nielsen; Tahir, 2012).

The Architectural Design is intrinsically related to the good use of the website and to navigational ease, and users can discern what is a priority and what is secondary on the website. This way, the information must be structured and well located; in order to show the structure of the website , it must include link “Site map”, be organized by the tasks that users wish to carry out on the website, reflect the users’ view of the website and its information and services. It is advisable to give essential task items a prominent place, as seen on the repository homepage (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

The “Site map” groups a large amount of information into a single overview. This feature must employ adequate technical writing to generate efficient and useful content. They recommend making a “Help” feature available on the top right corner of the webpage (Nielsen; Tahir, 2012).

3 Translation: “Not changing the colors of the links creates navigational confusion” (Nielsen; Loranger, 2006, p. 61, editorial translation).
4 Translation: “A simple, standard search box should be positioned in the same location on all pages [...]” (Nielsen; Loranger, 2006, p. 54, editorial translation).
5 Translation: “In addition to colored text, underlining is the second most important indication to users that the text is clickable [...]” (Nielsen; Tahir, 2012, p. 75, editorial translation).

The interface is the part of the system that is in contact with users directly, requirements for the Interface Design are: contain option “change the text size to large” (“A+” and “A-”) to allow accessibility by visually impaired users, as it results in better readability (Nielsen; Loranger, 2006).

The interface must include the name of the languages in said language (for example, use the word “English” as an anchor for the website translated into English) and avoid using a flag to indicate that the website is translated, as one country can have several languages, just as one language can be spoken in several countries (Nielsen; Tahir, 2012).

It is indispensable for the name and/or logo to be displayed on the homepage (not clickable); it does not need to be large, but it must be larger and more important than the items around it so that it attracts user attention. On other pages, the logo must be clickable and link to the homepage (Nielsen; Loranger, 2006).

The *homepage* must also be structured differently from all other existing pages on the website and emphasize the highest priority tasks so that users have a defined starting point on the homepage. Drop-down menus are not recommended, especially if the items contained in such menus are not self-explanatory (Nielsen; Tahir, 2012).

The interface must not include generic links for user community support, chats or other discussion resources; avoid the use of pop-up windows (Nielsen; Loranger, 2006; Nielsen; Tahir, 2012).

It is important that the login option is easy to view, as well as the option to create a profile and explain the advantages of user sign-up (Nielsen; Loranger, 2006).

Appendix A presents the CEIIDR created for IDR evaluation, composed of a set of requirements, heuristics, guidelines and their severity rating based on the heuristics of Nielsen and his collaborators, as well as their guidelines for Content Creation, Page Production, Navigational Design, Architectural Design and Interface Design (Anacleto; Villena, 2009).

FINAL CONSIDERATIONS

ILR showed the state of the art of techniques applied to usability and led to the creation of CEIIDR.

The CEIIDR proposal filled the existing gaps for the evaluation of usability by means of inspection testing and emerged from the ILR and the registration of the articles included in it. In these stages, a gap was identified in the existence of a checklist focusing on inspection testing in IDRs. The ILR and the registration allowed the selection of the method and the set of requirements for usability inspection in IDRs based on the heuristics of Nielsen and his collaborators, and their guidelines for Content Creation, Page Production, Navigational Design, Architectural Design and Interface Design.

The main contributions presented in this work are as follows:

- The creation of a Checklist for Ergonomic Inspection of Institutional Digital Repositories – CEIIDR;

- The possibility of applying CEIIDR to IDRs;
- The search for improving the usability of IDRs;
- Identification of points of suitability and inadequacy of usability in IDRs;
- Reducing the cognitive load of IDR interface users.

Implications for research can be suggested for the future, such as the validation of the usability evaluation *checklist,* application of the inspection test in IDRs, the creation of a manual with guidelines for inspection test application.

REFERENCES

AFONSO, A. P.; LIMA, J. R.; COTA, M. P. A heuristic evaluation of usability of Web interfaces. *In:* IBERIAN CONFERENCE ON INFORMATION SYSTEMS AND TECHNOLOGIES (CISTI 2012), 7., 2012, Madrid. **Proceedings** [...]. Madrid: Institute of Electrical and Electronics Engineers, 2012. p. 1-6.

ANACLETO, J.; VILLENA, J. **Interação Humano Computador**. São Carlos: UFSCar, 2009.

BOHMERWALD, P. Uma proposta metodológica para avaliação de bibliotecas digitais: usabilidade e comportamento de busca por informação na Biblioteca Digital da PUC-Minas. **Ciência da Informação**, Brasília, v. 34, n. 1, p. 95-105, 2005.

CAMARGO, L. S. A.; VIDOTTI, S. B. G. Uma estratégia de avaliação em repositórios digitais. *In:* SEMINÁRIO NACIONAL DE BIBLIOTECAS UNIVERSITÁRIAS, 15., 2008, São Paulo. **Anais** [...]. São Paulo: FEBAB, 2008.

CARVALHO, A.; ANACLETO, J. **Usabilidade e seus critérios para a avaliação de sistemas computacionais**. São Carlos: Departamento de Computação da Universidade Federal de São Paulo, 2002.

COLETI, T. A. **Um ambiente de avaliação da usabilidade de software apoiado por técnicas de processamento de imagens e reconhecimento de fala**. 2014. 154 f. Dissertação (Mestrado em Sistemas de Informação) – Escola de Artes, Ciências e Humanidades, Universidade de São Paulo, São Paulo, 2014.

CYBIS, W.; BETIOL, A.; FAUST, R. **Ergonomia e Usabilidade**: conhecimentos, métodos e aplicações. 2. ed. São Paulo: Novatec, 2010.

FACHIN, G. R. B.; STUMM, J.; COMARELLA, R. L.; FIALHO, F. A. P.; SANTOS, N. Gestão do conhecimento e a visão cognitiva dos repositórios institucionais. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 14, n. 2, p. 220-236, 2009.

FERREIRA, S. M. S. P. Repositório institucional em comunicação: o projeto REPOSCOM implementado junto à federação de bibliotecas digitais em Ciências da Comunicação. **Encontros Bibli**: revista eletrônica de biblioteconomia e ciência da informação, Florianópolis, v. 12, n. 1, p. 77-94, 2007. DOI 10.5007/1518-2924.2007v12nesp1p77.

FREIRE, L. L. **Método integrado para avaliação de usabilidade em e-Learning**. 2022. 241 f. Tese (Doutorado em Engenharia Industrial e de Sistemas) – Escola de Engenharia, Universidade do Minho, Portugal, 2022.

GAMEZ, L. **A construção da coerência em cenários pedagógicos online**: uma metodologia para apoiar a transformação de cursos presenciais que migram para a modalidade de educação à distância. 2004. 260 f. Tese (Doutorado em Engenharia de Produção) – Faculdade de Engenharia, UFSC, Florianópolis, 2004.

LEITE, F. C. L.; COSTA, S. Repositórios institucionais como ferramenta de gestão do conhecimento científico no ambiente acadêmico. **Perspectivas em Ci. Inf**., [*s. l.*], v. 11, n. 2, p. 206-219, mai./ago. 2006.

LIMA, I.; SOUZA, R.; DIAS, G. Interatividade e usabilidade nas bibliotecas digitais no processo ensino-aprendizagem. **DataGramaZero**: Revista de Informação, [*s. l.*], v. 13, n. 3, p. 1-12, 2012.

LIMA, L. **Integração quali-quantitativa em ergonomia com uso da EMG, dinamometria isométrica, captura de movimentos e questionários**. Proposta de método e estudo multicasos. 2021. 200 f. Tese (Doutorado em Engenharia de Produção) – Faculdade de Engenharia, UFSC, Florianópolis, 2021.

MENDES, K. D. S.; SILVEIRA, R. C. C. P.; GALVÃO, C. M. Integrative literature review: a research method to incorporate evidence in health care and nursing. **Texto e Contexto Enfermagem**, Florianópolis, v. 17, n. 4, p. 758-764, dez. 2008.

MORAES, L. M.; GONÇALVES, B. S. Bilingual digital educational resources design: a model for assessment and supporting checklist. **Estudos em Design**, Rio de Janeiro: v. 29, n. 3, p. 146-160, 2021. DOI https://doi.org/10.35522/eed.v29i3.1302.

NIELSEN, J. Heuristic Evaluation. *In:* NIELSEN, J; MACK, R. (ed.). **Usability inspection methods**. New York: Wiley, 1994. p. 25-62.

NIELSEN, J.; LORANGER, H. **Usabilidade na Web**: projetando websites com qualidade. Rio de Janeiro: Campus, 2006.

NIELSEN, J.; TAHIR, M. **Homepage***:* usabilidade: 50 websites desconstruídos. Rio de Janeiro: Campus, 2012.

OLIVEIRA, E. R. **Avaliação ergonômica de interfaces da SciELO – Scientific Electronic Library Online**. 2001. 112 f. Dissertação (Mestrado em Engenharia de Produção) – Faculdade de Engenharia, UFSC, Florianópolis, 2001.

RODRIGUES, E.; ALMEIDA, M.; MIRANDA, Â; GUIMARÃES; A. X.; CASTRO, D. RepositóriUM: criação e desenvolvimento do Repositório Institucional da Universidade do Minho. *In*: CONGRESSO NACIONAL DE BIBLIOTECÁRIOS, ARQUIVISTAS E DOCUMENTALISTAS, 8., 2004, Lisboa. **Anais** [...]. Lisboa: Associação Portuguesa de Bibliotecários, Arquivistas e Documentalistas, 2004.

ROGERS, Y.; PREECE, J.; SHARP, H. **Design de interação**: além da interação homem-computador. Porto Alegre: Bookman, 2013.

SANTOS, W. H. **Revisão integrativa sobre usabilidade e aplicação do Checklist de Inspeção Ergonômica de Repositórios Digitais Institucionais – CIERDI**. 2018. Dissertação (Mestrado em Gestão e Informática em Saúde) – Escola Paulista de Medicina (EPM), UNIFESP, São Paulo, 2018.

SANTOS, H. M.; FLORES, D. Repositórios digitais confiáveis para documentos arquivísticos: ponderações sobre a preservação em longo prazo. **Perspectivas em Ciência da Informação**, [*s. l.*], v. 20, n. 2, p.1 98-218, abr./jun. 2015.

SANTOS, W. H.; MANCINI, F.; GAMEZ, L. Implementação e avaliação da usabilidade da plataforma Mobile Moodle para cursos de EAD em saúde. *In*: CONGRESSO ACADÊMICO DA UNIFESP, 1., 2015, São Paulo. **Anais** [...]. São Paulo: UNIFESP, 2015.

SANTOS, W. H.; MANCINI, F.; GAMEZ, L. Proposta de especificações e recomendações ergonômicas para a interface do portal do repositório na área de saúde da Unifesp. *In:* SIED – SIMPÓSIO INTERNACIONAL DE EDUCAÇÃO A DISTÂNCIA; ENPED – ENCONTRO DE PESQUISADORES EM EDUCAÇÃO A DISTÂNCIA, 2016, São Carlos. **Anais** [...]. São Carlos: UFSCar, 2016a.

SANTOS, W. H.; MANCINI, F.; GAMEZ, L. Avaliação ergonômica de repositórios digitais institucionais. *In:* CIAED–CONGRESSO INTERNACIONAL ABED DE EDUCAÇÃO A DISTÂNCIA, 22., 2016, Águas de Lindóia. **Anais** [...]. Águas de Lindóia, SP: Associação Brasileira de Educação a Distância – ABED, 2016b.

SANTOS, W. H.; MANCINI, F.; GAMEZ, L. Avaliação ergonômica do portal do repositório na área de saúde da Unifesp: proposta de especificações e recomendações ergonômicas para sua interface. *In:* CONGRESSO ACADÊMICO DA UNIFESP, 2., 2016, São Paulo. **Anais** […]. São Paulo: UNIFESP, 2016c.

SANTOS W. H.; GAMEZ L.; MANCINI F. Ergonomic evaluation of the portal of the repository in the health area of UNIFESP: Proposal of Specifications and Ergonomic Recommendations for Its Interface. *In:* ANTONA, M.; STEPHANIDIS, C. (org.). **UAHCI – Universal Access in Human** – Computer Interaction. Human and Technological Environments. Lecture Notes in Computer Science: Springer International Publishing, v. 3, p. 26-38, 2017.

SANTOS, W. H.; MANCINI, F.; GAMEZ, L. Checklist de inspeção ergonômica de repositórios digitais institucionais – CIERDI. *In:* CONFERÊNCIA INTERNACIONAL SOBRE BIBLIOTECAS E REPOSITÓRIOS DIGITAIS DA AMÉRICA LATINA, 9., 2019, São Paulo. **Anais** [...]. São Paulo: UNINOVE, 2019.

SAYÃO, L. F. Repositórios digitais confiáveis para a preservação de periódicos eletrônicos científicos. **Ponto de Acesso**, [*s. l.*], v. 4, n. 3, p. 68-94, 2011.

SCAPIN, D.; BASTIEN, J. M. C. Ergonomic criteria for evaluating the ergonomic quality of interactive systems. **Behaviour and Information Technology**, [*s. l.*], v. 16, n. 4-5, p. 220-231, 1997.

SOARES, S. S. K. P. **Elaboração de materiais científicos educacionais multimídia na área da saúde utilizando conceitos de design gráfico de interfaces, usabilidade e ergonomia**. 2015. 130f. Tese (Doutorado em Clínica Cirúrgica) – Setor de Ciências da Saúde, UFPR, Curitiba, 2015. Available at: http://dspace.c3sl.ufpr.br/dspace/handle/1884/38174. Access on: 29 out. 2015.

SOUZA, R. B. **Usabilidade em ambiente virtual de aprendizagem**: avaliação da plataforma INDU a partir da oferta de curso autoinstrucional em Saúde Digital. 2022. Trabalho de conclusão de curso (Bacharelado em Gestão da Informação) – Centro de Artes e Comunicação, UFPE, Recife, 2022.

VEIGA, V. S. O.; MACHADO; R. R.; ALVES, A. S.; PIMENTA; D. N.; SILVA, C. H.; CAVALHO; M. C. R. Repositórios institucionais: avaliação da usabilidade na Fundação Oswaldo Cruz. *In:* ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 14., 2013, Florianópolis. **Anais** [...]. Florianópolis: UFSC, 2013.

WINCKLER, M.; PIMENTA, M. S. **Avaliação de usabilidade de sites web.** Escola de Informática da SBC SUL (ERI 2002). ed. Porto Alegre: Sociedade Brasileira de Computação (SBC), v. 1, p. 85-137, 2002.

ACKNOWLEDGMENTS

To the Coordination for the Improvement of Higher Education Personnel (CAPES) for the master's scholarship that funded this research work.

APPENDIX A

Requirements		Heuristics	Guideline	Severity Rating	Expected response
1	Display the IDR name and/or logo on homepage	7	Interface Design	1	Yes
2	The IDR name and/or logo is located on the top left corner of homepage	7	Page Production	1	Yes
3	Logo is available on all IDR pages	7	Page Production	1	Yes
4	Logo is clickable and links to IDR homepage	7	Navigational Design	1	Yes
5	Logo is clickable on IDR homepage (active link to homepage on homepage)	5	Interface Design	2	No
6	There is a tagline (explanatory note) explicitly summarizing what IDR does	9	Interface Design	1	Yes
7	IDR displays University clickable logo in a smaller size than its own and links to respective page	9	Content Creation	1	Yes
8	IDR pages maintain the external logos on the right side	9	Page Production	2	Yes
9	IDR pages keep external logos small and as discreet as possible in relation to the central content of homepage and IDR logo	9	Page Production	2	Yes
10	IDR has “Presentation” or “About Us” link that offers users an overview of IDR	9	Navigational Design	1	Yes
11	IDR has “Policy” link	9	Navigational Design	2	Yes
12	IDR has “Privacy Policy” link	9	Navigational Design	2	Yes
13	IDR has “Copyright” link citing current legislation	9	Navigational Design	1	Yes
14	IDR has safety certificate	9	Navigational Design	2	Yes
15	IDR has a “contact us” or “get in touch” option with all the contact information from the repository	9	Navigational Design	2	Yes
16	The “contact us” or “get in touch” option works	9	Navigational Design	2	Yes
17	IDR shows website structure , has a “Site map” link	1	Architectural Design	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
18	IDR has a dynamic site map that indicates the page from which it was accessed and has ways to highlight information of interest to specific user populations	1	Navigational Design	2	Yes
19	IDR has “Statistics” option	1	Navigational Design	2	Yes
20	IDR has “Help” link	10	Navigational Design	3	Yes
21	IDR content groups repository information such as About Us, Presentation, Policy, Privacy Policy in one reserved area	7	Content Creation	2	Yes
22	IDR homepage clearly informs consistency of available information	4	Content Creation	2	Yes
23	IDR makes structure visible and how IDR is organized	4	Page Production	2	Yes
24	IDR has permanent links	9	Page Production	1	Yes
25	IDR works equally well in Explorer, Mozilla, Opera and Google browsers	1	Navigational Design	3	Yes
26	IDR uses browser “back” arrow instead of link intended for this purpose	3	Navigational Design	2	Yes
27	IDR emphasizes the highest priority tasks so users have a defined starting point on homepage	3	Interface Design	2	Yes
28	IDR does not use word “website” to refer to any other aspect	9	Interface Design	1	Yes
29	IDR structures its homepage differently from all other pages on the website	9	Interface Design	1	Yes
30	IDR avoids using multiple text input boxes on homepage, particularly at the top of the page where people typically look for the search feature	9	Interface Design	1	Yes
31	IDR rarely uses drop-down menus, especially if the items contained in such menus are not self-explanatory	9	Interface Design	1	Yes
32	IDR does not provide generic links for user community support, chats or other discussion resources	9	Interface Design	1	Yes
33	IDR does not offer a “Guest Book” entry as it makes them look like amateurs	9	Interface Design	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
34	IDR includes the name of languages in said language (for example, using the word “English” as an anchor for the website translated into English)	9	Interface Design	1	Yes
35	The IDR avoids using a flag to indicate that the website is translated, as one country can have several languages, just as one language can be spoken in several countries	9	Interface Design	1	Yes
36	IDR prevents pop-up windows	9	Interface Design	1	Yes
37	IDR has “change text size to large” (“A+” and “A-“) option	3	Interface Design	2	Yes
38	IDR has login option	9	Interface Design	2	Yes
39	In IDR, the login option is easily visualized	9	Interface Design	2	Yes
40	IDR has a profile creation option	9	Interface Design	2	Yes
41	IDR explains (or, at least, mentions) Sign up and Profile creation advantages	9	Interface Design	2	Yes
42	IDR does not explain the benefits and publication frequency to users before asking for their email addresses	9	Interface Design	2	Yes
43	IDR is organized by the tasks users wish to perform on the website	4	Architectural Design	1	Yes
44	IDR reflects users’ view of the website and its information and services	4	Architectural Design	1	Yes
45	IDR’s homepage “welcomes” users to website	4	Architectural Design	1	No
46	IDR clearly informs on homepage if website freezes or important parts of website are not working	5	Architectural Design	1	Yes
47	IDR content is succinct	9	Content Creation	1	Yes
48	IDR content is written in easily-readable manner and avoids long paragraphs	9	Content Creation	1	Yes
49	IDR content uses subheadings and lists	9	Content Creation	1	Yes
50	IDR content uses hypertext to break up long sentences	9	Content Creation	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
51	IDR content is attentive to spelling	9	Content Creation	1	Yes
52	IDR content includes a summary of the material	9	Content Creation	1	Yes
53	IDR content is attentive to humor	9	Content Creation	1	Yes
54	IDR content does not include internal repository information (intended for employees, which must remain on intranet) on the public website	9	Content Creation	1	Yes
55	IDR homepage answers questions like “where am I?”, “what does this website do?” and “where can I go?”	1	Navigational Design	1	Yes
56	IDR content uses label sections and categories, with user-centric language according to the importance of those sections and categories for the user and not for IDR	2	Content Creation	1	Yes
57	IDR content does not use erudite sentences or marketing dialect so that people don’t need to struggle to understand what is being said	9	Content Creation	1	Yes
58	IDR content employs capitalization and other style standards consistently	9	Content Creation	1	Yes
59	IDR does not label a clearly defined area of the page if the content is sufficiently self-explanatory	9	Content Creation	1	Yes
60	IDR content avoids excessive itemization (lists with a single item)	9	Content Creation	1	Yes
61	IDR content uses non-separable spaces between words that need to remain together to be seen and understood in sentences	9	Content Creation	1	Yes
62	IDR content uses only imperative speech, such as “Enter a City or ZIP Code” in mandatory tasks, or qualifies the statement appropriately	9	Content Creation	1	Yes
63	IDR content explains the meaning of abbreviations, capital letters, acronyms and immediately follows them with the abbreviations, in the first occurrence	9	Content Creation	1	Yes
64	IDR content avoids exclamation points	9	Content Creation	1	Yes
65	IDR content rarely uses all capital letters and never as a formatting style	9	Content Creation	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
66	IDR content avoids inappropriate use of spaces and punctuation for emphasis	9	Content Creation	1	Yes
67	IDR content presents succinct but descriptive titles to convey as much information as possible in as few words as possible	9	Content Creation	1	Yes
68	IDR does not provide users with features to customize the basic appearance of homepage interface	3	Content Creation	1	Yes
69	IDR does not use icons that show users gestures that are offensive in their culture	9	Content Creation	1	Yes
70	IDR content does not use visual wordplay. A figure may have different meanings in different cultures	4	Content Creation	1	Yes
71	IDR content does not employ metaphors outside the information domain of website	4	Content Creation	1	Yes
72	IDR content uses full month name or abbreviations, but not numbers.	4	Content Creation	1	Yes
73	IDR pages produce productive hypertext	9	Page Production	1	Yes
74	IDR pages respect paragraphing	9	Page Production	1	Yes
75	On IDR pages, the number of graphic elements is reduced	9	Page Production	1	Yes
76	IDR pages avoid watermark graphics (background images with overlaid text)	9	Page Production	1	Yes
77	IDR pages do not use animation for the sole purpose of drawing attention to an item on homepage	9	Page Production	1	Yes
78	IDR pages never animate critical page elements such as logos, taglines or main titles	9	Page Production	1	Yes
79	IDR pages limit font styles and other text formatting attributes such as sizes and colors	9	Page Production	1	Yes
80	IDR pages use high-contrast text and background colors so that characters are as legible as possible	9	Page Production	1	Yes
81	IDR pages use fonts large enough to read	9	Page Production	1	Yes
82	IDR page background is white	9	Page Production	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
83	IDR has a scroll bar, up and down arrows and a scroll indicator	9	Page Production	1	Yes
84	IDR pages prevent horizontal scrolling at 800x600	9	Page Production	1	Yes
85	On IDR pages, the most critical elements of the page are visible “above the fold” (on the first screen of content, without scrolling), in the most predominant window size	9	Page Production	1	Yes
86	IDR pages use a fluid layout to allow adjustment of homepage size to various screen resolutions	9	Page Production	1	Yes
87	IDR does not include top-level domain name, such as “.br”, in window title bar	9	Page Production	1	Yes
88	IDR does not include the word “ Homepage” in the title	9	Page Production	1	Yes
89	IDR pages limit window titles to no more than seven or eight words and fewer than 64 characters	9	Page Production	1	Yes
90	IDR pages select words with high informational content with hypertext anchors	9	Page Production	1	Yes
91	IDR makes clear from the start the scope of the niche it wishes to serve	9	Page Production	1	Yes
92	IDR provides easy-to-use documentation	10	Page Production	1	Yes
93	IDR avoids internal links	9	Navigational Design	1	Yes
94	IDR makes it easy to access recently presented items on homepage, such as the last two weeks or the previous month, by providing a list of the latest presentations	9	Navigational Design	1	Yes
95	IDR does not use deep links	9	Navigational Design	1	Yes
96	In IDR, structural links are standard throughout website	9	Navigational Design	1	Yes
97	IDR supports user-controlled navigation	9	Navigational Design	1	Yes
98	IDR does not use generic instructions such as “click here” as the name of a link	9	Navigational Design	1	Yes
99	IDR does not use generic links such as “More...”, at the end of a list of items	9	Navigational Design	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
100	IDR does not use the word “ Links ” to indicate existing links on page	9	Navigational Design	1	Yes
101	IDR groups items in the navigation area so that similar items are close to each other	9	Navigational Design	1	Yes
102	IDR does not make up terms for category navigation options. Categories are differentiable from each other. If users do not understand the made-up terminology, they will not be able to distinguish categories	9	Navigational Design	1	Yes
103	IDR provides feedback mechanism, specifies the purpose of link, and other pertinent information	1	Page Production	1	Yes
104	IDR provides input box on homepage for entering search queries, rather than just providing a link to a search page	9	Navigational Design	1	Yes
105	IDR search box is white	9	Navigational Design	1	Yes
106	IDR search box is positioned on the same location on all pages	9	Navigational Design	1	Yes
107	IDR search box positioning is on the left or center, taking advantage of user experience on other websites, and the area is clear, leading user attention to this field	9	Navigational Design	1	Yes
108	Search box is not large enough for users to see and edit standard queries on website	9	Navigational Design	1	Yes
109	In the search bar with title, the word “Search” is used and not the magnifying glass symbol to the right of the box	9	Navigational Design	1	Yes
110	IDR does not perform spelling checks for both the search input data and terms in the consulted documents	9	Navigational Design	1	Yes
111	IDR does not offer synonym expansion for search data	9	Navigational Design	1	Yes
112	IDR provides simple searches on homepage, with a link to access advanced search or search tips	9	Navigational Design	1	Yes
113	Search box for advanced search is large enough for users to see and edit standard queries on website	9	Navigational Design	1	Yes
114	Search box for advanced search is color white	9	Navigational Design	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
115	In IDR, the title selected for search is highlighted and underlined	7	Navigational Design	3	Yes
116	In IDR, links are highlighted and underlined	7	Navigational Design	3	Yes
117	Text on IDR pages is black	9	Navigational Design	2	Yes
118	IDR clearly indicates which links lead to follow-up information about each example and which links lead to general information about the category as a whole	5	Navigational Design	2	Yes
119	IDR does not use underlining for texts other than hypertext anchors	9	Navigational Design	2	Yes
120	IDR allows colored links to indicate visited and unvisited status	9	Navigational Design	2	Yes
121	IDR indicates the presence of blue underlined links	9	Navigational Design	2	Yes
122	IDR makes sure that the link indicates exactly what will happen if it is clicked on (indicate whether link leads to another webpage, links a PDF file to the page, activates audio and video equipment or an email messaging app, etc.)	9	Navigational Design	2	Yes
123	In IDR, the search feature on homepage must search the entire website, by default	9	Navigational Design	1	Yes
124	In IDR, when searching for a keyword that does not exist, this information is returned	5	Navigational Design	4	Yes
125	IDR does not offer a “Search the web” feature, in the website search function	9	Navigational Design	1	Yes
126	In IDR, the search result: displays the classified occurrence list with the best results at the top; eliminates repeated occurrences of the same pages; displays a small snippet of the target page, capable of describing it	9	Navigational Design	1	Yes
127	IDR has a ”Show full record” link	10	Navigational Design	1	Yes
128	In IDR, the ”Show full record” link is highlighted and underlined	7	Navigational Design	3	Yes
129	In IDR, there is a with link permanent file address	10	Navigational Design	1	Yes

Requirements		Heuristics	Guideline	Severity Rating	Expected response
130	The link with permanent file address works	5	Navigational Design	2	Yes
131	IDR has the option “most downloaded items” after the search result	10	Navigational Design	3	Yes
132	IDR pages indicate the file size and format in parentheses, after the link	10	Page Production	1	Yes
133	In IDR, the selected title file opens in the same window	9	Navigational Design	3	Yes
134	The IDR addresses the usability requirements of non-web documents	4	Navigational Design	3	Yes
135	IDR makes the same link available in different locations in the navigation area	5	Navigational Design	1	Yes
136	IDR has standardized language throughout all pages	9	Page Production	3	Yes
137	Navigation by title is in alphabetical order	9	Navigational Design	1	Yes
138	Navigation by keyword is in alphabetical order	9	Navigational Design	1	Yes
139	Navigation by author is in alphabetical order	9	Navigational Design	1	Yes
140	Navigation by date works	9	Navigational Design	1	Yes

Analysis of knowledge production in Applied Social Sciences in Scientific Initiation

Andreza Pereira Batista
Master's Degree in Information Science at Universidade Federal do Ceará (UFC), Fortaleza, Ceará, Brasil.
BA in Library Science at Universidade Federal do Ceará (UFC), Fortaleza, Ceará, Brasil.
http://lattes.cnpq.br/3756124414854783
ORCID: https://orcid.org/0000-0002-5621-402X

Gabriela Belmont de Farias
PhD in Information Science at Universidade Estadual Paulista "Júlio de Mesquita Filho" (UNESP), Marília, São Paulo, Brasil.
Professor at the Department of Information Sciences and Graduate Program of Information Science at Universidade Federal do Ceará (UFC), Fortaleza, Ceará, Brasil.
http://lattes.cnpq.br/9393190768810116
ORCID: https://orcid.org/0000-0001-5743-4422

Submitted on: 03/31/2022. Approved on: 12/12/2022. Published on: 06/21/2024.

ABSTRACT

Higher education institutions play a vital role in generating scientific knowledge through programs like scientific initiation scholarships. Mapping the publications produced through these programs is a key method for assessing and highlighting the development of knowledge. This study examines the scientific outputs of. This article aims to analyze the scientific output of the Programa Institucional de Bolsas de Iniciação Científica (PIBIC) of the Federal University of Ceará, focusing on the communication mediums employed by researchers (e.g., journal articles, conference proceedings). Employing an exploratory, descriptive, and documentary research design with a mixed-methods case study approach, the research utilizes scientific initiation reports as data, categorized based on publication outcomes. The analysis focuses on projects within Applied Social Sciences (SAS) and is statistically grounded in theoretical frameworks related to the Qualis ratings of publications on the Plataforma Sucupira of the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CNPq). The findings reveal that scientific outputs from these initiation projects primarily take the form of journal academic papers and conference proceedings. Mapping these outputs provides a representative sample of the university's scholarly production, addressing institutional, scientific, and societal needs, and thereby supporting the educational development of undergraduate researchers in scientific initiation, a principal goal of the PIBIC program.

Keywords: scientific production; scientific communication; Programa Institucional de Bolsas de Iniciação Científica.

INTRODUCTION

Science advances through the contributions of its community, primarily by sharing results from specialized research. Various fields of knowledge not only progress but also drive social development, reflecting the collective intellectual frameworks they create. The 2019 Web of Science report highlights that approximately 60% of Brazil's scientific research is conducted within public universities.

These Higher Education Institutions (HEIs) are governed by a triad based on teaching, research, and university outreach, where teaching and learning activities are fundamental, and the latter two stem from the former, in favor of the country's social progress and as a producer of knowledge. Research is developed through various incentive plans, such as studies from graduate programs (PG) and undergraduate scientific initiation (IC) scholarships for undergraduates, which come in the form of institutional programs supported by funding agencies and investments from the HEIs themselves, as it is the case of the Institutional Scholarship Program for Scientific Initiation (PIBIC).

PIBIC aims to integrate students into research endeavors, preparing human resources essential for Brazilian science. Participants, alongside their advisors, are committed to testing research hypotheses and generating scientific texts for dissemination through conferences, as well as national and international journals.

It is vital to understand the outputs of these institutions to promote science and sustain investment. Programs like PIBIC justify their existence by their contributions to academic peers and the broader society, highlighting the importance of mapping scientific outputs as a significant area of study.

According to the Centro de Gestão e Estudos Estratégicos (CGEE) in its 2017 assessment of PIBIC remarks that "[…] é imperioso que seus resultados sejam periodicamente avaliados, a fim de que se determine se seus objetivos estão sendo atingidos e aperfeiçoamentos sejam desenvolvidos, caso sejam considerados relevantes" (2017, p. 13)[1]. This underscores the significance of PIBIC as a potent mechanism for engaging undergraduates in advanced studies.

Therefore, it is essential to understand how researchers and their advisees communicate their findings to academic communities. The final research reports recorded on the PIBIC platform are not published, which restricts public access to them unless there is an explicit effort by the researchers to disseminate their findings through various communication channels and media.

In light of these considerations, our research addresses the following questions: Do the Applied Social Sciences (SAS) projects associated with PIBIC at the Universidade Federal do Ceará (UFC in the Portuguese acronym) lead to scientific publications? What channels are used to disseminate the findings of these PIBIC/UFC projects?

1 Translation: "[…] it is imperative that its results be periodically evaluated, in order to determine whether its objectives are being met and improvements are developed, if deemed relevant." (Centro de Gestão e Estudos Estratégicos, 2017, p. 13, editorial translation).

Our goal is to examine and identify the scientific production presented in the reports of projects from the PIBIC/UFC programs of 2016/2017, 2017/2018, and 2018/2019 related to the SAS, as well as to understand which channels of communication are being adopted by the researchers affiliated with the program. We chose to investigate this sample because of the inclusion of Information Science (IC) and Library Science within the SAS, as well as the possibilities arising from exploring this area within the program, thus obtaining a general and specific overview of what is produced and published from the scientific initiation projects.

Scientific communication and production: some considerations

Communication represents both the starting and concluding point in the research cycle, encompassing the investigations undertaken by scholars and institutions. It is through this communication that members of various academic communities introduce new ideas and foster the development of knowledge across diverse fields.

According to Vasconcelos, Farias, and Farias (2019, p. 238)[2], scientific communication has the "[…] função primordial garantir o aprimoramento do conhecimento científico a partir do ciclo ininterrupto de corroborações, refutações, teorias e descobertas", and is "[…] responsável pelos fluxos de informação dentro da comunidade científica". It engages numerous participants in a diligent process of transforming research into publications targeted at both specialized and broader audience.

The diversity, innovation, and relevance of disseminated information are critical, as noted by Targino (2016, p. 130)[3] who emphasizes the expectation that scientists "[…] tragam à tona conhecimentos inovadores e pertinentes que fortaleçam sua função em meio à tessitura social". Science is inextricably linked with society, affecting and being affected by social changes. Droescher and Silva (2014) highlight that scientific communication also involves subjecting research to peer review, a crucial step for gaining recognition within the scientific community.

Costa (2008) describes the scientific communication process as starting with research and continuing through discussions with peers, culminating in submissions to conferences and journals. She advocates for a hybrid model of publication, both print and electronic. However, given the shift towards electronic media, primarily driven by advances in Information and Communication Technologies (ICT) since her analysis in 2008, the landscape now heavily favors digital formats.

2 Translation: "[...] primary function is to ensure the enhancement of scientific knowledge through an uninterrupted cycle of corroborations, refutations, theories, and discoveries […] responsible for the information flows within the scientific community" (Vasconcelos; Farias; Farias, 2019, p. 238, editorial translation).

3 Translation: "[...] bring to light innovative and relevant knowledge that strengthens their role within the social fabric" (Targino, 2016, p. 130, editorial translation).

Vasconcelos, Farias, and Farias (2019) and Costa (2008) both underline that the generation of documents is essential for materializing research outcomes, highlighting that production and communication are integral to the flows that define scientific practice and contribute to the consolidation of knowledge within the academic community.

The communication of science involves validating scientific outputs through peer-established criteria, according to Targino and Torres (2014). Originally, scientific communication was meant to circulate knowledge within the academic community, rooted in scientific inquiry and responsible for disseminating researchers' extensive findings. It forms a continuous loop where scientists act as producers, consumers, and evaluators of information. In this context, disseminating results primarily from scientific endeavors, such as academic papers, books, patents are vital for the ongoing construction of knowledge.

Journals remain the most familiar and widely utilized platforms for disseminating research, including papers, reviews, interviews, and more. These outlets are considered reliable due to the rigorous peer-review process each submission undergoes before publication. Academic papers also frequently appear in technical and scientific conference proceedings, further broadening their reach within the scientific community.

Regarding books, the *Dicionário de Biblioteconomia e Arquivologia* (Cunha; Cavalcanti, 2008) defines them as more exhaustive works about a particular subject or several subjects, whether they are scientific or artistic, generally printed (a reality that is being changed with the incorporation of ICT), and which differ from periodical publications and other forms of documentary materials.

Patents are concessions that "[…] um governo outorga a um inventor dando-lhe o direito exclusivo de explorar ou vender seu invento durante um tempo limitado" (Cunha; Cavalcanti, 2008, p. 277)[4], thus protecting intellectual property. Many patents emerge from research conducted in Higher Education Institutions (HEIs), showcasing their role in fostering innovation within society. While patents predominantly arise from the sciences and health fields within universities, the Applied Social Sciences (SAS) typically exhibit a lesser propensity for patent-producing research (Cunha, 2016).

Durham (1998) notes that public universities are pivotal in supporting research and training researchers in Brazil, governed by a triple helix model of teaching, research, and extension. This model facilitates robust communication across the three domains, enhancing social scientific development.

Publication remains a critical component of academic recognition and career progression. Biava, Pagani, and Oliveira (2017) argue that the reliance on scientific output as a metric of research capability prompts scrutiny of academic productivity and its societal and scientific impacts.

In the current scenario, the report *A pesquisa no Brasil: Promovendo a excelência* (WEB OF SCIENCE GROUP*,* 2019) assesses the country's research within a global framework.

4 Translation: "[...] a government grants to an inventor, giving them the exclusive right to exploit or sell their invention for a limited time" (Cunha; Cavalcanti, 2008, p. 277, editorial translation).

The document presents data on studies published between 2013 and 2018, highlighting the importance of international collaborations and exchange with industry in the impact and visibility of national research (Portal Periódicos da Capes, 2019).

According to this report, Brazil is currently ranked 13th in the global production of indexed research papers and reviews on the Web of Science. Brazilian scholars have published approximately 50,000 articles, witnessing a growth of 30% over the past six years – double the global average. Moreover, during the 2015-2017 period, 81% of joint publications from universities and industry originated from public universities. These institutions have long been the cornerstone of Brazilian Science and Technology Policies, driving their development for many decades.

Despite recent progress, Social Sciences, Humanities, and Arts remain underrepresented, and even overlooked in the report. This, as the authors themselves acknowledge, reflects the lower frequency of publication in the form of books or normative documents in these fields. The focus of research in Brazil has broadened over the last six years, with growth in all areas except Linguistics, Literature, and Arts, highlighting a need for enhanced public policy support in underrepresented disciplines to ensure balanced development across all fields of study.

The advancement of research excellence in Brazil is notably driven by public universities, which are central to fostering international and industrial collaborations. This progress is supported by a range of initiatives, encompassing graduate programs and various projects. Among these, the PIBIC stands out, extending its reach not only to undergraduate students but also, in some instances, to high school students.

Scientific initiation and the PIBIC program

Scientific initiation (IC) scholarships are pivotal in promoting research within undergraduate programs at Higher Education Institutions (HEIs). These scholarships are instrumental not only in nurturing students as researchers and potential graduate candidates but also in preparing them as professionals adept at meeting the demands of the traditional job market. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) ([201-], *online*)[5] articulates that "[…] para desenvolver um país é necessário desenvolver pessoas: elevar o patamar de informação disponível e prover a população de conhecimentos básicos de ciência e tecnologia". This knowledge is crucial for fostering the sociocultural and scientific advancement of the nation. In this context, IC scholarships serve as a catalyst for encouraging students to pursue careers in Science and Technology (S&T). They expose students to a scientific culture from the early years of formal education, engaging them in research projects under the guidance of faculty members who act as research mentors. This

5 Translation: "[…] o develop a country, it is essential to develop its people: to elevate the level of available information and to equip the population with fundamental knowledge of science and technology." (CNPq, [201-] *online*, editorial translation).

approach is designed to cultivate scientific skills and critical thinking necessary for navigating the traditional job market. Massi and Queiroz (2015, p. 7, our emphasis)[6] propose that IC can be viewed from two distinct perspectives within higher education:

> Na primeira, é um processo que abarca todas as experiências vivenciadas pelo aluno durante a graduação, com o **objetivo de promover o seu envolvimento com a pesquisa e, consequentemente, sua formação científica**, incluindo programas de treinamento, desenvolvimento de estudos sobre a metodologia científica (dentro de uma disciplina ou não), visitas programadas a institutos de pesquisa e a indústrias etc. Na segunda, […], a IC é definida como o **desenvolvimento de um projeto de pesquisa elaborado e realizado sob orientação de um docente da universidade, executado com ou sem bolsa para os alunos**.

This understanding emphasizes that IC is not strictly tied to specific programs or scholarships; it can proceed even without financial aid. In this context, scholarships serve as financial incentives, rewarding students' dedication to their projects, given the substantial time commitment required by research activities. Therefore, the comprehensive education of a student is achieved not only through traditional coursework within HEIs but also through immersive experiences in research and knowledge production.

Additionally, Canaan and Nogueira (2015) view IC scholarships as educational assets that enhance academic pathways. They argue that these scholarships are valuable resources that extend students' academic trajectories. Consequently, the PIBIC program emerges as a vital contributor to training human resources, benefiting not just research-oriented careers but also the conventional job market. By developing skills that aid in personal, academic, and professional growth, PIBIC equips students to better navigate various challenges.

PIBIC supports the IC policy implemented across educational and research institutions by allocating scholarships directly to these institutions. These institutions are responsible for selecting the research projects and participants for the program. Beyond the CNPq, various other research funding bodies contribute to IC. Notably, the Research Support Foundations (FAPs) in several Brazilian states also finance IC initiatives, such as the Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico (FUNCAP) in Ceará.

In this regard, according to Fava-de-Moraes and Fava (2000), IC offers various benefits to the student, among which we highlight: (a) escape from routine and curricular structure, differing in oral and written expressions; (b) overcoming fear and panic of the new through autonomy supported by the guidelines of the advisor; (c) better performance in selections, continuity and completion of graduated degrees; (d) better capacity for critical

6 Translation: "From one perspective, IC is seen as a holistic process that integrates various educational experiences during undergraduate studies. This approach aims to foster students' engagement with research and, consequently, their scientific training. It includes participation in training programs, studies on scientific methodology (both within and outside formal coursework), and organized visits to research institutes and industries. From a second perspective, IC is defined more narrowly as the development and execution of a research project under the supervision of a university faculty member. This project can be undertaken with or without a scholarship, providing students practical research experience." (Massi; Queiroz, 2015, p. 7, editorial translation).

analysis, intellectual maturity, and discernment to face difficulties in professional life; and (e) bring innovations during project development, which can guarantee creative and original problem solving abilities.

The benefits of the PIBIC program were further illuminated by a 2016 study conducted by the CGEE, which evaluated various of its aspects, particularly its influence on graduate degree training and the professional integration of current students and alumni. The report (CGEE, 2017, p. 44)[7] reamrks that "[…] os bolsistas avaliam muito positivamente as habilidades e competências que a bolsa lhes permitiu desenvolver". The report also found that 52% of students expressed satisfaction with having completed all the activities proposed by the program, linking the support, guidance, and opportunities provided by both the program and their advisors to effective use of the scholarship and the practical application of the skills acquired in their professional fields.

These benefits are crucial for integrating student training, particularly as they transition to master's and doctoral programs and bridge the gap between undergraduate and graduate studies. Additionally, they encompass skills and techniques that arise from addressing the challenges inherent in scientific work, thus empowering student agency. The development of critical thinking is a significant aspect of the program experience for most participants, as highlighted by the CGEE study (2017). This process of critical reflection includes promoting the dissemination of project results and presenting the university's outputs to the broader public, particularly those generated within the PIBIC projects.

It is also noteworthy that CNPq ([201-]) sponsors additional initiatives aimed at fostering scientific initiation for students in higher education and high school, enabling them to engage broadly with science. For higher education, notable programs include the Institutional Programa Institucional de Bolsas de Iniciação Científican nas Ações Afirmativas (PIBIC-Af), the Programa Institucional de Bolsas de Iniciação Científican de Desenvolvimento Tecnológico e Inovação Científica (PIBITI), and the Programa de Iniciação Científica e Mestrado (PICME). These programs are designed to enhance technical training and foster scientific and technological innovation.

At the high school level, programs such as the Programa de Iniciação Científica da Olimpíada Brasileira de Matemática (IC-OBMEP), Programa Institucional de Bolsas de Iniciação Científican para o Ensino Médio (PIBIC-EM), and the Programa de Iniciação Científica Júnior (IC-Jr) primarily aim to cultivate a scientific vocation among students and challenge the misconception that research is exclusively conducted within university settings. This limited perception may stem from inadequate dissemination of these initiatives, leaving much of the Brazilian population unaware of their scope and impact.

7 Translation: "[…] the fellows highly value the skills and competencies that the scholarship allowed them to develop" (CGEE, 2017, p. 44, editorial translation).

METHODOLOGY

This paper conducts both exploratory and descriptive research. Exploratory research, according to Gil (2008), seeks to provide a deeper understanding of concepts and ideas, offering a comprehensive view of the subject under study. In contrast, descriptive research aims to detail the characteristics of a specific population or phenomenon. The theoretical foundation of this study was established through a bibliographic survey, forming the basis of our literature review.

The methodology implemented encompassed documentary research, which enabled researchers to draw informed inferences from the data and organize this information in alignment with predefined objectives. This approach proved particularly effective due to its strategic application in analyzing data from PIBIC reports. Additionally, we employed a case study methodology, focusing on a specific instance that is representative of a broader category. This method allows for a thorough and comprehensive examination of one or a more subjects, facilitating detailed analyses and the generation of hypotheses concerning the phenomena observed. (Gil, 2008)

Furthermore, this study incorporated specific strategies for data analysis, which, according to Holanda, Ribeiro, and Jesus (2020), involve examining, categorizing, tabulating, or recombining evidence in alignment with the research objectives. Yin (2015, cited in Holanda, Ribeiro, and Jesus 2020, p. 693)[8] identifies three analytical strategies, which are described as follows:

> • Baseada em proposições teóricas: seguir as proposições teóricas que levaram ao estudo de caso. Essas proposições refletem o conjunto de questões da pesquisa e as revisões feitas na literatura sobre o assunto e as novas interpretações que possam surgir.
> • Pensando sobre explanações concorrentes: definir e testar explanações concorrentes; proposições originais talvez possam incluir hipóteses concorrentes.
> • Desenvolvendo uma descrição de caso: desenvolver uma estrutura descritiva a fim de organizar o estudo de caso.

For this paper, we employed an analytical strategy anchored in theoretical propositions, reflecting the objectives established and insights derived from both the theoretical framework and the collected data. We utilized reports from approved and completed PIBIC projects from the program call of 02/2016-PIBIC 2016/2017, 03/2017-PIBIC 2017/2018, and 02/2018-PIBIC 2018/2019, as provided by the Pró-Reitoria de Pesquisa e Pós-Graduação (PRPPG) of

8 Tranlation: "• Based on theoretical propositions: the case study followed theoretical propositions that reflected the research questions and revisions made in the literature on the subject, along with new interpretations that might emerge. • Considering competing explanations: defining and testing competing explanations was vital; original propositions might include these competing hypotheses.• Developing a case description: developing a descriptive framework was crucial to organize the case study." (Yin, 2015 apud Holanda; Ribeiro; Jesus 2020, p. 693, editorial translation).

UFC[9]. This dataset spanned three academic periods, with data tabulation and organization occurring from August 2019 to July 2020, and the analysis phase conducted between August and October 2020. The data encompassed the following dimensions:

a) Academic units (campuses, centers, institutes, and faculties of UFC);
b) The field of knowledge under which the project was registered;
c) Titles and subtitles of the projects (if applicable); and
d) Types of scientific communication employed by the projects, including patents, articles, books, book chapters, and presentations at conferences. Further analysis by the SAS also noted the inclusion of abstracts in these categories.

It is important to note that within the PIBIC/UFC projects the presentation at academic conferences are usually oral communications of the research findings. Consequently, a single research output could be documented both as an paper published in a journal and as a communication at conferences, with each instance being counted separately. To illustrate the distribution of these communications, we present **Table 1**, which details the total number of approved and completed reports from the PIBIC/UFC projects:

Table 1 – Universe of reports from the PIBIC/UFC projects

Period of the PIBIC/UFC project reports	Quantity of the PIBIC/UFC project reports	%
2016/2017	697	32,4%
2017/2018	742	34,5%
2018/2019	710	33%
Total	**2.149**	**100**

source: Research data (2020).

However, not all projects in the dataset were associated with scientific productions. Therefore, aligning with the objectives of our study, we filtered out projects that did not report any publications. This exclusion led to the removal of 1,255 reports from the initial pool of 2,149 PIBIC/UFC reports, corresponding to 58.4% of the total. Consequently, the research sample was narrowed to 894 project reports (41.6%) that met the publication criterion.

Upon defining this scope, we focused on data pertaining to SAS, segmented into six area as described in the data sample: Public Administration and Business, Accounting and Tourism; Architecture, Urbanism, and Design; Communication and Information; Law;

9 At Universidade Federal do Ceará the PIBIC is managed by the Coordination Office of the Pró-Reitoria de Pesquisa e Pós-Graduação (PRPPG) with the assistance of the Internal Committee, predominantly composed of PhDs, responsible for the management and evaluation of the program (Universidade Federal do Ceará, [20—]). The objectives of the program align with those of the CNPq, emphasizing the development and nurturing of students' vocations for scientific research, which is one of the most desired outcomes. Furthermore, the program significantly impacts the human, professional, and academic development of the scholarship students through their experiences in the program.

Economics; and Multidisciplinary/Interdisciplinary/Social Applied and Humanities Sciences. From this categorization, the final sample comprised 195 project reports that had been concluded and submitted to the PRPPG over the specified three periods, as detailed in **Table 2**.

Table 2 – Number of PIBIC/UFC project reports related to Social Applied Sciences fields with and without scientific publications

Area	2016/2017						2017/2018						2018/2019					
	Pr	%	Pc	%	Sp	%	Pr	%	Pc	%	Sp	%	Pr	%	Pc	%	Sp	%
Adm	16	26,2	06	21,4	10	30,3	18	24,7	16	42,1	02	5,7	12	19,7	08	24,2	04	14,3
Aud	0	0	0	0	0	0	09	12,3	05	13,2	04	11,4	10	16,4	06	18,2	04	14,3
Ci	18	29,5	14	50	04	12,1	15	20,5	10	26,3	05	14,3	15	24,6	10	30,3	05	17,9
Di	12	19,7	03	10,7	09	27,3	09	12,3	02	5,3	07	20	09	14,8	05	15,2	04	14,3
Ec	11	18	01	3,6	10	30,3	16	21,9	03	7,9	13	37,1	12	19,7	03	9,1	09	32,1
Mul/Int	04	6,6	04	14,3	0	0	06	8,2	02	5,3	04	11,4	03	4,9	01	3	02	7,1
Total	**61**	**100**	**28**	**100**	**33**	**100**	**73**	**100**	**38**	**100**	**35**	**100**	**61**	**100**	**33**	**100**	**28**	**100**

Source: Research data (2020).

Legend: **Pr** – SAS IC projects; **Pc** – IC projects with scientific publication; **Sp** – IC projects without scientific publication; **Adm** – Public Administration and Business; **Aud** – Urbanism, and Design; **Ci** – Communication and Information; **Di** – Law; **Ec** –Economics; **Mult/Int** – and Multidisciplinary/Interdisciplinary/Social Applied and Humanities Sciences

Table 2 shows the distribution of the 195 projects across the three evaluated years: 61 projects (31.2%) for 2016/2017, 73 projects (37.4%) for 2017/2018, and 61 projects (31.2%) for 2018/2019. These are SAS undergraduate research research (referred to herein as “Pr”). This subset represents approximately 11% of the 894 undergraduate research projects with scientific productions and 50.7% of the 195 projects associated with SAS. Furthermore, 99 projects (50.8% of the 195) yielded scientific productions (PC column in the table) in the selected areas, with distribution as follows: 28 in 2016/2017, 38 in 2017/2018, and 33 in 2018/2019.

For data analysis, we employed a mixed-methods approach, encompassing both quantitative and qualitative methodologies. This allowed us to investigate the typologies of papers published in national and international journals and conference proceedings. We utilized the Qualis Journals/CAPES classification system, a well-established evaluation criterion within the academic community, available on the CAPES Plataforma Sucupira. The following pragmatic steps were applied:

1. Identification of the title and, where needed, an internet search for the International Standard Serial Number (ISSN) for verification and/or data supplementation;
2. Search by title and/or ISSN on the Plataforma Sucupira, applying the “2013/2016 quadrennial classification” as the evaluation criterion (most recent official data available); and

3. Comparison of the journal/proceedings' evaluation area with the field of knowledge registered for the project.

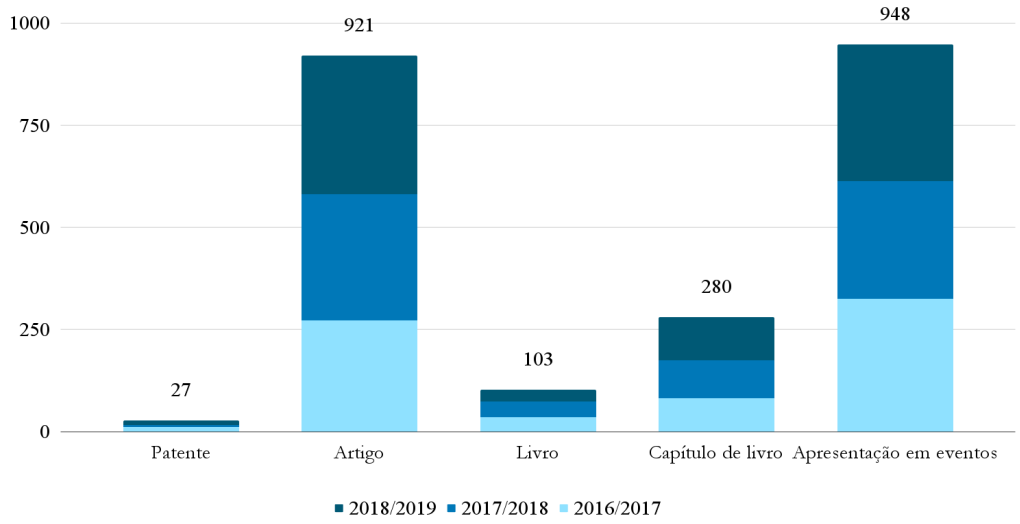
RESULTS ANALYSIS AND DISCUSSION

The data derived from the PIBIC/UFC project reports reveal a clear presence of scientific outputs within the Social Applied Sciences (SAS) field. These outputs primarily consist of journal papers and conference proceedings. Notably, SAS projects demonstrably address social needs, highlighting their engagement with human and societal issues regardless of the researchers' affiliations. While the characteristics of projects with and without publications remained consistent across the study periods, a significant rise in outputs was observed during the 2017/2018 academic year.

From the initial selection of 894 PIBIC/UFC projects, a total of 2,279 scientific productions were documented over the three years examined (725 in 2016/2017, 735 in 2017/2018, and 819 in 2018/2019). These figures encompass patents, articles, books, book chapters, and conference presentations, as documented in final reports and observed during data tabulation, as presented in **Chart 1** below. Among these productions, 246 were conference proceedings and 330 were journal publications (both international and national). Notably, proceedings hosted 432 outputs, while journals published 489, together constituting roughly 41% (921) of the total 2,279 outputs.

Chart 1 further delineates that academic papers (40.4%) and presentations at conferences (41.6%) are the most prevalent forms of scientific communication used by researchers. The prominence of academic paper comes with no surprise and reflect their commonality within scientific communities. Moreover, as noted earlier in section 2 of this study, this typology tends to appear more frequently in journals and conference proceedings, both in terms of the volume of publications per year and the number of works per issue.

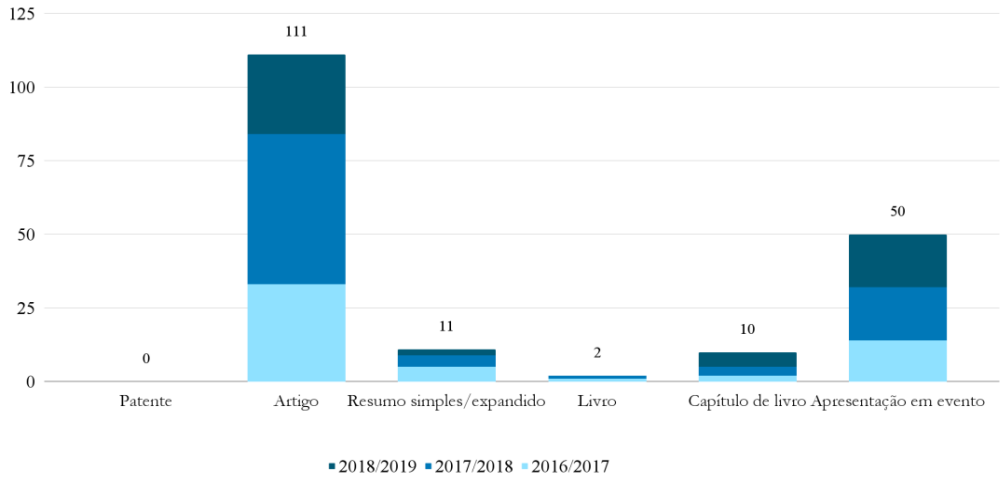
CHART 1 – Typologies of scientific productions identified in the PIBIC/UFC project reports for the periods 2016/2017, 2017/2018, and 2018/2019 (values corresponding to the total projects)



Source: Research data (2020).

From the initial selection of 894 PIBIC/UFC projects, a total of 2,279 scientific productions were documented over the three years examined (725 in 2016/2017, 735 in 2017/2018, and 819 in 2018/2019). These figures encompass patents, articles, books, book chapters, and conference presentations, as documented in final reports and observed during data tabulation. Among these productions, 246 were conference proceedings and 330 were journal publications (both international and national). Notably, proceedings hosted 432 outputs, while journals published 489, together constituting roughly 41% (921) of the total 2,279 outputs.

CHART 2 – Typologies of Scientific Productions Identified in the PIBIC/UFC Project Reports for the Periods 2016/2017, 2017/2018, and 2018/2019, Linked to the Applied Social Sciences



Source: Research data (2020).

The findings depicted in **CHART 2** contrast with those reported by the *Web of Science* (2019), which notes that researchers in the fields of Arts, Humanities, Social Sciences, and Applied Social Sciences frequently produce books or normative documents. These formats are less represented in database, yet Brazilian research in these areas notably achieves higher citation rates than the global average. Despite this, the prevalence of book chapters in our sample aligns with Cunha and Cavalcanti's (2008) description, suggesting that this medium allows for exhaustive discussions on specific subjects and is favored in the Human and Social Sciences for it allow for a more in-depth analysis.

It is crucial to note that no patents were found in our sample, corroborating the trends identified in science and technology literature: patents are predominantly derived from health and exact sciences. In contrast, Applied Social Sciences traditionally lack a history of research that leads to patents. Although the precise reasons for this absence are unclear, it is recognized that the disciplines within SAS are traditionally professionalized (CGEE, 2017), and therefore, rarely pursue initiatives aimed at producing research outputs in this typology. Nonetheless, this absence does not imply a lack of innovative elements within these projects. On the contrary, innovation remains essential for the progression of science. Indeed, PIBIC research projects have the potential to produce substantial outcomes and introduce fresh insights into established issues, thus embodying the essence of innovation.

In line with our research methodology, we will now proceed to map, identify, and describe the dates and outputs of academic-scientific conferences proceedings and papers published both nationally and internationally, evaluated through their Qualis Journals/ CAPES classification.

Our analysis of 99 PIBIC projects with documented outputs revealed that 88 reported producing papers and abstracts disseminated on various platforms. It's important to note that these numbers may not directly translate to 88 in our further analysis. If a project produced papers and abstracts for both conferences and journals, each instance was counted separately making it the simple sum unfeasible. Furthermore, the data on scientific outputs reflects the scientific production recorded by PIBIC/UFC researchers, as verified during data compilation. Any discrepancies between these reported outputs and the actual figures were addressed by adjusting the final totals used in our analysis.

Accordingly, **Table 3** details the number of PIBIC/UFC projects and scientific outputs that recorded publications in conference proceedings and journals in their final reports. Notably, the most frequent types of publications were papers and abstracts, particularly in academic conference settings – a result that aligns with the expectations set by the theoretical framework of this study. The analysis reveals that there are 91 project reports mentioning publications, with 50 projects (54.9% of the total) in conference proceedings and 41 projects (45.1%) in journals. Altogether, these accounted for 126 scientific outputs during the periods reviewed, with 77 in proceedings (61.1%) and 49 in journals (38.9%).

Table 3 – Quantitative of PIBIC/UFC projects and scientific productions by scientific communication vehicle for the periods 2016/2017, 2017/2018, and 2018/2019 linked to Applied Social Sciences

Scientific communication media	Period	Applied Social Sciences											
		PIBIC/UFC Projects						Scientific Production					
		Tot.	%	PI	%	PN	%	Tot.	%	PI	%	PN	%
Conference Proceedings	2016/2017	14	15,3	02	2,2	12	13,2	25	19,9	04	3,2	21	16,7
	2017/2018	19	20,9	01	1,1	18	19,7	33	26,2	02	1,6	31	24,6
	2018/2019	17	18,7	0	0	17	18,7	19	15	0	0	19	15
Total		**50**	**54,9**	**03**	**3,3**	**47**	**51,6**	**77**	**61,1**	**06**	**4,8**	**71**	**56,3**
Journals	2016/2017	16	17,6	03	3,3	13	14,3	16	12,7	03	2,4	13	10,3
	2017/2018	13	14,3	03	3,3	10	11	19	15	03	2,4	16	12,7
	2018/2019	12	13,2	02	2,2	10	11	14	11,2	02	1,6	12	9,5
Subtotal		**41**	**45,1**	**08**	**8,8**	**33**	**36,3**	**49**	**38,9**	**08**	**6,4**	**41**	**32,5**
Total		**91**	**100**	**11**	**12,1**	**80**	**87,9**	**126**	**100**	**14**	**11,2**	**112**	**88,8**

Source: Research data (2020).

Caption: **Tot –** Total; **PI –** Publications in international scientific communication vehicles; **PN –** Publications in national scientific communication vehicles

The data suggest a distinct preference among PIBIC/UFC researchers for producing and disseminating their work at conference proceedings. This preference likely stems from the nature of these academic events, that allow a more informal communication style and nearly synchronous debate with the scientific community. Such environments act as incubators for new ideas and their refinement, fostering interpersonal relationships that facilitate the renewal of knowledge and integration of insights into the social fabric, as Targino (2016) has observed.

Referring back to **Table 3**, there is a noticeable production increase in the 2017/2018 period, yet the data also indicate a consistency in publications across the years examined. This consistency underscores the sustained flow of scientific communication into the corpus of specialized knowledge (Vasconcelos, Farias, & Farias, 2019). Additionally, the data reveal that, despite the predominance of national publications, there is a significant international[10] presence: 11 project reports, representing 12.1% of the total, noted research-derived works published in international venues, totaling 14 scientific productions or 11.2% of the overall output.

The presence of international production demonstrates that the outputs from PIBIC projects transcend the barriers of Brazilian science, thereby contributing to achieving excellence in research. Regarding national publications, the number of projects with production published in conference proceedings and journals shows similar variations across the selected timeframe, with a total of 80 projects (87.9%), indicating that researchers maintain a consistent level of submission to both types of venues.

Reflecting on the total scientific productions identified in the PIBIC projects within SAS, which corresponds to 183, there are 126 outputs published in proceedings and journals, representing 68.9%. This accounts for more than half of the production in this context and can be seen as indicative of both the program's characteristics and the publication profiles of SAS projects, with a focus on communications aimed for Brazilian audiences. It is important to note that the remaining 57 publications from the aforementioned total were subtracted because they lacked detailed descriptions or had insufficient descriptions allowing a proper publication identification, or they described other types of outputs not selected for the purposes of this paper, such as undergraduate theses.

During the data tabulation and analysis phase, we observed a significant proportion of publications resulted from collaborative efforts and invitations to contribute to multi-authored edited volumes, particularly in the development of book chapters. This trend suggests a robust level of interaction among scientific communities, facilitating the dissemination of Science and Technology (S&T) information relevant to the study's theme. It is worth noting that this collaborative nature is initially reminiscent of the PIBIC program, which, by bringing together researchers from diverse academic backgrounds, fosters similar patterns of collaboration within the scientific community.

Furthermore, the dissemination of research findings provides researchers with recognition for their efforts. As previously highlighted by Droescher and Silva (2014) and

10 We highlight that the international publications included in our sample, which encompass both conference proceedings and journals, are those that are edited and published abroad. This inclusion reflects entries made by researchers in their final reports, underscoring the global reach of the scientific communication detailed in our analysis.

Targino (2016), this recognition motivates researchers to publish their work, thus enhancing their visibility and establishing their reputation within their field. This visibility also facilitates the formation of partnerships that perpetuate the scientific cycle. Consequently, we contend that the scientific output from PIBIC/UFC effectively fulfills one of the program's key objectives: the development of human resources for Brazilian research. This achievement benefits not only the advisors but also extends to the students involved, enhancing their visibility through the execution and publication of their research.

In accordance with the methodology outlined, we conducted a mapping of the conference proceedings and journals listed in the sample using the CAPES Plataforma Sucupira. This involved searching for the titles recorded in the data to identify both their Qualis strata and the knowledge areas associated with each publication. We assigned the label 'Not located' to those entries that could not be identified during the search.

It is important to note that some of the proceedings from the PIBIC projects were published with an International Standard Book Number (ISBN). Unlike traditional publications, these do not have a designated Qualis stratum but rather a scale level that allows researchers to summarize the characteristics of the publication and assign a specific stratum. Consequently, only a few of these are registered on the Plataforma Sucupira, as there is not yet a developed system to evaluate these type of scientific production (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, 2019).

To avoid redundancy in the titles of publication outlets, each title was considered only once per period. After tabulation, we identified a total of 47 proceedings titles, comprising 15 national and international publications in 2016/2017, 17 in 2017/2018, and 15 national publications in 2018/2019. For the journals, a total of 45 titles were found, with 16 national and international publications in 2016/2017, 19 in 2017/2018, and 10 national publications in 2018/2019.

Furthermore, of the 44 titles of conference proceedings published nationally, those that correspond to the knowledge areas identified by researchers in the PIBIC project reports are primarily in interdisciplinary (13.7%) and urban and regional planning/demography (3.9%). It is important to emphasize that the total count of 52 is based on the total amount of proceedings examined, even when title duplication occurred. We also observed that some studies presented at conferences are subsequently published in journals, as many conferences have partnerships with academic journals. This recurrence underscores that patterns of scientific communication flow and the dynamics within the academic community were reproduced in the PIBIC/UFC project sample.

Regarding their Qualis classification, there was a predominance of the designation 'Not located,' which applied to 42 titles (80.8%), followed by stratum C (19.2%), the only one observed among the ten evaluated outlets. As for the proceedings published internationally, it was not feasible to present them, since none of the three identified titles were located on the Plataforma Sucupira. We understand that both situations likely arose because these publications were issued under the ISBN identifier.

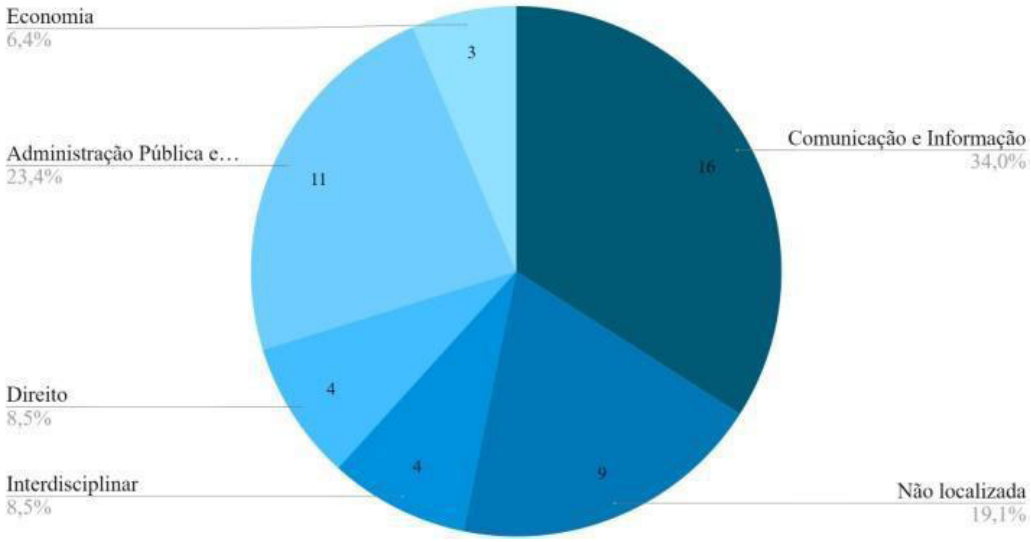
In the case of the four internationally published journals, the results covered three fields: “Communication and Information,” “Interdisciplinary,” and “Economics,” with Qualis classifications of A1, B1, and C (for two projects), respectively. It is noteworthy that there is an international journal classified in the highest stratum (A1), indicating a significant relevance of scientific communication in IC. However, it remains unclear whether the scholarship holders were involved in drafting the papers derived from their research.

Although some descriptions by PIBIC/UFC researchers did not explicitly state whether there was joint publication with PIBIC scholarship students, those mentioning it made it clear co-authorship in peer-reviewed scientific communication outlets. Therefore, we can assert that the critical thinking, skills, and expertise developed in students through participation in the program – as detailed in the CGEE study (2017) – also enrich the experiences of a portion of the PIBIC/UFC scholarship holders. A student’s propensity for research should not be overlooked as a significant factor in their IC experience. However, the encouragement and integration of these potential young researchers into scientific and academic practices have the capacity to retain human resources within Brazilian research community.

Regarding the 41 journal titles published in Brazil, **Chart 3** maps knowledge areas, highlighting the diversity within the selected analytical frame. Similar to the numbers of conference proceedings, which totals 47, with “Communication and Information” being the most prominent, accounting for 16 publications (34%). The category “Public Administration and Business, Accounting Sciences and Tourism,” unique to the FEAAC sample, includes 11 publications (23.4%) and follows the same standardization previously noted.

It is important to note that a significant portion of the journal productions classified under the ‘Not located’ designation – seven out of the nine in this category – were identified in the *Revista Encontros Universitários UFC*. This publication serves as the outlet for abstracts from Encontros Universitários, a conference held at UFC that plays a central role in integrating the academic and higher education community. Participation in these meetings is mandatory for all scholarship holders, including those in the PIBIC program, and currently, the journal does not possess a Qualis classification. This explains and justifies the relatively high percentage of entries in this category.

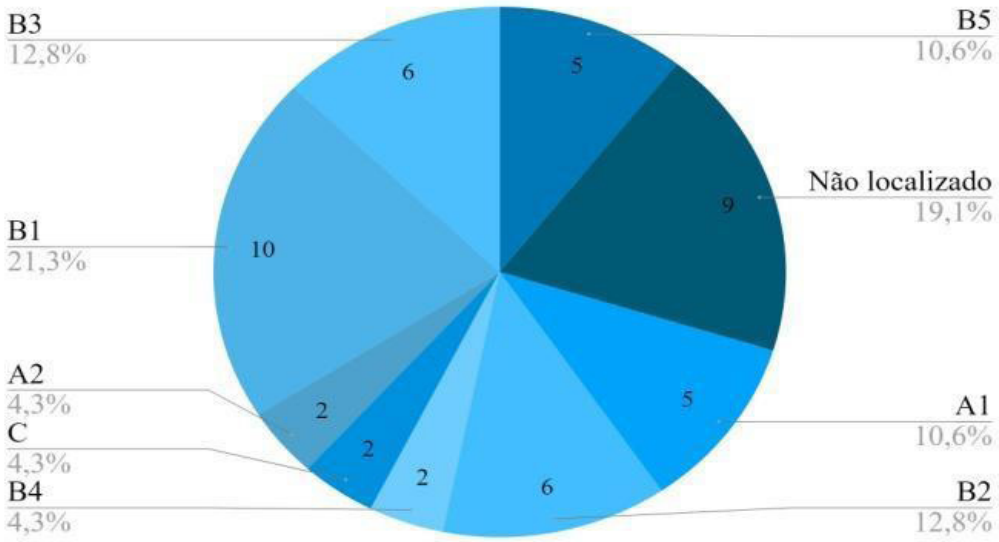
CHART 3 – Knowledge areas of the journals published at the national level linked to the Applied Social Sciences in PIBIC/UFC projects



Source: Research data (2020).

Regarding the Qualis classifications of these journals, the highest frequency observed was for the B1 stratum (21.3%), followed by the 'Not located' designation (19.1%), B2 and B3 (12.8%), A1 and B5 (10.6%), and finally A2, B4, and C (4.3%). This distribution, illustrated in **CHART 4**, showcases the diversity of journals in which PIBIC research results are disseminated. It highlights the potential use of these studies in the development of new knowledge within their respective fields and among the scientific communities to which the researchers and students are affiliated. Furthermore, this diversity aligns with the benefits identified by Fava-de-Moraes and Fava (2000) and the CGEE report (2017), emphasizing the positive impact of such dissemination on scientific advancement.

Chart 4 – Qualis identified in the journals published at the national level linked to the Applied Social Sciences of PIBIC/UFC projects.



Source: Research data (2020).

Considering the six selected knowledge areas, we observe their presence within the evaluation scopes of both journals and conference proceedings. This reflects a strategic preference for outlets where the results might most effectively contribute to the broader body of scientific knowledge. Our data indicate that nearly half of the 195 projects (50.7%) recorded at least one publication in their final report. While this figure represents a significant contribution to scientific output, it is important to recognize that some publications may have occurred after these reports were submitted to the PRPPG. Thus, the actual publication rate could potentially be higher, suggesting an even greater impact of the program as a producer of scientific information.

Among the communication typologies employed by PIBIC/UFC researchers exploring themes related to SAS, we noted a preference for publishing papers and presenting at national conferences. Journals and conference proceedings serve as the primary dissemination mediums, with proceedings often being the dominant channel for scientific output. In the case of journals, those ranked as Qualis B1 and, for proceedings, those ranked as stratum C, were particularly favored. The year 2017/2018 saw the highest number of projects and productions, a trend that persisted throughout the study period. Despite this, the data showed consistency in the values over the targeted timeframe, especially in terms of the proportion of project reports indicating productions and their respective quantities.

The predominance of these communication outlets and strata is understandable, as higher-strata outlets often impose more stringent restrictions on undergraduate participation in the publications and conferences. However, the presence of A1 and A2 journals underscores that the results of IC research contribute significantly to their respective fields, enhancing the development of the sciences and, by extension, the collective knowledge.

Moreover, we posit that the preference exhibited by researchers for specific communication typologies aligns with trends already recognized by academic communities, particularly in terms of reach and, occasionally, the ease of access to these forums. Conference presentations facilitate rapid exchanges of information in Science and Technology and a better opportunity for debates and academic exchange among the participants. Although these interactions are typically informal and somewhat transient, they nonetheless play a crucial role in fostering new studies within the academic scientific community and, frequently, the broader society.

While participation in international venues is markedly less common than national ones, it remains a significant aspect of the program. We did not investigate the direct contributions of students to these international endeavors, as it falls outside the scope of our research. However, when it occurred, such involvement undoubtedly provides the PIBIC scholarship holders with enriching experiences – such as publishing in foreign languages – that enhance their prospects upon transitioning from university to other professional environments, whether at a graduate level or the conventional job market.

Moreover, SAS does not rank among the most prominent areas in the PIBIC/UFC research projects, accounting for only 9% of the total 2,149 projects. However, a closer examination of its specific segment reveals a robust presence of scientific productions that have been published and communicated to peers across various academic and scientific communities. These contributions directly affirm the program's objectives by facilitating both professional and personal development for the students involved.

CONCLUSION

The development and dissemination of scientific communication are pivotal in the cycle of science, considering that such cycle is built upon knowledge that is both fallible and subject to change. This process is enriched through diverse interactions among researchers, educators, students, and the broader scientific communities, along with their networks. Such interactions foster the exchange of information, leading to increasingly specialized and comprehensive investigations.

From the perspective of IC projects, particularly those under the PIBIC program, mapping their outputs provides an effective means to assess the use and impact of resources allocated to educational institutions, especially within public universities. Therefore, this study aims to outline and diagnose the presence of scientific outputs within PIBIC projects within SAS, and to explore the communication outlets employed by the program's researchers for disseminating their findings.

We have identified scientific publications in PIBIC projects; although their representation is less prevalent compared to projects without such outputs, the presence of these publications within the program's scope remains significant. Empirically, a discrepancy is noted between the actual scientific outputs and the potential outputs of SAS projects. It seems that for some

projects, the funding period of 12 months may be inadequate for completing and publishing the proposed research. Consequently, a more detailed investigation into the causes of these publication gaps is necessary to identify underlying factors beyond mere time constraints.

In our analysis of the communication methods employed by the program's researchers, we noted a predominant reliance on papers and presentations at conferences to disseminate the research findings of IC projects. These are primarily published in conference proceedings and journals, which we have chosen as our focal points for analysis. The publications, rated as Qualis B1 and C, demonstrate interdisciplinary characteristics that correspond with the program's fundamentally multidisciplinary nature.

Thus, mapping the scientific publications within the program's framework is crucial for understanding the channels through which researchers make their results known. Journals and proceedings of higher strata not only exhibit greater citation and usage rates but also, the presence of IC-derived outputs within these publications underscores their quality and effectiveness, thereby demonstrating the value of the investments made in scientific initiation.

The process of scientific communication encompasses both the production and dissemination of knowledge, driven by a collective ambition to advance specific fields. Therefore, our aim is not to comprehensively address all aspects of scientific production within the outlined scope. Instead, we seek to integrate diverse perspectives from Information Sciences on this particular subject, thereby enhancing the field's presence in this area of study. Furthermore, we believe this study has contributed to mapping the scientific outputs from PIBIC research projects and the channels through which they are disseminated. We posit that these outputs may be representative of the contributions made by UFC for the Applied Social Sciences, helping to meet institutional demands and requirements of related fields. They generate crucial information in Science and Technology that contributes to both scientific and social development.

REFERENCES

BIAVA, L.; PAGANI, C.; OLIVEIRA, G. C. Indicadores de pesquisa científica como ferramenta para a gestão na universidade. *In*: COLÓQUIO INTERNACIONAL DE GESTÃO UNIVERSITÁRIA, 17., 2017, Mar del Plata. **Anais** [...] Mar del Plata: [*s. n.*], 2017. p. 1-17. Available at: https://www.brazilianjournals.com/index.php/BASR/article/view/695. Access on: 2 jan. 2021.

CANAAN, M. G.; NOGUEIRA, M. A. Bens em disputa no campo universitário: o efeito de fatores socioeconômicos e culturais no acesso à bolsa de iniciação científica. *In:* MASSI, L.; QUEIROZ, S. L. (org.). **Iniciação científica***:* aspectos históricos, organizacionais e formativos da atividade no ensino superior brasileiro. São Paulo: Editora UNESP, 2015. 160 p. Available at: http://books.scielo.org/id/s3ny4. Access on: 15 jan. 2021.

CENTRO DE GESTÃO E ESTUDOS ESTRATÉGICOS–CGEE. **A formação de novos quadros para CT&I**: avaliação do programa institucional de bolsas de iniciação. Brasília: Centro de Gestão e Estudos Estratégicos, 2017. 175 p. Available at: https://www.cgee.org.br/documents/10195/734063/2373_PIBIC_Relat%C3%B3rio_completo.pdf. Access on: 10 out. 2020.

CONSELHO NACIONAL DE DESENVOLVIMENTO CIENTÍFICO E TECNOLÓGICO – CNPq (Brasil). **Iniciação Científica***.* [Brasília], [201-]. Available at: http://memoria2.cnpq.br/web/guest/iniciacao-cientifica. Access on: 12 jan. 2021.

COORDENAÇÃO DE APERFEIÇOAMENTO DE PESSOAL DE NÍVEL SUPERIOR – CAPES (Brasil). Grupo de Trabalho Qualis Livro. **Proposta de Classificação de Livros***.* [Brasília]: CAPES, 2019. 23 p. Available at: https://www.gov.br/capes/pt-br/centrais-de-conteudo/12062019-proposta-de-classificacao-de-livros-gt-qualislivro-pdf/view. Access on: 12 jan. 2021.

COSTA, S. Abordagens, estratégias e ferramentas para o acesso aberto via periódicos e repositórios institucionais em instituições acadêmicas brasileiras. **Liinc em Revista**, Brasília, v. 4, n. 2, p. 218-232, set. 2008. Available at: http://revista.ibict.br/liinc/article/view/3175. Access on: 6 jan. 2021.

CUNHA, M. B.; CAVALCANTI, C. R. O. **Dicionário de Biblioteconomia e Arquivologia***.* Brasília: Briquet de Lemos, 2008. 451 p. Available at: https://repositorio.unb.br/handle/10482/34113. Access on: 6 jan. 2021.

CUNHA, M. B. **Para saber mais**: fontes de informação em ciência e tecnologia. 2. ed. Brasília: Briquet de Lemos, 2016.

DROESCHER, F. D.; SILVA, E. L. O pesquisador e a produção científica. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 19, n. 1, p. 170-189, jan./mar. 2014. Available at: https://brapci.inf.br/index.php/res/v/37717. Access on: 6 jan. 2021.

DURHAM, E. R. As universidades públicas e a pesquisa no Brasil. **Nupes**, São Paulo, documento de trabalho, v. 9, p. 1-28, 1998. Available at: http://nupps.usp.br/downloads/docs/dt9809.pdf. Access on: 22 set. 2020.

FAVA-DE-MORAES, F.; FAVA, M. A iniciação científica: muitas vantagens e poucos riscos. **São Paulo em Perspectiva**, São Paulo, v. 14, n. 1, p. 73-77, mar. 2000. Available at: https://repositorio.unesp.br/handle/11449/26413. Access on: 1 jan. 2021.

GIL, A. C. **Métodos e técnicas de pesquisa social**. 6. ed. São Paulo: Atlas, 2008. 220 p.

HOLANDA, P. M. C.; RIBEIRO, J. R.; JESUS, M. C. de. Estudo de caso: aplicabilidade em dissertações na área de ciência da informação. **Revista Ibero-Americana de Ciência da Informação**, [*s. l.*], v. 13, n. 2, p. 685–703, 2020. Available at: https://periodicos.unb.br/index.php/RICI/article/view/25012. Access on: 5 mar. 2022.

MASSI, L.; QUEIROZ, S. L. Apresentação. *In:* MASSI, L.; QUEIROZ, S. L. (org.). **Iniciação científica**: aspectos históricos, organizacionais e formativos da atividade no ensino superior brasileiro. São Paulo: Editora UNESP, 2015. p. 7-10. Available at: http://books.scielo.org/id/s3ny4. Access on: 15 jan. 2021.

PORTAL DE PERIÓDICOS DA CAPES. **Boletim eletrônico nº 72**. Pesquisa brasileira: desempenho e tendências. Brasília, 2019. Quinzenal. Available at: http://mailer.periodicos.capes.gov.br/?m=119&p=view&pi=ViewBrowserPlugin&uid=11e8f60055a1b7ef8d066f61704ff3c9. Access on: 13 set. 2020.

TARGINO, M. G. Produção e comunicação científica como estratégias da formação profissional do cientista da informação. **Ciência da Informação**, Brasília, v. 45, n. 1, p. 127-140, jan./abr. 2016. Available at: http://revista.ibict.br/ciinf/article/view/1890/3425. Access on: 29 abr. 2020.

TARGINO, M. G.; TORRES, N. H. Comunicação Científica Além da Ciência. **Ação Midiática – Estudos em Comunicação, Sociedade e Cultura**, [*s. l.*], jul, 2014. Available at: https://revistas.ufpr.br/acaomidiatica/article/view/36899. Access on: 9 dez. 2022.

UNIVERSIDADE FEDERAL DO CEARÁ. Pró-Reitoria de Pesquisa e Pós-Graduação. **Apresentação**. Fortaleza, [20—]. Available at: http://sysprppg.ufc.br/pibic/index.php/apresentacao. Access on: 19 out. 2020.

VASCONCELOS, M. C. N.; FARIAS, G. B.; FARIAS, M. G. G. Comunicação científica: conceitos e relações de poder. *In:* FARIAS, G. B. de; FARIAS, M. G. G. (org.). **Competência e Mediação da Informação**: percepções dialógicas entre ambientes abertos e científicos. São Paulo: Abecin, 2019. p. 238-251. Available at: http://www.repositorio.ufc.br/handle/riufc/46896. Access on: 10 jan. 2021.

WEB OF SCIENCE GROUP (Brasil). **A pesquisa no Brasil**: promovendo a excelência. São Paulo: Clarivate Analytics, 2019. 42 p. Available at: https://discover.clarivate.com/Research_Excellence_Awards_Brazil_Download. Access on: 13 set. 2020.

ACKNOLEDGMENTS

We thank the National Council for Scientific and Technological Development (CNPq) for funding the research through the Institutional Scholarship Program for Scientific Initiation of the Federal University of Ceará (PIBIC/UFC).

E-Health technology acceptance: a meta-analysis

Luiz Philipi Calegari
Master in Production Engineering and graduated in Engineering in the Chemical Area, with a qualification in Food, Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brasil.
http://lattes.cnpq.br/9002782604061052
ORCID: https://orcid.org/0000-0003-3793-7860

Diego de Castro Fettermann
PhD in Production Engineering, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brasil.
Associate professor, Universidade Federal de Santa Catarina (UFSC), Florianópolis, Santa Catarina, Brasil.
https://lattes.cnpq.br/9114671113378697
ORCID: https://orcid.org/0000-0001-9210-8622

Submitted on: 03/31/2022. Approved on: 12/29/2023. Published on: 06/21/2024.

ABSTRACT

Despite the potential benefits of e-health systems in sharing health information, the relationship between technology providers and potential users is inherently complex. This study aims to elucidate the factors driving the acceptance of new technologies among users by synthesizing results on the adoption of e-health technologies using the constructs and relationships outlined in the Unified Theory of Acceptance and Use of Technology (UTAUT) model. Additionally, the impact of moderating variables—including gender, age group, presence of illness, user types, technological application, and publication year—was examined through meta-regression. Significant effects were observed for “Performance Expectancy,” “Effort Expectancy,” and “Social Influence” on “Behavioral Intention,” as well as the influence of “Behavioral Intention” and “Facilitating Conditions” on “Usage Behavior.” Among the tested moderating variables, all except for “age group” demonstrated significant moderation effects in various relationships. This research provides detailed estimates of the factors influencing the acceptance of new health technologies and offers strategic directions for the development of e-health systems, considering user acceptance. It contributes to a deeper understanding of the complex interplay between e-health systems and their users, highlighting the importance of tailored approaches to enhance technology adoption.

Keywords: healthcare 4.0; smart health; internet of health things; technology acceptance; Information Technology.

INTRODUCTION

Health management systems have traditionally had rigid structures, based on classical models of administration that dictate the flow of information critical to decision-making (Guimarães; Évora, 2004). However, the digital inclusion of citizens provides governments with greater access to population data, enabling improved public policy planning (Moresi *et al.,* 2016; Calegari; Fettermann, 2022). In this context, e-health technologies are emerging as a significant and growing field in the medical sector (Razmak Belanger, 2017; Moresi *et al.,* 2016; Reeder; David, 2016; Safi; Danzer; Schmailzl, 2019; Kononova *et al.,* 2021). The term 'e-health' refers to health services provided or enhanced through the Internet and related technologies (Zolait *et al.,* 2019), including information and communication technologies (Costa *et al.,* 2018). The evolution of e-health technology offers promising alternatives for more effective and cost-efficient healthcare (Wang *et al.,* 2017). The literature highlights several benefits of e-health systems, such as reduced hospitalization needs (Piotrowicz, 2017), lowered risk of medical errors (Koch, 2006; Menachemi; Collum, 2011), continuous patient monitoring (Zolait *et al.,* 2019), and overall cost reductions in healthcare (Sharma; Ahmed; Rathinasamy, 2005). Numerous studies have explored the relationship between e-health systems' benefits and the specific needs of individual users, identifying applications in monitoring chronic diseases like diabetes (Karpova; Karyakina; Karyakin, 2020; Maritsch *et al.,* 2020; Zharkikh *et al.,* 2020), asthma (Van der Kamp *et al.,* 2020), and heart diseases (Marino *et al.,* 2020; Tsai *et al.,* 2020), as well as supporting mental health (Liu; Ni; Peng, 2020; Montagni *et al.,* 2020), cancer (Marino *et al.,* 2020; Nilsson *et al.,* 2020), and elderly health (Al-Khafajiy *et al.,* 2019; Debauche *et al.,* 2019), among others.

Despite the potential benefits, the relationship between e-health technology providers and potential users is often complex (Piotrowicz, 2017). Understanding the patterns of interaction between users and digital interfaces is essential for improving the use of Internet of Things-related technologies (Lacerda; Lima-Marques, 2015). Digital services require users to be more proactive in managing their health (Lapão, 2019). To better understand this dynamic, it is important to consider the factors that influence the acceptance of new technologies by potential users. The literature includes various models that aim to explain this acceptance, such as those proposed by Martins et al. (2020); Davis; Bagozzi; Warshaw (1989); Everett, 1995; Martins et al. (2020); Venkatesh et al. (2003). These models, which are applied to diverse contexts including smart energy meters (Fettermann *et al.,* 2020), educational technology (Nadlifatin *et al.,* 2020; Pittalis, 2020), hospitality and tourism systems (Sun *et al.,* 2020; Vishwakarma; Mukherjee; Datta, 2020), and food delivery apps (Jang; Jang, 2020), also help in understanding the factors that influence the adoption of health-related technologies (Chauhan; Jaiswal, 2017; Kamal; Shafiq; Kakria, 2020; Shemesh; Barnoy, 2020).

Capturing interactions with smart objects is crucial for detailed recognition of user behavior (Matassa; Riboni, 2020). User acceptance of technology plays a vital role in the success of new products and services (Calegari *et al.,* 2018; Echeveste *et al.,* 2017; Fettermann

et al., 2020; Fettermann *et al.,* 2021; Nascimento *et al.,* 2022), including e-health services (Khalifa; Liu, 2004; Venkatesh *et al.,* 2003). The literature reveals various challenges associated with the lack of acceptance of new health-related technologies by potential users (Brewster *et al.,* 2014; Hennemann; Beutel; Zwerenz, 2016; Sadoughi; Behmanesh; Sayfouri, 2020; Väisänen *et al.,* 2015; Yarbrough; Smith, 2007). One notable issue is the inconsistency of results, often showing a lack of convergence in findings (Piotrowicz, 2017). This inconsistency may be due, among other reasons, to the use of small samples of potential users or a failure to adequately target the intended research audience, which limits the generalizability of the results (Reeder; David, 2016).

Therefore, by using a meta-analysis approach this paper aims to synthesize the results on user acceptance of e-health technologies. This analysis will employ the relationships and constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003), which is extensively cited in related literature (Jayaseelan; Koothoor; Pichandy, 2020; Pal *et al.,* 2020; Wang *et al.,* 2020). Additionally, the effects of various moderating variables on these relationships will be tested using a meta-regression approach (Borenstein *et al.,* 2011; Card, 2015). The findings will provide a comprehensive overview of the relationships, key factors, and moderating variables that influence the acceptance of e-health systems by users.

MATERIALS AND METHODS

Meta-analysis and correlations

Meta-analysis seeks to consolidate and synthesize the findings of studies within a specific field (Borenstein *et al.,* 2011). When dealing with a quantitative dependent variable, it is essential to adjust for potential biases in the estimates, a process outlined in the psychometric meta-analysis or Hunter-Schmidt method (Borenstein *et al.,* 2011).This approach considers the weight of each study, its adjusted correlation, and sampling error, employing meta-analysis heuristics developed by Hunter and Schmidt (Hunter; Schmidt, 2004) and used in subsequent research (Ataseven; Nair, 2017; Nair, 2006; Xu *et al.,* 2020). The first heuristic, known as “ratio 1,” posits that a population correlation is positive if the calculated values are equal to or exceed two (Hunter; Schmidt, 2004). The second heuristic, “ratio 2,” addresses heterogeneity among studies, suggesting that if the result is below 0.75, moderating variables significantly impact the relationship, necessitating the addition of further moderators in the model (Ataseven; Nair, 2017; Nair, 2006; Xu *et al.,* 2020). Meta-regression is employed to estimate the effect of these moderating variables, using the Hunter-Schmidt method, which is recommended for psychometric data analysis in technology acceptance research (Borenstein *et al.,* 2011).

From this analytical framework, the presence of potential moderators in the proposed Unified Theory of Acceptance and Use of Technology (UTAUT) model relationships is investigated to reduce system heterogeneity. The objective is to determine the correlations between the constructs in the UTAUT model to measure user acceptance of e-health technologies.

Systematic Literature Review

Following the recommendations of the PRISMA method, this systematic literature review was conducted to identify empirical studies on the acceptance of e-health technologies by users. We applied the procedures recommended by PRISMA, which are widely used in technology and health field studies (Budrionis; Bellika, 2016; Drosatos; Kaldoudi, 2019).

Keyword Protocol

At the conclusion of the exploratory phase, we defined the following keywords for the systematic literature search: ‘e-health’, ‘internet of things AND health’, and ‘wearable AND health’ combined with ‘health’, ‘accept*’, ‘adopt*’, and ‘user’.

Elegibility Criteria

We included studies that utilized the modeling of relationships proposed in the Unified Theory of Acceptance and Use of Technology (UTAUT) model for technology acceptance. Efforts were made to select studies presenting constructs compatible with the proposed model, similar to other studies in the literature (Kemp; Palmer; Strelan, 2019; Venkatesh *et al.,* 2003). All identified studies providing a primary source of data were considered, with no restrictions regarding the quality or date of publication.

Sources of Information

Our systematic literature reviews primarily utilized articles published in journals indexed in databases such as Scopus®, known for hosting a diverse range of journals. This diversity is particularly useful for multidisciplinary studies like ours that incorporate perspectives from medicine, management, engineering, and social sciences. The search was conducted between May 4 and May 11, 2020.

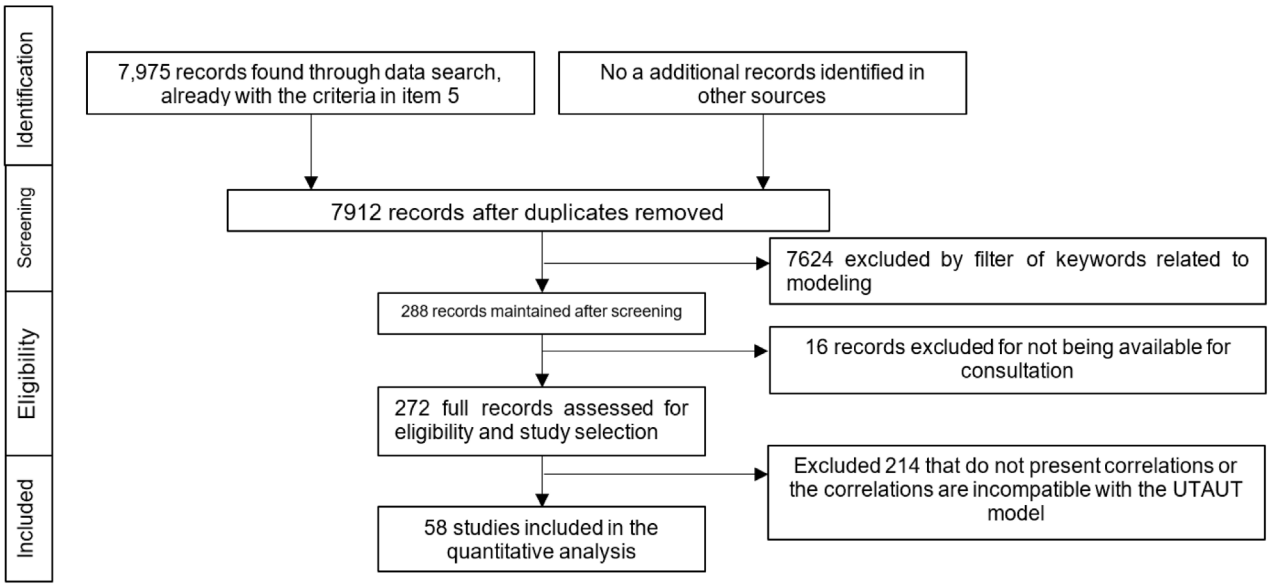
Study Selection

Considering the search strategy adopted, studies in the form of paper in English and published in journals, conferences, and symposiums were selected. The final selection of studies did not consider any temporal restriction on the published articles, including all

articles regardless of the date of their publication in the bibliographic portfolio. Initially, 7,975 articles resulting from the search were identified. Upon an initial analysis of this portfolio, articles containing terms such as 'structural equation modeling', 'partial least squares', 'PLS', 'technology acceptance model', 'regression', and 'health belief model' in their 'topic' fields were selected for their portrayal of models with correlations suitable for the meta-analysis. Consequently, the initial 7,975 articles were filtered again using the aforementioned keywords, yielding a portfolio of 288 articles. These articles underwent a thorough analysis during the identification process.

From this analysis, 91 articles were identified that used modeling of e-health technology acceptance and could be incorporated into the bibliographic portfolio. These articles were then reviewed to verify the availability of correlations between the constructs as presented in the UTAUT model (Venkatesh *et al.,* 2003), as well as constructs deemed compatible by the literature. A compatibility analysis with the proposed relationships and constructs led to the exclusion of 33 articles, resulting in a final portfolio of 58 articles. These articles depicted correlations compatible with the UTAUT technology acceptance model and were ultimately included in the meta-analysis. The complete flow of information, processed according to the PRISMA **Figure 1**.

Figure 1 – Information Flow Processed by PRISMA method



Source: Developed by the authors (2020).

The bibliographic portfolio comprises 58 articles, evaluating 136 relationships compatible with the UTAUT model and involving a total of 11,278 respondents. The analysis of each article included reviewing correlations between constructs, their internal consistencies, sample sizes, and data on moderating variables. Initially, correlations proposed by the UTAUT model for new technology acceptance were identified (Venkatesh *et al.,* 2003). Similarly,

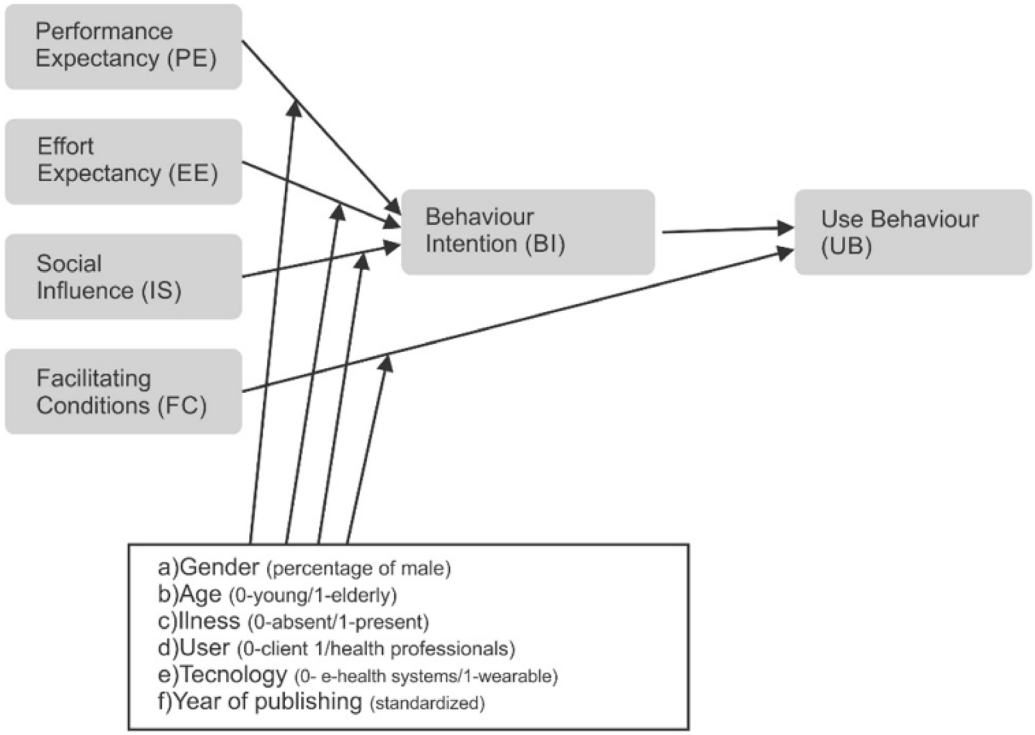
relationships that mirrored constructs from the UTAUT model were considered, aligning with findings from other studies (Kemp, Palmer, Strelan, 2019; Venkatesh *et al.,* 2003). The data collection framework was structured around the primary relationships defined in the UTAUT model. Details recorded for each study included sample size (, internal consistency of constructs (α_x and α_y), and the correlation coefficients (r). Additional data on moderating variables such as gender, age, illness presence, user type, technology used, and year of publication were also collected. Gender was coded as 0 for female and 1 for male. Age was categorized into studies focusing exclusively on elderly populations over 60 years (1), and studies involving various age groups or predominantly non-elderly respondents (0). User type was differentiated between health professionals (1) and general users (0), which included patients. Studies concerning illness presence were classified into those without respondents reporting illnesses (0) and those limited to users with illnesses (1). The technology variable distinguished between the use of wearables (1) and other forms of e-health technologies (0) such as online platforms, telemedicine systems, smartphones, cloud computing, and smart cards. The year of publication was standardized across studies, scaling values from 0 to 1 based on the time elapsed since publication. Lastly, the study weight value (*W*), as proposed by

Schmidt (2015) in Equation 2, was calculated from other identified variables, as *W* itself is not directly reported in the analyzed studies. The calculations of ratios 1 and 2, and *W*, were conducted using equations from Schmidt (Schmidt, 2015), and coefficients for relationships and moderations were estimated using the statistical software Stata® v.16.

Proposition of a Model for Meta-analysis

The UTAUT model outlines how the constructs “Performance Expectancy,” “Effort Expectancy,” and “Social Influence” relate to “Behavioral Intention.” This, combined with the construct “Facilitating Conditions,” influences usage behavior (Venkatesh *et al.,* 2003). Beyond these core relationships, the model proposed here also seeks to examine the moderating effects of six variables on these principal relationships within the UTAUT framework. These variables include gender, age group, presence of illness, user type, technology, and year of publication.

Figure 2 – Proposition of the Model Based on UTAUT Used in the Meta-Analysis



Source: Developed by the author (2020).

RESULTS AND DISCUSSION

Main Effects

The results reveal that all the relationships proposed in the UTAUT model exhibit positive and significant correlations (p-value < 0.001) as shown in **Table 1**. However, for four of these relationships, the calculated values for ratio 1 were below 2.0, despite the θ statistic confirming their significant positive nature. Notably, the strongest relationship was observed between the constructs “Behavioral Intention” (IC) and “Usage Behavior” (CU), which achieved a value of 0.67. This significance was affirmed by both the ratio 1 value and the θ statistic. Although the principal relationships were statistically significant as per the θ statistic hypothesis test, ratio 2 values falling below 0.75 suggest that including moderators could further elucidate the variability observed in all relationships.

Table 1 – Main Relationships of the UTAUT Model

Relationship	N (total)	K (studies)	Conf. (α-average)	*ratio* 1 (HS method)	*ratio* 2 (HS method)	Estim. efeito	IC (95%)	θ Stat
ED>IC	11278	51	0,8458	1,8557	0,0986	0,37	0,32-0,41	14,65***
EE>IC	9685	43	0,8202	1,1109	0,0982	0,23	0,17-0,39	7,76***
IS>IC	6278	24	0,8573	1,5788	0,1539	0,26	0,19-0,34	7,19***
IC>CU	3309	14	0,7905	2,3003	0,0559	0,67	0,53-0,81	9,64***
CF>CU	2364	6	0,8243	1,0276	0,0237	0,32	0,16-0,47	4,02***

Source: Developed by the author (2020).

* significant at 10% / ** significant at 5% / *** significant at 1%.

Moderating Effects

The results of moderating the main relationships of the UTAUT model with the six variables proposed as moderators are detailed in **Table 2**.

Table 2 – Meta-regression of Moderating Variables on the Proposed Main Relationships in UTAUT

Moderator	Coef.	Std. Error	z	Wald ()	I^2_{res} (%)	Q_{res} (Cochran)
ED>IC						
Gender (% masc)	0,6515	0,0629	10,3***	194,72***	99,98	78784,03***
Age group (0-geral/1-elderly)	-0,0111	0,0729	-0,10			
User (0-geral/1-health professional)	-0,0084	0,0828	-0,05			
Ilness (0-absent/1-present)	-0,1396	0,0914	-1,53			
Technology (0-e-health system/ 1-wearable)	0,0298	0,1013	0,55			
Years (standardized)	-0,1052	0,0276	-3,81***			
EE>IC						
Gender (% masc)	0,4263	0,0661	6,45**	72,36***	99,93	59992,01***
Age group (0-geral/1-elderly)	0,0787	0,0912	0,84			
User (0-geral/1-health professional)	0,1773	0,0838	2,12**			
Ilness (0-absent/1-present)	-0,3094	0,0956	-3,24**			
Technology (0-e-health system/ 1-wearable)	-0,1184	0,0641	-1,85*			
Years (standardized)	0,1867	0,0307	0,61			

Moderator	Coef.	Std. Error	z	Wald ()	I^2_{res} (%)	Q_{res} (Cochran)
IS>IC						
Gender (% masc)	-0,0007	0,0051	0,15	36,20***	99,96	53239,40***
Age group (0-geral/1-elderly)	0,03641	0,1282	0,28			
User (0-geral/1-health professional)	-0,1107	0,1850	-0,60			
Ilness (0-absent/1-present)	0,1439	0,1282	1,21			
Technology (0-e-health system/ 1-wearable)	0,3187	0,0669	4,76***			
Years (standardized)	-0,0231	0,0560	-0,41			
IC>CU						
Gender (% masc)	1,0075	0,1564	6,44***	55,43***	99,97	58169,11***
Age group (0-geral/1-elderly)	-	-	-			
User (0-geral/1-health professional)	-0,4706	0,2397	-1,96*			
Ilness (0-absent/1-present)	-	-	-			
Technology (0-e-health system/ 1-wearable)	0,2895	0,1978	1,46			
Years (standardized)	-0,0015	0,0843	-0,02			
CF>CU						
Gender (% masc)	-1.4431	0,2987	-4,83***	477,52***	99,29	3806,97
Age group (0-geral/1-elderly)	-	-	-			
User (0-geral/1-health professional)	-0,1152	0,06489	-1,78*			
Ilness (0-absent/1-present)	-	-	-			
Technology (0-e-health system/ 1-wearable)	2,0332	0,2726	7,46***			
Years (standardized)	-0,7197	0,1692	-4,25***			

Source: Developed by the author (2020).

* significant a 10% / ** significant a 5% / *** significant a 1%

The results validate the estimates obtained by the ratio 2 measure, which, despite an error (Error: Reference source not found), indicates that a majority of the tested moderating variables (13 out of 20) exhibit significant moderation effects (p-value <0.10). The Wald statistics from the moderation models further confirm that all tested relationships have significant coefficients (p-value <0.001), demonstrating the influence of significant moderators on these relationships. indicando que a maioria das variáveis moderadoras testadas (13/20) apresentaram moderação significativa (p-valor<0,10). The Wald statistic of the estimated moderation models also indicates that all the relationships tested showed significant coefficients (p-value <0.001), confirming the presence of significant moderators for the relationship.

Although all relationships tested showed some level of significance, the high $I^2_{residual}$ values indicate substantial heterogeneity in the residuals of the estimated models. The $I^2_{residual}$

values still show a high percentage of variability, attributed to variations among the studies analyzed, which is corroborated by the $Q_{residual}$ test, confirming significant heterogeneity (p-value <0.001) in the residuals across all relationships.

These findings imply that despite significant moderations in all relationships, additional explanation is required. This suggests the need to incorporate more moderators to better elucidate the main relationships proposed in the UTAUT model.

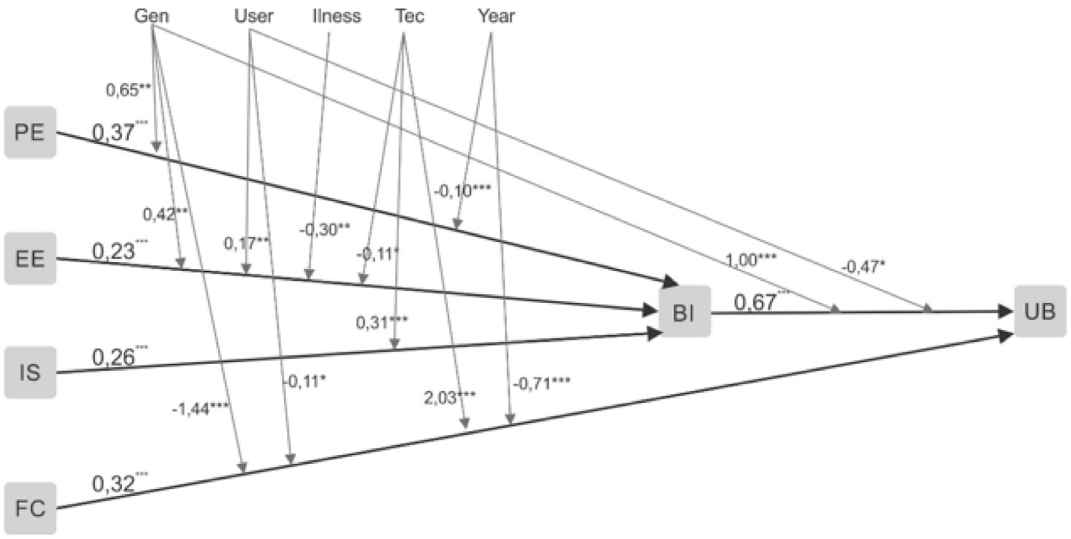
Among the tested moderating variables, gender consistently shows significant influence (p-value < 0.10) across various relationships. This finding corroborates the significance of gender in user acceptance of e-health technologies, as highlighted by Venkatesh et al. (2003). Although gender is recognized as a crucial variable, the data reveals that male users generally exhibit higher acceptance of e-health technologies, evident in the relationships between ED-IC, EE-IC, and IC-CU. In contrast, for the CF-CU relationship, higher acceptance among female users was noted for the “Usage Behavior” of e-health technologies.

Regarding other tested moderating variables, the age group variable, intended to discern acceptance differences among elderly users, showed no significant impact in any relationships. Despite previous research exploring this variable’s effects in various contexts (Alsswey; Al-Samarraie, 2020; Guo; Zhang; Sun, 2016), it did not emerge as a significant moderator in this meta-analysis. It’s worth mentioning that only a few studies in this review included elderly categorization among the subjects tested. The absence of significant moderating effects might also stem from the limited number of studies (eight) involving this demographic, impacting its representation in our analysis.

Discussion

The relevant results from the meta-analysis, also referenced in Error: Reference source not found and Error: Reference source not found, are presented graphically in **Figure 3**. It is important to highlight that the “age group” moderator did not show a significant effect in any of the relationships, hence it was not included in **Figure 3**.

Figure 3 – Meta-analysis model for the acceptance of e-health technologies



Source: Developed by the author (2020).

Caption: ED-Performance Expectancy/EE-Effort Expectancy/ IS-Social Influence/CF-Facilitating Conditions/IC-Behavioral Intention/ CU-Usage Behavior. Gen-Gender/Usu-User/Enf.-Illness/Tec-Technology/Ano-Year of publication.

Main Relationships of the UTAUT Model

Previous studies on the acceptance of e-health technologies underscore the significant impact of the ED construct on the IC construct (Pal *et al.,* 2018). However, literature also reports instances where this relationship yielded negative values (Enaizan *et al.,* 2020; Lin, Hsieh, and Ho, 2014; Macdonald *et al.,* 2019; Tsai *et al.,* 2020), and others where it significantly exceeded expectations, with relationships recorded at 0.97 (An, 2006) and 0.88 (Banna and Ottesen, 2018). This current meta-analysis incorporated data from an additional 51 studies, encompassing a total of 11,278 users, and found a positive relationship of 0.37 (p-value <0.001).

These findings align with previous studies indicating that the ED predictor's impact on IC is one of the strongest observed (Kijsanayotin, Pannarunothai, and Speedie, 2009; Yen *et al.,* 2017). In scenarios where potential users recognize the benefits of e-health technologies in enhancing medical care efficiency, acceptance is more likely (Beh *et al.,* 2019; Sergueeva, Shaw, and Lee, 2020; Talukder *et al.,* 2019). Conversely, when users perceive little utility in a technology, its adoption becomes unlikely (Kao, Nawata, and Huang, 2019).

The pronounced effect of the ED>IC relationship may also be attributed to most respondents' familiarity with technology, reducing perceived difficulties in using e-health solutions (Safi, Danzer, and Schmailzl, 2019). However, the established acceptance of the ED>IC effect warrants further exploration, particularly regarding its sustainability and potential long-term benefits, such as sharing medical history (Safi, Danzer, and Schmailzl, 2019). Marketing strategies should emphasize the correlation between technological efficacy and

health outcomes to enhance user understanding of e-health technologies' potential benefits. This approach is supported by evidence suggesting that positive perceptions of technology's benefits reinforce usage intentions (Chau *et al.,* 2019).

Users generally perceive enhanced effectiveness in managing their health when they find e-health technologies easy to use, leading to greater acceptance of these technologies (Wang *et al.,* 2020). The relationship between "Effort Expectancy" (EE) and "Behavioral Intention" (IC) was examined across 42 studies involving a total of 9,574 participants (refer to **Table 2**). While some studies in this review reported negative correlations (An, 2006; Lin, Hsieh, and Ho, 2014b; Macdonald *et al.,* 2019; Razmak, Bélanger, and Farhan, 2018), a positive correlation with a coefficient of 0.23 ($p < 0.01$) was predominantly observed for the EE>IC relationship.

This positive correlation between EE>IC suggests that when e-health systems provide functions that meet users' needs, it fosters an increased willingness to engage with the required effort to use e-health systems (Wu and Chen, 2017). If consumers perceive the technology as intuitive and user-friendly, they are more likely to recognize its benefits and value (Wiegard *et al.,* 2019). Previous research has suggested that the effort involved in adopting new technologies may no longer pose a significant barrier, as current users typically possess the necessary experience and skills (Wang *et al.,* 2015). For those unfamiliar with the latest technologies, integrating graphical features that simplify the user interface could significantly reduce perceived effort (Baba, Baharudin, and Alomari, 2019).

"Social Influence" (IS) is crucial for the acceptance of new products or services, particularly during the initial stages of development when user information is scarce (Adapa *et al.,* 2018; Pal *et al.,* 2018). The relationship between "Social Influence" (IS) and "Behavioral Intention" (IC) was explored in 24 studies, comprising a total sample of 6,278 users (refer to **Table 2**). Although one study reported a negative correlation (Zolait *et al.,* 2019), the prevailing finding is a positive, significant correlation with a coefficient of 0.26 ($p < 0.01$).

The positive correlation observed may be attributed to individuals' tendency to adopt views and behaviors prevalent within specific groups (Ifinedo, 2016). Acceptance of technology within communities often diminishes risk perceptions, thereby enhancing trust in the technology (Vahdat *et al.,* 2020). For more innovative products, consumer opinions are more significantly influenced by direct contacts (Venkatesh and Brown, 2001). In this landscape, social networks emerge as crucial platforms for shaping perceptions about products and brands through extensive information dissemination (Talukder *et al.,* 2019). Consequently, it is essential to allocate resources to support and data collection via social media. Furthermore, there is a need to develop innovations that enable the verification of information, particularly scientific, to enhance the reliability and quality of health information shared (Lopes, 2004).

Concerning the relationship between the "Facilitating Conditions" (CF) construct and "Usage Behavior" (CU), only six studies were analyzed, involving a total of 2,364 participants (**Table 2**). The findings reveal a positive correlation, with a coefficient of 0.32 ($p < 0.01$).

This positive result for the CF>CU relationship can be attributed to the beneficial effects of training and technical support, which alleviate users' concerns about adopting technological innovations (Li *et al.,* 2019).

The presence of an operational framework that offers straightforward guidance or a support system is positively correlated with the adoption of e-health technologies (Talukder *et al.,* 2019). Training programs, technical support, and financial assistance from professionals or family members are vital for the effective use of e-health devices (Li *et al.,* 2019). Manufacturers and service providers should organize training and provide technical support to mitigate concerns regarding the security of shared information (Dai *et al.,* 2019). Additionally, continuous improvements in e-health product functionalities can be achieved through Big Data analyses in healthcare (Martins, Costa, and Martins, 2018; Wu *et al.,* 2016).

Although some scholarship suggests that behavioral intention does not translate into actual use of technology (Lim *et al.,* 2011; Salgado; Tavares; Oliveira, 2020), studies more frequently indicate that "Usage Behavior" (CU) of an e-health technology is preceded and strongly influenced by "Behavioral Intention" (IC) (Bhattacherjee; Hikmet, 2008; Tavares; Oliveira, 2017). In the current analysis, for the relationship between the IC and CU constructs, 14 studies were used, with a total sample of 3,309 users (**Table 2**). A positive correlation on the IC>CU effect, with a coefficient of 0.67 (p-value <0.01), was found. Therefore, it is concluded that "Behavioral Intention" (IC) can be a good indicator of the actual "Usage Behavior" of users.

Relationship with Moderating Variables

Gender significantly influences the adoption of e-health technologies, as highlighted by the substantial moderation of the "gender" variable across most studied relationships (ED>IC, β=0.6515; EE>IC, β=0.4263; CF>CU, β=-1.4331; IC>CU, β=1.0075) (Hoque, Bao, and Sorwar, 2017). Literature indicates that men are traditionally associated with higher "Performance Expectancy" (ED) (Venkatesh *et al.,* 2003; Venkatesh and Morris, 2000), although recent studies suggest female moderation in this area as well (Khan *et al.,* 2019). In this investigation, men demonstrated a higher tendency towards performance expectancy, consistent with earlier findings (Venkatesh and Morris, 2000).

Research shows that women are more affected by "Effort Expectancy" (EE) (Venkatesh and Morris, 2000). Studies reveal that women use technology less frequently (Dutta, Peng, and Sun, 2018) and are less familiar with it (Ono and Zavodny, 2003; Van Slyke, Sonca, and Trimmer, 2002), suggesting that women are more likely to appreciate technologies that are user-friendly. However, the literature on e-health technologies indicates a more significant impact of EE on men.

Regarding women, only the CF>CU relationship was significantly moderated. Overall, men were more influenced by perceptions of utility and ease of use, whereas women were

more affected by the availability of structural support or resources that facilitate technology usage. This distinction may stem from men's greater propensity to explore new technologies, while women prioritize secure and supportive elements in technology use (Khan *et al.,* 2019).

Despite numerous studies affirming that the perceived benefits of technology positively influence the elderly's intention to adopt technology (Cimperman, Makovec Brenčič, and Trkman, 2016; Hoque, Bao, and Sorwar, 2017; Talukder *et al.,* 2020), this analysis did not find significant results for the moderation of the "age group" variable in the proposed model's relationships. Pal et al. (2018) suggest that this insignificance might be due to elderly users' concerns about the privacy of their health data. As the ease of data tracking through information technologies increases, it becomes imperative to address ethical issues related to data sharing and usage (Cavalcante *et al.,* 2015).

The findings from this meta-analysis reveal that the moderating variable "user type" significantly impacts three key relationships: EE>IC (β=0.1773), IC>CU (β=-0.4706), and CF>CU (β=-0.1152). It appears that "Effort Expectancy" (EE) plays a more crucial role in shaping the "Behavioral Intention" (BI) of health professionals compared to other user groups. Conversely, "Facilitating Conditions" (CF) and "Behavioral Intention" (BI) more significantly influence the "Usage Behavior" (IC) of general healthcare consumers.

This result can be explained by the fact that healthcare professionals seek greater practicality to perform their medical activities. Meanwhile, healthcare service consumers are more attracted to devices that provide support features that offer greater security for using e-health.

The significance of moderation exerted by the user's health condition in the use of new technologies has been reported in previous research (Chen; Chan, 2014; Li *et al.,* 2019; Or *et al.,* 2011). Individuals who feel more vulnerable to health risks, especially those who perceive the threats as severe, are more likely to use medical innovations (Beh *et al.,* 2019). According to Beh *et al*., (2019), individuals who perceive themselves at high risk of suffering from chronic diseases showed a greater willingness to find an alternative to avoid these diseases compared to individuals with low perceived risk. However, the moderation of the "presence of illness" variable was significant only for the EE>IC relationship, with a coefficient of -0.3094. The result obtained suggests a greater influence of the "Effort Expectancy" (EE) construct on the "Behavioral Intention" (IC) in individuals without illness, compared to those who have some type of illness. Despite studies presenting the opposite of the obtained result (Beh *et al.,* 2019), the negative influence for the EE>IC effect moderated by the "presence of illness" variable can also be observed in the literature on internet use (Nayak; Lee; White, 2010) and wearable devices for continuous health monitoring (Li *et al.,* 2019).

One can observe that the moderating variable "technological application" was significant in three relationships (EE>IC, β=-0.1184; IS>IC, β=0.31870; CF>CU, β=2.0332). Considering the results, it appears that "Effort Expectancy" (EE) has a greater influence on the "Behavioral Intention" (IC) of e-health users compared to users of wearables.

Wearable devices, while providing unique advantages, also present certain disadvantages compared to other e-health technologies. Concerns include prolonged electromagnetic exposure (Piwek *et al.,* 2016) and the necessity to synchronize with additional devices (Baba, Baharudin, and Alomari, 2019). Despite these issues, wearables often exhibit a lower “Effort Expectancy” (EE), largely due to their portability and the inclusion of features that offer both utilitarian and hedonic benefits (Canhoto and Arp, 2016). Additionally, “Social Influence” (SI) appears to have a more pronounced effect on the “Behavioral Intention” (BI) of users of wearable devices compared to those using other e-health systems.

Wearable devices, being less ubiquitous than other e-health platforms such as online systems, and their relatively high costs prompt potential users to seek extensive information before adoption. Moreover, users of wearables are notably influenced by “Facilitating Conditions” (CF). This influence likely stems from the characteristics of these portable systems, which often depend on wireless networks for continuous health data transmission (Li *et al.,* 2019).

Analysis of the moderating variable “year of publication” highlights its significance for two relationships (ED>IC, β=-0.1052; CF>CU, β=-0.7192), indicating that more recent studies have reported lower coefficients for these relationships. This trend underscores the importance of ongoing monitoring of these relational dynamics to better understand the evolving landscape of e-health technology acceptance.

CONCLUSIONS

This meta-analysis synthesized 136 relationships from 58 distinct studies, incorporating a total of 11,278 potential users of e-health technologies. The findings offer valuable insights into the factors influencing the acceptance of new technologies within the healthcare sector. Drawing upon the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh *et al.,* 2003), significant correlations were found across all proposed relationships within the model. Notably, the “Behavioral Intention” (IC) construct significantly impacted “Usage Behavior” (CU), with a coefficient of β=0.67, and the “Performance Expectancy” (ED) construct influenced “Behavioral Intention” (IC), with β=0.37. However, considerable heterogeneity was observed among the studies, reflecting substantial variability in the coefficients derived from primary research. Among the moderating variables tested, gender effects were most pronounced in the core relationships of the UTAUT model, followed by user type and technology employed.

The primary theoretical contribution of this research lies in quantifying factors that determine the acceptance of new health technologies. Yet, the results also exhibit notable heterogeneity, suggesting that additional, unexplored factors may influence the acceptance of e-health technologies among users. This study serves as a foundational guide to understanding the acceptance process of new e-health technologies, offering strategic insights for their development and user acceptance.

One key limitation of this research is its exclusive reliance on studies indexed in the Scopus® database. Future research should incorporate the burgeoning field of Big Data in health, utilizing bibliometric and scientometric analyses to provide a more comprehensive view of vital data that supports decision-making (Magalhães *et al.,* 2016). This study underscores the need for further investigation into this topic, particularly through the exploration of additional moderating variables to elucidate the observed heterogeneity in its findings.

REFERENCES

ADAPA, A.; NAH, F. F.; HALL, R. H.; SIAU, K.; SMITH, S. N. Factors Influencing the Adoption of Smart Wearable Devices. **International Journal of Human – Computer Interaction**, [*s. l.*], v. 34, n. 5, p. 399–409, May 2017. DOI https://doi.org/10.1080/10447318.2017.1357902.

AL-KHAFAJIY, M.; THAR BAKER; CHALMERS, C.; ASIM, M.; KOLIVAND, H.; FAHIM, M.; WARAICH, A. Remote health monitoring of elderly through wearable sensors. **Multimedia Tools and Applications**, [*s. l.*], v. 78, p. 24681–24706, Jan. 2019. DOI https://doi.org/10.1007/s11042-018-7134-7.

ALSSWEY, A.; AL-SAMARRAIE, H. Elderly users' acceptance of mHealth user interface (UI) design-based culture: the moderator role of age. **Journal on Multimodal User Interfaces**, [*s. l.*], v. 14, n. 1, p. 49–59, Mar. 2020. DOI https://doi.org/10.1007/s12193-019-00307-w.

AN, J. Y. Theory development in health care informatics: Information and communication technology acceptance model (ICTAM) improves the explanatory and predictive power of technology acceptance models. **Studies in Health Technology and Informatics**, [*s. l.*], v. 122, p. 63–67, Jun. 2006. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-39049191130&partnerID=40&md5=660d46f738142e34585767358c50dfb5. Access on: 5 mai. de 2020.

ATASEVEN, C.; NAIR, A. Assessment of supply chain integration and performance relationships: a meta-analytic investigation of the literature. **International Journal of Production Economics**, [*s. l.*], v. 185, p. 252–265, Mar. 2017. DOI https://doi.org/10.1016/j.ijpe.2017.01.007.

BABA, N. M.; BAHARUDIN, A. S.; ALOMARI, A. S. Determinants of users' intention to use smartwatch. **Journal of Theoretical and Applied Information Technology**, [*s. l.*], v. 97, n. 18, p. 4738–4750, Set. 2019. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85075540758&partnerID=40&md5=08eda88454b587327c8e8bec2afa2a2b. Access on: 11 mai. 2020.

BANNA, S.; OTTESEN, A. Health solutions in developing countries: case of Kuwait. 2018, Bangkok. *In*: IEEE International Conference on Innovative Research and Development, ICIRD 2018, Bangkok. **Conference** […]. Bangkok: Institute of Electrical and Electronics Engineers Inc., Jun. 2018. p. 1–6. DOI https://doi.org/10.1109/ICIRD.2018.8376316.

BEH, P. K.; GANESAN, Y.; IRANMANESH, M.; FOROUGHI, B. Using smartwatches for fitness and health monitoring: the UTAUT2 combined with threat appraisal as moderators. **Behaviour & Information Technology**, [*s. l.*], v. 40, n. 3, p. 282-299, Nov. 2021. DOI https://doi.org/10.1080/0144929X.2019.1685597.

BEN HASSEN, H.; DGHAIS, W.; HAMDI, B. An E-health system for monitoring elderly health based on Internet of Things and Fog computing. **Health information science and systems**, [*s. l.*], v. 7, n. 24, p. 1-9, Out. 2019.

BHATTACHERJEE, A.; HIKMET, N. Reconceptualizing organizational support and its effect on information technology usage: evidence from the health care sector. **Journal of Computer Information Systems**, [*s. l.*], v. 48, n. 4, p. 69–76, Jun. 2008. DOI 10.1080/08874417.2008.11646036.

BORENSTEIN, M.; HEDGES, L. V.; HIGGINS, J. P.; ROTHSTEIN, H. R. **Introduction to Meta-Analysis**. Reino Unido: Weley, 2011. 421 p. ISBN: 978-0-470-05724-7.

BREWSTER, L.; MOUNTAIN, G.; WESSELS, B.; KELLY, C.; HAWLEY, M. Factors affecting front line staff acceptance of telehealth technologies: a mixed-method systematic review. **Journal of Advanced Nursing**, [*s. l.*], v. 70, n. 1, p. 21–33, Jan. 2014. DOI https://doi.org/10.1111/jan.12196.

BUDRIONIS, A.; BELLIKA, J. G. The Learning Healthcare System: where are we now? A systematic review. **Journal of Biomedical Informatics**, [*s. l.*], v. 64, p. 87–92, Dec. 2016. DOI https://doi.org/10.1016/j.jbi.2016.09.018.

CALEGARI, L. P.; FETTERMANN, D. C. A review of e-health technologies applications. **International Journal of Bioinformatics Research and Applications**, [*s. l.*], v. 18, n. 4, p. 318-357, Oct. 2022.

CALEGARI, L. P.; BARBOSA, J.; MARODIN, G. A.; FETTERMANN, D. C. A conjoint analysis to consumer choice in Brazil: defining device attributes for recognizing customized foods characteristics. **Food research international**, [*s. l.*], v. 109, p. 1-13, July 2018.

CANHOTO, A. I.; ARP, S. Exploring the factors that support adoption and sustained use of health and fitness wearables. **Journal of Marketing Management**, [*s. l.*], v. 33, n. 1–2, p. 32–60, Oct. 2016. DOI https://doi.org/10.1080/0267257X.2016.1234505.

CARD, N. A. **Applied Meta-Analysis for Social Science Research**. New York: The Guilford Press, 2012. ISBN 978-1-60918-499-5.

CARACCIOLO, A. L. Mobile screening units for the early detection of breast cancer and cardiovascular disease: a pilot telemedicine study in southern italy. **Telemedicine and e-Health**, [*s. l.*], v. 26, n. 3, p. 286–293, Mar. 2020. DOI https://doi.org/10.1089/tmj.2018.0328.

CAVALCANTE, R. B.; PINHEIRO, M. M. K.; WATANABE, Y. J. Á.; SILVA, C. J. D. Grupo técnico de informação em saúde e populações: contribuições para a política nacional de informação e informática em saúde. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 20, n. 1, p. 92-119, jan./mar. 2015. DOI https://doi.org/10.1590/1981-5344/1905.

CHANG, Y. T.; CHAO, C. M.; YU, C. W.; LIN, F. C. Extending the Utility of UTAUT2 for Hospital Patients' Adoption of Medical Apps: Moderating Effects of e-Health Literacy. **Mobile Information Systems**, [*s. l.*], v. 2021, p. 1-10, 2021.

CHAU, K. Y.; LAM, M. H. S.; CHEUNG, M. L.; TSO, E. K. H.; FLINT, S. W.; BROOM, D. R.; TSE, G.; LEE, K.Y. Smart technology for healthcare: exploring the antecedents of adoption intention of healthcare wearable technology. **Health Psychology Research**, [*s. l.*], v. 7, n. 1, p. 80–99, Mar. 2019. DOI https://doi.org/10.4081/hpr.2019.8099.

CHAUHAN, S.; JAISWAL, M. A meta-analysis of e-health applications acceptance: moderating impact of user types and e-health application types. **Journal of Enterprise Information Management**, [*s. l.*], v. 30, n. 2, p. 295–319, 2017. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85014037761&doi=10.1108%2FJEIM-08-2015-0078&partnerID=40&md5=b5c6248f4bd66e4ea1975cf644ccb4c5. Access on: 5 maio 2020.

CHEN, K.; CHAN, A. H. S. Gerontechnology acceptance by elderly Hong Kong Chinese: a senior technology acceptance model (STAM). **Ergonomics**, [*s. l.*], v. 57, n. 5, p. 635–652, Mar. 2014. DOI https://doi.org/10.1080/00140139.2014.895855.

CIMPERMAN, M.; MAKOVEC BRENČIČ, M.; TRKMAN, P. Analyzing older users' home telehealth services acceptance behavior-applying an Extended UTAUT model. **International Journal of Medical Informatics**, [*s. l.*], v. 90, p. 22–31, Jun. 2016. DOI https://doi.org/10.1016/j.ijmedinf.2016.03.002.

DA COSTA, C. A.; PASLUOSTA, C. F.; ESKOFIER, B.; SILVA, D. B.; ROSA RIGHI, R. Internet of Health Things: toward intelligent vital signs monitoring in hospital wards. **Artificial Intelligence in Medicine**, [*s. l.*], v. 89, p. 61–69, Jul. 2018. DOI https://doi.org/10.1016/j.artmed.2018.05.005.

DAI, B; LARNYO, E.; TETTEH, E. A.; ABOAGYE, A. K.; MUSAH, A. A.I. Factors affecting caregivers' acceptance of the use of wearable devices by patients with dementia: an extension of the unified theory of acceptance and use of technology model. **American Journal of Alzheimer's Disease and other Dementias**, v. 2019, n. 35, p. 1-11, 2019. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85074693399&doi=10.1177%2F1533317519883493&partnerID=40&md5=c5c2056b537b5139942da30fd45d4576. Access on: 9 maio 2020.

DAVIS, F. D.; BAGOZZI, R.; WARSHAW, P. User acceptance of computer technology: a comparison of two theoretical models. **Management science**, [*s. l.*], v. 5, n. 8, p. 982–1003, Aug. 1989.

DEBAUCHE, O.; MAHMOUDI, S.; MANNEBACK, P.; ASSILA, A. Fog iot for health: a new architecture for patients and elderly monitoring. *In*: The 9th International Conference on Current and Future Trends of Information and Communication Technologies in Healthcare, 9., 2019, Coimbra. **Conference** […]. Coimbra: Elsevier, 2019. p. 289–297. DOI https://doi.org/10.1016/j.procs.2019.11.087.

DROSATOS, G.; KALDOUDI, E. Blockchain applications in the biomedical domain: a scoping review. **Computational and Structural Biotechnology Journal**, [*s. l.*], v. 2019, n. 17, p. 229–240, Jan. 2019. DOI https://doi.org/10.1016/j.csbj.2019.01.010.

DUTTA, B.; PENG, M. H.; SUN, S. L. Modeling the adoption of personal health record (PHR) among individual: the effect of health-care technology self-efficacy and gender concern. **Libyan Journal of Medicine**, [*s. l.*], v. 13, n. 1, Jan. 2018. DOI https://doi.org/10.1080/19932820.2018.1500349.

ECHEVESTE, M. E. S.; ROZENFELD, H.; FETTERMANN, D. C. Customizing practices based on the frequency of problems in new product development process. **Concurrent Engineering**, [*s. l.*], v. 25, n. 3, p. 245-261, 2017. DOI https://doi.org/10.1177/1063293X166861.

ENAIZAN, O.; ZAIDAN, A. A.; ALWI, N. H. M.; ZAIDAN, B. B.; ALSALEM, M A; ALBAHRI, O. S.; ALBAHRI, A S. Electronic medical record systems: decision support examination framework for individual, security and privacy concerns using multi-perspective analysis. **Health and Technology**, [*s. l.*], v. 10, n. 3, p. 795–822, May 2020. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85081328173&doi=10.1007%2Fs12553-018-0278-7&partnerID=40&md5=be0791658e15edec3e5aeff62287797d. Access on: 5 maio 2020.

EVERETT, R. **Diffusion of innovations**. 3. ed. New York: the free press, 1995. 453 p.

FETTERMANN, D. C.; BORRIELLO, A.; PELLEGRINI, A.; CAVALCANTE, C. G.; ROSE, J. M.; BURKE, P. F. Getting smarter about household energy: the who and what of demand for smart meters. **Building Research & Information**, [*s. l.*], v. 49, n. 1, p. 100-112, Aug. 2020. DOI https://doi.org/10.1080/09613218.2020.1807896.

FETTERMANN, D. C.; CAVALCANTE, C. G. S.; AYALA, N. F.; AVALONE, M. C. Configuration of a smart meter for Brazilian customers. **Energy Policy**, [*s. l.*], v. 2020, n. 139, p. 111309, Apr. 2020. DOI https://doi.org/10.1016/j.enpol.2020.111309.

GUIMARÃES, E. M. P.; ÉVORA, Y. D. M. Sistema de informação: instrumento para tomada de decisão no exercício da gerência. **Ciência da Informação**, Brasília, v. 33, p. 72-80, jan./abr. 2004.

GUO, X.; ZHANG, X.; SUN, Y. The privacy-personalization paradox in mHealth services acceptance of different age groups. **Electronic Commerce Research and Applications**, [*s. l.*], v. 16, p. 55–65, Mar. 2016. DOI https://doi.org/10.1016/j.elerap.2015.11.001.

HENNEMANN, S.; BEUTEL, M. E.; ZWERENZ, R. Drivers and barriers to acceptance of web-based aftercare of patients in inpatient routine care: a cross-sectional survey. **Journal of Medical Internet Research**, [*s. l.*], v. 18, n. 12, p. 337, Dec. 2016. DOI https://doi.org/10.2196/jmir.6003.

HOQUE, M. R.; BAO, Y.; SORWAR, G. Investigating factors influencing the adoption of e-Health in developing countries: a patient's perspective. **Informatics for Health and Social Care**, [*s. l.*], v. 42, n. 1, p. 1–17, Feb. 2016. DOI https://doi.org/10.3109/17538157.2015.1075541.

HUNTER, J. E.; SCHMIDT, F. L. **Methods of meta-analysis**: correcting error and bias in research findings. 3. ed. New York: SAGE Publications, 2014. 672 p.

IFINEDO, P. Applying uses and gratifications theory and social influence processes to understand students' pervasive adoption of social networking sites: perspectives from the Americas. **International Journal of Information Management**, [*s. l.*], v. 36, n. 2, p. 192–206, Apr. 2016. DOI https://doi.org/10.1016/j.ijinfomgt.2015.11.007.

JANG, W. J.; JANG, W. A study on current status and prospects of global food-tech industry. **Journal of the Korea Convergence Society**, [*s. l.*], v. 11, n. 4, p. 247–254, 2020. DOI: https://doi.org/10.15207/JKCS.2020.11.4.247.

JAYASEELAN, R.; KOOTHOOR, P.; PICHANDY, C. Index terms ICT, E-Health, UTAUT, Health Communication, Health Management, Medical Doctors. **Medical Doctors Article in International Journal of Scientific & Technology Research**, [*s. l.*], v. 9, n. 1, 2020. Available at: www.ijstr.org. Access on: 15 Jun. 2021.

KAMAL, S. A.; SHAFIQ, M.; KAKRIA, P. Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). **Technology in Society**, [*s. l.*], v. 2020, n. 60, p. 101212, Nov. 2019. DOI https://doi.org/10.1016/j.techsoc.2019.101212.

KAO, Y.-S.; NAWATA, K.; HUANG, C.-Y. An exploration and confirmation of the factors influencing adoption of IoT-basedwearable fitness trackers. **International Journal of Environmental Research and Public Health**, [*s. l.*], v. 16, n. 18, Sept. 2019. DOI 10.3390/ijerph16183227.

KARPOVA, E. V.; KARYAKINA, E. E.; KARYAKIN, A. A. Wearable non-invasive monitors of diabetes and hypoxia through continuous analysis of sweat. **Talanta,** [*s. l.*], v. 215, p. 120922, Aug. 2020. DOI: https://doi.org/10.1016/j.talanta.2020.120922.

KEMP, A.; PALMER, E.; STRELAN, P. A taxonomy of factors affecting attitudes towards educational technologies for use with technology acceptance models. **British Journal of Educational Technology**, [*s. l.*], v. 50, n. 5, p. 2394–2413, Sept. 2019. DOI: https://doi.org/10.1111/bjet.12833.

KHALIFA, M.; LIU, V. The state of research on information system satisfaction. **Journal of information technology theory and Application**, v. 5, n. 4, p. 37-49, 2004.

KHAN, I.; XITONG, G.; AHMAD, Z.; SHAHZAD, F. Investigating factors impelling the adoption of e-health: a perspective of african expats in China. **SAGE Open**, [*s. l.*], v. 9, n. 3, p. 1–12, Jul. 2019. DOI: https://doi.org/10.1177/2158244019865803.

KIJSANAYOTIN, B.; PANNARUNOTHAI, S.; SPEEDIE, S. M. Factors influencing health information technology adoption in Thailand's community health centers: applying the UTAUT model. **International Journal of Medical Informatics**, [*s. l.*], v. 78, n. 6, p. 404–416, June 2009. DOI: https://doi.org/10.1016/j.ijmedinf.2008.12.005.

KOCH, S. Home telehealth: current state and future trends. **International Journal of Medical Informatics**, [*s. l.*], v. 75, n. 8, p. 565–576, Aug. 2006. DOI: https://doi.org/10.1016/j.ijmedinf.2005.09.002.

KONONOVA, O., PROKUDIN, D., TIMOFEEVA, A., MATROSOVA, E. *In*: ZARAMENSKIKH, E., FEDOROVA, A. **Digital Transformation and New Challenges**. Lecture Notes in Information Systems and Organisation. [*s. l.*]: Springer, 2021. v. 45. p. 265-286.

LACERDA, F.; LIMA-MARQUES, M. Da necessidade de princípios de arquitetura da informação para a internet das coisas. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 20, n. 2, p. 158–171, abr./jun. 2015.

LAPÃO, L. V. Artificial intelligence: is it a friend or foe of physicians? **Einstein**, São Paulo, v. 17, n. 2, p. 1-2, 2019. DOI: https://doi.org/10.31744/einstein_journal/2019ED4982.

LI, J.; MA, Q; CHAN, A H; MAN, S S. Health monitoring through wearable technologies for older adults: smart wearables acceptance model. **Applied Ergonomics**, [*s. l.*], v. 75, p. 162–169, 2019. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85055573600&doi=10.1016%2Fj.apergo.2018.10.006&partnerID=40&md5=1044438afc955b49b48e2996788918bb. Access on: 6 maio 2020.

LIM, S.; XUE, L.; YEN, C. C.; CHANG, L.; CHAN, H. C.; TAI, B. C.; DUH, H. B. L.; CHOOLANI, M. A study on Singaporean women's acceptance of using mobile phones to seek health information. **International Journal of Medical Informatics**, [*s. l.*], v. 80, n. 12, p. e189–e202, Dec. 2011. DOI https://doi.org/10.1016/j.ijmedinf.2011.08.007.

LIN, S. P.; HSIEH, C. Y.; HO, T. M. Innovative Healthcare Cloud Service Model, **Applied Mechanics and Materials**, [*s. l.*], v. 543, p. 4511–4513, Mar. 2014. DOI: https://doi.org/10.4028/www.scientific.net/AMM.543-547.4511.

LIU, I.; NI, S.; PENG, Kaiping. Happiness at your fingertips: assessing mental health with smartphone photoplethysmogram-based heart rate variability analysis. **Telemedicine and e-Health**, [*s. l.*], v. 26, n. 12, p. 1–9, Feb. 2020. DOI https://doi.org/10.1089/tmj.2019.0283.

LOPES, I. L. Novos paradigmas para avaliação da qualidade da informação em saúde recuperada na Web. **Ciência da Informação**, Brasília, v. 33, p. 81-90, jan./abril. 2004.

MACDONALD, E. M.; PERRIN, B. M.; HYETT, N.; KINGSLEY, M. I.C. Factors influencing behavioural intention to use a smart shoe insole in regionally based adults with diabetes: a mixed methods study. **Journal of Foot and Ankle Research**, [*s. l.*], v. 12, n. 1, p. 1–9, May. 2019. DOI: https://doi.org/10.1186/s13047-019-0340-3.

MAGALHÃES, J. L.; Hartz, Z.; Menezes, M. S.; Quoniam, L. Big Data e a saúde negligenciada em dengue, zika e chicungunha: uma análise translacional da tríplice ameaça no século 21. **Ciência da Informação**, Brasília, v. 45, n. 3, p. 234 – 250, set./dez. 2016.

MARINO, M. M.; RIENZO, M.; SERRA, N.; MARINO, N.; RICCIOTTI, R.; MAZZARIELLO, L.; LEONETTI, C. A.; CERALDI, M. P.; CASAMASSIMI, A.; CAPOCELLI, F.; MARTONE, G.; MARITSCH, M.; FÖLL, S.; LEHMANN, V.; BÉRUBÉ, C.; KRAUS, M.; FEUERRIEGEL, S.; KOWATSCH, T.; ZÜGER, T.; STETTLER, C.; FLEISCH, E.; WORTMANN, F. Towards wearable-based hypoglycemia detection and warning in diabetes. *In*: CHI EA '20: Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems, 20., 2020. New York. **Anais** […]. New York: Association for Computing Machinery (ACM), 2020. p. 1–8. DOI: https://doi.org/10.1145/3334480.3382808.

MARTINS, A. Q.; PERES, A. M.; DYNIEWICZ, A. M.; TONIOLO, R. M.; GONÇALVES, L. S.; NETO, P. P. Integração da informação na Rede de Urgência e Emergência: percepção dos profissionais sobre o E-Saúde. **Ciência da Informação**, Brasília, v. 49, n. 1, p. 92-105, jan./abr. 2020. DOI: 10.18225/ci.inf.v49i1.4804.

MARTINS, T. G. S.; COSTA, A. L. F. A.; MARTINS, T. G. S. Big Data use in medical research. **Einstein**, São Paulo, v. 16, n. 3, p. 1–2, Sept. 2018. DOI: https://doi.org/10.1590/S1679-45082018ED4087.

MATASSA, A.; RIBONI, D. Reasoning with smart objects' affordance for personalized behavior monitoring in pervasive information systems. **Knowledge and Information Systems**, [*s. l.*], v. 62, n. 4, p. 1255-1278, Mar. 2020.

MATHIESON, K. Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. **Information Systems Research**, [*s. l.*], v. 2, n. 3, p. 173–191, Sept. 1991. DOI https://doi.org/10.1287/isre.2.3.173.

MENACHEMI, N.; COLLUM, T. H. Benefits and drawbacks of electronic health record systems. **Risk Management and Healthcare Policy**, [*s. l.*], v. 2011, n. 4, p. 47–55, 2011. DOI: https://doi.org/10.2147/RMHP.S12985.

MONTAGNI, I.; TZOURIO, C.; COUSIN, T.; SAGARA, J. A.; BADA-ALONZI, J.; HORGAN, A. Mental health-related digital use by university students: a systematic review. **Telemedicine and e-Health**, [*s. l.*], v. 26, n. 2, p. 131–146, Feb. 2020. DOI https://doi.org/10.1089/tmj.2018.0316.

MORESI, E. A. D.; LOPES, M. C.; MORAIS, M. A. A. T. O cidadão como sensor inteligente. **Ciência da Informação**, Brasília, v. 45, n. 3, 2018. DOI 10.18225/ci.inf.v45i3.4047.

NADLIFATIN, R.; MIRAJA, B. A.; PERSADA, S. F.; BELGIAWAN, P. F.; REDI, A.A.N P.; LIN, S.-C. The measurement of university students' intention to use blended learning system through technology acceptance model (tam) and theory of planned behavior (tpb) at developed and developing regions: lessons learned from taiwan and indonesia. **International Journal of Emerging Technologies in Learning (iJET)**, [*s. l.*], v. 15, n. 9, p. 219–230, 2020. DOI 10.3991/ijet.v15i09.11517.

NAIR, A. Meta-analysis of the relationship between quality management practices and firm performance-implications for quality management theory development. **Journal of Operations Management**, [*s. l.*], v. 24, n. 6, p. 948–975, Dec. 2006. DOI: https://doi.org/10.1016/j.jom.2005.11.005.

NASCIMENTO, D. R.; TORTORELLA, G. L.; FETTERMANN, D. Association between the benefits and barriers perceived by the users in smart home services implementation. **Kybernetes**, [*s. l.*], v. 52, n. 12, p. 6179-6202, 2022. DOI https://doi.org/10.1108/K-02-2022-0232.

NAYAK, L.; LEE, P.; WHITE, A. P. An application of the technology acceptance model to the level of Internet usage by older adults. **Universal Access in the Information Society**, [*s. l.*], v. 9, n. 4, p. 367–374, Nov. 2010.

NILSSON, L.; HELLSTRÖM, A.; WENNERBERG, C.; EKSTEDT, M.; EKSTEDT, M.; EKSTEDT, M.; SCHILDMEIJER, K. Patients' experiences of using an e-Health tool for self-management support after prostate cancer surgery: a deductive interview study explained through the FITT framework. **BMJ Open**, [*s. l.*], v. 10, n. 6, p. e035024, June 2020. DOI https://doi.org/10.1136/bmjopen-2019-035024.

ONO, H.; ZAVODNY, M. Gender and the internet. **Social Science Quarterly**, [*s. l.*], v. 84, n. 1, p. 111–121, Mar. 2003. DOI: https://doi.org/10.1111/1540-6237.t01-1-8401007.

OR, C. K. L.; KARSH, B. T.; SEVERTSON, D. J.; BURKE, L. J.; BROWN, R. L.; BRENNAN, P. F. Factors affecting home care patients' acceptance of a web-based interactive self-management technology. **Journal of the American Medical Informatics Association**, [*s. l.*], v. 18, n. 1, p. 51–59, Jan. 2011. DOI: https://doi.org/10.1136/jamia.2010.007336.

PAL, D.; FUNILKUL, S.; CHAROENKITKARN, N.; KANTHAMANON, P. Internet-of-Things and smart homes for elderly healthcare: an end user perspective. **IEEE Access**, [*s. l.*], v. 6, p. 10483–10496, 2018. DOI: https://doi.org/10.1109/ACCESS.2018.2808472.

PAL, D.; ARPNIKANONDT, C.; FUNILKUL, S.; CHUTIMASKUL, W. The adoption analysis of voice based smart IoT products. **IEEE Internet of Things Journal**, [*s. l.*], v. 7 n. 1, p.10852 –10867, Nov. 2020. DOI https://doi.org/10.1109/jiot.2020.2991791.

PIOTROWICZ, E. The management of patients with chronic heart failure: the growing role of e-Health. **Expert Review of Medical Devices**, [*s. l.*], v. 14, n. 4, p. 271–277, Apr. 2017. DOI: https://doi.org/10.1080/17434440.2017.1314181.

PITTALIS, M. Extending the technology acceptance model to evaluate teachers' intention to use dynamic geometry software in geometry teaching. **International Journal of Mathematical Education in Science and Technology,** [*s. l.*], v. 52, n. 9, p. 1–20, May 2021. DOI: https://doi.org/10.1080/0020739X.2020.1766139.

PIWEK, L.; ELLIS, D. A.; ANDREWS, S.; JOINSON, A. The rise of consumer health wearables: promises and barriers. **PLOS Medicine**, San Francisco, v. 13, n. 2, Feb. 2016. DOI https://doi.org/10.1371/journal.pmed.1001953.

RAZMAK, J.; BÉLANGER, C. H.; FARHAN, W. Development of a techno-humanist model for e-health adoption of innovative technology. **International Journal of Medical Informatics**, [*s. l.*], v. 120, p. 62–76, Dec. 2018. DOI: https://doi.org/10.1016/j.ijmedinf.2018.09.022.

REEDER, B.; DAVID, A. Health at hand: A systematic review of smart watch uses for health and wellness. **Journal of Biomedical Informatics**, [*s. l.*], v. 63, p. 269–276, Oct. 2016. DOI: https://doi.org/10.1016/j.jbi.2016.09.001.

SADOUGHI, F.; BEHMANESH, A.; SAYFOURI, N. Internet of things in medicine: a systematic mapping study. **Journal of Biomedical Informatics**, [*s. l.*], v.103, p. 1- 20, Mar. 2020. DOI https://doi.org/10.1016/j.jbi.2020.103383.

SAFI, S.; DANZER, G.; SCHMAILZL, K. J. G. Empirical research on acceptance of digital technologies in medicine among patients and healthy users: questionnaire study. **Journal of Medical Internet Research**, [*s. l.*], v. 21, n. 11, Oct. 2019. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85076128742&doi=10.2196%2F13472&partnerID=40&md5=7af447c1ed2be1efbb3ac5f2dbc04e4f. Access on: 11 maio 2020.

SALGADO, T.; TAVARES, J.; OLIVEIRA, T. Drivers of mobile health acceptance and use from the patient perspective: survey study and quantitative model development. **JMIR mHealth and uHealth**, [*s. l.*], v. 8, n. 7, Jul. 2020. DOI: https://doi.org/10.2196/17588.

SCHMIDT, F. L. History and development of the Schmidt-Hunter meta-analysis methods. **Research Synthesis Methods**, [*s. l.*], v. 6, n. 3, p. 232–239, Sept. 2015. DOI: https://doi.org/10.1002/jrsm.1134.

SERGUEEVA, K.; SHAW, N.; LEE, S. H. Understanding the barriers and factors associated with consumer adoption of wearable technology devices in managing personal health. **Canadian Journal of Administrative Sciences**, [*s. l.*], v. 37, n. 1, p. 45–60, Mar. 2020. DOI: https://doi.org/10.1002/cjas.1547.

SHARMA, S. K.; AHMED, N.; RATHINASAMY, R. S. E-healthcare: a model on the offshore healthcare delivery for cost saving. **International Journal of Healthcare Technology and Management**, [*s. l.*], v. 6, n. 3, p. 331–351, Mar. 2005. DOI: https://doi.org/10.1504/IJHTM.2005.006540.

SHEMESH, T.; BARNOY, S. Assessment of the intention to use mobile health applications using a technology acceptance model in an israeli adult population. **Telemedicine and e-Health,** [*s. l.*], v. 26, n. 9, p. 1–9, Jan. 2020. DOI: https://doi.org/10.1089/tmj.2019.0144.

SUN, S.; LEE, P. C.; LAW, R.; ZHONG, L. The impact of cultural values on the acceptance of hotel technology adoption from the perspective of hotel employees. **Journal of Hospitality and Tourism Management**, [*s. l.*], v. 44, p. 61–69, Sept. 2020. DOI: https://doi.org/10.1016/j.jhtm.2020.04.012.

TALUKDER, M.; CHIONG, R.; BAO, Y.; MALIK, B. H. Acceptance and use predictors of fitness wearable technology and intention to recommend: an empirical study. **Industrial Management and Data Systems**, [*s. l.*], v. 119, n. 1, p. 170–188, Feb. 2019. DOI: https://doi.org/10.1108/IMDS-01-2018-0009.

TALUKDER, M. S.; SORWAR, G.; BAO, Y.; AHMED, J. U.; PALASH, M. Predicting antecedents of wearable healthcare technology acceptance by elderly: a combined SEM-Neural Network approach. **Technological Forecasting and Social Change**, [*s. l.*], v. 150, p. 1-13, Jan. 2020. DOI: https://doi.org/10.1016/j.techfore.2019.119793.

TAVARES, J.; OLIVEIRA, T. Electronic Health Record Portal Adoption: a cross country analysis. **BMC Medical Informatics and Decision Making**, [*s. l.*], v. 17, n. 1, p. 1–17, Jul. 2017. DOI: https://doi.org/10.1186/s12911-017-0482-9.

TSAI, T.; LIN, W.; CHANG, Y.; CHANG, P.; LEE, M. Technology anxiety and resistance to change behavioral study of a wearable cardiac warming system using an extended TAM for older adults. **PLOS ONE**, [*s. l.*], v. 15, n. 1, Jan. 2020. DOI: https://doi.org/10.1371/journal.pone.0227270.

VAHDAT, A.; ALIZADEH, A.; QUACH, S.; HAMELIN, N. Would you like to shop via mobile app technology? The technology acceptance model, social factors and purchase intention. **Australasian Marketing Journal**, [*s. l.*], v. 29, n. 2, Jan. 2020. DOI: https://doi.org/10.1016/j.ausmj.2020.01.002.

VÄISÄNEN, J. **Consumer acceptance of future my data based preventive ehealth services**. Orientador: Koivumäki T.; Lappi M. 2015. 48 f. Dissertação (Master in Marketing) - OULU BUSINESS SCHOOL, Finlândia, 2015.

VAN DER KAMP, M. R.; KLAVER, E. C.; SPECTRUM, M.; BERNARD, T.; THIO, J.; JEAN, T.; DRIESSEN, M. M.; TWENTE, Z.; TABAK, M.; RESEARCH, R.; VAN DER PALEN, J. HERMESNS, H. J. WEARCON: Wearable home monitoring in children with asthma reveals a strong association with hospital based assessment of asthma control. **Research square**, [*s. l.*], p. 1–23, Jun. 2020. DOI: https://doi.org/10.21203/rs.3.rs-15928/v2.

VAN SLYKE, C.; CONCA, C.; TRIMMER, K.; Requirements for SME Information Technology. *In*: HARVIE, C.; LEE, B. C. (ed.). **Globalisation and SMEs in East Asia.** [*s. l.*]: Elgar, 2002. p. 158-189.

VENKATESH, V.; BROWN, S. A. A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. **MIS Quarterly***:* Management Information Systems. Minnesota, v. 25, n. 1, p. 71–98, Mar. 2001. DOI: https://doi.org/10.2307/3250959.

VENKATESH, V.; MORRIS, M. G. Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. **MIS Quarterly**: Management Information Systems, [*s. l.*], v. 24, n. 1, p. 115–136, 2000. DOI: https://doi.org/10.2307/3250981.

VENKATESH, V.; MORRIS, M. G.; DAVIS, G. B.; DAVIS, F. D. User acceptance of information technology: Toward a unified view. **MIS Quarterly**: Management Information Systems, Minnesota, v. 27, n. 3, p. 425–478, Mar. 2003-0. DOI https://doi.org/10.2307/30036540.

VISHWAKARMA, P.; MUKHERJEE, S.; DATTA, B. Impact of cashback usage restriction exemption on travel booking: a goal-directed approach. **Tourism Recreation Research**, [*s. l.*], v. 45, n. 2, p. 218–230, Apr. 2020. DOI: https://doi.org/10.1080/02508281.2019.1683687.

WANG, H.; TAO, D.; YU, N.; QU, X. Understanding consumer acceptance of healthcare wearable devices: an integrated model of UTAUT and TTF. **International Journal of Medical Informatics**, [*s. l.*], v. 139, p. 1-10, July 2020. DOI https://doi.org/10.1016/J.IJMEDINF.2020.104156.

GAO, Y.; HE, L.; LUO, Y. An empirical study of wearable technology acceptance in healthcare. **Industrial Management and Data Systems**, [*s. l.*], v. 115, n. 9, p. 1704–1723, Oct 2015. DOI https://doi.org/10.1108/IMDS-03-2015-0087.

WANG, Y.; XUE, H.; HUANG, Y.; HUANG, L.; ZHANG, D. A systematic review of application and effectiveness of mhealth interventions for obesity and diabetes treatment and self-management. **Advances in Nutrition**: an international review journal, [*s. l.*], v. 8, n. 3, p. 449–462, May 2017. DOI: https://doi.org/10.3945/an.116.014100.

WIEGARD, R.; GUHR, N.; KRYLOW, S.; BREITNER, M. H. Analysis of wearable technologies' usage for pay-as-you-live tariffs: recommendations for insurance companies. **Zeitschrift fur die gesamte Versicherungswissenschaft**, [*s. l.*], v. 108, n. 1, p. 63–88, Feb. 2019. DOI: https://doi.org/10.1007/s12297-019-00431-2.

WU, B.; CHEN, X. Continuance intention to use MOOCs: integrating the technology acceptance model (TAM) and task technology fit (TTF) model. **Computers in Human Behavior**, [*s. l.*], v. 67, p. 221–232, Feb. 2017. DOI: https://doi.org/10.1016/j.chb.2016.10.028.

WU, J.; LI, He; CHENG, S.; LIN, Z. The promising future of healthcare services: when big data analytics meets wearable technology. **Information and Management**, [*s. l.*], v. 53, n. 8, p. 1020–1033, Dec. 2016. DOI: https://doi.org/10.1016/j.im.2016.07.003.

XU, L.; PENG, X.; PAVUR, R.; PRYBUTOK, V. Quality management theory development via meta-analysis. **International Journal of Production Economics**, [*s. l.*], v. 229, p. 1-16, Nov. 2020. DOI: https://doi.org/10.1016/j.ijpe.2020.107759.

YARBROUGH, A. K.; SMITH, T. B. Technology acceptance among physicians: a new take on TAM. **Medical care research and review**: MCRR, New York, v. 64, n. 6, p. 650–72, Dec. 2007. DOI: https://doi.org/10.1177/1077558707305942.

YEN, P.; MCALEARNEY, A. S.; SIECK, C. J.; HEFNER, J. L.; HUERTA, T. R. Health Information Technology (HIT) Adaptation: refocusing on the journey to successful hit implementation. **JMIR medical informatics**, [*s. l.*], v. 5, n. 3, Sept. 2017. DOI: https://doi.org/10.2196/medinform.7476.

ZHARKIKH, E. V.; LOKTIONOVA, Y. I.; KOZLOV, I. O.; ZHEREBTSOVA, A. I.; SIDOROV, V. V.; ZHEREBTSOV, E. A.; DUNAEV, A. V.; RAFAILOV, E. U. Wearable laser Doppler flowmetry for the analysis of microcirculatory changes during intravenous infusion in patients with diabetes mellitus. **Proceedings of Spie**, [*s. l.*], v. 11363. p. 57. Apr. 2020. DOI: https://doi.org/10.1117/12.2552464.

ZOLAIT, A.; RADHI, N.; ALHOWAISHI, M. M.; SUNDRAM, V. P. K.; ALDOSERI, L. M. Can Bahraini patients accept e-health systems? **International Journal of Health Care Quality Assurance**, [*s. l.*], v. 32, n. 4, p. 720–730, 2019. DOI: https://doi.org 10.1108/IJHCQA-05-2018-0106.

Semi-automatic assessment of ICT Master Plan contents with Natural Language Processing technologies

Ethel Airton Capuano
PhD in Information Science from the Universidade of Brasília (UnB), Brasília, DF, Brazil.
University of Brasília (UnB), Brasília, Brazil.
Civil servant, Ministry of Integration and Regional Development, Brasília, Brazil.
http://lattes.cnpq.br/1075438704907683

Submitted on: 04/03/2022. Approved on: 01/25/2024. Published on: 06/21/2024.

ABSTRACT

This paper presents the results of a research on searching and semi-automatic assessment of interesting textual content on the Information and Communication Technology Master Plans published by a significant sample of Union's government agencies. Using natural language processing technologies, it was retrieved useful information and made interesting discoveries from the documents of the plans for assessment of the state-of-the-art on ICT in the agencies, some of which having caused surprise (due to serendipity), such as the demand management model in some units based on estimates of the teams' delivery capacity. It is concluded that the plans are in compliance with the official standards, including the observed interest of most agencies in current management issues, such as governance and risk management, and maturity in the assessment of market fads, but also is evident that its contents still lack approaches on some important ICT management practices to guide its technical evolution.

Keywords: natural language processing; text mining; semantic evaluation of ICT master plans.

INTRODUCTION

This paper presents the results of a research on textual search and semi-automatic assessment of technological contents of the Information and Communication Technology Master Plans (ICTMP) of Executive, Legislative and Judiciary Branch agencies, in addition to the Federal Prosecutor's Office, in force between 2013 and 2019, using Natural Language Processing (NLP) technologies.

What motivated this research was the idea of testing the possibility of automating processes for assessing the textual content of public sector documents with NLP technologies and a scientific curiosity concerning the technological contents addressed by agencies in their ICTMP, in a context of multidimensional and multidisciplinary assessment. Considering, as a research premise, that ICTMPs reflect, albeit with some limitations, the state-of-the-art of ICT in federal agencies, relevant questions that can be best understood based on the research results are: "How is the 'state-of-the-art' of ICT doing in the Union's agencies, in terms of internal organization (architecture)?"; "How are current ICT issues being addressed?"; "How are the most technical and structuring topics of ICT management being addressed?"; "Which agencies have the largest ICT budgets, which therefore require greater attention in terms of governance, risk management and controls?"; "How are the teams in the ICT units of the agencies and entities doing, as workforces?"

Although the state-of-the-art ICT for federal agencies has evolved since the advent (in Brazil) of the *World Wide Web* and the *Internet* in the second half of the 1990s, there is a certain consensus that this evolution has not occurred in the necessary pace for the desired advancement of public service digitalization projects, as can be seen in the revealed bottlenecks in some important services today (Batista; Azevedo; Hessel, 2020). While it is recognized, in some sectors, that continuous investments in digital services that are supported by robust ICT architectures have shown unquestionable success, as in the case of income tax declaration systems (which serve tens of millions of taxpayers by simultaneously accessing the automatic service channels) and in the case of courts of justice, which have digitized almost all of their procedural services, the investments of recent decades do not seem to show satisfactory results in other public services.

As examples of the pioneering spirit of courts of justice in innovations with intensive use of Information and Communication Technology (ICT), the Brazilian Federal Supreme Court (STF), in the second half of the 1990s, innovated the Brazilian public sector by implementing a *push system* (automatically "pushing" information to users on the world wide web) so that legal professionals could monitor the progress of their clients' cases remotely, via the *Internet*. Judiciary Branch agencies also innovated, even in the first decade of this millennium, by establishing entirely digital channels for exchanging procedural documents with the legal department of the Brazilian National Social Security Institute (INSS), given the materiality (in quantity and values) of the suits against that defendant autarchy. And, recently, the Regional Federal Appellate Court of the 4th Region (TRF-4) innovated by implementing,

with remarkable success, the first Electronic Document Management (EDM) system modeled, at source, for the Brazilian public sector – the Electronic Information System (EIS), which is also being progressively adopted by Federal Executive agencies.

The general objective of the research, therefore, focused on the practical testing of NLP technologies for a more substantive and less formal assessment of ICT planning in Union agencies and entities. In summary, this general objective consisted of verifying, with tools for automating text search processes, whether this government planning model could effectively contribute to the development of appropriate ICT solutions in accordance with market standards and best practices and the jurisprudence of control agencies. As specific objectives, evidence of relevant and current technical topics addressed by agencies and entities was sought in the texts of the selected plans.

RESEARCH METHODS, PROCESSES AND TECHNOLOGIES

The multidisciplinary research method was used, with qualitative (semantic) approaches related to the search, retrieval and processing of textual content (Coneglian; Segundo, 2023; Kao; Poteet, 2007; Meadow *et al.*, 2007; Konchady, 2006) , but also with quantitative approaches, employing textual statistics (Scott, 2019), with the aim of assessing the levels of interest of agencies in each research topic shown in the ICTMPs.

As areas of knowledge, research methodology can be framed, in theoretical terms (albeit partially), within Linguistics (Scott, 2019) and Information Science (Falcão; Lopes; Souza, 2022; Meadow *et al.*, 2007), the latter in a subject referred to as “Information Retrieval” These two areas of knowledge methodologically support the two main instrumental subjects used in this research: Natural Language Processing *(NLP)* and Textual Analysis *(Analytics)*. This set of technologies also contributes to the composition of solutions in market concepts known as Text Mining and Data Science.

The textual information retrieved from the ICTMP texts refers both to attributes selected *a priori*, in the planning stage of the research project, and to *clusters* (compositions) of substantive and interesting words based on the most frequent keywords. In the search processes, both simpler technologies were used, such as electronic text editing software , as well as a more sophisticated market application software, for Natural Language Processing (NLP), which implements more advanced resources for retrieving the information, such as clusters, and statistics on texts in Portuguese (Scott, 2019). Discourse analysis was also used as a method of selecting relevant information about some attributes of interest in the ICTMPs collected.

The documents were retrieved from the agencies’ digital portals by searching the *World Wide Web* (Web), on the *Internet*. Excluding, in accordance with project decision, Federal Education Institutions (FEI) and government-controlled companies, in the Federal Executive Branch, the sample of ICTMPs surveyed, with 72 agencies in total, covers 17 of the 23 ministries in force as of Law No. 13.502, of November 1, 2017 (being it employed,

however, the ICTMP 2017-2019 of the new Ministry of Justice and Public Security and not the ICTMP of the Ministry of Justice and the Ministry of Public Security provided for in the last amendment to this Law), 42 of the 80 autarchies and foundations remaining after the exclusion of the FEI, 2 agencies of the Federal Legislative Branch, 10 agencies of the Federal Judiciary Branch and the Federal Prosecutor's Office.

The set of textual information generated from the collection of documents and the textual analysis of the ICTMPs was entered in an electronic spreadsheet for proper statistical analysis, and the contents were included according to attributes to be observed in the documents in columns and the corresponding agencies and separate entities according to a political-administrative categorization of Union agencies in lines: 3 Branches (sample with 72 agencies and entities), Executive Branch (59 agencies), Executive Branch – Direct Administration (17 agencies), Executive Branch – Indirect Administration (42 agencies and foundations), Legislative Branch (2 agencies), Judiciary Branch (10 agencies), Federal Prosecutor's Office (one agency).

In short, textual content on 37 research attributes was retrieved from each ICTMP, arranged in the spreadsheet according to the following analysis blocks and data formats:

I. Basic Document Analysis (with 7 attributes): file volume (in MB); font and size of ICTMP letters (text); spacing between lines (actual number); number of pages (whole number); number of attachments (whole number); whether the version of the plan was new or an extension of a previous plan (binary data: "yes" or "no"); and planning time frame in years (whole number);

II. Existence of Thematic Chapters (with 7 attributes) on: business and ICT strategies articulated in the ICTMP ("yes" or "no" for each strategy); business, information and technical (or systems) architecture ("yes" or "no" for each architecture); ICT project management methodology ("yes" or "no"); risk management ("yes" or "no"); governance ("yes" or "no");

III. ICT needs (with 9 attributes): number of pages expressing ICT needs (or demands) (whole number); ICT needs items (whole number); occasional ICT project items (whole number); clarity in the presentation of demands ("yes" or "no"); technical analysis of ICT demands (before inclusion in ICTMP) ("yes" or "no"); records of redundant demands ("yes" or "no"); mention of Systems Development Methodology (SDM) ("yes" or "no"); mention of Business Intelligence (BI) solution ("yes" or "no"); use of methodology to prioritize meeting needs ("yes" or "no");

IV. Previous ICTMP Performance (one attribute): percentage, revealing the executed portion of the planned needs and/or projects;

V. ICTMP Estimated Budget (one attribute): monetary data relating to the forecast of expenses for implementing the plan within the expected time frame;

VI. Declaration of Human Resources Gaps in the ICT Team (one attribute): binary data ("yes" or "no"), based on a declaration from the management unit; and

VII. Frequency of Words and Thematic Expressions (11 attributes): strategy; georeferencing; Information management; Knowledge management; Information security; GIS/SIG; Satellite Image; Drone/UAV; Cloud Computing ; Big Data; Mobile Application (App).

The statistical parameters calculated in the spreadsheet, for each political-administrative category of Union agencies and entities, were:

a) average: for all attributes, but using numerical data adding the presence of "yes" in each ICTMP analyzed in the case of binary data;

b) standard deviation: same; and

c) variation coefficient (ratio between the standard deviation and the average): same.

Regarding their documentary structures, the researched plans of Executive Branch agencies follow, in most of their contents, the "Guia de Elaboração de PDTI do SISP" (Brasil, 2012), the SISP ICTMP Preparation Guide, in Portuguese, in a logical reasoning based on the principles and guidelines, strategies of ICT, work plan for the preparation of the ICTMP, *SWOT* Matrix, human resources assessment of the ICT team, prioritization method adopted, inventory of needs and *portfolio* of projects and actions, risk assessment, goal and action plan, and estimated budget.

LITERATURE REVIEW

Although the public familiar with ICT management in agencies do not find most of the concepts covered in this paper a novelty, some of them require definition, in order to avoid misinterpretations regarding the research context, and considering the institutional context of these organizations, compliance standards should also be highlighted.

Technical concepts

The first important concept is the "Information and Communication Technology Master Plan", which is expressly defined in Decree 8.638/2016 as an "instrument for diagnosis, planning and management of information and communication technology resources and processes, with the purpose of meeting the final and informational needs of an agency or entity for a given period."

The concept of "diagnosis" adopted in the reference guide (Brasil, 2012), however, deserves special attention, as it may not coincide exactly with what is understood by diagnosis in other contexts, as shown in the following text:

> Após a fase de preparação, na qual foram organizadas as principais atividades do projeto de elaboração do PDTI, inicia-se a 2ª fase do processo: a fase de diagnóstico. Essa fase caracteriza-se por buscar compreender a situação atual da TI na organização para, em consonância com esse quadro, identificar as necessidades (problemas ou oportunidades) que se espera resolver. Para isso, contempla processos relacionados a análise do planejamento anterior, análise estratégica e levantamento de necessidades. (...) O levantamento de necessidades parte daquelas relacionadas à

> informação e se desdobra em todas as outras associadas à TI: serviços, infraestrutura, contratações e pessoal de TI. (...) Um dos principais artefatos produzidos nessa fase, e muito importante para todo o processo de elaboração do PDTI, é o Inventário de Necessidades (Brasil, 2012, p. 33)[1].

Another primary concept, adopted as a motivation for the research, is the "technical adequacy" of the ICTMP, which should not necessarily be confused with the adequacy formally required in the governing standards, as these do not address in depth all topics relevant to ICT management in agencies, such as "enterprise architecture" (also referred to as "business architecture"), "information architecture" and "technical architecture" (or systems architecture).

The concepts related to "architecture", on the other hand, when applied to the context of ICT management in organizations, are addressed in several reports and technical articles produced, for example, by company specialized in market research *Gartner Group*, well known by ICT managers, and other authors (Gartner Group, 2020a; Costelo, 2019; Hermans, 2015; Ross; Weill; Robertson, 2008). However, originally, the concept of "architecture", in a broader context of business management with intensive use of computer information systems, is due to the pioneering research initiative known as *Business Systems Planning (BSP),* implemented in the 1960s by several researchers working for company IBM (Kotusev, 2016, 2017), highlighting, subsequently, the business descriptive construct developed by Zachman (1987), better known as "Zachman Framework"*,* which is intended to describe and integrate, effectively and efficiently, the most relevant ontological elements that constitute a company (Nicolaidou *et al.*, 2009; Zachman, 2008).

The concept of "Enterprise Architecture" *(EA)*, one of the management items researched in ICTMP, which in this context can be understood as "business architecture", is defined as such by ICT market research company *Gartner Group*:

> […] uma disciplina para as empresas proativamente e holisticamente líderes responderem a forças disruptivas mediante a identificação e análise da execução de mudanças conforme a visão de negócios e os resultados desejados. A arquitetura empresarial entrega valor apresentando aos líderes de negócios e de TIC recomendações para o ajuste de políticas e projetos de modo a alcançar os resultados de negócios visados, que consolidam rupturas de negócios relevantes (Gartner Group, 2020a, *online*, tradução nossa)[2].

1 Translation: "After the preparation stage, in which the main activities of the ICTMP preparation project were organized, the 2nd stage of the process begins: diagnosis. This stage is characterized by seeking to understand the current IT situation in the organization in order to, in line with this framework, identify the needs (issues or opportunities) that are expected to be resolved. To this end, it includes processes related to the analysis of previous planning, strategic analysis and needs assessment. (...) Needs assessment begins with needs related to information and unfolds into all other needs associated with IT: services, infrastructure, hiring and IT personnel. (...) One of the main artifacts produced in this stage, and very important for the entire process of preparing the ICTMP, is the Inventory of Needs" (Brasil, 2012, p. 33, editorial translation).

2 Original: "[...] is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve targeted business outcomes that capitalize on relevant business disruptions" (Gartner Group, 2020a, *online*).

In summary, in the research context, “business architecture” would address the identification, description, assessment and functional integration of the main resources of an agency, in a systemic and synergistic manner, to achieve its institutional goals. These resources can be classified as: human, material, heritage, technological, information and knowledge.

The more recent concepts of “information architecture” and “systems architecture”, which also refer to two thematic objects researched in the ICTMP, are defined by a larger group of other authors, with sometimes different meanings between the authors concerning the same topic. The pioneering author of the idea of “information architecture” is Wurman (1997), who defined it, in general terms, as an expansion of the occupation of the traditional architect applied to the organization of information. Lima-Marques and Macedo (2006), along the same lines, but with a *sui generis* philosophical approach, define this discipline *as a methodology for structuring information systems applied to any informational environment, which is understood as the space that integrates context, content and users.*

However, the most appropriate concept of “information architecture”, in the current research context, seems to be that of Hagedorn, according to Lima-Marques and Macedo (2006, p. 245): *art and science of organizing information to effectively help people to satisfy their information needs. It involves research, analysis, design and implementation.*

With regard to the concept of “technical architecture”, also referred to as “systems architecture”, it refers to the smart organization of information systems and the technologies that support them in organizations. This type of architecture would be the cognitive basis for using the organizations’ technological support components, integrating hardware components (workstations, servers, massive storage units, segmentation control devices in telecommunications networks, etc.) and basic software (such as operating systems and application servers), in addition to other fundamental software for computational operations, such as security applications, backups and load balancing.

This concept, didactically presented by Crawley (2007), is important to guide the processes of acquisition and/or development of new systems, integration between legacy systems, interoperability between components and systems, portability of legacy systems from one obsolete technological environment to a more current one, combination of legacy and new technologies, etc. The most promising model of “technical architecture”, also for federal agencies today, is that known as “Service-Oriented Architecture” *(SOA)*, which incorporates logical and physical aspects, as defined by Bell (2008, p. 309):

> A disciplina de arquitetura lógica orientada a serviço é principalmente voltada para o reuso, utilização e consumo. (...) essa disciplina tem como foco os três maiores aspectos funcionais de uma arquitetura lógica: (1) o relacionamento entre pacotes de softwares implementados, (2) as preocupações estruturais das entidades dos pacotes orientados a serviços, e (3) o comportamento e a colaboração das soluções empacotadas. A arquitetura física orientada a serviço se refere a tudo que é fisicamente

> endereçável aos componentes orientados a serviço. Esse endereçamento consiste no mapeamento das entidades de *software* em componentes de hardware e nos seus locais endereçáveis numa rede de comunicação de dados[3].

This construct of ICT organization is also addressed by Abrams and Schulte (2008), from company *Gartner Group*, the technical glossary of which defines it as follows:

> [...] é um paradigma e uma disciplina de desenho que auxilia a TI no atendimento das demandas do negócio [...] SOA reduz a redundância e incrementa a usabilidade, manutenibilidade e valor. Isto resulta em sistemas interoperáveis e modulares, que são mais fáceis de usar e de manter. SOA cria sistemas mais simples e velozes, que incrementam a agilidade e reduzem o Custo Total de Propriedade (TCO) (Gartner Group, 2020b, *online*, tradução nossa)[4].

Incidentally, it should be noted that this strategy based on information and ICT architectures seems to coincide with the current proposal for structural change in the service provision model of Federal Executive Branch agencies, with greater digital interaction between agencies and citizens. (Batista; Azevedo; Hessel, 2020)

However, in practice, one questions: "How should technical architecture be designed and implemented in organizations?" In response, it is argued that this architecture can be developed based on a primary design conceived according to the best technical thinking in ICT, editing internal standards in organizations for their compulsory use, which provides for certain standards and best practices, such as standards technologically defined for operating systems and relational database management systems (RDBMS).

As an example of a recurring situation where the advantages of a standardized technical architecture could avoid expenses to the treasury, hypothetically, is the acquisition or development of a new application outside the walls (by partner agencies, often), that requires, for it to be installed in the technological environment of the requesting agency, a database product not yet used or mastered by the ICT support team at that agency. As a result, there will be a need for the acquisition and technical mastery (of the database support team), in the short term, of a new software that is quite complex, thus contributing to making ICT environments even more costly, resulting in the overload of ICT management units with more tasks that could be avoided.

3 Translation: "The discipline of service-oriented logical architecture is mainly focused on reuse, use and consumption. (...) this discipline focuses on the three major functional aspects of a logical architecture: (1) the relationship between implemented software packages, (2) the structural concerns of service-oriented package entities, and (3) the behavior and collaboration of packaged solutions. Service-oriented physical architecture refers to everything that is physically addressable to service-oriented components. This addressing consists of mapping software entities into hardware components and their addressable locations in a data communication network" (Bell, 2008, p. 309, editorial translation).

4 Original: "[...] is a design paradigm and discipline that helps IT meet business demands [...] SOA reduces redundancy and increases usability, maintainability and value. This produces interoperable, modular systems that are easier to use and maintain. SOA creates simpler and faster systems that increase agility and reduce total cost of ownership (TCO)" (Gartner Group, 2020b, *online*).

Compliance standards

Federal Executive Branch agencies must carry out their ICT management activities in accordance with technical standards and best market practices, but also in accordance with the standards approved by the central agency of the Information Technology Resources Administration System (SISP, in Portuguese) and the extensive jurisprudence established by internal and external control agencies over the last two decades. The government management model by means of structuring systems, in the Federal Executive Branch, dates back to Decree-Law No. 200, of February 25, 1967, which established:

> Art. 30. Serão organizadas sob a forma de sistema as atividades de pessoal, orçamento, estatística, administração financeira, contabilidade e auditoria, e serviços gerais, além de outras atividades auxiliares comuns a todos os órgãos da Administração que, a critério do Poder Executivo, necessitem de coordenação central.
> § 1º Os serviços incumbidos do exercício das atividades de que trata este artigo consideram-se integrados no sistema respectivo e ficam, consequentemente, sujeitos à orientação normativa, à supervisão técnica e à fiscalização específica do órgão central do sistema, sem prejuízo da subordinação ao órgão em cuja estrutura administrativa estiverem integrados.
> (...)
> Art. 31. A estruturação dos sistemas de que trata o artigo 30 e a subordinação dos respectivos Órgãos Centrais serão estabelecidas em decreto (Brasil, 1967, *online*)[5].

Originally, the SISP was established by Decree No. 1.048, of January 21, 1994, which was then referred to as the Information and Computer Science Resources Administration System. In its current version, Decree No. 7.579, of October 11, 2011 (which also refers to Decree-Law 200/1967), defined the way in which SISP is organized and, in its art. 2, established the purpose of systemic management, with the basic substantive functions that are most relevant to the assessment of ICTMP carried out in the research in question *(in litteris)*:

> IV – estimular o uso racional dos recursos de tecnologia da informação, no âmbito do Poder Executivo federal, visando à melhoria da qualidade e da produtividade do ciclo da informação;
> V – estimular o desenvolvimento, a padronização, a integração, a interoperabilidade, a normalização dos serviços de produção e disseminação de informações, de forma desconcentrada e descentralizada (Brasil, 2011, *online*)[6].

5 Translation: "Art. 30. Personnel, budget, statistics, financial administration, accounting and auditing, and general services activities will be organized in a system form, in addition to other auxiliary activities common to all Administration agencies that, at the discretion of the Executive Branch, require central coordination. Paragraph 1 The services responsible for carrying out the activities referred to in this article are considered to be integrated into the respective system and are, consequently, subject to regulatory guidance, technical supervision and specific inspection by the central agency of the system, without prejudice to subordination to the agency into the administrative structure to which they are integrated.
(...) Art. 31. The structuring of the systems referred to in article 30 and the subordination of the corresponding Central Agencies will be established by decree" (Brasil, 1967, online, editorial translation)

6 Translation: "IV – encourage the rational use of information technology resources, within the scope of the federal Executive Branch, aiming to improve the quality and productivity of the information cycle;
V – encourage the development, standardization, integration, interoperability, normalization of information production and dissemination services, in a deconcentrated and decentralized manner" (Brasil, 2011, online, editorial translation).

ANALYSIS AND DISCUSSION OF ICTMP CONTENT

Based on the electronic spreadsheet completed with the information collected from the documents and the calculated textual statistical parameters, the content analysis stage highlighted the aspects of the ICTMP presented below.

Execution performance

Performance data in the execution of previous plans, one of the information requirements for the diagnosis provided for in the SISP guide, is still a challenge for transparency in the ICT management of the agencies, noting that only 11 of the 17 agencies (64.7%) of the Direct Administration and 26 of the 42 agencies (61.9%) of the Indirect Administration of the Federal Executive Branch included these assessments in their ICTMPs. Although several agencies mention the existence of attached documents with this assessment item, they were often not found on the digital portals of the agencies.

According to **Table 1**, the average performance of Federal Executive Branch agencies in executing ICTMPs is only 44.3%, with a 0.4 variation coefficient, showing that more than half of the plan contents do not materialize or are only partially executed (the average of the Judiciary should not be considered because it represents data from only three non-random agencies). It is hoped that further research will be able to show the causes of this level of performance: whether the delivery expectations of the agencies' ICT unit are excessive, given their resources (thus requiring a greater sense of reality in the process of prioritizing needs); or the assessment of the time for implementation, due to the lack of detail of ICT needs in the planning stage, has been too optimistic; or a combination of these two causes.

Table 1 – Estimated delivery capacity calculation (hypothetical)

Available Human Resources				Time Consumption of Profiles per Activity (A_i) and Project (P_i) (man-hours)					
Profiles	Working Time (man hours))								
	Day	Year	PDTIC	A_1	A_2	A_3	A_4	P_1	P_2
Perfil A	8	2.000	6.000	750	1.500	750	750	1.500	750
Perfil B	16	4.000	12.000	3.000	5.500	1.500	250	1.250	500
Perfil C	16	4.000	12.000	1.000	5.500	1.500	2.000	1.000	1.000
Perfil D	24	6.000	18.000	0	3.000	0	0	8.000	7.000
Perfil E	24	6.000	18.000	1.000	3.000	500	500	7.000	6.000
Perfil F	6	1.500	4.500	1.000	2.000	250	500	500	250
Perfil G	12	3.000	9.000	750	2.000	3.000	750	2.000	500
Time of Team (mh)	**106**	**26.500**	**79.500**	**7.500**	**22.500**	**7.500**	**4.750**	**21.250**	**16.000**

Source: Prepared by the author (2022).

Delivery capacity as a prioritization criterion

In analyzing the discourse expressed by the authors of the texts, passages in which human resources gaps in ICT management units are mentioned were identified in 46 of the 72 (63.9%) ICTMPs researched, 45 of which were in Federal Executive Branch agencies (in 13 Direct Administration and 32 Indirect Administration agencies). In other words, gaps in human resources for ICT management are mentioned in more than 76.0% of Federal Executive Branch agencies, both in Direct Administration and Indirect Administration.

In particular, we highlight the initiative of some ICT management units to use a more detailed method of assessing their delivery capacity over the plan's time frame, based on a prior assessment of their human resources. The SISP Guide, despite providing for this assessment, does not propose any specific "end-to-end" methodology for the process, resulting in the assessments found in the ICTMP focusing, in general, only on available human resources, without human resource estimates necessary to implement the plans.

With this somewhat innovative (and courageous, one might add) approach, a greater sense of realism is adopted to prioritize meeting the needs of those who seek solutions. The construct (reasoning structure) presented in **Table 1**, with hypothetical data from any agency, supports the algorithm for calculating the delivery capacity of the ICT unit, with data on its workforce (in man-hours), and the consumption of this workforce to implement ICTMP in the agency. This calculation must counter a sum of the daily and annual net working hours

(man-hours) available for each team member (excluding hours committed to other activities in the unit) with a distribution of these hours in the various actions planned for carrying out the ICTMP in its time frame.

With implementation periods (horizons) of three years, for example, note that in the fourth column from left to right the sum of man-hours in the “ICTMP” column is equal to three times the annual sum of net hours available for each professional profile involved in the execution of the ICTMP (79,500 / 26,500 = 3).

With this calculation algorithm, detailed planning of the time consumption of each professional profile that makes up the ICT management team in the organization is carried out. It forces the ICT team to estimate, in advance, the total time consumption for each activity or project provided for in the ICTMP, within the planning horizon, and distribute this time with the corresponding available time of the professionals who will be involved in the execution. The most developed ICTMPs in this item, in a preliminary assessment, are those of the following agencies: Federal Prosecutor’s Office (MPF), National Council of Justice (CNJ), Brazilian Space Agency (AEB) and Private Insurance Superintendence (SUSEP).

This management innovation makes ICTMP more realistic, based on evidence, as recommended in Appellate Decision No. 2608/2018-TCU-Plenário (Brasil, 2018) in relation to public policies, plans and programs. Although this ICT team delivery capacity assessment model also presents risks of erroneous estimates, it will certainly be closer to the unit’s effective delivery capacity, as one of the applicable prioritization criteria.

Technical chapters of interest

The research project also provided for the textual verification of the possible presence of specific technical chapters of interest that would highlight the technical level of the ICTMP, whether or not provided for in the SISP Guide. The technical research topics were presented in **Table 2**: “Strategies”, “Architectures”, “PMM” (ICT Project Management Methodology), “Risk Management” and “Governance”.

Using the word search features of a word processing software, the presence or absence of chapters with certain contents of interest for the research was identified, with the titles indicated in **Table 2**. As a precaution, a search for these chapters in the bodies of the ICTMP texts was also carried out, considering that sometimes the summaries of the plans are not detailed in relation to the chapter contents.

Table 2 – Specific technical chapters

Union Branches and Entities	ICTMP Qty	Quantity of ICTMP with Technical Chapters				
		Strategies	Architectures	PMM (*)	Risk Management	Governance
Executive Branch	59	4	15	2	51	29
Direct Administration	17	2	2	1	15	7
Indirect Administration	42	2	13	1	36	22
Legislative Branch	2	1	1	0	0	1
Judiciary Branch	10	0	1	0	0	5
Federal Prosecutor's Office	1	0	0	0	0	1
Total	**72**	**5**	**17**	**2**	**51**	**36**

Source: Prepared by the author (2022).

(*) PMM: ICT Project Management Methodology

Topic "strategies" refers to express and detailed demonstrations of articulation between business and ICT strategies in the ICTMP itself, in order to highlight, technically, the integration and synergy between these strategies (this is not, therefore, just a mention to this arrangement). With the results presented in **Table 2**, one concludes that only 5 of the 72 agencies (6.9%) minimally demonstrate this synergy, being it noted that several agencies refer this vision of arrangement between strategies to other agency documents, which do not make up the ICTMP, such as strategic planning documents.

The data in the "architectures" column in **Table 2** consolidates the three architectures that are the subject of research in the ICTMP: corporate or business architecture, information architecture and technical or systems architecture. It is observed that only 17 of the 72 agencies (23.6%) elaborate on this topic in chapters in their ICTMP, given that the agencies of the Indirect Administration of the Executive Branch have a higher rate: 13/42, or 31.0%.

Perhaps the most frustrating result is that related to the presence of thematic chapters on ICT project development methodologies (column "PMM"): only 2 of the 72 agencies surveyed elaborated on the topic in a specific chapter in the ICTMP itself, even though several of them mention the existence of a methodology or the intention to adopt a methodology. With this result, an important methodological issue does not become transparent for technical scrutiny external to the agency, or for the exchange of experiences and learning between ICT management units and outside-the-wall specialists.

However, it should be considered a positive result that most ICTMPs present thematic chapters on two very current topics (under the terms of Decree No. 9.203, of November 22, 2017): "risk management" and "governance". The Federal Executive Branch agencies include, in their ICTMP, a chapter on "risk management" in 51 of the cases (70.8%), with

better results for Direct Administration agencies, in 15 of the 17 agencies (88.2%). These rates decrease for topic “governance”, although they are significant and quite similar in all categories of agencies; in the Federal Executive Branch agencies, 29 out of 51 (or 56.9%) include chapters on “governance” in their ICTMPs.

Current topic quotes

Another block of semantic research objects focused on the search for textual quotes, not necessarily in specific chapters, on the following topics: “strategy”; “information security”; “GIS” *(Geographical Information System)*; “SIG” (Sistema de Informações Geográficas); “georeferencing”; “satellite image”; *“Drone”*; “UAV” (Unmanned Aerial Vehicle); “mobile device application”, *“mobile”* (mobile device application); *“app”* (*software application*); “information management”; “knowledge management”; *“cloud computing”* and *“big data”*. **Table 3** presents the combined results of this search in each ICTMP, highlighting that topics related to georeferencing were consolidated into a single item for data analysis (also adding the frequencies of quotes “GIS”, “SIG”, “ satellite image”, “drone” and “UAV”), as well as search results for “application”, *“mobile”* and *“app”* (consolidated in “Mobile Device Application”), given that quotes “information management” and “knowledge management” were combined on account of the natural connections between them.

Table 3 – Current topic quotes

Research Topics		Branches and Entities (*) and Observed Frequencies of Thematic Quotes						
#	Thematic Expression	EB	EB-DA	EB-IA	LB	JB	FPO	Subtotal
1	**Strategy**	1.629	514	1.115	13	137	36	1.815
2	**Information security**	1.240	371	869	5	77	15	1.337
3	**GIS/SIG, Georeferencing, Satellite Image, Drone/UAV (**)**	628	98	530	3	23	0	654
4	**Mobile Device Application**	234	162	72	6	18	3	261
5	**Information and Knowledge Management**	209	55	154	5	2	2	218
6	**Cloud Computing**	180	49	131	9	27	11	227
7	**Big Data**	16	7	9	0	4	2	22
Quantity of ICTMP (A)		**59**	**17**	**42**	**2**	**10**	**1**	**72**
Total Quotes Found (B)		**4.136**	**1.256**	**2.880**	**41**	**288**	**69**	**4.534**
Total Quotes / ICTMP (C=B/A)		**70,1**	**73,9**	**68,6**	**20,5**	**28,8**	**69,0**	**63,0**

Source: Prepared by the author (2022).

(*) EB: Executive Branch; EB-DA: Direct Administration of the Executive Branch; EB-IA: Indirect Administration of the Executive Branch; LB: Legislative Branch; JB: Judiciary Branch; FPO: Federal Prosecutor's Office.

(**) *Drone* (in English) or UAV (VANT in Portuguese): Unmanned aerial vehicle.

The most relevant aspects of the searches, observing the results in **Table 3**, are:

a) the two most cited topics are, by far, "strategy" (with 1,815 quotes found) and "information security" (with 1,337 quotes);

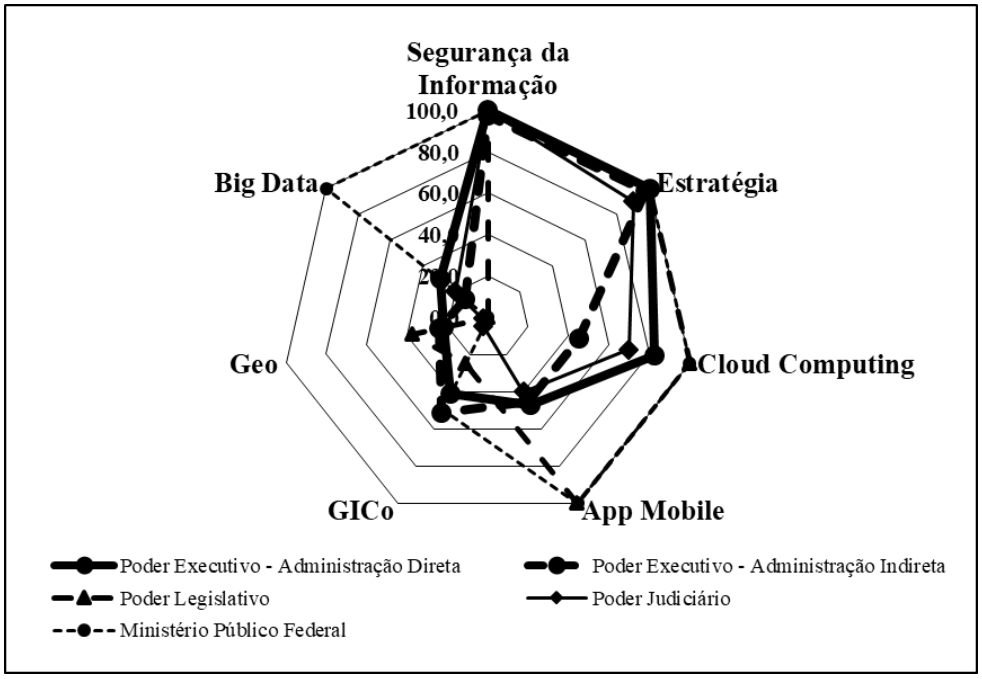
b) As for topics related to "georeferencing" and "mobile device application", the first topic seems to be of more interest to Indirect Administration agencies than to Direct Administration Federal Executive Branch agencies, with frequency ratios of around 12.6 quotes per agency (530/42) and 5.8 quotes per agency (98/17), respectively, while the second topic seems to be of much greater interest to Direct Administration agencies, at a rate of 9.5 quotes per agency (162/17) , against 1.7 quotes per agency (72/42) in Indirect Administration;

c) although widely discussed, in recent years, topic "cloud computing" (does not appear very frequently in the plans of agencies in general and in the Federal Executive Branch, on average, only 3.1 quotes were found per ICTMP (180/59); even less so is topic "big data", with only 16 quotes in total (16/59, or just one quote for almost four ICTMPs).

Considering the relevance of digital georeferencing in its context, the National Department of Mineral Production (DNPM) calls its plan the “Plano Diretor de Tecnologia da Informação, Comunicações e Geoprocessamento 2017-2019”(2017-2019 Master Plan for Information Technology, Communications and Geoprocessing).

In terms of the number of agencies in which quotes on this topic appear, in relation to the number of agencies with ICTMP researched (percentages of agencies with quotes), the “radar” style graph in **Figure 1** highlights the concentrations, with percentages ranging from 0 to 100, of ICTMP with thematic research quotes by Union Branch and Entity. There is a greater concentration of quotes on topics “strategy” and “information security” in Executive Branch Direct Administration agencies (thicker solid line) and lower in Indirect Administration agencies (thicker dotted line).

Figure 1 – Percentages of ICTMP with quotes on current topics



Source: Prepared by the author (2022).

Analysis of ICT needs

This block of research data refers to the demands for ICT solutions expressed in the ICTMP, which correspond to the item diagnosis referred to as “ICT needs” in the SISP Guide. In summary, in this cognitive logic, needs represent the most important indicator according to which the ICT management unit must direct its resources and, thus, contribute to the technological evolution of the organization.

Table 4 presents the quantities of items that appear as “ICT needs” in the plans of the surveyed agencies, grouped by political-administrative category. As provided for in the

SISP Guide, some agencies define items for the acquisition or development of goods and services as “ICT needs”, without a more detailed breakdown, while others detail their needs in projects and actions and, sometimes, in goals.

Table 4 – ICT needs

Union Branches and Entities	ICTMP Qty. (A)	Quantities of Items defined as “Needs”	
		Subtotal (B)	Average (C=B/A)
Executive Branch	59	3.982	67,5
Direct Administration	17	832	48,9
Indirect Administration	42	3.150	75,0
Legislative Branch (*)	2	133	66,5
Judiciary Branch (*)	10	863	86,3
Federal Prosecutor’s Office (**)	1	-	-
Total	**72**	**4.978**	**69,1**

Source: Prepared by the author (2022).

(*) Recorded as needs or projects.

(**) Demands are not consolidated in the same format as that of the other agencies.

In general, the Federal Executive Branch agencies express their ICT needs on 24 pages of the ICTMP, on average (with a 1.2 variation coefficient), while the agencies of the Judiciary Branch have a slightly lower average, around 19 pages, with a 0.9 variation coefficient. The total documentary volume recording the ICT demands of the ICTMP surveyed totaled 1,693 pages with 4,978 “needs” and 6,106 projects or actions with some detail.

It is important to note that the agencies of the Legislative and Judiciary Branches and the Federal Prosecutor’s Office (FPO) are not subordinate to the SISP, reason for which their ICTMP do not generally have the same structure and data presentation formats that those of the Federal Executive Branch agencies. In relation to the ICT demands observed, several agencies of the Legislative and Judiciary Branches and the Federal Prosecutor’s Office defined their demands directly as “projects”, not as “needs”.

With discourse analysis of the chapter texts on ICT needs, it was observed that the descriptions of the items are generally at very high levels of abstraction, with little clarity, from a technical point of view, about what is being demanded, or needs are described with objects so broad that they should certainly have been broken down into a number of smaller and more specific demands (needs or projects/actions). As examples of unclear inventoried needs, items were found described (literally) as: “needs assessment and deployment of resources to improve the availability of ICT infrastructure”, “improve the strategic decision-making process”, “implement knowledge management technologies in support of strategic

issues", "develop computer-based information systems using standardized platforms, using defined and mature processes", "increased productivity and delivery capacity", "development of mobile applications", "develop new systems", "acquisition of products/systems to meet specific needs of business areas", "integrated monitoring center", "solution for human resources management", "implement/acquire/customize computerized systems according to the stated needs after feasibility studies", "improved quality of IT services provided by the agency to its users", "improved building networks", "increase use of market solutions".

Another point of concern is that in the overwhelming majority of Federal Executive Branch agencies surveyed, apparently redundant needs are found in the same ICTMP, which could be consolidated by employing a more corporate and integrated approach to service, perhaps resulting from the lack of more in-depth technical analyzes of ICT needs presented by the various internal units of the agencies.

The data in **Table 5** shows the list of the 10 nominative words (nouns that generate denominations of objects, actions or ideas) most frequently found in the "ICT Needs" chapters of the ICTMPs researched, having excluded from this table words (acronyms) "IT" and "ICT", which, due to its direct relationship with the general topic of the texts, is repeated thousands of times without adding anything new (relevant information). The third column from left to right shows the corresponding frequencies with which these words, individually, are found in texts, in absolute numbers (total count), and the fourth and last column, from left to right, shows the quantities of noun clusters (noun phrases) formed by combining each of the most frequent words observed (in the singular and plural).

Table 5 – 10 Most frequent words and formed clusters

#	Word	Word frequency	Cluster frequency
1	**system/systems**	3.360	2.049
2	**service/services**	1.856	1.824
3	**information**	1.840	1.482
4	**Management**	1.580	2.118
5	**data**	1.331	1.011
6	**project/projects**	1.330	680
7	**process/processes**	1.316	963
8	**solution/solutions**	1.241	953
9	**acquisition/acquisitions**	1.001	763
10	**software**	908	1.021

Source: Prepared by the author (2022).

The word clusters are identified in the texts and computed, in terms of frequency of occurrences, only using specific NLP software, such as that related to the work of Scott

(2019), with several other search textual statistics functions not found in common word processors. The linguistic structures in word clusters, in this case compositions of nouns with other nouns, are semantically richer than isolated nouns, as in the following example: “management” does not clarify much about the context of the management application, but “information management” identifies the management application area, presenting a more specific context, with greater explanatory power; the same occurs with noun “security”, which when added to “information” becomes “information security”.

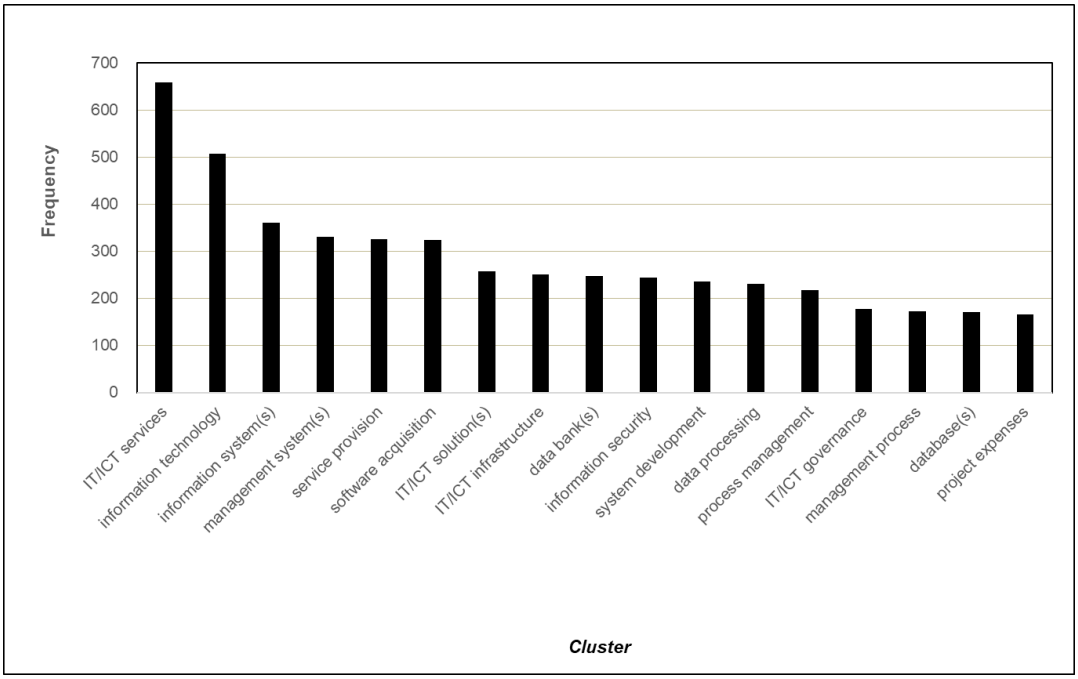
However, as a measure of saving computational research resources (text processing time), only the clusters with frequency equal to or greater than 10 were added, thus inferring that the frequencies of noun phrases formed with the 10 most frequent words (top ten) will be even more numerous. The most frequent *clusters* are composed with word “management”, totaling 2,118 appearances, which generally presupposes the management of something, therefore requiring a nominal complement, appearing in technical texts as “management of...”; otherwise, the composition of a cluster can also appear as “management process(/es)”, where “management” is the nominal complement of another noun (this composition of clusters appeared 173 times in the set of the ICTMPs surveyed).

The second structure of most frequent clusters is composed of word “system(s)”, with 2,049 appearances, and the third is composed of word “service(s), totaling 1,824 appearances. This number of clusters observed (with frequency equal to or greater than 10) related to the concept of “service(/s)” denotes a concern on the part of agencies with the provision of ICT-based services, a positive sign of the larger objectives of ICTMPs, even if this evolution does not occur at the desired pace.

The results of the search for the most frequent clusters in the ICTMP researched are shown in **Chart 1**. Nominative expression “ICT services” appears as the most frequent cluster, with 658 appearances, followed by “information technology”, with 506 occurrences, and “information system(/s)”, with 361 occurrences. It should be noted that of the 10 most frequent words presented in **Table 5**, only 2 do not make up clusters among the 10 most frequent: process(/es) and project(/s).

Considering that the term “solution”, from Normative Instruction No. 4/2010-SLTI/MPOG, has become a standard expression to refer to a set of ICT resources combined and intended to solve a business problem, we sought, in the ICTMPs, in the chapters on “ICT needs”, structured noun phrases (compound nominative expressions), such as “solution/solutions of...” and “solution/solutions for ...”, observing in the resulting phrases, the complementary nominative term in the sequence, which qualifies word “solution(s)”. With this textual search operation, the results presented in **Chart 2** were obtained, where “IT/ICT solution(s), “management solution(s)” and “security solution(s)” appear as the three most frequent clusters.

Chart 1 – Most frequent clusters among “ICT needs”

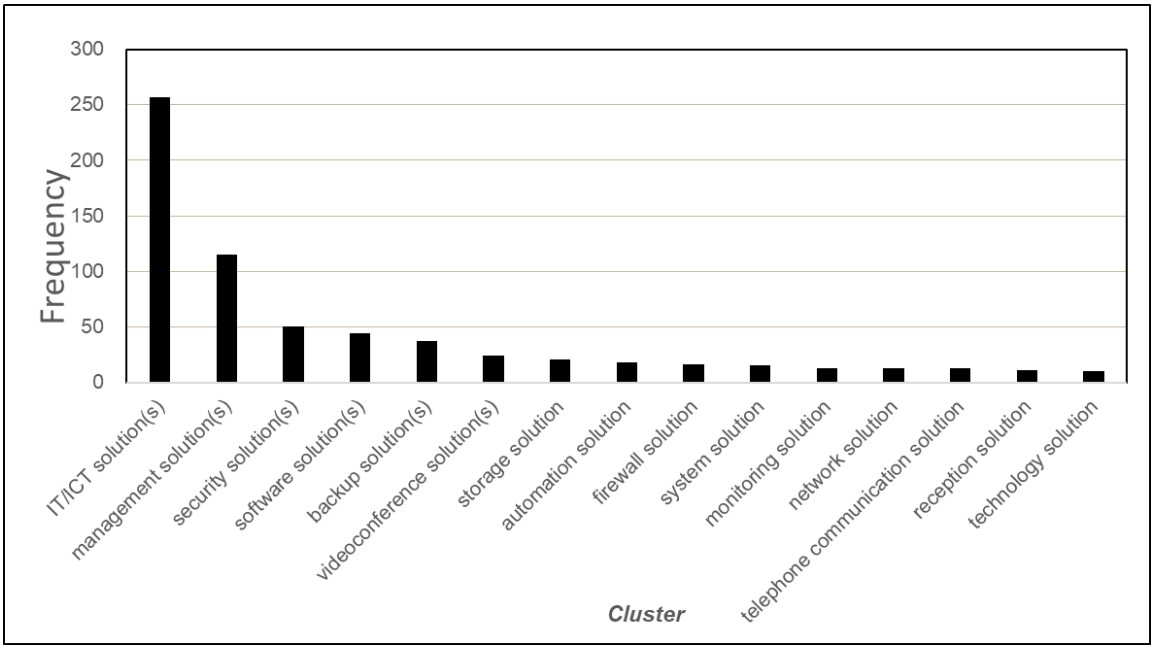


Source: Prepared by the author (2022).

Considering that the term “solution”, from Normative Instruction No. 4/2010-SLTI/MPOG, has become a standard expression to refer to a set of ICT resources combined and intended to solve a business problem, we sought, in the ICTMPs, in the chapters on “ICT needs”, structured noun phrases (compound nominative expressions), such as “solution/solutions of...” and “solution/solutions for ...”, observing in the resulting phrases, the complementary nominative term in the sequence, which qualifies word “solution(s)”. With this textual search operation, the results presented in **Chart 2** were obtained, where “IT/ICT solution(s), “management solution(s)” and “security solution(s)” appear as the three most frequent clusters .

These results corroborate the results presented in **Figure 1** regarding the high frequency of needs for “information security” solutions expressed in the ICTMPs researched, and it is also interesting to note the significant frequency of a need for a solution that is rarely commented on: “videoconference solution”. With regard to the other needs mentioned, such as “backup solution/solutions”, “network solution”, “storage solution” and “telephone communication solution”, for example, these are not new in the ICTMPs as they constitute common infrastructure needs to the agencies.

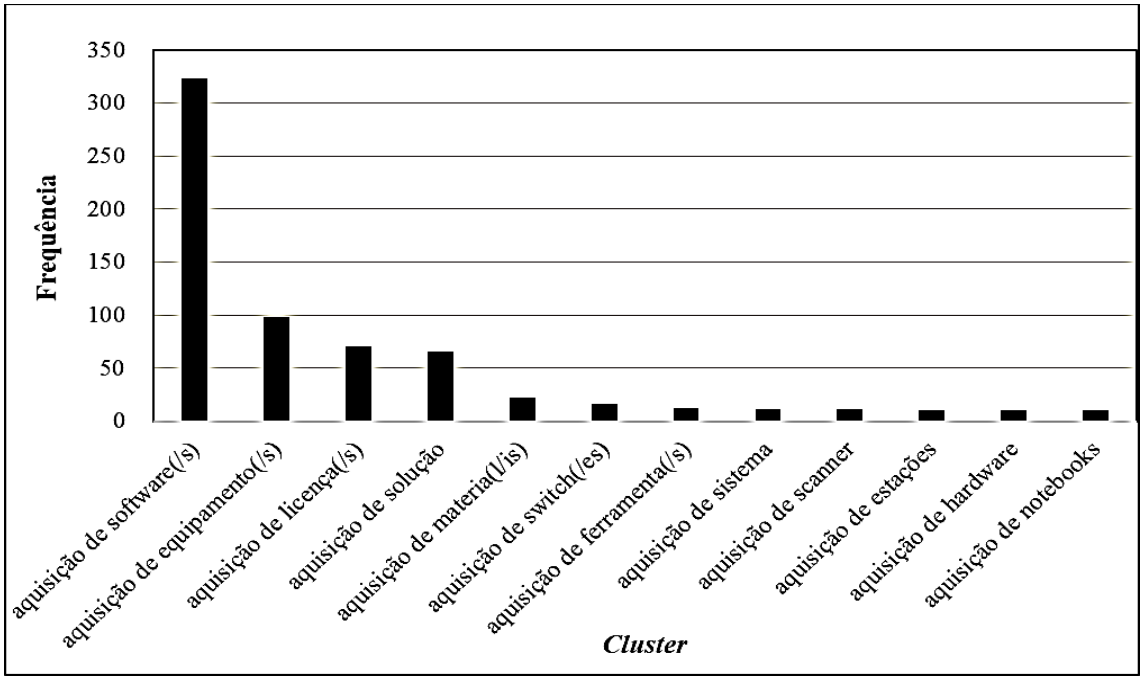
CHART 2 – Most frequent clusters with “solutions)”



Source: Prepared by the author (2022).

With **CHART 3**, the power of PLN technologies is again evident, including, among the 10 most frequent clusters (with frequencies equal to or greater than 10) observed among the “ICT Needs”, a series of interesting clusters composed of the word “acquisition”. These expressions reveal purchasing intentions for ICT components.

CHART 3 – Most frequent clusters with “acquisition”



Source: Prepared by the author (2022).

Another interesting aspect of this syntagmatic analysis refers to the clusters composed of word “management”: when adding the frequencies of the clusters with structures “management system(s)” and “management solutions”, more than 400 clusters contain this idea – that of solutions or computer information systems for managing agencies. It is concluded, given the textual evidence present in the ICTMPs researched, that there is at least a genuine concern on the part of Union agencies with the automation of their management processes.

With regard to ICT budgets, the plans researched revealed that the largest budgets belong to larger agencies in every sense, with decentralized regional units in the country and higher number of public servants, such as the Ministry of Health, Ministry of Finance, National Department of Transport Infrastructure, Ministry of Justice and Public Security and Ministry of Agriculture, Livestock and Supply. It was also observed that the budgetary issue is not addressed in all agencies of the Executive Branch, where only 49 of the 59 agencies surveyed (83.1%) had estimated their expenses.

As for values, the average budget amount for each ICTMP surveyed is R$ 115.8 million over the average planning time frame (which is 2.8 years), resulting in an average annual expenditure per agency of approximately R$ 41.3 million.

CONCLUSION

It is concluded, based on the sample size and the research results brought in this article, firstly that Natural Language Processing (NLP) technologies can effectively contribute to semi-automatic assessment processes of textual content of documents in the public sector, such as in the case of plans; and, second, that the ICTMPs published between 2013 and 2019 appear to be prepared in accordance with the SISP Guide and thus contribute to the technological evolution of the agencies, but they still lack significant technical improvements to become more effective instruments in this sense.

The research results show positive developments in current ICT management issues, with frequent mentions of governance and risk management topics, and significant interest in the adoption of disruptive technologies by some Federal Executive Branch agencies, such as digital georeferencing technologies and applications for mobile devices, although perhaps excessively cautious given the cost/benefit ratio of these technologies. Another positive aspect is that some more controversial ICT management models, even if adopted by companies in the market, seem to be considered within the scope of SISP in view of their complexity in an eventual scale implementation in the federal public sector, as in the case of cloud computing.

Another relevant aspect, which refers to a fortunate finding of this research, is that some ICT management units are daring to innovate in the demand management model, opposing, technically (with data), on the one hand the ICT needs and, on the other hand, estimates of the actual delivery capacity of their teams. With this, ICT management in agencies could become a more data and evidence-based activity, therefore more realistic, in accordance with the recommendations of the Federal Audit Court in Ruling 1603/2008-TCU-Plenário

(Brasil, 2008), on the needs for human resources in the agencies' ICT units, and in Ruling 2608/2018-TCU-Plenário (Brasil, 2018), on technical criteria for the development of public policies, plans and programs.

Statistical data on textual content also reveals, on the other hand, according to the perception of a recently published government authority, that in general, the Federal Executive Branch agencies still lack an evolution in ICT "from the door in" (Batista ; Azevedo; Hessel, 2020), to resolve bottlenecks in technological infrastructure and integration of computer information systems that prevent full service to citizens. The level of detail of the demands included in the ICTMP, generally superficial (and with redundancies), also does not contribute to the assessment of service efforts and better management of ICT needs in the agencies.

The little interest revealed in the elaboration of information architecture and technical architecture may be contributing to the slow progress of SISP agencies in meeting the technical requirements for integration, interoperability and portability of systems provided for in Ordinance No. 92/SLTI/MPOG, of December 24, 2014 (which established the "ePING" interoperability architecture), as well as the institutional objectives proposed in Decree No. 10.046, of October 9, 2019 (on governance in data sharing processes). Considering a natural analogy between ICT architecture and traditional architecture (in civil construction), developing a computing environment without information architecture and technical architecture is equivalent to constructing a building without an architectural design, assuming the risks of inadequacy of spaces and inappropriate use of costly ICT resources.

Obviously, one cannot ignore adverse aspects that go beyond the governability of the ICT units in the agencies, such as issues with inadequate corporate business strategies and processes and inadequate or absent governance models. The most obvious example refers to the hierarchical level at which the holders of ICT management units are located in the agencies, the overwhelming majority of whom are located in intermediate positions, which demonstrates, in practice, the level of priority for ICT management.

REFERENCES

ABRAMS, C.; SCHULTE, R. W. **Service-oriented architecture overview and guide to SOA research**. [*s. l.*]: Gartner Group, 2008.

BATISTA, V.; AZEVEDO, A.; HESSEL, R. Força-tarefa contra filas no INSS ganha reforço. **Correio Braziliense**, Brasília, 17 jan. 2020. Economia, p. 7.

BELL, M. **Service-oriented modeling: service analysis, design, and architecture**. New Jersey: Wiley, 2008. ISBN 0470141115.

BRASIL. **Decreto-lei nº 200**, de 25 de fevereiro de 1967. Dispõe sobre a organização da Administração Federal, estabelece diretrizes para a Reforma Administrativa, e dá outras providências. Presidência da República, Brasília, 1967.

BRASIL. **Decreto-lei nº 7.579**, de 11 de outubro de 2011. Dispõe sobre o Sistema de Administração dos Recursos de Tecnologia da Informação–SISP, do Poder Executivo federal. Presidência da República, Brasília, 2011.

BRASIL. Ministério do Planejamento, Orçamento e Gestão. **Guia de elaboração de PDTI do SISP: Versão 1.0**. Brasília: MPOG, 2012. Disponível em: http://www.sisp.gov.br/.../Guia_de_Elaboração_de_PDTI_v1.0... pdf. Acesso em: 2 jan. 2020.

BRASIL. Tribunal de Contas da União. **Acórdão nº 2608/2018-TCU-Plenário**. Lei 13.707/2018, art. 124. Relatório de políticas públicas elaborado com objetivo de subsidiar o Congresso Nacional na elaboração da Lei Orçamentária. Acórdão 2127/2017-Plenário. Monitoramento. Adoção de diversas medidas, por parte do Poder Executivo, para atender às recomendações. Oportunidade de melhorias. Recomendações aos órgãos mencionados e a unidades deste Tribunal. Brasília: Tribunal de Contas da União, 2018. Disponível em: https:// pesquisa.apps.tcu.gov.br/#/documento/acordao-. Acesso em: 25 out. 2020.

BRASIL. Tribunal de Contas da União. **Acórdão nº 1603/2008-TCU-Plenário**. Levantamento de auditoria. Situação da governança de Tecnologia da Informação – TI na Administração Pública Federal. Ausência de Planejamento Estratégico Institucional. Deficiência na estrutura de pessoal. Tratamento inadequado à confidencialidade, integridade e disponibilidade das informações. Recomendações. Brasília: Tribunal de Contas da União, 2008. Disponível em: https://pesquisa.apps.tcu.gov.br/#/resultado/acordao-completo/. Acesso em: 25 out. 2020.

CONEGLIAN, C. S.; SEGUNDO, J. E. S. Inteligência artificial e ferramentas da *web* semântica aplicadas a recuperação da informação: um modelo conceitual com foco na linguagem natural. **Informação e Informação**, Londrina, v. 27, n. 1, p. 625–651, jan./mar. 2022. Disponível em: https://ojs.uel.br/revistas/uel/index.php/informacao/article/view/44729. Acesso em: 9 dez. 2023.

COSTELO, K. **The Evolution of Enterprise Architecture**. Gartner Group, 2019. Disponível em: https://www.gartner.com/smarterwithgartner/the-evolution-of-enterprise-architecture/. Acesso em: 2 jan. 2020.

CRAWLEY, E. **Introduction to system architecture**: architecture to value. Lecture Notes. Massachusetts: MIT, 2007. Disponível em: https://ocw.mit.edu/courses/engineering-systems-division/esd-34-system-architecture-january-iap-2007/lecture-notes/lec1.pdf. Acesso em: 21 jan. 2020.

FALCÃO, L. C. J.; LOPES, B.; SOUZA, R. R. Absorção das tarefas de processamento de Linguagem Natural (NLP) pela Ciência da Informação (CI): uma revisão da literatura para tangibilização do uso de NLP pela CI. **Em Questão**, Porto Alegre, v. 28, n. 1, p. 13-34, jan./mar. 2022. Disponível em: https://seer.ufrgs.br/EmQuestao/article/view/111323/64623. Acesso em: 9 dez. 2023.

GARTNER GROUP. **Gartner glossary:** enterprise architecture. [*s. l.*]: Gartner Group, 2020a. Disponível em: https://www.gartner.com/en/information-technology/glossary/enterprise-architecture-ea. Acesso em: 2 jan. 2020.

GARTNER GROUP. **Gartner Glossary**: Service-oriented Architecture (SOA). [*s. l.*]: Gartner Group, 2020b. Disponível em: https://www.gartner.com/en/information-technology/glossary/service-oriented-architecture-soa. Acesso em: 22 jan. 2020.

HERMANS, P. **The Zachman Framework for architecture revisited**: on conceiving the informational enterprise. Semiosis, [*s. l.*], p. 1-18, 2015.

KAO, A.; POTEET, S. R. (ed.). **Natural language processing and text mining**. London: Springer, 2007.

KONCHADY, M. **Text mining application programming**. Massachusetts: Charles River Media, 2006.

KOTUSEV, S. Enterprise architecture: what did we study? **International Journal of Cooperative Information Systems**, [*s. l.*], v. 26, n. 4, 2017. Disponível em: https://www.academia.edu/36770941/Enterprise_Architecture_What_Did_We_Study. Acesso em: 24 out. 2020.

KOTUSEV, S. The history of enterprise architecture: an evidence-based review. **Journal of Enterprise Architecture**, [*s. l.*], v. 12, n. 1, p. 29-27. 2016. Disponível em: https://www.researchgate.net/publication/308936998_The_History_of_Enterprise_Architecture_An_Evidence-Based_Review/link/.../download. Acesso em: 24 out. 2020.

LIMA-MARQUES, M.; MACEDO, F. L. O. Arquitetura da Informação: base para a gestão do conhecimento. *In*: TARAPANOFF, K. (org.). **Inteligência, Informação e Conhecimento**. Brasília: UNESCO: IBICT, 2006, p. 241-255.

MEADOW, C. T.; BOYCE, B. R.; KRAFT, D. H.; BARRY, C. **Text information retrieval systems**. 3. ed. [*s. l.*]: Elsevier, 2007.

NICOLAIDOU, M.; TSADIMAS, A.; ALEXOPOULOU, N.; ANAGNOSTOPOULOS, D. Employing Zachman Enterprise Architecture Framework to Systematically Perform Model-Based System Engineering Activities. *In*: PROCEEDINGS OF THE 42ND HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES 2009, 42., 2009, Havaí. **Anais** […] Hawaii: HICSS, 2009.

ROSS, J. W.; WEILL, P.; ROBERTSON, D. C. **Arquitetura de TI como estratégia empresarial**. Tradução Roger Maioli dos Santos. São Paulo: M. Books, 2008.

SCOTT, M. **WordSmith Tools Manual**. Version 7.0. Stroud: Lexical Analysis Software Ltd., 2019.

WURMAN, R. S. **Information architects**. New York: Graphis, 1997.

ZACHMAN, J. A. **The concise definition of the Zachman Framework**. [*s. l.*], Zachman International, 2008.

ZACHMAN, J. A. A framework for information systems architecture. **IBM Systems Journal**, [*s. l.*], v. 26, n. 3, 1987, p. 276-292.

Perspectives of open educational resources for the library-information field: insights from Ranganathan

Jessika Palmeira Alves
Masters Degree in Library Sciences, Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Rio de Janeiro, RJ, Brasil.
Technician at the Instituto Federal do Rio de Janeiro (IFRJ), Rio de Janeiro, RJ, Brasil.
http://lattes.cnpq.br/2666155519357733

Alberto Calil Elias Junior
Ph.D in Social Sciences, Universidade do Estado do Rio de Janeiro (UERJ), Rio de Janeiro, RJ, Brasil
Associate professor level III at the Library Sciences Gratuate Program at the Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Rio de Janeiro, RJ, Brasil.
http://lattes.cnpq.br/9490009776453579

Submitted on: 04/06/2022. Approved on: 03/01/2024. Published on: 06/21/2024.

ABSTRACT

Sociotechnical transformations propelled by information and communication technologies, coupled with the integration of computers into telecommunication networks, have profoundly impacted the daily lives of contemporary individuals. In response to these shifts, libraries are increasingly adapting their services and products to virtual environments. This adaptation aims to foster practices that encourage democratic access to knowledge, particularly through Open Educational Resources (OER). The evolution of library and information professional roles, along with the emergence of OER, is made possible within a context of growing utilization of information and communication technologies integrated into the knowledge and practices of these institutions. This paper offers an overview of the scientific production concerning OER in the library and information science field during the 2013-2016 quadrennium, as published in relevant journals and on the Sucupira platform. The search was restricted to titles classified as A1, A2, B1, and B2, focusing on national (Brazilian) and Latin American literature.

Keywords*:* open educational resources; OERs; information and communication technologies; ICT; library; virtual environments.

INTRODUCTION

The sociotechnical transformations of recent years, particularly those related to Information and Communication Technologies (ICT) and the integration of computers with telecommunications networks, have significantly impacted the daily lives of contemporary individuals. The expansion of cyberculture, driven by the advent of the internet, has maximized computer-mediated communication on a global scale. According to Gasque (2016), it is anticipated that in the coming years, individuals will increasingly make use of internet resources and digital media.

This digital immersion is transforming the ways we acquire knowledge and engage with the world in contemporary societies. From civic services to work, education, and leisure, our practices are increasingly embedded in virtual environments. Social media platforms and other virtual spaces have become central to various information ecosystems, shaping our actions, thoughts, and relationships with the world and one another.

Libraries, playing a vital role in ensuring access to culture and information, are “por excelência o espaço adequado para o empoderamento das pessoas por meio da alfabetização midiática e informacional “ (Declaração, 2019, p. 1)[1]. As a result, libraries are progressively migrating many of their services and products to virtual environments, enhancing information retrieval from their databases and better serving their users.[2]

These practices are particularly crucial in the current era, where the informational ecosystem facilitates the production, circulation, and consumption of misinformation. This has led to an exponential increase in the volume of information, known as the infodemic and disinfodemic, creating a landscape of informational disorder (Wardle & Derakhshan, 2019; Araujo, 2021).

In this context, the importance and urgency of developing media and information literacy (MIL) policies and strategies become evident. These policies aim to reduce inequalities and provide individuals with the necessary tools to critically engage in the search, analysis, and evaluation of information sources in their daily lives. The ability to assess the quality of knowledge available online is essential for citizens to make informed decisions about their social and personal lives.

According to the *Declaração de Santiago* (2019), libraries are “strategic” partners in disseminating content across various fields. Initiatives that promote engagement with the digital information universe, emphasizing sharing, reuse, adaptation, readaptation, translation, and localization, have given rise to a movement around new resources for teaching and learning practices, known as Open Educational Resources (OER).

1 Translation:”ideally positioned to empower individuals through media and information literacy” (Declaração, 2019, p. 1, editorial translation).

2 Processes that gained greater support and adherence with the onset of the SARS-COVID-19 pandemic in 2020, which forced the closure of many libraries due to circulation restrictions, accelerated the shift towards computer networks as the primary channel for communication with readers.

OER are designed to provide flexible educational opportunities without barriers to access. At the World Congress on OER held in Paris by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), OER were defined as,

> […] os materiais de ensino, aprendizagem e investigação em quaisquer suportes, digitais ou outros, que se situem no domínio público ou que tenham sido divulgados sob licença aberta que permite acesso, uso, adaptação e redistribuição gratuito por terceiros, mediante nenhuma restrição ou poucas restrições. O licenciamento aberto é construído no âmbito da estrutura existente dos direitos de propriedade intelectual, tais como se encontram definidos por convenções internacionais pertinentes, e respeita a autoria da obra (UNESCO, 2012)[3].

Arimoto and Barbosa (2012) suggest that Open Educational Resources (OER) were inspired by the open-source software movement, with the aim of providing quality educational materials with open access. In this context, open data and content can be shared, transformed, and utilized by anyone for various purposes, which are fundamental principles of open science[4].

From another angle, this paper proposes a reflection on OER through the lens of virtual reference services[5] in libraries, as this service is characterized by the establishment of relationships between the reader, the library, and information through technological mediation. Supporting this perspective, Accart (2012, p. 183)[6] notes:

> […] o serviço de referência virtual não constitui, falando propriamente, uma ferramenta da web 2.0, mas disso se aproxima muito, com as múltiplas possibilidades de interação oferecidas: pela troca de mensagens de correio eletrônico com a finalidade de esclarecer uma questão, a entrevista de referência se "virtualiza"; pelo bate-papo que permite travar um diálogo ao vivo; grupo de discussão, etc.

In this scenario, the library emerges as a space to foster practices that encourage democratic access to knowledge through OER, making them readily available to its users. This paper aims to provide an overview of the scientific production on OER within the library and information science field in Brazil and Latin America.

With that in mind, this study performed a mapping of the scientific production on OER in the national and Latin American contexts. The research was structured using the Capes journal database, accessed through the Sucupira platform, to establish parameters for data collection.

---

3 Translation: "[…] teaching, learning, and research materials in any format, digital or otherwise, that reside in the public domain or have been released under an open license, permitting no-cost access, use, adaptation, and redistribution by others with no or limited restrictions. Open licensing functions within the established framework of intellectual property rights, as defined by relevant international conventions, and fully respects the authorship of the work " (UNESCO, 2012, editorial translation).

4 According to the Open Science Training Handbook, "open science is the practice that allows others to collaborate and contribute, where research data, laboratory notes, and other research processes are freely available" (Rodrigues; Fernandes; Correia, 2019, online).

5 The term "virtual" carries some implications, as highlighted by the author Pierre Levy (1996), which are beyond the scope of this paper. Instead, the perspective advocated by Accart (2012) has been adopted to frame the definition of Virtual Reference Service as discussed herein.

6 Translation: "[…] the virtual reference service is not, strictly speaking, a Web 2.0 tool, but it is very close to it, with the multiple possibilities of interaction offered: through the exchange of e-mail messages with the aim of clarifying a question, the reference interview is "virtualized"; through chat, which allows for a live dialogue; discussion groups, etc." (Accart, 2012, p. 183, editorial translation).

Firstly, it is important to elucidate the research protocols employed in this study. The initial phase of research involved identifying relevant journals in the field. Utilizing the Sucupira platform, the search was refined to include only publications with Qualis ratings A1, A2, B1, and B2, specifically from Brazil and Latin America. The timeframe was limited to 2013-2016 due to constraints within the database.[7] The descriptor "OPEN EDUCATIONAL RESOURCES" was chosen to ensure precise retrieval. The focus on Brazilian and Latin American journals was intended to streamline the research.

During the analysis, the study also sought to establish a dialogue between the central theme of Open Educational Resources (OER) and recurring themes in the library and information science field, particularly "Virtual Reference Service" and "Information Literacy." The decision to connect these themes to the paper's central focus during the research phase derived from the study's bibliographic references pointing to serveral relationships between these categories.

The thematic analysis aimed to identify the prevalence of topics related to Open Educational Resources in the scientific production of the field. The investigation sought to analyze the current state of discussions on OER in Library and Information Science, highlighting trends in academic production and the practical implications for librarians' work emerging from this literature.

Information and communication tehnologies and their impact on the library environment

Libraries, when integrated with contemporary technologies, create a space for the continuous transformation of information. It is imperative for libraries to embrace these technologies to facilitate the interpretation and understanding of information and communication practices. As Prado and Correa (2016, p. 168) assert:)[8]:

> A presença digital de qualquer organização é efetiva quando se aliam suas ferramentas, espaços e estratégias das quais dispõem. Ela é criada e engajada principalmente pelas mídias sociais, que são uma das mais importantes ferramentas da web 2.0.

In this context, ICTs are increasingly woven into the daily lives of readers[9], shaping their thoughts, actions, and relationships. Reinforcing this notion, Gasque (2016, p. 14)[10] states that "[...] a internet possibilita o acesso à informação, à comunicação e a interação com pessoas em várias partes do mundo".

7 Notably, during the paper's research phase, this was the most recent period available in the database.

8 Translation: "The digital presence of any organization is effective when it aligns its tools, spaces, and strategies. It is primarily created and engaged through social media, which are among the most important tools of Web 2.0." (Prado; Correa, 2016, p. 168, editorial translation).

9 In this paper, the term "reader" will be primarily used to refer to individuals who are libraries users, as it is the preferred term of the theorist Ranganathan, a key author informing this study. However, alternative terms such as "users," "clients," or "interactors" may also be employed regarding library user as well.

10 Translation: "[...] the internet enables access to information, communication, and interaction with people in various parts of the world". (Gasque, 2016, p. 14, editorial translation).

Given the contemporary sociability processes that unfold in cyberspace and through various ICTs, the digital presence of libraries becomes paramount for establishing meaningful connections between libraries and their users. Prado and Correa (2016, p. 169)[11] underscore this by stating "[...] estar presente no mundo digital representa a possibilidade de tornar a biblioteca conhecida, criar e manter redes de comunicação e informação, ampliar seu espectro de inserção na sociedade e atingir um público ainda maior para além das suas paredes".

Furthermore, by embracing this trend, libraries can democratize access to information by creating and maintaining virtual environments tailored to their users, as well as providing the means (both material and technical) for users to access the internet within the library space, with the aim of offering personalized and high-quality service. These resources are concentrated in the reference services offered by libraries.

According to Accart (2012), the philosophy of reference service is to highlight the institution's collection and to elevate the status of information professionals working in reference services. These professionals curate responses provided by search engines and present the results to the reader. However, it is advantageous for readers to develop their own search and research methods, which requires a basic understanding of information search, retrieval, and utilization. Accart (2012) also notes that the internet has facilitated the dissemination of information, providing access to grey literature[12] and scholarly works. Additionally, cyberspace has empowered researchers to take on the role of publishers themselves.

Another aspect to consider is the transformation of reading and writing practices in light of technological advancements. Laufer (2000) suggests that researchers must proactively share information with peers, fostering cooperative dialogues that incorporate new information sources as they emerge. With the rise of the internet, opportunities for these dialogues have expanded, opening up new possibilities and changing reading practices through electronic media. This shift replaces textual linearity with hypertext, allowing readers greater freedom in constructing their own reading paths rather than following a prescribed sequence.

Gradually, libraries are transitioning their practices to virtual environments, moving closer to what Laufer (2000, p. 161)[13] terms the "hyperlibrary." In line with this thought, he states that:

> A ampliação do uso das novas tecnologias nas grandes bibliotecas generalistas vai nos afastar e nos aproximar do passado. Continuaremos a consultar os exemplares de papel, mas a maior parte de nosso trabalho será feita com os dados digitalizados.

This perspective, as presented by Laufer, opens avenues for understanding how library functions, the roles of information professionals, and the emergence of Open Educational Resources (OER) are adapting within the context of the growing integration of information and communication technologies into the knowledge systems and practices of these institutions.

---

11 Translation: "[...] being present in the digital world represents the possibility of making the library known, creating and maintaining communication and information networks, expanding its societal reach, and attracting a larger audience beyond its walls" (Prado; Correa ,2016, p. 169, editorial translation).

12 According to Cunha and Cavalcanti (2008), these are printed or multi-copied documents that are neither edited nor commercially distributed.

13 Translation: "The expansion of new technologies in large general libraries will simultaneously bridge the gap between the past and present while also transforming traditional practices. While physical books will remain a valuable resource, the majority of library work will increasingly involve digitized data." (Laufer, 2000, p. 161, editorial translation).

Reference service, reader, information professional, and the dissemination of knowledge

Ranganathan, through his unique observations of various libraries worldwide and their services, developed influential concepts, theories, and principles. Known as the "father of Indian library science," his conclusions and observations continue to shape the field of library and information science.

In the domain of reference service, Ranganathan left his mark through two seminal works: "Five Laws of Library Science," first published in 1931, and "Reference Service," published in 1961. While the latter, which explores 167 case studies covering various facets of reference service, has not gained the same recognition in Brazilian librarianship as the "Five Laws of Library Science," it nonetheless remains a valuable resource rich in specialized knowledge.

Ranganathan (1961) believed that reference service is an indispensable practice, particularly in university libraries, where readers, primarily students and professors, engage in more in-depth research. Moreover, reference service serves as the nexus for the implementation of his five laws. The **first law**, "books are for use," began to gain widespread acceptance in Western college libraries in the 19th century. Ranganathan (2009, pp. 46-47)[14] elaborates:

> Para prestar esse serviço pessoal, o conhecimento e a experiência dos funcionários da biblioteca devem ser de tal natureza que eles sejam capazes de recomendar, com o devido discernimento, livros adequados sobre um mesmo assunto para homens e mulheres que difiram amplamente em termos de aptidão, educação e objetivos.

The analysis of the first law of library science reveals that its formulation led to a series of transformations in libraries and their services, including changes in book storage, library layout, furniture design, and the development of a new profile for library staff. However, discussions about reference service began to emerge in other countries even before Ranganathan's "five laws." In 1876, American theologian Samuel Swett Green introduced a work titled "The desirableness of establishing personal intercourse between librarians and readers in popular libraries. " (Grogan, 1995, p. 24), which advocated for assisting readers. Grogan (1995) notes that Green's pioneering work was presented at the Philadelphia Librarians' Conference, which established the American Library Association (ALA) in October of the same year.

Conceptions of reference service, and the role of the reference librarian, have long been a subject of debate. This division can be traced back to the 19th century, notably at the 1882 American Library Association conference. While Green championed unconditional assistance to readers by librarians, other theorists opposed this new trend, arguing that reference librarians were not expected to have comprehensive knowledge of the entire collections. This is because, for a significant period, supporting readers' research was a secondary function in these institutions. As Grogan (1995, p. 28)[15] points out, "[...] a assistência

14 Translation: "To provide this personal service, the knowledge and experience of library staff must be such that they can judiciously recommend suitable books on the same subject to men and women who are widely different in term of aptitude, education, and objectives" (Ranganathan, 2009, p. 46-47, editorial translation).

15 Translation: "[...] assistance to readers was practically nonexistent until the mid-20th century" (Grogan, 1995, p. 28, editorial translation).

aos leitores era praticamente inexistente até meados do século XX." However, with the expansion of the publishing industry, increased access to education, and transformations in science and technology, libraries adapted to these changes. Consequently, a new readership with evolving information needs emerged, shaping the reference service as it exists today.

Ranganathan (1961) posits that reference service establishes a link between the document and the reader, aiding the reader in finding the desired subject matter quickly, accurately, and comprehensively. However, it is crucial to recognize that reference service goes beyond mere assistance; it guides users towards fulfilling their information needs.

The debate on the role of the reference librarian and reader guidance remains pertinent today. With the automation of information search processes facilitated by the internet and digital technologies, readers gain a degree of autonomy in utilizing search tools, provided they possess the skills to effectively navigate and interpret information. The structural possibilities for readers to independently locate, select, organize, and utilize information, transforming it into knowledge, are intertwined with the concept of information literacy, which will be discussed further. Alongside the promotion of these practices, opportunities arise for dialogue between theoretical and practical reflections in the fields of library and information science, education, and technology. It is within this intersection that Open Educational Resources (OER) are situated.

At the heart of the reference process lies the interaction between the reader and books or other resources, perspectives, and plans that fulfill their informational needs. This dynamic can be linked to Ranganathan's **second law** (2009, p. 179)[16], "a cada leitor seu livro", which emphasizes the importance of the library's collection being tailored to the informational needs of its community. The second law reaffirms the revolution initiated by the first law and expands the idea of interaction between the reader, the book, and the library.

Ranganathan (2009, p. 92)[17] posits that "a segunda lei tratará a todos como iguais e oferecerá a cada um o seu livro". This law underscores the responsibility of information professionals to understand their readers and the library's collection, aiding each reader in finding their book. However, it is worth supplementing Grogan's (1995, p. 8)[18] assertion that "o serviço de referência [...] é mais do que um expediente para a comodidade do usuário". In this context, reference professionals should not merely select information sources and passively provide them to the user. They must ensure adequate structural conditions so that readers can autonomously exercise their right to information, becoming capable of critically understanding and discerning their informational needs and the appropriate sources to meet those needs.

The **third law**, "to every book its reader," complements the revolution initiated by the first law. According to Ranganathan (2009), its understanding is linked to the "open

16 Translation: "to every reader his book" (Ranganathan, 2009, p. 179, editorial translation).
17 Translation: "he second law will treat everyone as equals and provide each with their book" (Ranganathan, 2009, p. 92, editorial translation).
18 Translation: "reference service [...] is more than a convenience for the user." (Grogan 1995, p. 8, editorial translation).

access system." For the author, open access means "a oportunidade de ver e examinar o acervo de livros com a mesma liberdade que temos em nossa própria biblioteca particular" (Ranganathan, 2009, p. 189)[19]. (Ranganathan, 2009, p. 189).

This freedom of access to having the shelves available for the readers has significantly increased library usage worldwide. In this scenario, the expectation placed on reference service professionals is to identify essential books and documents for each reader. Reinforcing this idea, Ranganathan (2009, pp. 197-198)[20] states:

> Este contato direto com os leitores enseja a observação de seus gostos e carências, suas ações e reações e suas simpatias e antipatias. Como resultado desse contato direto, um experiente bibliotecário de referência instintivamente trava relações entre leitores e livros e, reciprocamente, um livro amiúde sugere um leitor a quem ele atrairá.

Moreover, the librarian's use of advertising techniques, according to Ranganathan (2009), can further attract readers to these spaces or even transforms non-readers into readers. Consequently, information is produced, organized, and disseminated on a large scale. Bringing this vision of information expansion to the present day, the OER movement is dedicated to broadening and solidifying the sharing of ideas, information, and knowledge on a global level. With the experience of the open access system, Ranganathan (2009) asserts that readers frequently make new discoveries through direct contact with books on the shelves. Connecting this idea of "frequent discoveries" to the present, there is the notion of lifelong learning explored by Demo (2012, p. 12).[21] For the author:

> pode-se entender bem a ideia do aprender a aprender como habilidade, quando associada à aprendizagem permanente e ao manejo de conteúdos não restrito à memorização, mas implicando igualmente a capacidade de manter-se aprendendo sempre (renovar os conteúdos).

This notion of continuously developing learning throughout life is closely related to the concept of information literacy. Additionally, it is crucial to keep pace with technological transformations manifested through digital media platforms. This discussion about the consolidation of the digital world and its impact on libraries will be explored further.

Technology, cyberspace, information literacy, media, and the element of time

While the first three laws prioritize the use of books by the widest possible audience, the **fourth law**, "save the time of the reader," introduces the element of time and centers

19 Translation: "the opportunity to see and examine the book collection with the same freedom we have in our own private library" (Ranganathan, 2009, p. 189, editorial translation).

20 Translation: "This direct contact with readers allows for the observation of their tastes and needs, their actions and reactions, and their likes and dislikes. As a result of this direct contact, an experienced reference librarian instinctively establishes connections between readers and books and, reciprocally, a book often suggests a reader to whom it will appeal." (Ranganathan, 2009, p. 197-198, editorial translation).

21 Translation: "We can understand the idea of learning to learn as a skill when associated with lifelong learning and the handling of content not limited to memorization but also involving the ability to keep learning continuously (renewing the content)" (Demo, 2012, p. 12, editorial translation).

on its significance. This law emphasizes the importance of cataloging, classifying, and indexing documents within libraries. These tools, combined with a skilled team of reference professionals, significantly reduce the time readers spend on research, allowing them to meet their needs more swiftly, efficiently, and effectively. Additionally, the fourth law addresses practices related to library lending services. Ranganathan (2009) notes that once-cumbersome lending systems have been replaced by streamlined procedures designed to save time for both readers and library staff.

This perception of time is reconfigured in the modern world through the nexus of technology and cyberspace. Pierre Levy (1999, p. 92)[22] defines cyberspace as:

> espaço de comunicação aberto pela interconexão mundial dos computadores e das memórias dos computadores. Essa definição inclui o conjunto dos sistemas de comunicação eletrônicos (aí incluídos os conjuntos de rede hertzianas e telefônicas clássicas), na medida em que transmitem informações provenientes de fontes digitais ou destinadas à digitalização.

The emergence of cyberspace is inextricably linked to the development of digital technology and its pervasive influence on contemporary societies. Castells (2005, p. 23)[23] supports this perspective, stating that "as pessoas integraram as tecnologias nas suas vidas, ligando a realidade virtual com a virtualidade real, vivendo em várias formas tecnológicas de comunicação, articulando-as conforme as suas necessidades". Thus, this notion of time evolves in relation to technological adaptations over time, impacting the daily lives of communities.

In this context, communicative processes have shifted from traditional mass media, which offered limited or no interaction with the receiver, to cyberspace, where digital social media platforms, built on interactions between parties, now dominate the landscape of information production and consumption. In this scenario, "o objetivo é fornecer um maior volume de informações multimodais (sons, imagens e textos) de forma simultânea, multiplexados e transmitidos a uma velocidade cada vez maior" (Castells, 2005, p. 227)[24]. All this interaction that happens through the internet aims to be collaborative, at least in theory, as these environments are structured for the production and sharing of content by participants on these platforms.

In this vein, Calil Junior (2017, p. 148)[25] defines social media as "um conjunto de práticas sociotécnicas, em que sujeitos e/ou instituições estabelecem relações com e a partir de artefatos tecnológicos". With the rise of social media, new practices have emerged

22 Translation: " a space of communication opened by the worldwide interconnection of computers and computer memories. This definition includes all electronic communication systems (including traditional wireless and telephone networks), as long as they transmit information from digital sources or are intended for digitization." (Pierre Levy, 1999, p. 92, editorial translation).

23 Translation: "people have integrated technologies into their lives, linking virtual reality with real virtuality, living in various technological forms of communication, and articulating them according to their needs" (Castells, 2005, p. 23, editorial translation).

24 Translation: "the goal is to provide a greater volume of multimodal information (sounds, images, and texts) simultaneously, multiplexed, and transmitted at an ever-increasing speed" (Castells, 2005, p. 227, editorial translation).

25 Translation: "a set of sociotechnical practices, in which individuals and/or institutions establish relationships with and through technological artifacts" (Calil Junior, 2017, p. 148, editorial translation).

around content creation and dissemination in digital environments. According to Okada (2013, p. 166)[26] collaborative productions on social media can be built from the adaptation of existing resources. Thus,

> a mídia social pode ser muito útil para o aprendizado colaborativo através de REA, devido a vários fatores importantes, tais como: a disseminação global, respostas e edição instantâneas, a disponibilidade para qualquer usuário de Internet contribuir, interface fácil de usar e pouco ou nenhum custo.

Indeed, the increasing ubiquity of information and communication technologies in people's lives necessitates transformations that also encompass educational practices. Social media platforms like Wikis, Blogs, Groups, Twitter, MySpace, Facebook, LinkedIn, Flickr, YouTube, Last.fm, Second Life, Wikipedia[27] and countless others empower users to create or reproduce content themselves. These environments allow all information produced and disseminated on these platforms to be accessed, reinterpreted, and reshaped collectively and collaboratively. Okada (2013) emphasizes the fundamental importance of social media in providing a space for interaction and fostering more dynamic and autonomous teaching. Following this reasoning, "o conteúdo significativo compartilhado pelas mídias sociais pode permitir o discurso reflexivo, uma nova experiência e a aprendizagem participativa" (Okada, 2013, p. 166)[28]. Thus, the potential of social media platforms for collaboration, information sharing, and the collective production of knowledge is underscored.

As cyberspace expands through the nodes of networkss[29] new information proliferates, making this virtual space increasingly nebulous. In this landscape, Castells (2005) emphasizes the importance of contextualizing information, so that it is transformed into specific knowledge through skills related to decision-making, storage, and critical evaluation of the obtained content. Processing, gathering, and organizing the vast amounts of information dispersed in a virtual network is an insurmountable task.

Furthermore, quantity does not always translate into quality, especially in an informational ecosystem that fosters the production, circulation, and consumption of misinformation. Thus, it is essential to focus on the information literacy of communities, understood here as:

> conjunto de saberes e práticas articulados dialogicamente e que possibilitam a construção do pensamento crítico, da avaliação criteriosa e do uso solidário e ético da informação, bem como as estruturas que promovam ações cidadãs e engajadas com o bem comum (Calil Junior; Sá; Zattar, 2021)[30].

---

26 Translation: "social media can be very useful for collaborative learning through OER, due to several important factors, such as: global dissemination, instant responses and editing, availability for any internet user to contribute, easy-to-use interface, and little or no cost." (Okada, 2013, p. 166, editorial translation).

27 Social media examples given by Okada (2013).

28 Translation: "the meaningful content shared by social media can enable reflective discourse, new experiences, and participatory learning" (Okada, 2013, p. 166, editorial translation).

29 For Recuero (2009), "node" encompasses all types of representations of people in cyberspace.

30 Translation: "a set of knowledge and practices articulated dialogically that enable the construction of critical thinking, careful evaluation, and the ethical and supportive use of information, as well as structures that promote citizen actions engaged with the common good" (Calil Junior; Sá; Zattar, 2021, editorial translation).

Structural conditions must be ensured so that individuals, in their daily lives, have the opportunity to engage with the vast array of information now accessible through cyberspace connections. In this regard, UNESCO (2016, p. 5)[31] advocates that Media and Information Literacy (MIL) "é uma base para aumentar o acesso à informação e ao conhecimento, intensificar a liberdade de expressão e melhorar a qualidade da educação". MIL supports critical dialogue among social actors through learning that focuses on the development of informational and media competencies arising from the digital environment. The advantage of mastering such effective skills to access information in cyberspace is the assurance of obtaining rational, cohesive, and coherent content from research. In this context, "não há dúvida de que a proliferação das mídias, a explosão de novas tecnologias e o advento das mídias sociais permitiram múltiplas fontes de acesso a informações e conhecimentos (...)" (Unesco, 2016, p. 17)[32].

Therefore, the intensification of continuous and dynamic knowledge production through technologies and the flexibility of communication are driving trends, influences, and possibilities around the dimension of services offered by libraries to their readers, such as virtual reference service, as we will explore next.

The role of the reference professional, the virtual, and the emergence of Open Educational Resources

Building upon his five laws of library science, S. R. Ranganathan deepened his exploration of reference service, applying insights gleaned from his tenure at the University of Madras Library in India. His 1961 work, "Reference Service," traces the evolution of this service, revealing how the laws of library science have shaped the library's ongoing transformations in both function and technique.

According to the Indian author, in the 19th century, the reference service was only responsible for making books available and did not establish any assistance or research relationship with the reader. Additionally, the staff working in libraries at that time were unaware of any quality standards for dealing with readers. Drawing from his personal experience, Ranganathan describes that "[...] o único vestígio de serviço de referência que experimentou em todos os anos que frequentou a escola, foi quando o encarregado da biblioteca apresentou a ele dois documentos que o seu professor estava fazendo cópias" (Ranganathan, 1961, p. 20, tradução nossa)[33].

However, contrasting this with his perspective as a librarian, Ranganathan emphasized the importance of approaching readers with enthusiasm and warmth, conveying the value of the library as a "human institution." He advocated for reference professionals to guide new

31 Translation: "it's a basis for increasing access to information and knowledge, enhancing freedom of expression, and improving the quality of education." (Unesco, 2016, p. 5, editorial translation).

32 Translation: "here is no doubt that the proliferation of media, the explosion of new technologies, and the advent of social media have allowed multiple sources of access to information and knowledge [...]" (Unesco, 2016, p. 17, editorial translation).

33 Original: "The atendant in charge of the library was Daniel. He had one essential quality of a reference librarian geniality. But he could read only the backs of books. At the end of a term, I had the benefit of a sort of reference servisse from him. He introduced me to Milne's Weekly problem Papers. He said, 'Prof Chinnatambi Pillai has been copying out something from these two books'! This is the Only kind of reference service experienced by me till my leaving the college" (Ranganathan, 1961, p. 20).

users through the library's collections, classification system, catalog access, and available services. He stressed that effective reference librarians must possess comprehensive bibliographic knowledge, familiarity with the library's subject areas, and an understanding of reader interests.

In essence, Ranganathan believed that libraries should prioritize reader care and information accessibility. This entails personalizing reference services to ensure reader satisfaction, guiding them toward optimal use of resources, and fostering autonomy in the information-seeking process.

The advent of the internet has ushered in a vast and accessible information ecosystem, offering readers a wealth of resources. Given these societal shifts, with the proliferation of content created, reused, and shared on digital platforms, libraries must continually adapt, enhancing their products and services to remain relevant and engaging.

The internet and its associated technologies have enabled the development of virtual interactions with readers, while also unlocking access to previously unattainable information. Notably, the synergy between Virtual Reference Service (VRS) and multimedia technologies has significantly enhanced information search and retrieval, fostering "um ambiente digital de pesquisa apropriado a certas necessidades e sobre determinados assuntos" (Accart, 2012, p. 195)[34].

These evolving library services exemplify Ranganathan's fifth law of library science: "a biblioteca é um organismo em crescimento" (Ranganathan, 2009, p. 241)[35]. For Ranganathan, this growth is fueled by the interconnectedness of books, readers, and staff. Accroding to him:

> Deve-se ter plena consciência de que um acervo de livros sem leitores não tem mais direito de ser chamada de biblioteca do que um grupo de leitores sem livro, e que a mera justaposição de livros e leitores sem o pessoal, que sabe promover o contato certo entre o leitor certo e o livro certo, no tempo certo e do modo certo, tampouco constitui uma biblioteca (Ranganathan, 2009, p. 242)[36].

The fifth law encourages libraries to growth in various dimensions: expanding collections, increasing staff, attracting more readers, and disseminating knowledge. Above all, Ranganathan (2009, p. 263)[37] highlights that the library's core principle, maintained throughout its evolution, is to serve as, "é ser um instrumento de educação universal que reúne e difunde livremente todos os recursos de ensino e dissemina o conhecimento". In the contemporary landscape, libraries retain their vital role in effecting social change through literacy, learning, and research programs, upholding the right to reading, information, education, and culture.

---

34 Translation: "a digital research environment tailored to specific needs and subjects" (Accart, 2012, p. 195, editorial translation).
35 Translation: "the library is a growing organism" (Ranganathan, 2009, p. 241, editorial translation).
36 Translation: "It must be fully understood that a collection of books without readers has no more right to be called a library than a group of readers without books, and that the mere juxtaposition of books and readers without the staff who knows how to promote the right contact between the right reader and the right book, at the right time and in the right way, does not constitute a library" (Ranganathan, 2009, p. 242, editorial translation).
37 Translation: "an instrument of universal education that freely gathers and disseminates all teaching resources and knowledge". (Ranganathan, 2009, p. 263, editorial translation).

However, the task of reimagining and adapting pedagogical practices in conjunction with a culture of collaborative knowledge is not without its challenges. *Open Educational Resources* (OER),[38] have emerged as a global movement offering innovative solutions to teaching and learning. This movement began to coalesce in 2002 with a UNESCO-sponsored event at the Massachusetts Institute of Technology (MIT). In its early stages, Ferreira and Carvalho (2018) note that OER benefited from substantial financial support, particularly from the William and Flora Hewlett Foundation,[39] which continues to champion OER's educational advancement. They also observe that the OER movement has gained momentum in Brazil, driven by efforts to integrate education and technology with the aim of "democratizar o conhecimento e expandir o acesso à educação" (Ferreira; Carvalho, 2018, p. 740)[40]. This growth is evident in the incorporation of OER into various public education policies in Brazil in recent decades.

The quality of OER has steadily improved, particularly since the 2012 UNESCO World Congress on Open Educational Resources in Paris.[41] The resulting Paris Declaration offers recommendations for promoting OER access to enhance education quality worldwide. In this context, Sebriam and Gonsales (2017, p. 39)[42], assert that OER:

> é focado em três princípios básicos: conteúdo de aprendizagem; licenças de uso que permitam maior flexibilidade e o uso legal de recursos didáticos e o uso de formatos técnicos abertos que sejam fáceis de modificar em qualquer software.

Reinforcing this notion, Santos (2013) posits that Open Educational Resources offer the potential for democratic access to education through technologies like the internet, wikis, and virtual learning environments. The core principles of OER are encapsulated in the 5 Rs[43]: reuse, revise, remix, redistribute, and retain. The following table (**Table 1**) provides a detailed explanation of each term:

Table 1 – Terms and Definitions of the 5 Rs

Term	Definition
Reuse	Use the content in its unaltered form
Revise	Adapt, adjust, or alter the content
Remix	Combine the original or revised content with other material to create something new
Redistribute	Share copies of the original content, your revisions, or your remixes with others

38 OER are also referred to as learning objects or open content (Santos, 2013).
39 Site: https://hewlett.org/about-us/.
40 Translation: "democratizing knowledge and expanding access to education" (Ferreira; Carvalho, 2018, p. 740, editorial translation).
41 Site: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/CI/WPFD2009/Portuguese_Declaration.html.
42 Translation: "is focused on three basic principles: learning content; usage licenses that allow greater flexibility and the legal use of educational resources; and the use of open technical formats that are easy to modify in any software". (Sebriam; Gonsales, 2017, p. 39, editorial translation).
43 Terms and definitions as per David Wiley. Available at: https://opencontent.org/blog/archives/3221. Accessed on: August 14 ago, 2020.

Term	Definition
Retain	Make, own, and control a copy of the content

Source: Based on the study by David Wiley (2014).

In this context, Open Educational Resources offers authors more flexible copyright management. They have the autonomy to determine which freedoms (portions of their work) will be available to end users through more adaptable licenses.

ANALYSIS AND DISCUSSION OF RESULTS

Building upon the discussions regarding Open Educational Resources and their significance within library and information science, this investigation identified national and Latin American journals that have published content on OER.

The search strategy involved a semantic analysis of the Portuguese and Spanish terms for OER, respectively: “Recursos Educacionais Abertos” in Portuguese and “Recursos Educativos Abiertos” in Spanish, found across 24 library and information science journals with Qualis ratings of A1, A2, B1, and B2. The subsequent tables present the titles of the analyzed journals, categorized as national or Latin American based on their country of origin, along with their CAPES classification and the number of articles focused on Open Educational Resources

Table 2 – Brazilian journals analyzed

Journal Title	Origin	Classification	Return of articles on OER
Perspectivas em ciência da informação	Brazil	A1	0
Transiformação	Brazil	A1	0
Em questão	Brazil	A2	1
Encontros Bibli	Brazil	A2	3
Informação & Informação	Brazil	A2	1
Brazilian Journal of information science	Brazil	B1	0
Ciência da Informação	Brazil	B1	0
InCID: Revista de Ciência da Informação e Comunicação	Brazil	B1	1
Intexto	Brazil	B1	0
Liinc em Revista	Brazil	B1	1
Perspectiva em Gestão e Conhecimento	Brazil	B1	0
Pesquisa Brasileira em Ciência da Informação e Biblioteconomia	Brazil	B1	2
Revista Ponto de Acesso	Brazil	B1	0
RBBD Revista Brasileira de Biblioteconomia e Documentação	Brazil	B1	0

Journal Title	Origin	Classification	Return of articles on OER
RDBCI: Revista Digital de Biblioteconomia e Ciência da Informação	Brazil	B1	0
Revista Ibero-Americana de Ciência da Informação	Brazil	B1	1
Tendências da pesquisa Brasileira em Ciência da Informação	Brazil	B1	0
ATOZ: Novas Práticas de Informação e conhecimento	Brazil	B2	0
Cadernos de Biblioteconomia, Arquivistica e Documentação*	Brazil	B2	0
Comunicação e informação	Brazil	B2	0
Revista ABC: Biblioteconomia em Santa Catarina	Brazil	2	0

Source: Created by the author (2020).

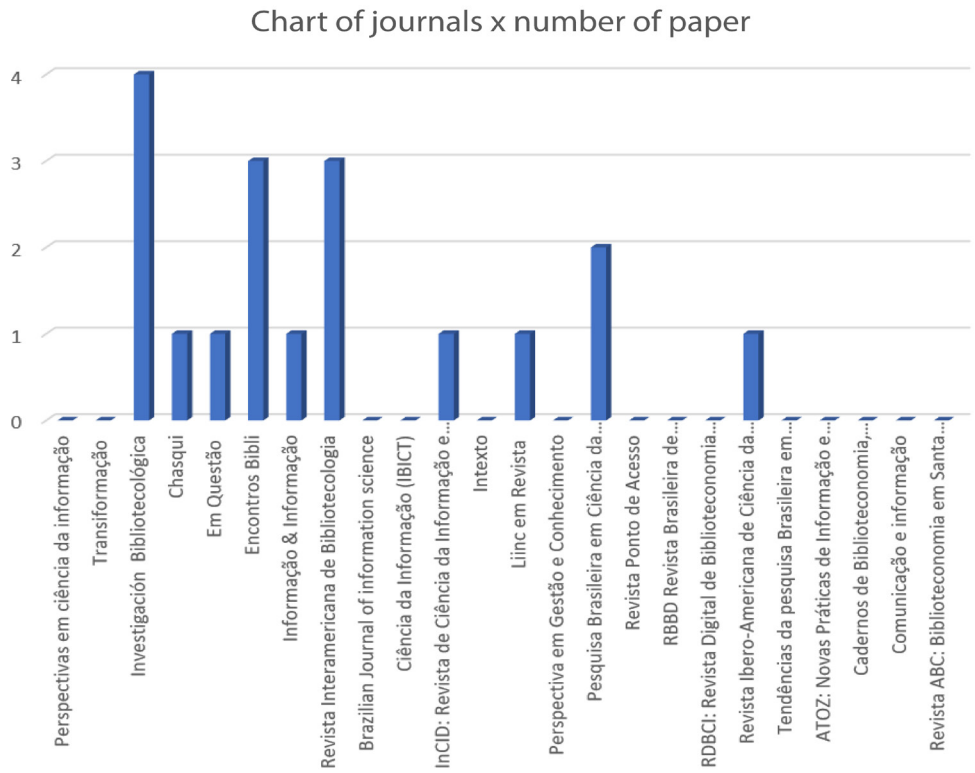
Tabela 3 – Latin American journals analyzed

Journal Title	Origin	Classification	Return of articles on OER
Investigación Bibliotecológica	Mexico	A1	4
Chasqui	Equator	A2	1
Revista Interamericana de Bibliotecologia	Colombia	A2	3

Source: Created by the author (2020).

Given the low number of papers, one can infer that the topic of Open Educational Resources is not widely disseminated in the field of library and information science. In the 24 journals investigated, only 10 of them had published a total of 18 papers about OER. From the analysis of the table were found, regarding the journals that disseminated any information about Open Educational Resources, three publications contained three and four diverse contents about OER: Investigación Bibliotecológica, Encontros Bibli, and Revista Interamericana de Bibliotecología. It is also worth noting that the journal with the highest concentration of articles on OER was Investigación Bibliotecológica, from Mexico, with four papers on the subject.

Figure 1 – Chart of journals x number of paper



Source: Created by the author (2020).

Analysis of the scholarly output on Open Educational Resources (OER) reveals distinct categories within the reviewed literature, prominently including “information sources,” “distance education,” “democratic access to knowledge,” and “communication spaces,” among others. Building upon these frameworks, many authors investigating the topic understand OER as embodying innovative proposals that encourage a rethinking of teaching and learning processes based on autonomy and collaborative practices.

The discussions surrounding OER in academic articles are categorized along various thematic lines, with a particular emphasis on information sources, distance education, democratic access to knowledge, and communication spaces. Many authors perceive OER as presenting a novel approach to shaping the teaching and learning process in a more autonomous way, creating space for collaborative teaching practices. Another aspect explored in the articles is the dialogue between learning theories and reflections on technology, emphasizing perspectives that highlight the possibilities of providing access to education anywhere, at any time. The foundation of debates involving Open Educational Resources lies in its potential to promote the dissemination of knowledge through access and sharing of educational materials in various formats, with the aim of enabling comprehensive and borderless learning.

In this respect, considering the categorization of the research, the discourse produced by both Brazilian and Latin American authors aligns with the conceptualization of Open

Educational Resources from an educational perspective. Moreover, both Brazilian and Latin American articles converge in highlighting the importance of technologies in supporting OER, elucidating the trend of collaborative learning as a new global pedagogical model.

CONCLUSIONS

As of January 2022, the world was facing the third year of the SARS-CoV-2 pandemic. The trajectory of the pandemic and the end of the health emergency remained uncertain, despite widespread yearning for a return to normalcy frequently expressed in traditional and social media. However, amidst the uncertainties, it is evident that the pandemic has accelerated ongoing societal processes. The necessity for physical distancing has propelled products, services, and practices into virtual environments.

In this context, theoretical and practical reflection on OER becomes both necessary and urgent, as contemporary information and communication practices increasingly converge in virtual spaces. Individuals with the structural and material means to access the internet often opt to consult information sources available online, regardless of their reliability, including messages circulating on platforms like WhatsApp or Telegram.

This paper's research finds points to several directions that merit highlighting: Primarily, it reveals that, within the established scope, scholarly production on OER within the library and information science field is still in its early stages. Given the increasing use of OER as information sources, there is a clear need for more research on the topic, with the goal of building a critical mass of knowledge regarding theoretical and methodological approaches, as well as the use and adoption of OER in libraries and other information units.

The identification of the most prevalent categories in the literature – such as "information sources," "distance education," and "access to knowledge" – highlights the points of dialogue and convergence that have been used thus far in addressing OER within the library and information science field. While this article could not fully explore the meanings attributed to these categories from the perspective of OER use, their emergence in the analysis points to two key perspectives regarding OER.

In the first one of them, OER is seen as an "innovation," enabling both autonomy in teaching and learning processes and the fostering of a collaborative approach inherent in these practices through the use of OER. This perspective is accompanied by an "optimistic" view of technological transformations, in which technologies, including OER, are presented as tools that facilitate democratic access to education and information.

However, it is important to emphasize that despite the many opportunities that arise from the adoption of OER by libraries and the pressing need to develop a theoretical and methodological framework on the topic within the library and information science field, there are crucial issues that need to be addressed. These issues include the material and structural conditions for accessing OER, the integration of information literacy into society, and the complexities of the current information ecosystem. Furthermore, the widespread dissemination

of misinformation and the role of libraries should be central to debates and practical actions surrounding OER, ensuring that libraries (and their participants) are actively involved in the pursuit of social justice and the fight against inequality.

REFERENCES

ACCART, J. P. **Serviço de referência**: do presencial ao virtual. Brasília: Brinquet de Lemos, 2012.

ARAUJO, C. A. A. Infodemia, desinformação, pós-verdade: o desafio de conceituar os fenômenos envolvidos com os novos regimes de informação. **International Review of Information Ethics**, [*s. l.*], v. 30, n. 1, ago. 2021.

ARIMOTO, M. M.; BARBOSA, E. F. Um conjunto preliminar de práticas para o desenvolvimento ágil de recursos educacionais abertos. *In*: Simpósio Brasileiro de Informática na Educação, 23, 2012, Rio de Janeiro. **Anais**. Rio de Janeiro, 2012.

CALIL JUNIOR, A. Bibliotecas públicas como lócus da alfabetização midiática. **Revista Brasileira de Biblioteconomia e Documentação**, São Paulo, v. 13, n. esp., p. 136- 154, jan./ jul. 2017.

CALIL JUNIOR, A.; SÁ, N. O.; ZATTAR, M. A extensão universitária e o exercício da práxis no campo informacional: práticas para apropriação da informação e do saber. **International Review of Information Ethics**, [*s. l.*], v. 30, ago. 2021.

CASTELLS. M.; CARDOSO, G. (org.). **A sociedade em rede**: do conhecimento à política. Belém: Imprensa Nacional; Casa da Moeda, 2005.

CUNHA, M. B.; CAVALCANTI, C. R. O. **Dicionário de Biblioteconomia e Arquivologia**. Brasília: Brinquet de Lemos, 2008.

WINLEY, D. The access compromise and the 5th R. **Improving Learning**. [*s. l.*], 2014.

DECLARAÇÃO de Santiago. **Declaração de Santiago**: o acesso à informação para alcançar o desenvolvimento sustentável na América Latina e no Caribe. [*S. l.*: *s. n.*], 2019. Available at: https://www.ifla.org/publications/declaracao-de-santiago/. Access on: 3 jul. 2020.

DEMO, P. **Habilidades e competências no século XXI**. Porto Alegre: Editora Mediação, 2012.

FERREIRA, G. M. S.; CARVALHO, J. S. Recursos educacionais abertos como tecnologias educacionais: considerações críticas. **Educ. Soc**. Campinas, v. 39, n. 144, p. 738-755, jul./set. 2018.

GASQUE, K. C. G. D. Internet, mídias sociais e as unidades de informação: foco no ensino-aprendizagem. **Brazilian Journal of Information Science**: research trends, [*s. l.*], v. 10, n. 2, nov. 2016. DOI 10.36311/1981-1640.2016.v10n2.03.p14.

GRIZZLE, A.; MOORE, P.; DEZUANNI, M.; ASTHANA, S.; WILSON, C.; BANDA, F. ONUMAH, C. **Alfabetização midiática e informacional**: diretrizes para a formulação de políticas e estratégias. Brasília: Unesco, 2016.

GROGAN, D. **A prática do serviço de referência**. Brasília: Brinquet de Lemos, 1995.

LAUFER, R. "Novas ferramentas, novos problemas." *In*: BARATIN, M; JACOB, C. (org.). **O poder das Bibliotecas**: a memória dos livros no Ocidente. Rio de Janeiro: Editora UFRJ, 2000.

LEVY, P. **O que é o virtual?** São Paulo: Ed. 34, 1996.

LEVY, P. **Cibercultura**. São Paulo: Ed. 34, 1999.

OKADA, A. (org.). **Recursos educacionais abertos e redes sociais**. São Luis: EDUEMA, 2013.

PRADO, J. M. K; CORREA, C. D. C. Bibliotecas universitárias e presença digital: estabelecimento de diretrizes para o uso de mídias sociais. **Perspectivas em Ciência da Informação**, Minas Gerais, v. 21, n. 3, p. 165-181, jul./set. 2016.

RANGANATHAN, S. R. **As cinco Leis da Biblioteconomia.** Rio de Janeiro: Brasília, 2009.

RANGANATHAN, S. R. **Reference service**. 2. ed. Asia: Publishing House, 1961. Available at: http://dlist.sir.arizona.edu/. Access on: 8 jun. 2020.

RECUERO, R. **Redes sociais na Internet**. Porto Alegre: Meridional, 2009.

RODRIGUES, E.; FERNANDES; P. L.; CORREIA, A. (coord.). **Manual de Formação em Ciência Aberta**. [*s. l.*]: Foster, 2019.

SANTOS, A. I. **Recursos educacionais abertos no Brasil**: o estado da arte, desafios e perspectivas para o desenvolvimento e inovação. São Paulo: Comitê Gestor da Internet no Brasil, 2013. Available at: https://www.cetic.br/media/docs/publicacoes/8/rea-andreia-inamorato.pdf. Access on: 11 fev. 2022.

SEBRIAM, D; GONSALES, P. **Inovação aberta em educação**: conceitos e modelo de negócios. São Paulo: CIEB, 2017. Available at: https://cieb.net.br/cieb-estudos-2-inovacao-aberta-em-educacao-conceitos-e-modelos-de-negocios/#:~:text=A%20partir%20dos%20questionamentos%20%E2%80%9C%20De%20que%20forma,ser%20considerados%20por%20quem%20busca%20inovar%20em%20educa%C3%A7%C3%A3o. Access on: 16 jun. 2020.

UNESCO. **Declaração REA de Paris 2012**. Paris. 2012.

WARDLE, C.; DERAKHSHAN, H. Reflexão sobre a “desordem da informação”: for-matos da informação incorreta, desinformação e má-informação. *In*: UNESCO. **Jornalismo, fake news & desinformação**: manual para educação e treinamento em jornalismo. Brasília: UNESCO, 2019. p. 47-58. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000368647. Access on: 2 fev. 2020.

Disaster Victim Identification in the Context of Information Science

Rodrigo Goncalves Teixeira
Expert in Forensic Science Applied to Crime Scenes, Academia Nacional de Polícia (ANP/PF), Brasília, DF, Brasil.
Federal Forensic Expert, Delegacia de Polícia Federal em Santos (DPF/STS/SP), Santos, São Paulo, Brazil.
http://lattes.cnpq.br/3274864610636523

Adilson Luiz Pinto
PhD in Documentation, Universidad Carlos III de Madrid, Getafe, Comunidad Autonoma de Madrid, Spain.
Associate Professor 4, Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brasil.
http://lattes.cnpq.br/4767432940301118

Submitted on: 04/11/2022. Approved on: 01/15/2024. Published on: 06/21/2024.

ABSTRACT

Disasters are topics of great sociological interest for several reasons, including the deaths that eventually occur and the serious damage caused. In disasters with multiple fatalities, forensic identification is essential for humanitarian, civil and criminal reasons. This identification process is internationally called Disaster Victim Identification (DVI). The DVI process dynamics requires protocol adoption aiming to minimize the damages resulting from the event and to maximize the available resources to accomplish the mission successfully. In this vein, it's imperative the definition of an effective communication structure that ensures critical information is transmitted to recipients. Objects of Information Science study are present in all activities developed in a DVI response, from the origin of information to its retrieval and use. The objective of this article is to demonstrate some aspects of Information Science in the DVI response, for this in the first section there is an introduction aiming to offer a first contact with the proposed theme, followed by a section with a literature review on DVI. The third section seeks to present the relationship and some aspects of Information Science in the DVI activity. In the fourth section, the dynamics of the activities are presented in a real case: the DVI response on the occasion of the rupture of the Brumadinho dam. The fifth and last section presents the final considerations.

Keywords: disaster victim identification; mass disaster; information science; Brumadinho; information management.

INTRODUCTION

Disasters are phenomena that generate great social interest, and are considered the result of adverse events, whether natural or man-made, on a (vulnerable) ecosystem, causing human, material and/or environmental damage and resulting in economic and social losses (Brasil, 1999).

The *United Nations Developed Program* (UNDP, 2004) defines natural disasters as a serious disruption triggered by a natural hazard that causes human, material, economic or environmental losses that exceed the ability of those affected to address it. According to this concept, if local resources are not sufficient to address the incident, the event is considered a disaster, therefore, this classification is not directly related to the number of possible casualties.

For example, in 2014, the crash of the plane carrying Presidential candidate Eduardo Campos in Santos/SP killed seven people in total, not a high number of deaths when compared to several other past disasters; however, due to the characteristics of such event, agencies from other cities and even other states participated in the service; therefore, the fact can be classified as a disaster.

Disaster management involves the actions of different actors, with different responsibilities and capabilities, for example, volunteers, agencies at different levels (local, state and federal), victims in a position to assist (Mattedi, 2017) and disaster victim identification (DVI). The main purpose of the DVI response is identifying bodies in mass disasters, with the aim of delivering the remains to the corresponding families, thus enabling funeral rituals according to each religion, as well as providing the resolution of legal aspects, such as, for example: death certificates and life insurance.

In the context of disaster management, DVI response must be guided by existing protocols aimed at minimizing damage resulting from the event and maximizing available resources so that the goals are successfully achieved. One important definition is the development of a communication structure that ensures that critical information is conveyed to recipients.

In view of the sociological aspects involving the proposed theme in light of the disaster victim identification paradigm, this paper aims to address concepts and research areas of Information Science in the DVI process, guided by the standardized procedures in the International Criminal Police Organization–INTERPOL DVI Guide (2018). As a specification, we will address a case study (Brumadinho Disaster) based on the DVI process and its four phases (1- Scene examination; 2- *Post mortem*; 3- *Ante mortem*, and; 4- Reconciliation).

The INTERPOL DVI Guide proposes to the member countries of this Community a working methodology, as well as tactical and operational guidelines to be used in multinational events. This manual aims to provide synchronization and alignment of conduct in a situation that requires the adoption of the DVI process, for a quick and efficient response.

For this article, a bibliographical review of concepts on topic DVI was conducted, emphasizing some points in this process regarding the timeliness and precision required in information flows. Subsequently, the relationship between Information Science, the topic

and the DVI process was outlined. Then, the case study was applied, working on the DVI process and how Information Science complements its understanding. At last, the final considerations of the study.

Methodologically, this study focused on establishing an applicable list of the contributions of Information Science in the DVI response protocol and did not follow a systematic review of the literature for a simple reason: there are few studies of this kind. Thus, the focus was, first, to gather texts that address disasters and, subsequently, to identify the nuances of the DVI protocol with Information Science and its classical studies in the reasoning.

This way, the entire relationship between DVI and Information Science seems extensive, however it seems logical to contemplate numerous representations, such as Information Retrieval in the Scene Examination phase process; the application of the Organization of Information and Knowledge in the *Post mortem* phase; the representation of the Information Service in the *Ante mortem* phase; of Technology and Information System in the Reconciliation phase, and; Information flow for the case study context in Brumadinho. Of course, indirectly, but present in the DVI context. Due to these relationships, these contributions were made clear.

The present study was based on the experience of one of the authors, a Federal Forensic Expert, of handling the DVI response in Brumadinho/MG, occasion on which he had the opportunity to participate in phase 1 (Scene examination) of the process and also becoming familiar with the routine of phases 2 (*Post mortem*), 3 (Ante mortem) and 4 (Reconciliation).

This work is presented so that readers can understand the dynamics of the DVI process and its conceptual relationship with Information Science, bringing to light fundamental concepts of the Organization and Representation of Knowledge and the need for Information to be objective for it to be useful. The idea of researching the topic arose as one of the authors, a Federal Forensic Expert, is pursuing his Master's degree in Information Science by means of an agreement between the Federal University of Santa Catarina and the Federal Police in a project called "Acordo MINTER" (MINTER Agreement), the other author being a researcher at the University.

DVI

Disasters have always generated great interest in society due to several factors linked to these phenomena. Aspects related to causes, consequences and effects motivate research every time an event occurs. Among the different areas of knowledge that research this topic, there are specific ones that focus on DVI response. The relevance of DVI can be seen in countless ways, as Almeida (2000, p. 29)[1] wrote:

1 Translation: "Identification therefore constitutes one of the main objectives of handling mass disaster casualties, having a medical-legal and sociological basis. Medical-legal reasons include factors as diverse as death certificate, succession and the right to take legal action for damages suffered, in addition to the payment of insurance policies. The sociological reasons are based on the unquestionable right to identity, which is common to all human beings, even after death, a fact corroborated by one of the clauses of the United Nations Declaration of Human Rights, as well as by the justified respect for the will of the deceased, traditionally respected, in the sense of carrying out their funeral ritual according to their wishes" (Almeida, 2000, p. 29, editorial translation).

> A identificação constitui, portanto, um dos principais objetivos da manipulação das vítimas de desastres de massa, tendo fundamentação médico-legal e sociológica. As razões médico-legais compreendem fatores tão diversos quanto à certidão de óbito, a sucessão de bens e o direito de mover ações legais pelos danos sofridos, além do pagamento de apólices de seguro. Os motivos sociológicos têm base no inquestionável direito à identidade, que é comum a todos os seres humanos, ainda que após a morte, fato corroborado por uma das cláusulas da Declaração de Direitos Humanos da Organização das Nações Unidas, assim como pelo justificado respeito à vontade do falecido, tradicionalmente respeitada, no sentido de efetuar o ritual fúnebre consoante o seu desejo.

The DVI process is basically divided into four phases: scene examination, *post mortem*, *ante mortem* and reconciliation (Brasil, 2020):

scene examination: set of systematized procedures for searching, rescuing and storing bodies, carried out at the disaster site;

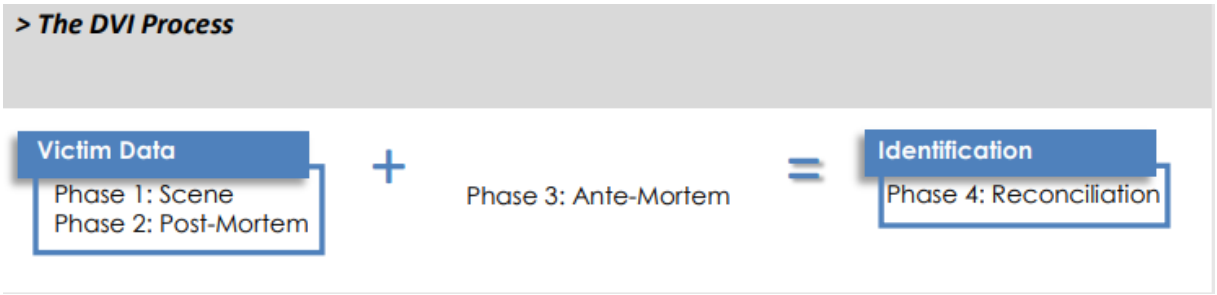
post mortem: collection and recording of the victims' data by means of a systematized process of internal and external examination of bodies and remains;

ante mortem: collection and recording of data on missing persons by means of a systematized process of searching for information from family members and other institutions, and;

reconciliation: carrying out primary and secondary identifications.

These four phases interact insofar as the activities carried out in phases scene examination, *post mortem* and *ante mortem* will produce the necessary information to encourage reconciliation with a view towards identification. In this context, specifically, the scene examination and *postmortem* phases are developed sequentially, and there must be a refined communication channel between them, defined by the coordination of the activity.

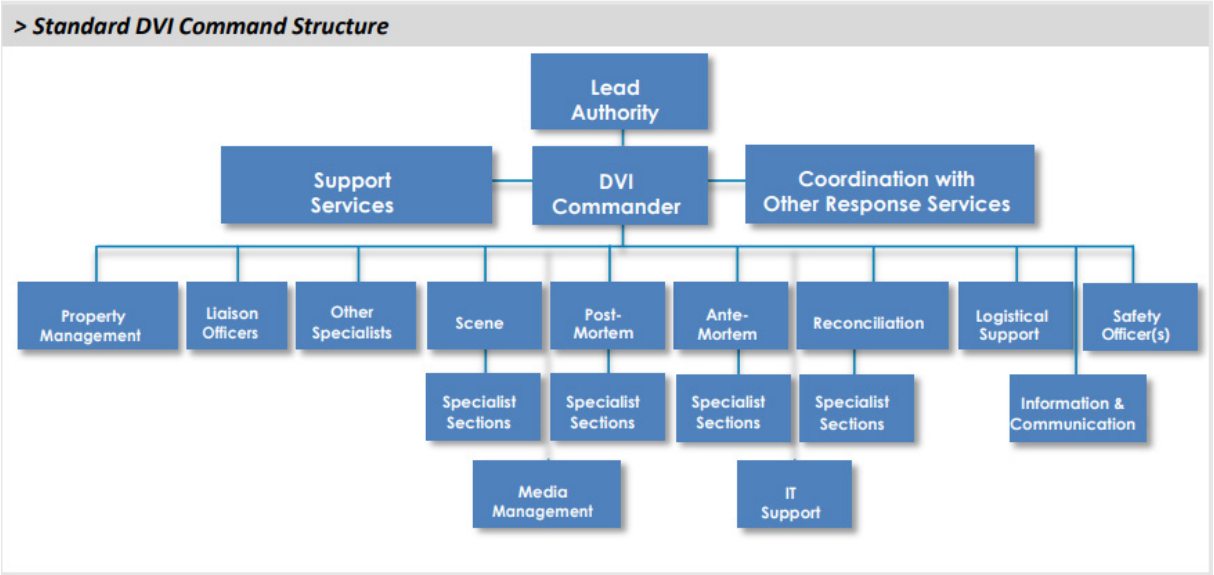
Figure 1 – DVI Process I



Source: Elaborated by the author based on the INTERPOL DVI Guide (2018).

The INTERPOL DVI Guide (2018) includes a suggestion for a management structure that aims to enable the coordination, control and monitoring of all phases of the process through pre-established channels for information flow, as well as enabling an effective connection with key members of the general disaster response command and other institutions participating in the event.

Figure 2 – Standard DVI Command Structure



Source: Elaborated by the author based on the INTERPOL DVI Guide (2018).

Among the various functions of the DVI Commander listed in the INTERPOL DVI Guide (2018), two are of special interest to this research, namely: appointing DVI phase coordinators and implementing communication channels that facilitate the coordination and flow of information. DVI Phase Coordinators are expected to be able to monitor all aspects of their work area to ensure that procedures are being followed correctly, that issues are addressed proactively, and that the DVI Commander is accurately informed of the key questions.

Winksog, Tsokos and Byard (2012, p. 82, our translation)[2] emphasize:

> Um desastre quando ocorre requer intervenção profissional, coordenada e uma abordagem ponderada deve ser adotada, ao invés de *ad hoc* ou uma mobilização não autorizada de indivíduos treinados de forma variável ou equipes que atuaram algumas vezes no passado [...] e isso levará a uma melhor coordenação entre os profissionais de diferentes formações ao trabalharem juntos para objetivos mútuos importantes de localização da vítima, preservação, identificação e repatriação.

The accuracy of information and information flows is crucial for carrying out DVI activities. With accurate and timely information, for example, it is possible to optimize the locations of search and recovery teams (Cardoso, 2015).

As recommended in the INTERPOL DVI Guide (2018), in the scene examination phase, the scene must be treated as a crime scene, therefore all procedures generally used for this type of forensic examination must be used, such as isolating the area and preserving evidence traces until these are analyzed by forensic experts and DVI specialists. At this phase,

2 Original: "When a disaster occurs that requires professional intervention, a coordinated and considered approach should be adopted rather than ad hoc and unauthorized mobilization of variably trained individuals and teams that has sometimes occurred in the past [...] and that this will lead to better coordination between disciplines when working together towards the important mutual goals of victim location, preservation, identification and repatriation" (Winksog; Tsokos; Byard, 2012, p. 82).

DVI activities include photographic records, recordings, description, labeling, georeferencing, among others, which need to be coordinated and associated with the recovery, storage and transport of mortal remains.

Following existing protocols, forensic experts when working on DVI responses have the ability to guide less experienced forensic professionals, as well as other actors working on the incident. Observance of theoretical principles tends to increase interaction between all agents involved (Winksog; Tonkin; Byard, 2012).

As recommended in the INTERPOL DVI Guide (2018), in the *postmortem* phase, the processing, examination and storage of all recovered remains is carried out, and such remains must be kept under protection pending formal identification and release by the coroner or other established formal authority. Examination processes and methods applied during the *postmortem* phase include photography, papilloscopy (fingerprinting), radiology, dentistry, DNA sampling, and autopsy procedures. In addition to examining the remains, personal items such as clothing and jewelry must be thoroughly examined, cleaned, and stored.

Conceptual relationship of Information Science in the DVI process

Disaster scenarios can have different specificities, but, as a rule, chaos ensues at the scene of the event itself and can spread for kilometers. Lack of electricity, water, food, shelter, access (roads/streets) are examples of facts that may be present in these places. Therefore, the response of government agencies must be quick, first, preserving the physical integrity of the rescue teams so that they do not become rescuees, and immediately seek to rescue victims of the event. Information and information flows must be efficient and timely.

Many believed that Knowledge Organization would be restricted to Library Science and Information Science environments, however, research and studies developed in recent decades have shown its applicability to various types of knowledge and services that would require Organization and Knowledge Representation systems (Dahlberg, 1993), as is the case with the DVI process.

The relevance of information is associated with its timely provision, in an effective and efficient manner, capable of eliminating non-relevant information because “[...] se não é relevante, não é informação [...]” (Pinheiro, 2004)[3]. The quality of information is directly related to its reliability, relevance and consistency (Wu, 2018). The users’ perception of the usefulness of the information will allow the evaluation of its quality.

Thus, we can cite the teachings of Borko (1968), who stated that Information Science investigates the informational properties and behavior, the forces that govern its flow, aiming to optimize accessibility and its use.

Borko (1968) also pointed out that Information Science studies the source, collection, organization, storage, retrieval, interpretation, transmission, transformation and use of information. Initially, what is sought in the DVI process is to obtain accurate information, both

3 Translation: “[...] if it is not relevant, it is not information [...]” (Pinheiro, 2004, editorial translation).

on the bodies and on the missing persons, which would be the sources of the information. Then, continuously, without a continuity solution, there is concern for all areas studied by Information Science.

"O propósito da Ciência da Informação é facilitar a comunicação de informações entre seres humanos" (Belkin; Robertson, 1976)[4]. So, if the purpose of the DVI process is to obtain precise information and refined information flows, Information Science is adhered to the process.

Regarding information retrieval, which is the most important component of Information Science (Saracevic, 1996), a practical example that takes place in the DVI process, and is of utmost importance, is the search in government databases for information on missing person reports. In Brazil, the State Law Enforcement Departments are required to submit the civil identification records of missing persons, since, as a rule, they include the fingerprints, which can enable papilloscopic comparisons, which is a quick and effective identification. Thus, it is clear that Information Science permeates the DVI process, and can offer opportunities for improvements in various activities and flows.

Capurro (2003, online)[5] addressed topic Information System as follows:

> Vê-se aqui claramente que a avaliação de um sistema de informação não está baseada meramente no *matching* de um dado de entrada (*input*) com outro dado previamente registrado, mas que esse dado registrado é concebido como uma oferta frente à qual o usuário desempenhe um papel eminentemente ativo. Tal atividade procede não só de sua consciência ou de seus "modelos mentais", mas seus conhecimentos e interesses prévios à busca estão de início entrelaçados nas redes social e pragmática que os sustentam.

The DVI process can be analyzed as an Information System, where the inputs would be the information on bodies and missing persons (sources of information) that allow identification, in this case the outputs (use of information). In this system, the collection, organization, storage, recovery, interpretation, transmission and transformation would occur during the various activities that permeate the process, such as, for example, the preservation of bodies, examinations by coroners and dentists, in the flows of information between teams and coordinations. Processes are the forms of interaction, coordination, communication and decision-making through which resource inputs, data on bodies and victims are transformed into products and services of greater value: identification (Christensen, 1997).

The training of actors involved in a DVI response can facilitate information flows, because, since several activities take place simultaneously, a leveling of prior knowledge is of paramount importance, as it allows "everyone to speak the same language" and have an idea of how the system mechanism works, and thus understand the context in which they are

4 Translation: "The purpose of Information Science is to facilitate the communication of information between human beings" (Belkin; Robertson, 1976, editorial translation).

5 Translation: "It is clear that the evaluation of an information system is not based merely on matching an input data with a previously recorded data, but that this recorded data is conceived as an offer against which the user performs an eminently active role. Such activity originates not only from their consciousness or their "mental models", as their knowledge and interests prior to the search are initially intertwined in the social and pragmatic networks that support them" (Capurro, 2003, online, editorial translation).

acting and how their attributions impact and are impacted by other actors. The message being enunciated, intentionally, in the transfer is not enough, it must reach compatible semantic spaces in sensitivity, understanding and acceptance (Barreto, 1999).

Capurro (2003, online)[6] addressed the issue of pre-understanding a specific field of knowledge in which the user is, in a certain way, inserted when addressing hermeneutics as a paradigm of Information Science:

> A hermenêutica como paradigma da ciência da informação postula justamente a diferença entre pré-compreensão, oferta de sentido e seleção, tomando como marco de referência, não a pré-compreensão de um sujeito ou usuário isolado, mas as de determinada comunidade assim como a de um campo específico de conhecimento e/ou de ação no qual o usuário está já implícita ou explicitamente inserido.

Training DVI teams is a relevant matter in the INTERPOL DVI Guide (2018), which recommends that "in order to maintain adequate competency standards in contemporary DVI practices, protocols and procedures, jurisdictions should consider maintaining training regimes that cover all DVI aspects and disciplines". In this sense, the value of information lies precisely within the possibility of applying knowledge to a practical demand (Capurro, 2003).

In several manuals, articles and books that address DVI, there is great concern for Information Management, present in all activities in this process, ensuring its availability to all areas involved and requiring appropriate spaces to store it (Araujo, 2014). This management is a key function for the main purpose to be achieved: identification (Morgan, 2009). Information management is the process in which accurate, adequate, timely information is sourced in an appropriate location aiming to employ resources to manage it within an organization (Ponjuán Dante, 2007).

DVI response in Brumadinho: information flow

In this section we intend to associate Information Science concepts with a real case, the DVI response in Brumadinho. In this event, one of the authors, a Federal Forensic Expert, worked in the scene examination phase over the course of twelve days, and had the opportunity to learn about activities carried out in the other three DVI phases: *post mortem*, *ante mortem* and reconciliation.

On January 25, 2019, around noon, the B1 Dam of the Córrego do Feijão Mine, located in the municipality of Brumadinho, in Minas Gerais, collapsed. This rupture triggered the displacement of a large mass of mud and waste from the mining process, which spread for kilometers from the epicenter of the event, killing 270 people and causing enormous environmental damage. In addition to the operational and administrative areas of mining

6 Translation: "Hermeneutics as a paradigm of information science postulates precisely the difference between pre-understanding, provision of meaning and selection, taking as a reference point, not the pre-understanding of an isolated subject or user, but that of a given community as well as that of a specific field of knowledge and/or action in which the user is already implicitly or explicitly inserted" (Capurro, 2003, online, editorial translation).

corporation Vale, the mud flowed into communities in the region, reaching the Paraopeba River, a tributary of the São Francisco River. Considering the extent of the disaster, the Law Enforcement Department of the State of Minas Gerais relied on the support of professionals from other states, as well as the cooperation of the Federal Police.

Scene Examination Phase

The scene itself was the region affected by the mudflow. In this region, access was restricted to professionals authorized to work in that area of interest. To support the operations carried out on site, an operational base was set up in a nearby region using the facilities of the Nossa Senhora das Dores Church, known in the theater of operations as Base Igrejinha.

At Base Igrejinha, an expert station was set up where forensic experts, coroners and investigators took turns. In addition to this unit, several professionals with different functions were assigned to work there, such as: sheriffs, police clerks, drivers, social workers, coordinators, IT technicians, administrative technicians, communication service and other professionals from the Civil Police of the state of Minas Gerais, integrated with firefighters, the military police, armed forces (army), civil defense and volunteers with the mission of organizing and managing the work process from location of the fatal victims to the proper disposal of the bodies (Rocha, 2020).

The operational recovery flow began from the time the search teams located a body or fragment of a body, which was treated as if it were a body. Mud removal was carried out in detail, in order to preserve all traces linked to the body, such as, for example, badges, wallets, cell phones, as these could be of great interest for the identification process. The next step was to place the body and related remains in a body bag and request the helicopter to transfer it from where the body was found to the forensic station at Base Igrejinha. The location from which the helicopter removed bodies was georeferenced and this data was passed to the Command Center. Each body removed also received a sequential number starting every work day, composed of the date and time stamp. This set of data (sequential numbering, date and time stamp, and coordinates) was made available by the Command Center to all the Institutions involved, thus enabling uniformity in control records.

As advised by the *postmortem* phase teams, a procedure that was adopted over the days by the search and recovery teams was the bagging of the heads and hands, aiming to preserve the dental and papilloscopic remains, from the site to processing at the Forensic Medicine Institute.

Special attention was given to traces not linked to bodies, but that could serve as a support in the identification process. Several backpacks were found, as well as badges, documents and cell phones. These traces were georeferenced, described, photographed and then collected for submission to the Forensic Medicine Institute.

Georeferencing the remains found at the scene helped determine the distribution of search and recovery teams, as the processing of this information allowed one to understand

the mudflow dynamics. For example, the Vale restaurant was one of the places where the largest number of people was expected to be found, as the event took place close to lunchtime. The location of traces from the restaurant led the search and recovery teams to work more intensively in that region.

Upon receiving the bodies at the forensic station at Base Igrejinha, the professionals described, labeled, photographed and associated them with data on the geographic coordinates of the recovery site, and associated them with the sequential number and date and time stamp using data from Command Center. After such procedures, the bodies were stored in a refrigerated container until they were transferred via hearse to the Forensic Medicine Institute, which would receive, in addition to the bodies, all the documentation produced on site.

Postmortem Phase

The *postmortem* phase activities were carried out at the Belo Horizonte Forensic Medicine Institute, approximately 70 kilometers from the scene of the incident. That is where coroners, dentists, papilloscopists, forensic anthropologists, autopsy assistants, among other professionals, worked. The exams aimed to identify, determine the cause of death, as well as define the harmful agent.

In order to deal with the large number of bodies and body fragments, logistics were necessary to adapt the Forensic Medicine Institute's procedures. In the first few days, technical discussions took place, and as the days went by, a work process focused on that specific demand started being reorganized (Rocha, 2020).

Upon receiving the bodies carried in hearses, the professionals working at the Forensic Medicine Institute registered, numbered and immediately refrigerated such bodies. The refrigerated bodies were subjected to radiological examinations, tomography scans, collection of genetic material and papilloscopic examinations, then were sent to await necroscopic and dental examinations.

Forensic anthropology handled bodies in an advanced state of decomposition. Identification by this branch of Science takes place through the validation of generic identity factors, called biological profile, which encompasses four parameters: ancestry; age at death (age group); sex and height (Cunha, 2019).

The great fragmentation of the bodies, due to the intensity of the destruction, generated obstacles to the provision of Death Certificates. How can one claim someone is dead when the only part that was found was their hand? A software was developed during the Brumadinho incident response to control the segments found, making it possible to know whether a given fragment was from an unidentified individual or not, and how many parts are missing to make up the full body. This software was recently presented at an INTERPOL[7] annual meeting on DVI in Singapore (Rocha, 2020).

7 INTERPOL: The International Criminal Police Organization.

Ante mortem Phase

The *ante mortem* phase activities were held at the Minas Gerais Police Academy (ACADEPOL/MG), where, among other professionals, social workers and psychologists provided support to the families of missing persons; such families were interviewed and subjected to a registry to facilitate the identification of fatal victims. In the interviews, family members provided information about the missing persons (particular skin spots, dental exams, congenital malformations, medical records, surgical information, use of orthoses and prostheses, among others), aiming to contribute to the identification of the bodies. Later, family members were called to take part in procedures to identify and release the bodies.

One of the initial problems was that persons were reported missing by more than one family member, generating repeated information. Initially, 517 families were registered with ACADEPOL/MG and reported missing family members in the tragedy (Rocha, 2020). Organizing the list of missing persons was one of the main activities of the *ante-mortem* teams, in order to generate a reliable list of missing persons.

Reconciliation Phase

The primary means of identification are papilloscopy, forensic dentistry and forensic genetics; through these, identification is carried out. Secondary means of identification (personal description, medical findings, tattoos, objects and clothing) were used to guide the identification using the primary means or as a way of excluding certain findings (Rocha, 2020).

One of the tools used for identification via papilloscopy was Alethia software, which made it possible to identify 47% of the rescued victims and considerably reduced the response time for their families. This system was developed by the National Identification Institute (INI) of the Federal Police, consisting of a portable Automated Fingerprint Identification System (AFIS) and a biometric kit (Souza *et al*., 2021).

Regarding identification by forensic dentistry, *software* PLASSDATA was used, as recommended by INTERPOL for managing DVI data. The system was fed with data from medical records using dental information provided by the relatives of the missing persons.

At this phase, the teams were also responsible for releasing the bodies and guarding materials for reconciliation examinations.

FINAL CONSIDERATIONS

In the DVI process, the main input is information. Information related to dead bodies, obtained at the site where they were found and by means of due processing carried out at the Forensic Medicine Institute. Information related to missing persons, obtained mainly from family members. Reconciling this information allows identification.

Actors involved in a DVI response must be prepared to work in inhospitable environments where sociological and humanitarian appeals cause great pressure for immediate responses. Psychological, physical and DVI training must be considered in this desired preparation.

Initially, a lot of data related to the event is offered by several different sources, such as, for example, people, audiovisual records and traces. This data must be treated accurately to be transformed into relevant information and feed the system that aims to identify fatal victims. Once the system is fed, actors involved in different activities taking place at the same time will be able to carry out the desired work within their attributions, producing new information and knowledge.

The INTERPOL DVI Guide proposes a work methodology divided into four phases that take place concomitantly. Information Science, with all its scientific apparatus, can add value to the DVI process by means of informational processing, filtering, data visualization, and sizing aimed at explaining the informational processes. Therefore, the combination of the DVI processes proposed by INTERPOL, with the frameworks that Information Science has to offer in a critical disaster situation, tends to be a branch of informational processing, which is also the research subject of this Science.

For future research, one may suggest research on the existence of Information Technology tools in other countries that can optimize the collection, storage and recovery of information from multiple casualties in disaster environments.

REFERENCES

ALMEIDA, C. A. P. **Proposta de protocolo para identificação odonto-legal em desastres de massa**. 2000. 79 f. Tese (Doutorado em Odontologia Legal e Deontologia) – Faculdade de Odontologia de Piracicaba da Universidade Estadual e Campinas, Piracicaba, 2000.

ARAUJO, C. A. Á. Fundamentos da Ciência da Informação: correntes teóricas e o conceito de informação. **Perspectivas em Gestão & Conhecimento**, João Pessoa, v. 4, n. 1, p. 57-79, jan./jun. 2014. Available at: https://periodicos.ufpb.br/ojs2/index.php/pgc/article/view/19120. Access on: 11 mar. 2022.

BARRETO, A. A. Os destinos da Ciência da Informação: entre o cristal e a chama. **Informação & Sociedade**: estudos, Paraíba, v. 9, n. 2, 1999. Available at: https://periodicos.ufpb.br/ojs2/index.php/ies/article/view/397. Access on: 06 jan. 2022.

BELKIN, N. J.; ROBERTSON, S. E. Information Science and the phenomenon of information. **Journal of the American Society for Information Science**, [*s. l.*], v. 27, n. 4, p. 197-204, jul/ago. 1976. DOI: 10.1002/asi.4630270402.

BORKO, H. Information science: what is it?. **American Documentation**, [*s. l.*], v. 19, n. 1, p. 3-5, jan. 1968.

BRASIL. Polícia Federal. Instrução Normativa nº 176-DG/PF, de 25 de agosto de 2020. [Institui a Comissão Permanente de Identificação de Vítimas de Desastres – CPDVI da Polícia Federal e disciplina o acionamento e a resposta em Identificação de Vítimas de Desastres – DVI no âmbito da Polícia Federal]. Brasília: **Ministério da Justiça e Segurança Pública**, 26 ago. 2020.

BRASIL. Resolução nº 3, de 2.7.99, do Conselho Nacional de Defesa Civil. Institui o Manual para a Decretação de Situação de Emergência ou de Estado de Calamidade Pública. Brasília: **Diário Oficial da União,** 1999. Available at: https://www.defesacivil.rs.gov.br/upload/arquivos/201511/04145516-02-manual-para-decretacao-de-situacao-de-emergencia-ou-de-estado-de-calamidade-publica-volume-1.pdf. Access on: 11 ago. 2021.

CAPURRO, R. Epistemologia e Ciência da Informação. *In*: V ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 5., 2003, Belo Horizonte. **Anais** [...]. Belo Horizonte: UFMG, 2003. Available at: http://www.capurro.de/enancib_p.htm. Access on: 30 set. 2021.

CARDOSO, D. **Enchentes**, deslizamentos e a sociedade em rede: um estudo sobre o fluxo de informação em desastres naturais a partir do caso de Petrópolis 2013. 2015. 65 f. Dissertação (Mestrado em Ciência da Informação) – Universidade Federal de Santa Catarina, Centro de Ciências da Educação. Programa de Pós-Graduação em Ciência da Informação, Florianópolis, 2015.

CHRISTENSEN. C. **O dilema da inovação**: Quando as novas tecnologias levam as empresas ao fracasso. São Paulo: MBooks, 1997.

CUNHA, E. Devolvendo a identidade: a antropologia forense no Brasil. **Ciência e Cultura**, São Paulo, v. 71, n. 2, p. 30-34, abr./jun. 2019. Available at: http://dx.doi.org/10.21800/2317-66602019000200011. Access on: 11 ago. 2021

DAHLBERG, Ingetraut. Knowledge Organization: Its: Scope and Possibilities. **Knowledge Organization**, v. 20, n. 4, p. 211-222, 1993.

INTERPOL. **Disaster victim identification guide**. 2018. Available at: https://www.interpol.int/How-we-work/Forensics/Disaster-Victim-Identification-DVI. Access on: Access on: 11 ago. 2021.

MATTEDI, M. Dilemas e perspectivas da abordagem sociológica dos desastres naturais. **Tempo Social**, São Paulo, v. 29, n. 3, p. 261-285, dez. 2017.

MORGAN, Oliver. **La gestión de cadáveres en situaciones de desastre**: guía práctica para equipos de respuesta. Washington, D.C.: OPS, 2006. ISBN 92 75 32630 4.

PINHEIRO, L. V. R. Informação: esse obscuro objeto da Ciência da Informação. **Revista Morpheus**: estudos interdisciplinares em memória social, Rio de Janeiro, v. 3, n. 4, 2014. Available at: https://seer.unirio.br/morpheus/article/view/4108. Access on: 06 maio 2021.

PONJUÁN DANTE, G. **Gestión de Información**: dimensiones e implementación para el éxito organizacional. Gijón: Trea, 2007. ISBN: 978-84-9704-324-3.

ROCHA, C. S. **Atuação da equipe multidisciplinar do Instituto Médico Legal de Belo Horizonte frente ao rompimento da Barragem B1, da Mina do Córrego do Feijão, em Brumadinho**. 2020. 72 f. Dissertação (Mestrado Profissional em Promoção de Saúde e Prevenção da Violência) – Faculdade de Medicina da Universidade Federal de Minas Gerais, Belo Horizonte, 2020.

SARACEVIC, T. Ciência da informação: origem, evolução e relações. **Perspectivas em Ciência da Informação**, Minas Gerais, v. 1, n. 1, p. 41-62, jan./jun. 1996.

SOUZA, M. A.; URTIAGA, G. O.; MELO, F. R.; DA SILVA, L. M. Identificação de vítimas de desastre por impressões digitais: o rompimento da barragem de Brumadinho. **Revista Brasileira de Ciências Policiais**, Brasília, v. 13, n. 7, p. 337–350, jan./abr. 2022. ISSN 2178-0013. ISSN Eletrônico 2318-6917. DOI: 10.31412/rbcp.v13i7.839.

UNITED NATIONS DEVELOPMENT PROGRAMME – UNDP. **Report Reducing Disastrer Risk**: a challenge for development a global report. New York: John S. Swift Co., Inc. 2004. p. 146. Available at: https://www.undp.org/publications/reducing-disaster-risk-challenge-development. Access on: 11 ago. 2021.

WINKSOG, C.; TSOKOS, M.; BYARD, Roger W. The progression from disaster victim identification (DVI) to disaster victim management (DVM): a necessary evolution. **Forensic Science, Medicine e Pathololology**, [*s. l.*], v. 8, n. 2, p. 81-83, 2012. DOI: 10.1007/s12024-011-9295-9. Available at: https://link.springer.com/article/10.1007/s12024-011-9295-9. Access on: 11 mar. 2022.

WINKSOG, C.; TONKIN, A.; BYARD, R. W. The educational value of disaster victim identification (DVI) missions-transfer of knowledge. **Forensic Science, Medicine and Pathololology**, [*s. l.*], v. 8, n. 2, p. 84-87, jun. 2012. Available at: https://link.springer.com/article/10.1007/s12024-011-9259-0. Access on: 11 mar. 2022.

WU, B. Patient continued use of online health care communities: web mining of patient-doctor communication. **Journal of Medical Internet Research**, Shanghai, v. 20, n. 4, p. 1-15, abr. 2018. Available at: 10.2196/jmir.9127.

Brazilian scientific publications in Information Science indexed in the Web of Science

João Paulo Pastana Neves
Master Degree in Information Science from Universidade Federal do Pará (UFPA)
Duly assigned librarian at Universidade Federal do Pará (UFPA), Pará, Brazil
http://lattes.cnpq.br/6105948858806831

Roberto Lopes dos Santos Júnior
PhD in Information Science from Ibict/UFRJ
Associate Professor in Archival Science at the Postgraduate Program in Information Science at Universidade Federal do Pará (UFPA), Pará, Brazil
http://lattes.cnpq.br/3355963647616547

Submitted on: 04/14/2022. Approved on: 02/15/2024. Published on: 06/21/2024.

ABSTRACT

In the 50 years of Information Science history at Brazil, a lot of research has been carried out in the field of scientific information being the genesis of CI, contributing to scientific advancement is its journey in the hall of science. The objective of the article was to analyze the scientific production of CI in Brazil in the 50 years of history in the Web of Science (WoS), through a quantitative and qualitative approach, using bibliometric analysis as a method. After data collection, this analysis took place using the VOSvierwer and Gephi software, 207 scientific publications were retrieved from the year 1971 to the year 2021, including scientific articles (original, review and annals). The publications involved 416 authors, 23 countries, 142 institutions, 46 journals and 708 keywords, with 87.27% of the publications concentrated in the last 11 years. The periodical Informação Sociedade Estudos was the scientific journal that most published scientific documents, with 39 of the total. In addition, researchers Bufrem (UNESP) and Martinez-Ávila (ULE-ESP/UNESP) and the institutions UNESP and UFMG were the largest producers of scientific publications. Regarding international collaboration, 12.72% of the works were produced in partnership with various institutions around the world, with Europe being the highlight with 71.46%.

Keywords: scientific production; information science; bibliometry; Web of Science; Brazil.

INTRODUCTION

Information Science, in its 50 years of history in Brazil, has provided perspectives in the field of scientific information both in how to organize it and how to mediate it. With regard to the organization of knowledge information, according to Guimarães (2015), it consists of differentiating knowledge from the individual, subjective or objective process, from a fact, or state in which there is no transfer, and it is only acquired through reflection; its object is its registered and disclosed form, such as, for example, in the occurrence of registered documents, allowing easy access and retrieval.

For Araújo Júnior and Souza (2018), it establishes the relationship between the organization and retrieval of information, which is directly linked to the relationship between the arrangement of collections in the physical description and their informational content and, then, to locating the document and the informational items stored in the knowledge base.

Understood as systems for organizing knowledge, they include the variety of schemes that organize, manage and retrieve information, since ancient times, and which are currently present in all areas of human knowledge, from the simplest to the most complex. They cover classification, thesaurus and ontology, as well as our well-known glossaries and dictionaries, specific to each area and linked to libraries and other information management organizations, with a view to organizing, retrieving and disseminating information (Tristão; Fachin; Alarcon, 2004).

Concerning the type of system described above, we present *Web of Science* – multidisciplinary scientific knowledge base, sponsored by *Clarivate Analytics*, which has *Journal Impact Factor* (JIF) as a journal-level metric, calculated from data indexed in the *WoS Core Collection* –, which aggregates IS journals in its category.

From this contextualization, we intend to discover: how has research related to IS been conducted in Brazil during its 50 years of history in WoS?

Therefore, this article intends to analyze the scientific production of IS in Brazil in WoS, based on a quantitative and qualitative survey by means of a bibliometric analysis between 1971 and 2021. This research is justified by the quality of scientific production related to the topic in question.

The research initially provided a brief overview of the main characteristics linked to the organization of scientific knowledge information and the information system for this knowledge, WoS. Subsequently, the research methods used and the results obtained in this research were discussed, indicating the main trends in scientific collaboration and analysis on the topic.

Communication system in Information Science

The first steps to have been reported regarding the scientific communication system in IS may have taken place with the birth of modern science, around the 16th century, in meetings of scientific societies, the communication of which was carried out by means of

letters disseminating studies and discoveries. This means of communication was a next step towards the creation of journals, around the 17th century, which consolidated the process of scientific communication and information (Pinheiro, 2002a). At that time, two remarkable journals appeared, in the year 1665, the *Journal des Sçavans*, from France, and *Philosophical Transactions,* from England, thus beginning the process of scientific communication and information, considering that both are pioneering scientific journals today (Meadows, 1999).

Regarding scientific communication systems in IS, the following events are milestones of this historic achievement, as Pinheiro (2002b) notes:

a) the creation of the International Institute of Bibliography (IIB), in 1895, during the 1st International Bibliography Conference, in Brussels, Belgium; and

b) the transformation of IIB into the International Institute for Documentation (IID), in 1931, at the suggestion of Paul Otlet and Henri de La Fontaine, during the 10th International Bibliography Conference, in Brussels, Belgium.

Other events contributed to the emergence of IS, as mentioned by Queiroz and Moura (2015a):

a) the Scientific Information Conference, of the *Royal Society*, in 1948, in the city of London, United Kingdom;

b) the Conference of the International *Union on Pure and Applied Chemistry* (IUPAC), in London, United Kingdom, in 1955; and

c) the International Conference on Scientific Information, of the National Academy of Sciences, in Washington, D.C., United States of America, in 1958.

In Brazil, the first research activities in IS possibly date back to 1968, and are more specific in the scope of Scientific Documentation, as this is its field of application. Within the scope of the activities, research and development (R&D), in particular, can be considered, on account of its concentration on technologies linked to automation. Around the 1970s, the first graduate courses in IS emerged, which may have solidified research activities in the field (Gomes, 1981), with the emergence of communications at conferences across the country, such as:

a) the Brazilian Information Science Meetings (REBRACI), in 1975 and 1979, of great repercussion, which allowed time for ideas to mature and, at the end of the following decade, the implementation of the National Association for Research in Information Science (ANCIB) (Pinheiro, 2007a);

b) the National Meeting of Research in Information Science (ENANCIB), which stood out as the largest and most significant research event in IS in Brazil, starting in 1989;

c) the National Meeting of Information Teaching and Research (CINFORM), previously named the National Meeting of Information Science, promoted by the Information Science Institute (ICI) of Universidade Federal da Bahia (UFBA), in 1998;

d) the National Meeting of Education in Information Science (ENECIN), created in 2004 by the Brazilian Association of Education in Information Science (ABECIN), which aimed to discuss emerging issues related to education and teaching didactics in the field; and

e) the Regional Meeting on Education in Information Science (ERECIN), which focused on the particularities of each region of the country, the Regional Workshops and Pedagogical Seminars, where guiding documents for teaching practice in the field were produced (Araújo; Valentim, 2019).

Scientific journals

In Brazil, the reported emergence of journals took place around the 19th century, by means of the Portuguese Court, which allowed the press in the country and created numerous scientific institutions, beginning science practice and studies in Brazilian territory. Therefore, printed journal *Gazeta do Rio de Janeiro* emerged with the role of publicizing scientific matters in the country (Freitas, 2007).

In general, in the field of IS, the emergence of the first journals took place with the publication of *American Documentation*, in the United States of America, and *Nachrichten für Dokumentation*, in Germany, both in 1950, which continue to be relevant journals in this field.

In the Union of Soviet Socialist Republics (USSR), the first journal was created in 1952, the *Vserossiisky Institut Nauchnoi i Tekhnicheskoi Informatsii* (VINITI), or, in English, *All-Union Institute for Scientific and Technical Information*, linked to the Russian Academy of Sciences, the function of which was to provide information to scientists and specialists in technical and natural sciences (Silva; Freire, 2012a).

Returning to the national scenario, the first IS journal published was *Information Science*, created in 1972 by the then Brazilian Institute of Bibliography and Documentation (IBBD), currently called the Brazilian Institute of Information in Science and Technology (Ibict), responsible for its publishing and for contributing to the development of the field in the country (Queiroz; Moura, 2015b).

Another aspect of IS consolidation in Brazil was the promotion of research from the 1990s onwards by the National Council for Scientific and Technological Development (CNPq) and the Coordination for the Improvement of Higher Education Personnel (CAPES), which now include IS amongst the supported areas and recognize its national institutionalization (Pinheiro, 2007b).

In the following section, a brief historical fact is discussed, characteristic of IS at the national and international level.

Information Science: history and characteristics

Information Science began with the technical-scientific revolution and entered the Second World War period. This emergency state culminated in the emergence of new areas or the replacement of interdisciplinary relationships in already known areas of knowledge, having this transition been witnessed in recent decades by cognitive science. Thus, IS, like other areas of scientific knowledge, has followed the same evolutionary processes in science (Saracevic, 2008a).

The origin of IS is marked by two basic foundations, such as the connection with social and scientific ancestors who contributed to the principle of IS in its form of phenomenon manifestation, cause, motive and origin and milestones of institutional, technical and scientific occurrences to promote its journey in beginning and ascendancy (Silva; Freire, 2012b).

In Brazil, IS was introduced in the 1970s with the Master's program in Information Science, implemented by the IBBD, which is currently named Ibict (Russo, 2010; Queiroz; Moura, 2015c).

Regarding the ascendancy of IS, three general characteristics constitute the rationality of its existence and its evolution, shared by other areas of knowledge (Saracevic, 2008b):

1. IS is, by nature, interdisciplinary, although its relationships with other disciplines are changing. The interdisciplinary evolution is far from complete;
2. IS is inexorably linked to information technology. The technological imperative determines IS, as it does in other fields. In a broad sense, the technological imperative is imposing the transformation of modern society into information society, information age or post-industrial society; and
3. IS is, along with many other disciplines, an active and deliberate participant in the evolution of the information society. IS did and does have an important role to play due to its strong social and human dimension, which goes beyond technology.

These three characteristics (or rationality of IS) pointed out by the author make up a standard for understanding its past, present and future, and the means and problems and issues it faces.

Bibliometrics

Bibliometrics, also known as multidisciplinary practice, began by identifying behaviors in scientific literature and evolved in a defined context and time. It was first determined by Otlet, in 1934, as an integration of bibliography as a measure or quantity applied to books. Therefore, bibliometrics has the quantifiable method for recording scientific knowledge (Bufrem; Prates, 2006).

With this understanding, bibliometrics applies mathematical and statistical methods to books and other subjects related to scientific production (Pritchard, 1969). It is associated with measurement and aimed at any type of document, it is related to the study of quantitative

processes of production, dissemination and use of information, as well as advanced online search processes and mechanisms and information retrieval techniques, such as, for example, the Boolean operators (*AND*, *OR* and *NOT*).

In Brazil, it emerged around 1970, under the influence of metric studies, by means of discipline Data Processing in Documentation, taught in the Master's program in Information Science at IBBD, currently Ibict (Alvarado, 1984). This historic achievement made Ibict the first nationwide disseminator of bibliometrics, which came to be used in various fields of scientific knowledge.

The three bibliometric laws

IS presents, prominently, the three laws that aim to understand a certain phenomenon described, observed and verified by means of a prediction (Pinheiro, 1997a). According to Pinheiro, the most commonly used bibliometric laws related to scientific productivity are:

1. Lotka's Law (1926), which focuses on the productivity of authors;
2. Zipf's Law (1929), which addresses the frequent use of words in a text; and
3. Bradford's Law (1934), which was formulated for the distribution of journals in a certain area of knowledge.

These laws play an important role in the measurement of Science and highlight, in advance, "[...] o marco definitório da Ciência da Informação (1962) e de Bibliometria (1969)" (Pinheiro, 1997b, p. 10)[1].

METHODS

The research was conducted on March 23, 2022, based on the scientific productions in IS in Brazil indexed in WoS in the last 50 years, between 1971 and 2021. This article, by means of bibliometric studies and the help of *software VOSvierwer* and *Gephi*, had a quantitative and qualitative approach, and publications were surveyed in the WoS scientific knowledge base. The search strategy consisted of using descriptors "*Information Science*" and "*Brazil*".

The exact match search was conducted using quotation marks ("") in both terms and the filter used was Boolean operator AND between the descriptors. When retrieving information on topic "scientific publications in IS indexed in WoS", the "topic" field was used, which allowed search for more qualitative information. Furthermore, when searching for both terms, fields "titles", "abstracts" and "keywords" were used, and when excluding items, Boolean operator "NOT" was used to discard editorial materials, allowing articles only. The organization of data consisted of titles, year, indexed journals, conferences, and type of documents. The results and discussion on the topic are presented below.

1 Translation: "[...] the defining framework of Information Science (1962) and Bibliometrics (1969)" (Pinheiro, 1997b, p. 10, editorial translation).

RESULTS AND DISCUSSION

In the WoS scientific knowledge base, 220 scientific productions were recovered, 13 of which were discarded because they were not scientific articles, totaling 207 documents collected, among which: 191 articles, 11 conference articles and 5 review articles, as shown in **Table 1** below.

Table 1 – Scientific knowledge base and data analysis.

Scientific knowledge base	Search expression	Title	Journals/ Conferences	Document types	Analysis period
Web of Science	Topic: "Information Science" AND Tópico: "Brazil"	207	46 journals 11 conferences	191 articles 11 submissions 5 review articles	1971 to 2021

Source: Prepared by the authors based on research data (2022).

In identifying the 207 documents, of which 196 are articles (originals and reviews), and both indexed in 46 scientific journals, 11 are conference communications. These works were produced by 416 authors, linked to 142 institutions in 23 countries. There were also 708 keywords, data presented in **Table 1**.

Table 1 – Bibliographic information of the research

Bibliographic information	Frequency
Publications **Journals** **Annals**	207 46 11
Authors	416
Institutions	142
Countries	23
Keywords	708

Source: Prepared by the authors based on research data (2022).

Regarding the main sources of publications that addressed topic "scientific productions in IS in Brazil indexed in WoS", **Table 2** presents the ten most cited publications, in addition to year of publication, journals, average citation per year and Impact Factor (IF) of the journal.

Table 2 – Most cited publications first, average citation per year and journal IF in WoS

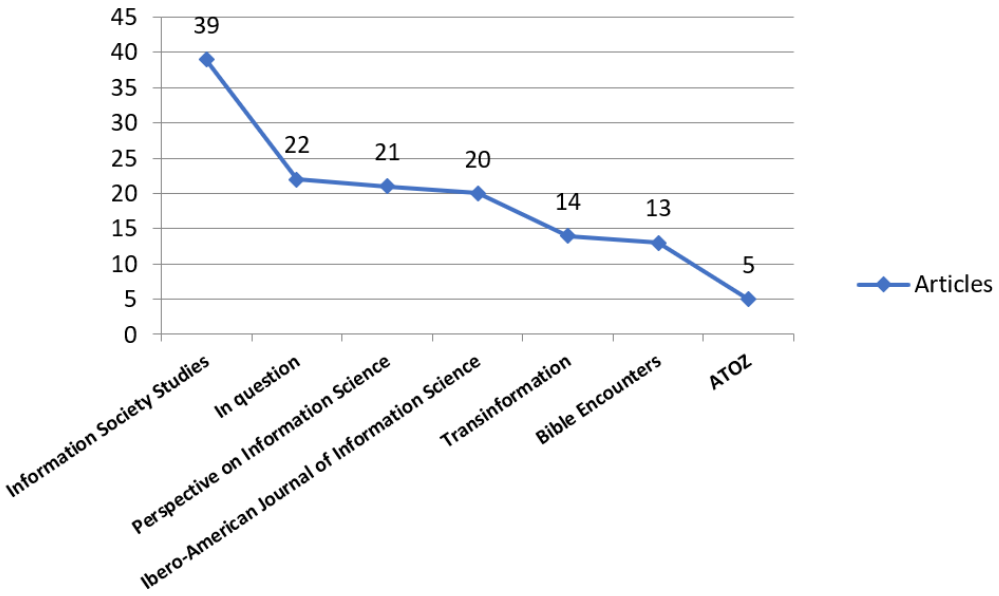
Ranking of IS publications in Brazil most cited first in WoS	Year of publication	Journals	Average citation per year	Impact factor (IF)
Information Science Research in Brazil: institutional milestones, scenarios and perspectives	2009	Perspectivas em Ciência da Informação	0.71	0.106
Information science as area of knowledge: viewed through research and Postgraduate studies in Brazil	2009	Perspectivas em Ciência da Informação	0.64	0.106
Articles from Brazilian scientific journals in information areas: evolution of production and multiple authorship	2008	Perspectivas em Ciência da Informação	0.6	0.106
The theory and practice of interdisciplinarity in Information Science	2011	Perspectivas em Ciência da Informação	0.67	0.106
Thematic characterization of research on Information Science in Brazil from 2000-2009	2013	Transinformação	0.7	0.648
Scientific production about competitive intelligence of the School of Science Information of Brasilia University	2012	Perspectivas em Ciência da Informação	0.64	0.106
Scenario and perspectives of scientific literature on information literacy in BRAZIL: study of production within the ANCIB	2016	Informação Sociedade Estudos	0.86	0.311
The production of scientific research in national events in the field of information science	2011	Trasinformação	0.5	0.648
Appearance and consolidation of Documentation: subsidies for the understanding of the history of Information Science in Brazil	2009	Perspectivas em Ciência da Informação	0.43	0.106
Visibility of studies in social network analysis in South America: Its evolution and metrics from 1990 to 2013	2014	Transinformação	0.56	0.648

Source: Prepared by the authors based on research data (2022).

It can be seen from the table above that the journals with the most citations of publications in the WoS scientific knowledge base are: *Perspectivas em Ciência da Informação*, with 6 articles, *Transinformação*, with 3 productions, and *Informação Sociedade Estudos*, with one article.

As for the journals that produced the most scientific articles in the period analyzed, the Brazilian IS journals are showed in **Chart 1**.

Chart 1 – Journals with the most publications.

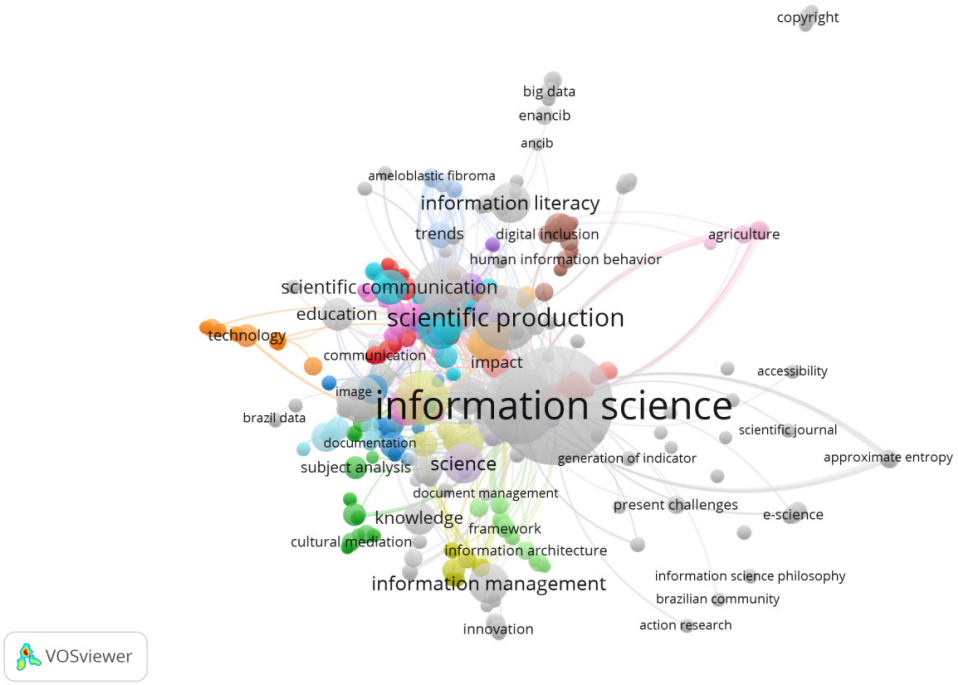


Source: Prepared by the authors based on research data (2022).

It can be seen, in the chart above, that the productivity contribution of scientific articles in IS by Brazilian journals in WoS is segregated as follows: *Informação Sociedade Estudos*, with 39 articles, representing 18.84%; *Em questão*, with 22 (10.62%); *Perspectiva em Ciência da Informação*, with 21 (10.14%); *Revista Ibero Americana de Ciência da Informação*, with 20 (9.66%); *Transinformação*, with 14 (6.76%); *Encontros Bibli*, with 13 (6.28%); and *ATOZ Novas Práticas em Informação e Conhecimento*, with 5 (2.41%).

Figure 1 below shows the thematic approaches in scientific publications in IS in Brazil indexed in WoS. The associative and correlated dynamics of the 708 keywords are observed as of the creation of the network of terms in software *VOSviewer*.

FIGURE 1 – Analysis network of the topics covered

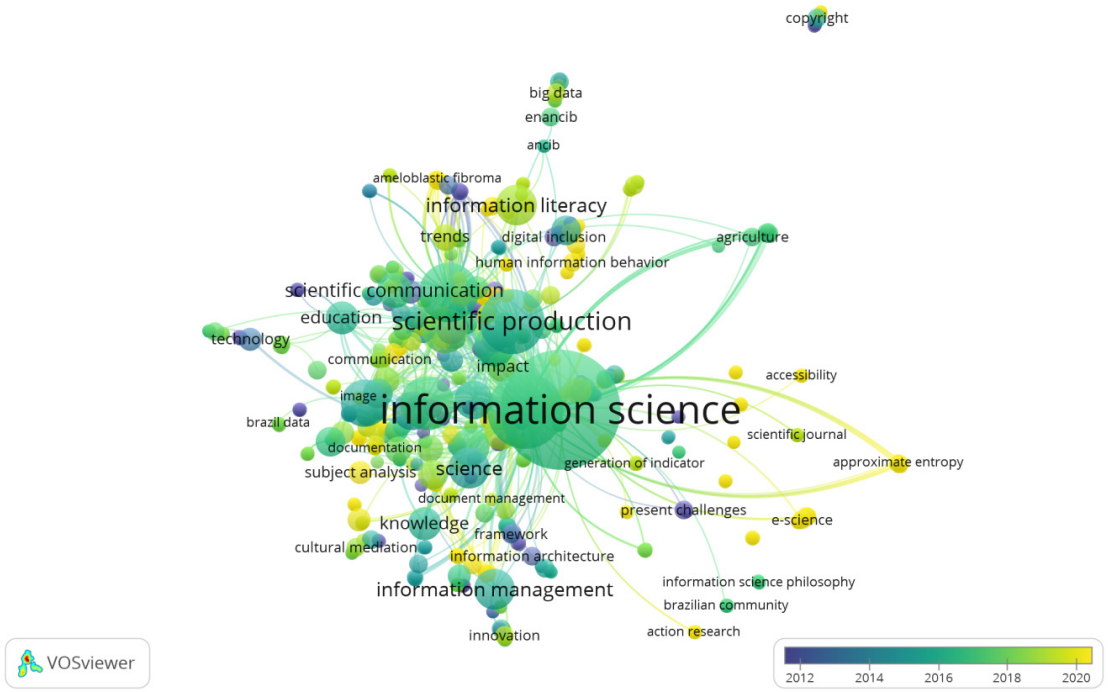


Source: Prepared by the authors based on research data (2022).

In identifying the network above, the topics with the highest occurrences, in addition to Information Science, within the period analyzed, are: scientific production, with 23 occurrences; bibliometrics (19); knowledge organization (16); information management (9); information literature and scientific communication, both with 6 occurrences.

FIGURE 2 shows the thematic trends analyzed during the period.

FIGURE 2 – Thematic trend analysis network

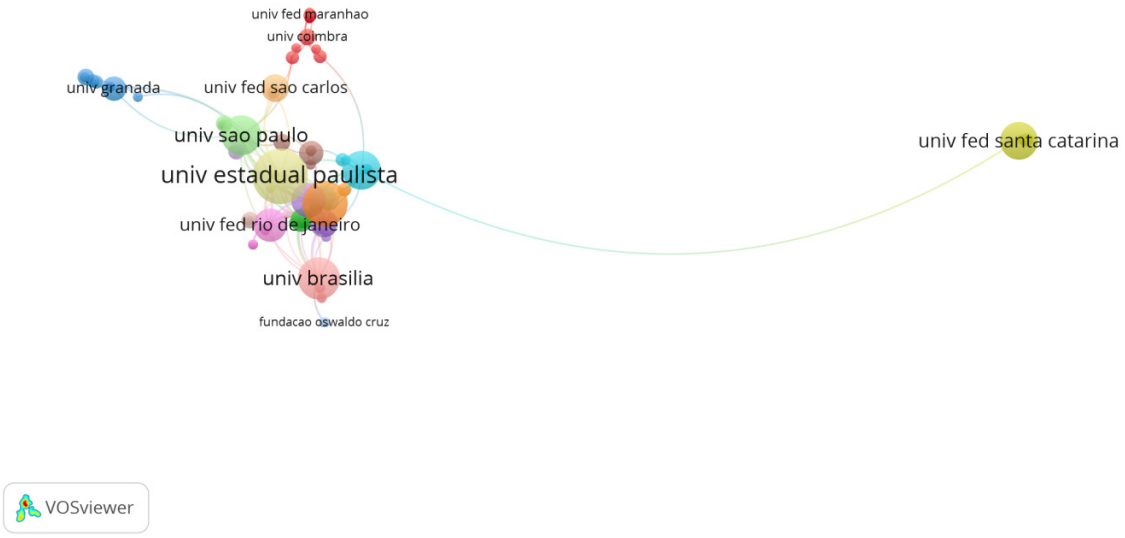


Source: Prepared by the authors based on research data (2022).

The themes that have been addressed in IS research in Brazil were identified among the topics distributed in the network above. In a yellow circle, the representation of these trends observed in the period between 2018 and 2021 stands out in topics such as *libraries*, in 2019; *subject analysis*; *digital citizenship*; *information policy*; *covid-19*; *ethics* and *accessibility*, in 2020; and *human information behavior* in 2021.

The network analysis of the 142 productive institutions is seen in **FIGURE 3**.

FIGURE 3 – Analysis network of productive institutions



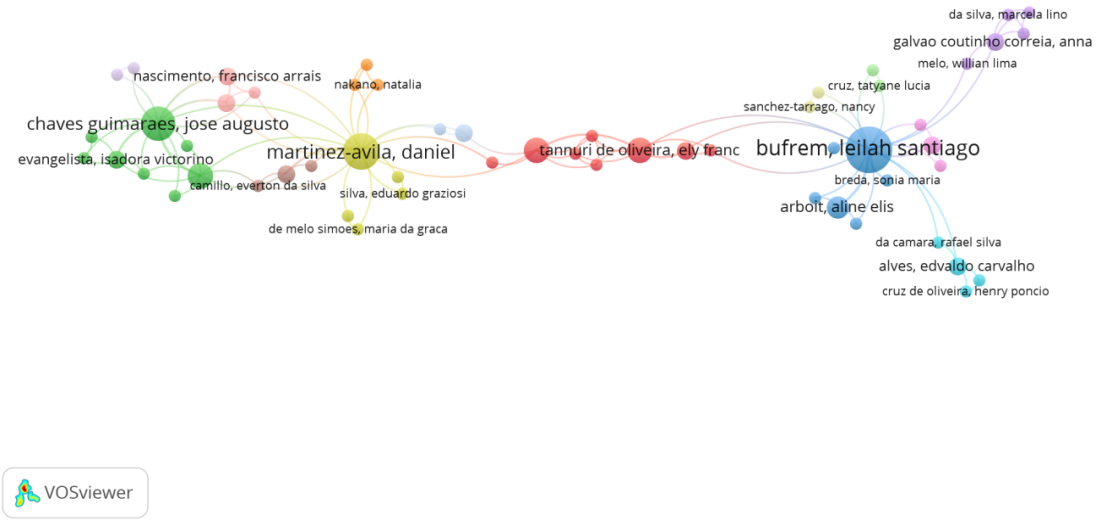
Source: Prepared by the authors based on research data (2022).

It can be seen that the most productive institutions are located in southeastern Brazil, such as Universidade Estadual Paulista (UNESP), with 42 occurrences (20.29%); Universidade Federal de Minas Gerais (UFMG), with 21 (10.14%); Universidade de São Paulo (USP), with 16 (9.17%); Universidade Federal do Rio de Janeiro (UFRJ), with 13 (6.28%); Universidade Federal de São Carlos (UFSCar), with 8 (4.34%); Universidade Federal do Paraná (UFPR), with 7 (3.38%); and Universidade Federal Fluminense (UFF), with 5 (2.41%).

However, the following associations have also been noted: in the northeast, Universidade Federal de Pernambuco (UFPE), with 17 occurrences (8.21%); Universidade Federal da Paraíba (UFPB), with (12) (5.79%); Universidade Federal do Ceará (UFC), with 8 (3.86%) and Universidade Federal do Rio Grande do Norte (UFRN), with 2 (0.96%); and in the midwest, Universidade de Brasília (UnB), with 19 works (9.17%). On the other hand, the institution from the southern region that appears furthest away in the chart is Universidade Federal de Santa Catarina (UFSC), with 15 occurrences (7.24%), at the same time that it has strong association and correlation with UFPE, from the northeast, as found in the analysis.

The most productive authors in the period are presented on the network, as shown in **FIGURE 4** below.

FIGURE 4 – Network of most productive authors and collaboration

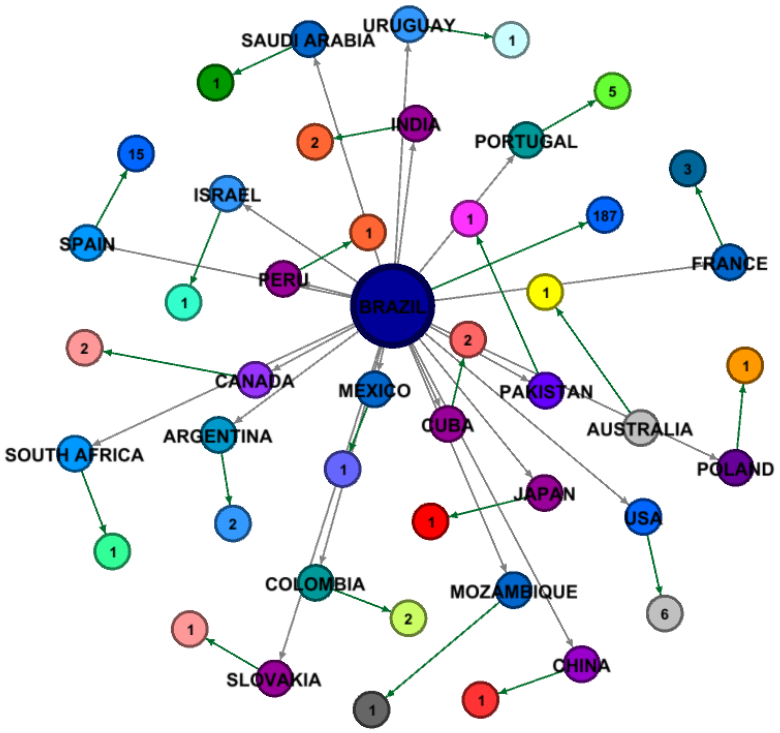


Source: Prepared by the authors based on research data (2022).

In the analysis of the most productive authors and collaboration, Bufrem appears with 13 scientific articles, including one work in which she was the only author and twelve works in collaboration with 19 national and 1 international authors. Second is Martinez-Ávila with 8 productions, including the collaboration of 17 national and 2 foreign authors. And finally, there is Guimarães with 7 productions, in partnership with 10 national authors and 2 international authors in different works. One point noted in the analysis: author Martinez-Ávila is Spanish and an assistant professor doctor at Universidad de León, in Spain. Moreover, he has been a full professor in the Graduate Program in Information Science (PPGCI) at Universidade Estadual Paulista (UNESP) since 2014.

Scientific collaboration can be described as two or more research groups in a graph analysis network (Bastian; Heymann; Jacomy, 2009). The collaboration between Brazil and foreign countries on the research topic of this paper is presented in the graph network below using software *Gephi*, as seen in **FIGURE 5**.

FIGURE 5 – Scientific collaboration network between foreign countries and Brazil



Source: Prepared by the authors based on research data (2022).

Regarding scientific collaboration between foreign countries and Brazil, the graph network shows the countries that collaborated the most, within the scope of IS, in the following order: Spain, with 15 publications; followed by the United States of America, with 6; Portugal, with 5; and France, with 3.

FINAL CONSIDERATIONS

The quantitative and qualitative survey on the topic – Information Science publications in Brazil indexed in the WoS scientific knowledge base – made it possible to observe the growing number of material published in the period analyzed.

Among the factors that contributed to the increased number of publications from 2011 onwards, one can point out the expansion of research related to the growing trend in the number of IS-related courses, such as, for example, Library Science, Archival Science, Museology and Management and its aspect of interdisciplinarity on a large scale with other fields of knowledge, as well as in studies of social relations.

The research, based on the 207 works identified, by focusing on the three most productive researchers and the topics covered, indicates the existence of a variety of multidisciplinary and interdisciplinary subjects in the production of scientific articles, such as scientific collaboration, productivity of authors, organization of knowledge, discourse analysis,

information representation, Access to Information Law, copyright, gender and ethics, and showed, through keywords, the expansion of other topics such as digital citizenship, *covid-19*, accessibility and human information behavior.

In this study, it is identified, at a theoretical level, that scientific productions on IS in Brazil are extremely important for scientific advancement in the country, favoring its recognition abroad, as indicated by scientific collaborations with other countries. Thus, in the quantitative and qualitative survey, the participation of these elements showed the advancement that IS has perpetuated in the scientific community both at a national and international level.

It is also noted that there is a considerable interdisciplinary trend in research, as different areas of knowledge have been working together with IS, in addition to Social Sciences such as Computer Science, Health Science, Engineering, Environmental Science, Agricultural Sciences, and Linguistics.

The data obtained in this research showed that IS in Brazil has been increasingly evolving over the last fifty years of studies in the country, both in institutional, interdisciplinary aspects, which is its essence, and in scientific collaboration, that is, in groups of national and international authors, also taking into account foreign countries.

Therefore, future investigations into Brazilian scientific publications in IS are recommended, that is, research into other scientific knowledge databases. Therefore, studies like this allow one to see that Information Science is in constant social, economic and political construction, based on information, which is its vocation.

REFERENCES

ALVARADO, R. U. A Bibliometria no Brasil. **Ciência da Informação**, Brasília, v. 13, n. 2, p. 91–105, 1984. Available at: http://revista.ibict.br/ciinf/article/view/200. Access on: 10 abr. 2022.

ARAÚJO JÚNIOR, R. H.; SOUSA, R. T. B. Estudo do ecossistema de Big Data para conciliação das demandas de acesso, por meio da representação e organização da informação. **Ciência da Informação**, Brasília, v. 45, n. 3, p.187-198, 2018. DOI: 10.18225/ci.inf.v45i3.4057. Available at: http://revista.ibict.br/ciinf/article/view/4057. Access on: 10 abr. 2022.

ARAÚJO, C. A. V.; VALENTIM, M. L. P. A ciência da Informação no brasil: mapeamento da pesquisa e cenário institucional. Bibliotecas. **Anales de Investigación**, [*s. l.*], v. 15, n. 2, p. 232-259, 2019. Available at: http://hdl.handle.net/20.500.11959/brapci/112206. Access on: 10 abr. 2022.

BASTIAN, M.; HEYMANN, S.; JACOMY, M. Gephi: an open-source software for exploring and manipulating networks. *In*: INTERNATIONAL ICWSM CONFERENCE, 3., 2009, San Jose. **Proceedings** [...]. San Jose: Association for the Advancement of Artificial Intelligence, 2009.

BUFREM, L. S.; PRATES, Y. O saber científico registrado e as práticas de mensuração da informação. **Ciência da Informação**, Brasília, v. 34, n. 2, p. 9-25, 2006. DOI: 10.18225/ci.inf.v34i2.1086. Available at: http://revista.ibict.br/ciinf/article/view/1086. Access on: 7 abr. 2022.

FREITAS, M. H. A. Considerações acerca dos primeiros periódicos científicos brasileiros. **Ciência da Informação**, Brasília, v. 35, n. 3, p. 54-66, 2007. DOI: 10.18225/ci.inf.v35i3.1113. Available at: http://revista.ibict.br/ciinf/article/view/1113. Access on: 7 abr. 2022.

GOMES, H. E. Como vai o sistema de comunicação na Ciência da Informação?. **Ciência da Informação**, Brasília, v. 10, n. 1, p. 71-73, 1981. Available at: http://revista.ibict.br/ciinf/article/view/163. Access on: 10 abr. 2022.

GUIMARÃES, J. A. C. Análise de domínio como perspectiva metodológica em organização da informação. **Ciência da Informação**, Brasília, v. 43, n. 1, p.13-21, 2015. DOI: 10.18225/ci.inf.v43i1.1415. Available at: http://revista.ibict.br/ciinf/article/view/1415. Access on: 10 abr. 2022.

MEADOWS, A. J. **A comunicação científica**. Brasília: Briquet de Lemos, 1999.

PINHEIRO, L. V. R. **A Ciência da Informação entre sombra e luz**: domínio epistemológico e campo interdisciplinar. 1997. 276 f. Tese (Doutorado) – Escola de Comunicação, Centro de Filosofia e Ciências Humanas, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 1997. Available at: https://ridi.ibict.br/bitstream/123456789/35/1/lenavaniapinheiro1997.pdf. Access on: 10 abr. 2022.

PINHEIRO, L. V. R. Cenário da Pós-graduação em Ciência da Informação no Brasil, influências e tendências. *In*: Encontro Nacional de Pesquisa em Ciência da Informação, 8., 2007, Salvador. **Anais** [...]. Salvador: ANCIB, 2007. p. 1-14. Available at: http://www.enancib.ppgci.ufba.br/artigos/GT1—226.pdf. Acesso em 11 abr. 2022.

PINHEIRO, L. V. R. Gênese da Ciência da Informação ou sinais anunciadores da nova área. *In*: AQUINO, Miriam de Albuquerque (org.). **O campo da Ciência da Informação**: gênese, conexões e especificidades. João Pessoa: Universitária/UFPB, 2002.

PRITCHARD, A. Statistical bibliography or bibliometrics?. **Journal of Documentation**, London, v. 25, n. 4, p. 348-349, dec. 1969.

QUEIROZ, D. G. C.; MOURA, A. M. M. Ciência da Informação: história, conceitos e características. **Em Questão**, Porto Alegre, v. 21, n. 3, p. 26–42, 2015. DOI: 10.19132/1808-5245213.26-42. Available at: https://seer.ufrgs.br/index.php/EmQuestao/article/view/57516. Access on: 10 abr. 2022.

RUSSO, M. **Fundamentos de biblioteconomia e Ciência da Informação**. Rio de Janeiro: E-papers, 2010. Available at: https://pt.scribd.com/doc/108500908/Fundamentos-de-Biblioteconomia-e-Ciencia-da-Informacao. Access on: 10 abr. 2022.

SARACEVIC, T. Ciência da informação: origem, evolução e relações. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 1, n. 1, mar. 2008. Available at: https://periodicos.ufmg.br/index.php/pci/article/view/22308. Access on: 10 abr. 2022.

SILVA, J. L. C.; FREIRE, G. H. A. Um olhar sobre a origem da ciência da informação: indícios embrionários para sua caracterização identitária. **Encontros Bibli**: Revista Eletrônica de Biblioteconomia e Ciência da Informação, Brasília, v. 17, n. 33, p. 1-29, 2012. DOI: 10.5007/1518-2924.2012v17n33p1. Available at: https://periodicos.ufsc.br/index.php/eb/article/view/1518-2924.2012v17n33p1/21708. Access on: 10 abr. 2022.

TRISTÃO, A. M. D.; FACHIN, G. R. B.; ALARCON, O. E. Sistemas de classificação facetados e tesauros: instrumentos para organização do conhecimento. **Ciência da Informação**, Brasília, v. 33, n. 2, 2004. DOI: 10.18225/ci.inf.v33i2.1058. Available at: http://revista.ibict.br/ciinf/article/view/1058. Access on: 10 abr. 2022.

Correlations between representation theory and intentionality theory: contributions to information findability

Fernanda Alves Sanchez
PhD student in Information Science at Universidade Estadual Paulista (Unesp), Marília, São Paulo, Brazil.
https://orcid.org/0000-0003-1543-2773

Fabiano Ferreira de Castro
PhD in Information Science, Universidade Estadual Paulista (Unesp), Marília, São Paulo, Brasil. Professor of Information Science at Universidade Federal de São Carlos (UFSCar), São Carlos, São Paulo, Brazil.
https://orcid.org/0000-0002-8712-2654

Fernando Luiz Vechiato
PhD in Information Science, Universidade Estadual Paulista (Unesp), Marília, São Paulo, Brasil. Professor of Information Science at Universidade Federal do Rio Grande do Norte (UFRN), Natal, Rio Grande do Norte, Brazil.
https://orcid.org/0000-0002-4157-740X

Silvana Aparecida Borsetti Gregorio Vidotti
PhD in Education, Universidade Estadual Paulista (Unesp), Marília, São Paulo, Brasil. Professor at the Information Science Graduate Program (PPGCI), Universidade Estadual Paulista (UNESP), Marília, São Paulo, Brazil.
https://orcid.org/0000-0002-4216-0374

Submitted on: 07/04/2022. Approved on: 12/04/2024. Published on: 06/21/2024.

ABSTRACT

The Theories of Representation and Intentionality have emerged from various fields of knowledge, including Psychology, Philosophy, and Cognitive Sciences. Within the realm of Information Science, the concept of Information Representation has gained widespread acceptance, while studies on Intentionality Theory remain relatively limited. In light of the post-custodial paradigm, informational subjects are recognized as active participants in the socio-informational landscape, employing their intentionality to produce, organize, represent, and seek information across diverse digital information environments. This research endeavors to identify the correlations between Representation and Intentionality Theories within the context of Information Science, examining their contributions to Information Findability. Information Findability encompasses a theoretical-practical approach to designing, implementing, and evaluating information environments. This study adopts a bibliographical and exploratory approach, employing qualitative methods and utilizing databases such as the Coordination for the Improvement of Higher Education Personnel (CAPES) Periodicals Portal, the Information Science Database (BRAPCI), and Google Scholar. The research findings reveal correlations between Representation and Intentionality Theories, highlighting the significance of these theoretical underpinnings in enhancing Information Findability. In conclusion, the study underscores the need for further exploration of Intentionality

in Information Science, given the scarcity of research in this area and its relevance in incorporating the informational subject's perspective into the concept of Information Findability.

Keywords: information representation; intentionality of informational subjects; digital information environments; information findability.

INTRODUCTION

Etymologically, the meaning of the word “representation” refers to the act of making something, someone, or an idea present through another object. According to Makowiecky (2003), until the birth of the sciences with Descartes, the etymology of the word “representation” was linked to the relationship between things that occur by similarity. Thomas Aquinas, an Italian philosopher and theologian, stated that “To represent a thing is to contain the likeness of that thing.”

Within this context, the concept of representation originates from the Theory of Representation, which has been developed in various areas of knowledge. In this study, the focus is on Psychology due to its points of correlation with studies in Theory of Intentionality within the realm of Information Science.

The Theory of Intentionality, in turn, is deemed the core doctrine of Phenomenology, which is characterized by the search for the essence of things in harmony with experience through the senses, “[...] configura a raiz dos atos da consciência e da intencionalidade”. (Prado, 2013, p. 2)[1]. In Husserl’s Phenomenology (2012, p. 332)[2], it is understood that the “[...] própria consciência é a complexão das vivências [...]”, meaning a large collection of life experiences.

Within the domain of Information Findability (IF), the Theory of Intentionality supports the principle that “[...] importância em se enfatizar as experiências e habilidades dos sujeitos informacionais no projeto de ambientes e sistemas de informação.” (Vechiato; Oliveira; Vidotti, 2016, p. 7)[3], This principle is recognized as one of the thirteen attributes of Effective Information (EI), specifically named the Intentionality of informational subjects.

The central question driving this paper arises from a desire to explore how the interplay between the Theory of Representation and the Theory of Intentionality might enhance Information Findability (IF) in digital contexts. Consequently, this paper aims to identify and analyze the correlations between these two theories to determine how the dialogue between them could enhance IF, particularly within digital informational environments.

METHODOLOGY

The methodological procedures for this exploratory research, which adopts a mixed qualitative and quantitative approach, were initially established in September 2021 and subsequently refined during a review in April 2023. These procedures utilized databases well-recognized for their qualitative and quantitative rigor and significance in the scientific community. Notable sources included the Portal de Periódicos of the Coordenação de

1 Translation: “[...] constitutes the root of the acts of consciousness and intentionality”. (Prado, 2013, p. 2, editorial translation).
2 Translation: “[...] consciousness itself is the complex of experiences [...]” (Husserl, 2012, p. 332, editorial translation).
3 Translation: “importance of emphasizing the experiences and skills of informational subjects in the design of information environments and systems” (Vechiato; Oliveira; Vidotti, 2016, p. 7, editorial translation).

Aperfeiçoamento de Pessoal de Nível Superior (CAPES) accessed via Acesso CAFe[4] at the Universidade Estadual Paulista (UNESP), the Base de Dados em Ciência da Informação (BRAPCI), and Google Scholar.

For the bibliographic survey, the keywords used were: Theory of Representation; Theory of Intentionality; Findability of Information; Information Representation; Intentionality and Intentionality of Information Subjects, in Portuguese, English, and Spanish.

The search in the Portal de Periódicos CAPES was conducted using the advanced search engine, starting with the keywords in all three languages, always using quotation marks for compound terms, in the “title” and “subject” fields with the “is exact” filter. In the second line, the Boolean operator “and” was used in the “any field” area, with the “contains” filter within the field of Information Science, to find results relevant to the research scope; the numbers obtained represent the sum of searches in title and subject without year restriction or duplication checks.

The search within the BRAPCI database, which is dedicated to Information Science (CI), did not require area-specific filtering. Keywords were searched in Portuguese, English, and Spanish, with compound terms enclosed in quotation marks. The searches were filtered by ‘title’ and ‘keywords.’ The total number of texts presented excludes duplications, thanks to the database’s built-in feature that automatically selects and verifies metrics to ensure the uniqueness of each entry.

For the Google Scholar search, the advanced search engine was employed without limiting the search by area, as the platform does not support such filters. Search terms were enclosed in quotation marks and searches were specifically limited to the ‘title’ filter. The results reported are raw data, with no restrictions based on publication year or checks for duplication. This approach is beneficial for uncovering literature from various fields of knowledge. Due to Google Scholar’s ranking by relevance and the vast quantity of results, only the first three pages were considered. The relevance of these results was then assessed in relation to the research objectives, focusing on classic texts and those that contribute to interdisciplinary studies within Information Science.

It is crucial to note that this research did not aim to conduct a systematic literature review on each theme. Instead, the objective was to identify and analyze texts that could elucidate connections between theories seldom explored within Information Science. The primary focus was to establish a link between Information Representation – a key area in Information Science–and the Intentionality of informational subjects, which is currently viewed primarily as a facet of Information Findability.

Ongoing research, including a doctoral thesis, indicates that the concept of Intentionality of informational subjects, derived from theoretical frameworks, may emerge as a significant field of study within Information Science. This is particularly pertinent for understanding the roles of informational subjects who are not only consumers but also producers, disseminators, organizers, and representers of information in the digital realm.

4 It is important to note that this type of access is specific to the Unesp domain, as search results may differ across other domains.

Following the data collection from the databases, an exploratory study was conducted to deepen the understanding and comprehension of the scholarship that forms the basis of the paper's theoretical framework. This involved reviewing works by pioneering authors in the Theories of Representation and Intentionality, as well as incorporating insights from other disciplines such as Psychology, Phenomenology, and Philosophy."

We emphasize the study by Sanchez, Vidotti, and Vechiato (2021), which notes that the concept of Intentionality is still emerging in Information Science, both in national and international contexts. As a result, references are limited; in 2021, only eight academic papers specifically addressing the themes of the Theory of Intentionality and Information Science were identified across the databases Portal de Periódicos Capes, BRAPCI, and the Library & Information Science Collection (LISA).

Given the limited research on Intentionality and the objective of this study to correlate it with the Theory of Representation, it is important to recognize the advancements in this area. While the concept of Representation is well-established in Information Science, Intentionality remains an area under development.

In this context, the search results for 'Intentionality' in the Portal de Periódicos Capes and BRAPCI encompass most of the scholarly production in Information Science. A total of twenty-five (25) publications were identified, noting some duplication across and within these databases. This reflects a national increase in relevant publications, including four new papers since the previous survey.

A significant methodological shift from the study by Sanchez, Vechiato, and Vidotti (2021) in this research is the expanded search strategy, which included using 'Intentionality' as a 'subject' term, not just within titles. In the Portal de Periódicos Capes, this approach alone located twelve papers in the subject field, with eleven in English and one in Spanish.

Adhering to the mixed qualitative-quantitative approach of our methologhy, **Table 1** showcases the quantitative findings from the searches conducted in the three languages.

Table 1 – Results of database searches

Keyword	CAPES Journal Portal	BRAPCI	Google Scholar
Teoria da Representação	0	5	38
Representation Theory	25	3	5890
Teoría de la Representación	0	1	115
Representação da Informação	112	215	479
Information Representation	68	67	944
Representación de la Información	13	38	127
Teoria da Intencionalidade	1	1	13
Intentionality Theory	0	0	18
Teoría de la Intencionalidad	0	0	5
Intencionalidade	5	6	450
Intentionality	16	1	7370
Intencionalidad	1	0	1170
Encontrabilidade da Informação	25	32	100
Information Findability	2	12	21
Encontrabilidad de la Información	0	7	1

Source: Created by the authors(2023).

Ultimately, the overall number of references used in this paper totaled thirty-six (36) publications, divided among the subjects of Representation, Intentionality, and Findability in: journal papers, book chapters, master's and doctoral dissertations – all open access. Within this total, the divisions by subject are as follows:

- Nine (9) on the field of Representation in Information Science (IS), four (4) from the area of Psychology, and one (1) from Philosophy, which contributed to the construction of the framework;
- Five (5) on Intentionality in IS, an additional four (4) from the area of Phenomenology, which complements the theoretical framework, and two (2) on elements of Artificial Intelligence that were part of the practical discussions of the research;
- Ten (10) on Findability, which is directly linked to Intentionality by presenting it as an attribute, and two (2) texts developed on Information Architecture of Information (AI), the discipline seen as a solution to Findability issues derived from AI;
- Two (2) texts on Information as a phenomenon and Informational Subjects, which were included to highlight and contextualize relationships between the Theory of Representation and Information Representation in IS, as well as to clarify the use of the term Informational Subjects (linked to Intentionality).

After outlining the methodological procedures of the study, the subsequent sections will present the results of the bibliographic survey and the development of theoretical frameworks concerning the Theories of Representation and Intentionality. This discussion aims to contribute both theoretically and practically to the field of Information Science.

Theory of representation and the representation of informations

Representation Theory is prominent in various fields, especially those examining the cognitive aspects of individuals. The act of representation is intrinsically linked to human beings and their brain structure, which facilitates associations that are textual, visual, acoustic, and even related to smells, sensations, emotions, and memories, etc.

Fields such as Philosophy, Psychology, and Cognitive Sciences provide valuable perspectives and foundational theories for understanding Representation. Notable figures in this area include Arthur Schopenhauer, a 19th-century German philosopher known for his profound influence; Serge Moscovici, a French psychologist; and Denise Jodelet, a French philosopher and notable researcher in Psychology.

Schopenhauer is well-known for his 1819 work – *O mundo como vontade e representação*. In his studies, the philosopher addresses discussions involving the understanding of what representations are concerning the subject and object dichotomy: "Ser objeto para o sujeito e ser nossa representação ou imagem mental é a mesma coisa. Todas as nossas representações são objetos do sujeito, e todos os objetos do sujeito são nossas representações" (Schopenhauer, 1995, p. 41-42, tradução nossa)[5]. In this context, Schopenhauer understands the general concept of representation as "[...] um objeto que se relaciona necessariamente a um sujeito cognoscente [...]" (Carvalho, 2013, p. 49)[6], implying that the subject is "[...] o único capaz de transcender suas limitações através dos múltiplos conhecimentos que lhe são proporcionados pela sua faculdade cognitiva" (Carvalho, 2013, p. 90)[7]. For Schopenhauer (2005), all knowledge is representation, and the modern philosophical issues concerning the relationship between the ideal and the real hinge on the condition of consciousness.

Among the debates about the different types of representation related to the subject and the object, it is worth highlighting a connection Schopenhauer makes about the Will, which is one of the central themes of his most well-known work. For Schopenhauer, this Will can be attributed, for example, to the acts of the body or to the sensations and feelings of individuals. These discussions can be correlated with the ideas of John Searle, a pioneering philosopher of the Theory of Intentionality, whom we will mention later in the discussions of this research.

5 Original: "Objekt Für Das Subjekt Seyn, Und Unsere Vorstellung Seyn, Ist Das Selbe. Alle Unsere Vorstellungen Sind Objekte Des Subjekts, Und Alle Objekte Des Subjekts Sind Unsere Vorstellungen" (Schopenhauer, 1995, p. 41-42). Translation: "To be an object for the subject and to be our representation or mental image are the same thing. All our representations are objects of the subject, and all the objects of the subject are our representations" (Schopenhauer, 1995, p. 41-42, editorial translation).

6 Translation: "[...] an object that necessarily relates to a knowing subject [...]" (Carvalho, 2013, p. 49, editorial translation).

7 Translation: "[...] he only one capable of transcending his limitations through the multifaceted knowledge provided by his cognitive faculty." (Carvalho, 2013, p. 90, editorial translation).

In summary, Schopenhauer (2005) argues that pain and pleasure are not representations, but rather pathological experiences of the Will manifesting through the body. However, when these bodily sensations are not attributed to the Will, they can become representations. John Searle builds on this idea by examining mental states like feelings, sensations, and beliefs, investigating whether they possess intentionality, which signifies a directedness towards objects or goals.

Serge Moscovici and Denise Jodelet two prominent scholars in the Theories of Social Representations argue that:

> [...] a noção de representação social nos coloca no ponto em que o psicológico e o social se cruzam. Em primeiro lugar, diz respeito à forma como nós, sujeitos sociais, apreendemos os acontecimentos da vida diária, as características do nosso ambiente, informações que nele circulam, às pessoas do nosso meio próximo ou distante (Jodelet, 1986, p. 473, tradução nossa).[8]

Regarding the Theory of Social Representations, Jodelet (2018) in one of her studies, presents the approach of representative phenomena occurring in social life, slightly modifying the intellectual approach to representation. She states that within these spaces of study on representation, it:

> 1) Indica que as representações, como conhecimentos práticos, implicam uma relação inseparável entre um sujeito e um objeto. O sujeito é sempre social, por sua inscrição no espaço das relações sociais e por seu vínculo com o outro. Pode ser um indivíduo ou um grupo que é observado do ponto de vista epistêmico, psicológico ou pragmático. O objeto pode ser humano (e diz respeito a um ou mais atores sociais) ou social (diz respeito a um grupo ou coletivo, ou a um fenômeno que interessa à vida pública ou privada). Também pode pertencer ao universo material ou ideal. 2) Em sua relação com o objeto, a representação está em uma relação de simbolização (e ocorre a dessimbolização) ou de interpretação (atribui um sentido). Em sua relação com o sujeito, a representação tem função expressiva e é produto de uma construção. (Jodelet, 2018, p. 6, tradução nossa)[9].

8 Original: "[...] la noción de representaión social nos sitúa em el punto donde se entersectan lo psicológico y lo social. Antes que nada concierne a la manera cómo nosotros, sujetos sociales, apreendemos los acontecimentos de la vida diária, las características de nuestro médio ambiente, las informaciones que en él circulan, a las personas de nuestro entorno próximo o lejano." (Jodelet, 1986, p. 473). Translation: "[...] the notion of social representation places us at the intersection of the psychological and the social. It first concerns the way we, as social subjects, apprehend the events of daily life, the characteristics of our environment, the information circulating within it, and the people in our close or distant milieu" (Jodelet, 1986, p. 473, editorial translation).

9 Original: "Indica que las representaciones, como saber práctico, implican una relación indisociable entre un sujeto y un objeto. El sujeto es siempre social, por su inscripción en el espacio de relaciones sociales y por su lazo con el otro. Puede tratarse de un individuo o de un colectivo al que se observa desde un punto de vista epistémico, psicológico o pragmático. El objeto puede ser humano (y concernir a uno o más actores sociales) o social (y concernir a un grupo o un colectivo, o a un fenómeno que interese a la vida pública o privada). También puede pertenecer al universo material o ideal. En su relación con el objeto, la representación está en una relación de simbolización (y tiene lugar desimbolización) o de interpretación (le asigna un significado). En su relación con el sujeto, la representación tiene una función expresiva y es el producto de una construcción." (Jodelet, 2018, p. 6). Translation: "1) Indicates that representations, as practical knowledge, imply an inseparable relationship between a subject and an object. The subject is always social, due to their inscription in the space of social relations and their connection with others. The subject can be an individual or a group observed from an epistemic, psychological, or pragmatic point of view. The object can be human (concerning one or more social actors) or social (concerning a group or collective, or a phenomenon that interests public or private life). It can also belong to the material or ideal universe.
2) In its relationship with the object, the representation is in a relationship of symbolization (and desymbolization occurs) or interpretation (assigning meaning). In its relationship with the subject, the representation has an expressive function and is the product of a construction." (Jodelet, 2018, p. 6, editorial translation).

Similar to Schopenhauer's ideas on the Will and Searle's concept of intentionality, Moscovici and Jodelet's research on social representations strengthens the notion of "informational subjects." Their work highlights how a subject's cognitive background, shaped by social contexts, influences their intentionality. In other words, the information we acquire through social interactions plays a role in directing our thoughts and actions.

Thus, the approach of Representation Theory in this text emphasizes the treatment of information as a human and social phenomenon, "[...] que compreende tanto o dar forma a ideias e a emoções (informar), como a troca, a efectiva interacção dessas ideias e emoções entre seres humanos (comunicar)". (Silva, 2006, p. 150)[10].

As previously mentioned, there are schools of thought within Psychology that have contributed to the development of studies on Representation. The psychoanalyst Sigmund Freud coined the concept of Representation Theory, with his discussions beginning in 1891 with his work titled "Sobre a concepção das afasias".

According to Peres, Caropreso, and Simanke (2015, p. 163, emphasis added)[11], Freud establishes an argument that is "[...] persuasivo, sistemático e bem fundamentado para a transformação da psicologia de uma ciência da consciência em uma ciência das **representações mentais conscientes** e **inconscientes"**.

Following this line, Representation Theory comprises two concepts: "word representation" and "object representation," which can be defined as follows:

> A **representação de palavra** corresponderia a um complexo associativo constituído por imagens acústicas, visuais, quirocinestésicas e glossocinestésicas cujo elemento acústico seria o principal fator organizador. A **representação de objeto** também corresponderia a um complexo associativo composto por imagens sensoriais variadas no qual o elemento organizador seria, mais frequentemente, a imagem visual. (Peres; Caropreso; Simanke, 2015, p. 164, grifo nosso)[12].

Regarding "word representation," according to Andrade (2016, p. 282), "[...] when the connection of the word with the representation of the object is established, the language apparatus articulates representations that produce a meaning".

The concept of "object representation" was later reformulated as "thing representation." As Andrade (2016) argues, this shift goes beyond mere terminology. It reflects a move from a neurological to a psychoanalytic theoretical framework. The "thing representation" is now directly linked to the content of the unconscious:

10 Translation: "[...] which encompasses both the shaping of ideas and emotions (informing) and the exchange, the effective interaction of these ideas and emotions between human beings (communicating)."(Silva, 2006, p. 150, editorial translation).

11 Translation : "persuasive, systematic, and well-founded [argument] for the transformation of psychology from a science of consciousness into a science of conscious and unconscious mental representations" (Peres; Caropreso; Simanke. 2015, p. 163, emphasis added, editorial translation).

12 Translation: "The **representation of word** would correspond to an associative complex consisting of acoustic, visual, chirokinesthetic and glossokinesthetic images whose acoustic element would be the main organizing factor. The **object representation** would also correspond to an associative complex composed of varied sensory images in which the organizing element would, most often, be the visual image. " (Peres; Caropreso; Simanke, 2015, p. 164, emphasis added, editorial translation).

> [...] provêm de, ou remetem a, representações sensoriais, porém o conteúdo das mesmas não é determinado pela coisa representada. A representação aqui se distingue do traço mnêmico, uma vez que a primeira reinveste, reaviva, este traço, que em si mesmo não é mais do que a impressão de um acontecimento. (Arnao, 2008, p. 197)[13].

The literature reveals the complexity surrounding Representation Theory, largely due to its origins in the cognitive background of informational subjects. These subjects are shaped by a multitude of conditions and circumstances that influence their development of skills, competencies, experiences, and knowledge.

In line with these perceptions, it is worth noting that since the inception of studies within the scope of Information Science (IS), research related to Representation Theory has been developed. These studies are found under different perspectives, such as Archival Information Representation, Knowledge Representation, Social Representation, Documentary Representation, Thematic Information Representation, and the most well-known, Information Representation.

Souza e Ramalho (2019, p. 143)[14] state that representations are responsible for grounding "[...] o entendimento humano sobre o funcionamento da vida e do mundo, são formas desenvolvidas para codificar a natureza e as relações entre os seres para uma linguagem assimilável à razão". Lima e Alvares (2012, p. 21)[15] concur, defining representing as "[...] ato de utilizar elementos simbólicos – palavras, figuras, imagens, desenhos, mímicas, esquemas, entre outros – para substituir um objeto, uma ideia ou um fato".

Additionally, Novellino (1998, p. 137)[16] onceptualizes Information Representation as:

> [...] a substituição de uma entidade linguística longa e complexa – o texto de um documento – por sua descrição abreviada. Sua função é demonstrar a essência do documento. A representação da informação é um processo primeiro da transferência da informação e necessário para enfatizar o que é essencial no documento, considerando sua recuperação.

Thus, information representation is directly linked to the speed and success with which users can access and utilize information. The retrieval, findability, and appropriation of information depend on enriched forms of representation with structures tailored to specific environments, ensuring a satisfactory user experience in accessing the desired information (Castro, 2008).

13 Translation: "[...] they come from or refer to sensory representations, but their content is not determined by the represented thing. The representation here is distinguished from the memory trace, as the former reinvests, revives this trace, which in itself is nothing more than the impression of an event." (Arnao, 2008, p. 197, editorial translation)

14 Translation: "[...] human understanding of the functioning of life and the world; they are forms developed to encode nature and relationships between beings into a language assimilable to reason". (Souza; Ramalho, 2019, p. 143, editorial translation).

15 Translation: "[...] the act of using symbolic elements – words, figures, images, drawings, mimics, schemes, among others – to substitute an object, an idea, or a fact." (Lima; Alvares, 2012, p. 21, editorial translation).

16 Translation: "[...] the substitution of a long and complex linguistic entity – the text of a document – its abbreviated description. Its function is to convey the essence of the document. Information representation is a primary process of information transfer and is crucial for emphasizing what is essential in the document, particularly for its retrieval." (Castro, 2008, p. 75, emphasis added, editorial translation).

Makowiecky (2003, p. 23)[17] suggests that it is within representation that individuals "[...] encontra reflexos do seu próprio pensar". In the context of a socioinformational environment, individuals are considered informational subjects – diverse and active agents who produce, interpret, appropriate, and mediate information in their daily lives, both individually and collectively within society (Carmo & Araújo, 2020).

Within digital informational environments, these subjects:

> [...] ao interagirem com um determinado ambiente, devem ter em mente algum tipo de representação de segmentos deste ambiente, ou seja, ter **representações internas**. Em contrapartida, temos as **representações externas**, ou seja, manipulações que operam as representações numa externalização do comportamento do sujeito que poderia conduzir a estabilidade entre o sujeito e o ambiente. (Castro, 2008, p. 75, grifo do autor)[18].

The role of informational subjects amidst constant societal changes, particularly in the realm of Information and Communication Technologies (ICT), is crucial. These subjects constantly consume and produce information, and as Massoni and Luis note, "[...] ao acessarmos uma **informação** em qualquer prática cotidiana, estamos acessando uma **representação** sobre aquilo que é informado", (Massoni; Luis, 2018, p. 76, grifo nosso)[19].

Therefore, digital informational environments must offer effective forms of representation to ensure findability and, most importantly, to enable the appropriation of information and the subsequent generation of knowledge by socioinformational subjects. As Marcondes aptly puts it, "De nada adianta a informação existir, se quem dela necessita não sabe da sua existência, ou se ela não puder ser encontrada" (Marcondes, 2001, p. 61)[20].

The theory of intentionality and the intentionality of informational subjects

The Theory of Intentionality is intertwined with Phenomenology, which emerged in the mid-20th century through the works of Edmund Husserl, Heidegger, Merleau-Ponty, and Brentano. It continued into the 21st century with Post-Phenomenology, featuring theoretical studies stemming from IDHE (Oliveira, 2014; Marandola Jr., 2013; Figueiredo, 2012).

At the core of Phenomenology lies the doctrine of Intentionality, adhering to the school of thought that "[...] cada ato de consciência que nós realizamos, cada experiência que nós temos, é intencional: é essencialmente 'consciência de' ou uma 'experiência de' algo ou

17 Translation: "[...] find reflections of their own thinking" (Makowiecky, 2003, p. 23, editorial translation).

18 Translation : "[...] when interacting with a certain environment, must have in mind some type of representation of segments of this environment, that is, have **internal representations**. On the other hand, we have **external representations**, that is, manipulations that operate the representations in an externalization of the subject's behavior, which could lead to stability between the subject and the environment " (Castro, 2008, p. 75, emphasis added, editorial translation).

19 Translation : "[...] when we access **information** in any daily practice, we are accessing a **representatio**n of what is informed" (Massoni; Luis, 2018, p. 76, emphasis added, editorial translation).

20 Translation : "It is useless for the information to exist if those who need it do not know of its existence or if it cannot be found" (Marcondes, 2001, p. 61, editorial translation).

de outrem". (Sokolowski, 2004, p. 17)[21]. Within this perspective, Husserlian Intentionality or Phenomenological Intentionality is "[...] **visada de consciência e produção de um sentido** que permite perceber os fenômenos humanos em seu teor vividos" (Husserl, 2008, pp. 28-29, grifo do autor)[22].

Thus, consciousness is Intentionality and should be conceived as meaning – initially as sense, then direction, and finally, signification. Therefore, "[...] consciência não é coisa, mas é aquilo que dá sentido às coisas. O sentido não se constata à maneira de uma coisa, mas se interpreta" (Husserl, 2008, p. 30)[23].

Alongside the central idea of Phenomenology, concerning the human-world relationship through the intentionality of subjects, Post-Phenomenology emerges with the human-[technology]-world relationship. Given the need for studies focused on concerns with the world and mediations through technological tools, this school of thought can contribute, for example, to research related to information seeking (Figueiredo, 2012).

John Searle, a philosopher and pioneer in the study of Intentionality Theory, states on one of his books covers that "[...] representação de uma sentença deriva da Intencionalidade da mente". Searle considers sentences to be intentional states, containing intrinsic states of the human mind, such as beliefs and desires. These sentences can be "[...] os sons emitidos pela boca ou os sinais gráficos que se fixam no papel" (Searle, 2002, p. 8)[24].

When discussing Intentionality, we often associate it with the notion of intention in the sense of action, purpose, desire, etc. However, Searle (2002, p. 4)[25] asserts that: "[...] intencionalidade é direcionalidade; ter a intenção de fazer algo é apenas uma forma de Intencionalidade entre outras". In a preliminary definition of Intentionality, Searle (2002, p. 18) [26] argues that: "[...] chave para o entendimento da representação está nas condições de satisfação. Todo estado Intencional com uma direção de ajuste é uma representação de suas condições de satisfação".

Given this definition, it's necessary to understand the elements that comprise Intentionality. Inherent to this concept, we have mental states and intentional states, which, although related, are not identical.

Miranda (2018, p. 42), based on Searle's (2002) discussions, exemplifies these states:

> Em primeiro lugar, nem todos os estados mentais são estados intencionais, como por exemplo, alguns estados de ansiedade, exaltação e melancolia. Em segundo lugar, é preciso distinguir Intencionalidade e consciência, pois ter consciência de algumas sensações, como a ansiedade, não significa que ela esteja direcionada para algo, ou

21 Translation: "[...] "each act of consciousness we perform, each experience we have, is intentional: it is essentially 'consciousness of' or an 'experience of' something or someone" (Sokolowski, 2004, p. 17, editorial translation).

22 Translation: "[...] **the aiming of consciousness and the production of a meaning** that allows us to perceive human phenomena in their lived content" (Husserl, 2008, pp. 28-29, emphasis on the original, editorial translation).

23 Translation: "[...] consciousness is not a thing, but that which gives meaning to things. Meaning is not ascertained like a thing, but interpreted" (Husserl, 2008, p. 30, editorial translation).

24 Translation: "[...]the representation of a sentence derives from the Intentionality of the mind". "[...] the sounds emitted by the mouth or the graphic signs that are fixed on paper" (Searle, 2002, p. 8, editorial translation).

25 Translation: "[...] intentionality is directionality; having the intention to do something is just one form of Intentionality among others" (Searle 2002, p. 4, editorial translation).

26 Translation: "[...] the key to understanding representation lies in the conditions of satisfaction. Every Intentional state with a direction of fit is a representation of its conditions of satisfaction." (Searle, 2002, p. 18, editorial translation).

> seja, que possua Intencionalidade. Em terceiro lugar, o sentido de tencionar algo não significa que há uma direcionalidade com algo ou que as crenças sejam Intencionais. (Miranda, 2018, p. 42)[27].

Regarding mental and intentional states, Searle (2002) posits that both occur only within what he defines as the **Network** and the **Background**. Furthermore, according to Carvalho (2021), it is not possible to experience a mental or intentional state in isolation, as this experience is supported by a network of other states.

Searle understands the Background as a "[...] conjunto de capacidades mentais não-representacionais que permite a ocorrência de toda representação" (Searle, 2002, p. 198)[28]. This Background can be divided into two aspects: the **basic or deep Background**, related to the biological constitution of the human being (abilities, competencies, behaviors); and the **local Background**, which encompasses experiences acquired culturally in social life, meaning these capacities are acquired and can be influenced by context (social, cultural, political, technological, etc.) (Searle, 2002; Carvalho, 2021).

The conditions of satisfaction are directly linked to what Miranda (2018) calls the process-product, which encompasses both the requirement and the thing required. Within the perspective of IS studies, an example of this situation refers to the information-seeking process and the desired IE by the subject. Thus, by understanding the informational needs of subjects (their representation of intentionality), we can meet their conditions of satisfaction within a digital informational environment.

Given these explanations, we can understand that Intentionality precedes the concepts of Representation and deepens the entire process involving the act of representing something. In this sense, intentional states can be understood as representative contents. Speech acts, for example, are representations of the intentional states of subjects, even though Intentionality is not solely linguistic, as observed from the definition of sentences presented earlier.

Speech acts as a representative state of Intentionality are composed of three points: I) the direction of fit; II) sincerity when expressing a speech act with propositional content; and III) the conditions of satisfaction. The first point, direction of fit, is related to the purpose of the speech act, characterized as statements, descriptions, and assertions (assertive speech acts) and orders, commands, and requests (directive speech acts). The second, sincerity when expressing a speech act with propositional content, pertains to the content of the speech act, characterized as propositional content (desires, doubts, beliefs) or its representative content. A speech act can be insincere, ironic, or even a lie – in this case, there is no direction of fit, and the propositional content becomes presupposed by the other. The third point, the

27 Translation: "Firstly, not all mental states are intentional states, such as some states of anxiety, excitement, and melancholy. Secondly, it's necessary to distinguish between Intentionality and consciousness, as being aware of certain sensations, like anxiety, doesn't mean it's directed towards something, that is, that it possesses Intentionality. Thirdly, the sense of intending something doesn't mean there's directionality towards something or that beliefs are Intentional." (Miranda, 2018, p. 42, editorial translation).

28 Translation: [...] set of non-representational mental capacities that allows for the occurrence of all representation." (Searle, 2002, p. 198, editorial translation).

conditions of satisfaction, is linked to the success of the speech act, meaning the fulfillment or understanding when making a statement or an order. These conditions are internal to the intentional states (Miranda, 2018).

Thus, Searle (2002, p. 244)[29] states that the "[...] principal função derivada da Intencionalidade pela linguagem é, obviamente, sua capacidade de representar". Therefore, if a:

> [...] representação é algo que está no lugar de outra coisa, e por conseguinte é intencional e, ao mesmo tempo tanto as representações de palavra, que não remetem a uma única coisa, nem as representações de coisa a um único traço mnêmico ou objeto indiferente à maneira de objetivo, então o próprio conceito de intencionalidade se torna mais complexo e, com ele, o de significado. (Arnao, 2008, p. 200)[30].

As for the perspective of meaning, Searle (2002) suggests that there are two aspects to the intentions of signification: the intention to represent and the intention to communicate. In this context, "[...] para a consciência, o objeto seria nada, se ela não consumasse um representar que o fizesse precisamente objeto e tornasse, assim, possível que ele fosse também objeto de sentimento, de desejo etc." (Husserl, 2012, p. 368)[31].

In the field of Information Science, the intention to represent occurs with the possibility of adjustments in communication processes, aiming to meet the informational needs and facilitate the appropriation of information by subjects. In other words, information is our object.

Bringing the discussions about the Theory of Intentionality to an approach from the perspective of human-social Information within the scope of IS, it is evident that few studies have been developed. Miranda (2010), in her thesis, was the first to address the theory in this area. The author develops discussions about information as a property in the context of Intentionality and Findability – the English term for the concept of IF. Regarding IF, the author addresses the definition of the concept of Intentionality for Findability, which:

> [...] significa *direcionalidade* de informação e se funda na experiência de cada sujeito (*user experience* para controle na produção, organização e partilha de informação); a informação que é produzida é sempre *acerca de e dirigida a*, isto é, um sujeito, com a sua experiência, cria informação acerca de e dirigida a para atingir seus objetivos. E é nesse sentido, da capacidade da experiência do usuário, da consciência Intencional, que se baseia a *web* da inovação, do paradigma atual (Miranda, 2010, p. 273)[32].

29 Translation: "[...] the main function derived from Intentionality by language is, obviously, its capacity to represent" (Searle 2002, p. 244, editorial translation).

30 Translation: "[...] representation is something that stands in place of something else, and is therefore intentional, and at the same time both word representations, which do not refer to a single thing, nor thing representations to a single mnemonic trace or object indifferent in the manner of an objective, then the very concept of intentionality becomes more complex and, with it, that of meaning" (Arnao, 2008, p. 200, editorial translation).

31 Translation: "[...] for consciousness, the object would be nothing if it did not accomplish a representation that precisely made it an object, thus allowing it to also be an object of feeling, desire, and other experiences." (Husserl, 2012, p. 368, editorial translation).

32 Translation: "[...] means directionality of information and is based on the experience of each subject (user experience for control in the production, organization, and sharing of information); the information that is produced is always about and directed to, that is, a subject, with their experience, creates information about and directed to achieve their goals. And it is in this sense, of the capacity of the user's experience, of the Intentional consciousness, that the web of innovation, of the current paradigm, is based." (Miranda, 2010, p. 273, editorial translation).

Following Miranda's (2010) thesis, Vechiato (2013), addresses the concept of IF and the theme of the Theory of Intentionality through the creation of the attribute **Intentionality of Informational Subjects**, which is loaded with,

> [...] experiências, necessidades e competências (tanto as informacionais quanto as tecnológicas), entendimento, cognição e satisfação, fornecendo, inclusive, subsídios para a estruturação de sistemas e ambientes informacionais (Vechiato; Vidotti, 2014, p. 113)[33].

IF is connected to the concept of Architecture of Information (AI): both terms employ a conceptual and operational approach regarding the design, implementation, and evaluation of digital informational environments (Brandt; Vechiato; Vidotti, 2018). For Vechiato and Vidotti, IF occurs in two intances: "[...] a partir da busca prévia de informação por meio da **navegação** ou de estratégias de pesquisa em um **mecanismo de busca** (*Search Engine*), as quais, em um primeiro momento, são realizadas via palavras-chave" (Vechiato; Vidotti, 2014, p. 110, ephasis added)[34]. Its application should be viewed based on both the potential of the **functionalities** and the quality of informational resources inserted into an information system, as well as on the **characteristics and behaviors of informational subjects** (Vechiato & Vidotti, 2014).).

In line with the importance that Miranda (2010) places on the subject in her definition of Intentionality, Vechiato and Vidotti (2014) state that, for Intentionality to sustain IF, informational subjects have the role of being mediators in all processes of infocommunicational flow and mediation – "[...] deriva dos termos informação e comunicação, explicando que só há informação se ela estiver inserida em um processo de comunicação" (Custódio; Vechiato, 2016, p. 3)[35].

In this context, Intentionality is not isolated but rather contingent on relationships. Thus, within the scope of Intentionality, several actors come into play: the information seeker, information professionals, the information producer, the informational space, the type of information, language, the material embodying the information, the context, the forms of information representation, and others.

To provide a foundation for the discussions on the correlations between the Theory of Intentionality and the Theory of Representation, and their contributions to digital informational environments through the perspective of IF, it is necessary to present **Table 2**, which establishes IF's thirteen (13) attributes.

33 Translation: "[...] experiences, needs, and competencies (both informational and technological), understanding, cognition, and satisfaction, even providing subsidies for the structuring of information systems and environments." (Vechiato; Vidotti, 2014, p. 113, editorial translation).

34 Translation: "[...] rom the prior search for information through **navigation** or search strategies in a **search engine**, which, at first, are performed via keywords" (Vechiato; Vidotti, 2014, p. 110, added emphasis, editorial translation).

35 Translation: "[...] derives from the terms information and communication, explaining that there is only information if it is inserted in a communication process" (Custódio; Vechiato, 2016, p. 3, editorial translation).

Table 2 – Attributes of Information Findability (AEI)

Attribute	Description
Navigational Taxonomies	Used in top-down organizational structures, they refer to the organization of informational categories to facilitate navigation and the discovery of information. These categories, for example, are usually organized in menus or in the body of web pages, in communities and collections of repositories, or in captions used for subject description on library shelves, organized in advance from a classification system. According to Aquino, Carlan, and Brascher (2009), navigational taxonomies should be supported by the following aspects: coherent categorization of subjects in relation to the understanding of subjects; terminological control to reduce ambiguity; hierarchical relationship between terms; and multidimensionality, allowing a term to be associated with more than one category according to the context of use.
Terminological Control Instruments	Include controlled vocabularies, such as thesauri and ontologies, to support the representation of informational resources.
Folksonomies	Related to the social organization of information, they allow subjects to classify informational resources, as well as find information through navigation (a tag cloud, for example) or search mechanisms, expanding access possibilities. They are used in bottom-up organizational structures. When associated with controlled vocabularies and semantic technologies, they enhance the possibilities of information findability..
Metadata	Comprise the representation of informational resources and are stored in databases for information retrieval purposes.
Mediation of Computer Scientists	Associated with the development of systems, devices, databases, and interfaces using computational languages, aiming at information management and retrieval.
Mediation of Information Professionals	Occurs in informational environments where there are institutional subjects involved in the selection, structuring, and dissemination of information.
Mediation of Informational Subjects	Related to the infocommunicational actions that informational subjects undertake in any information systems and environments, for example, regarding the production and organization of information and knowledge in collaborative environments, generated from their knowledge, behavior, and competencies that characterize their Intentionality.
Affordances	Function as incentives and clues that objects possess and provide to subjects to perform certain actions in the environment's interface. These actions are related to orientation, location, findability, access, discovery of information, among others.
Wayfinding	Associated with spatial orientation, using aspects that facilitate the location, findability, and discovery of information through navigation in the environment's interface.
Information Discovery	Conditioned by the other attributes of information findability regarding the facilities that the interface (navigation and/or search mechanisms) offers to find the information appropriate to the subject's informational needs, as well as possible secondary informational needs.
Accessibility and Usability	Related to the system's ability to allow equitable access to information (accessibility) within the scope of the target audience established in a project with facilities inherent to the use of the interface (usability).
Intentionality	The theory of Intentionality underlies the importance of emphasizing the experiences and skills of informational subjects in the design of information environments and systems.

Attribute	Description
Mobility, Convergence, and Ubiquity	Associated with the environment, external to information systems and environments, but including them, making them dynamic and enhancing the possibilities for subjects to find information through different devices and in different contexts and situations.

Fonte: Vechiato, Oliveirae e Vidotti (2016, p. 7).

Observing the composition of these attributes, it becomes evident that Information Representation and the Intentionality of informational actors directly and indirectly influence the thirteen (13) attributes of IF. Both concepts can be understood as structural pillars that affect the performance of a digital information environment in both its user interface and underlying infrastructure.

The Intentionality of Informational actors is manifested through its formalization, which are the forms of representation. Thus, every decision made by an actor within an environment, such as the choice of specific visual and textual elements that influence IF, navigation and discovery, has been shaped by Intentionality. In particular, the concept of Intentionality is intertwined with the Mediation attributes, referred to within the IF concept as: mediation of computer scientists, mediation of information professionals, and mediation of informational actors – as these are attributes linked to human action.

Regarding Information Representation, it's possible to look beyond its conceptual aspect and envision various applicable forms, informational and technological resources that can enhance this environment, such as: the use of open and international metadata standards; the use of Semantic Web technologies like ontologies to improve the terminological control instrument attribute; the use of elements from Artificial Intelligence, such as natural language processing incorporated into the environments' search mechanisms, thereby enriching the information discovery attribute.

PRESENTATION AND DISCUSSION OF RESULTS

This section will present discussions and reflections from two perspectives: theoretical and practical, as well as a table summarizing the study's results regarding the guiding question and objective of this research.

Theoretical Reflections

Based on the literature review presented, it was possible to establish correlations between the theoretical contributions of Representation Theory and Intentionality Theory. Initially, we can begin these discussions by stating that Intentionality precedes the representation

process carried out by informational actors, as it is through intentional states that the representational phenomenon occurs. We can thus say that the Intentionality of informational actors is intrinsic to Information Representation.

It is relevant to present and clarify the importance of the concept of Information Mediation linked to the Theories of Representation and Intentionality. Rojas (2018) states that mediation and intentionality are inseparable, as intentionality supports, directs, and gives meaning to documentary records. Through the attributes presented in **Table 2**, it is noted that the concept of Mediation also occupies an important space in IF, with three (3) of the thirteen (13) attributes dedicated to this act, which are divided into: mediation of computer scientists; mediation of information professionals; and mediation of informational actors.

Thus, considering the relationship of mediation with both theories, we can affirm that the extrinsic mediation of information – which would be like the "product" of mediation – can be understood as the representations within a digital information environment, which will always be imbued with Intentionality, as they are independent of the qualification of the mediator (computer scientist or information professional). As an informational actor has their particularities, in this case, there is an even greater concern regarding professional responsibility and ethics when mediating, to make it possible to transfer and not manipulate information.

In this sense, when we establish the importance of the informational actor and their intentionality when representing information, we must consider that these are multifaceted and complex beings who carry in their cognitive baggage a series of aspects that influence and determine their interpretation upon receiving information. Social, cultural, political, linguistic, and technological aspects intertwine with aspects inherent to human characteristics, such as intelligence, skills, senses, aesthetic perceptions, knowledge, values, desires, feelings (love, hate, happiness, sadness, anxiety) (Rojas, 2018).

Given this complexity, the relevance of information dissemination stands out, as it is a:

> [...] ato social para o qual o reconhecimento do contexto é fundamental. O significado de cada informação não é estabelecido previamente por quem organiza, mas vai sendo estabelecido durante o processo de comunicação, havendo um sentido partilhado de valor, considerando-se, não apenas a essência ou o conteúdo da informação mas, também, seus contextos de produção e os possíveis contextos de uso (Novellino, 1998, p. 138)[36].

In this context, organizing and representing information within a digital information environment must always consider the specific context and target audience. Offering diverse ways to share information is crucial, ensuring the environment is suitable and enriched with various forms of representation, particularly in its interface, thereby enhancing IF. This dynamic

36 Translation: "[...] social act for which the recognition of context is fundamental. The meaning of each piece of information is not established beforehand by the organizer, but is established during the communication process, with a shared sense of value, considering not only the essence or content of the information but also its production contexts and the possible contexts of use" (Novellino, 1998, p. 138, editorial translation).

approach to providing information within a given space caters to diverse information seekers who can interpret the same content or resource differently, particularly due to their unique perspectives (social, affective, or cognitive).

It is essential to clarify that IF is not synonymous with Information Retrieval, as retrieval is just one component of the Findability process (Vechiato & Vidotti, 2014; Roa-Martínez, 2019). IF aligns with the satisfaction an information seeker experiences when their information need is met. This satisfaction stems from the quality and structure of information resource representations within a digital information environment. Information Retrieval, conversely, focuses on the results: the environment must provide the best answers to the user's query; the Findability process can only occur based on the quality of these results.

Revisiting the discussions of psychoanalyst Freud and philosopher Searle, Freud's science of conscious and unconscious representations resonates with Searle's beliefs regarding networks of intentional states and the background of information seekers, thus supporting the assertion that intentionality precedes representations. Additionally, both Freud and Searle extensively discuss the significance of speech and/or language and the power of signification inherent in this act. In this same vein of signification, both engage with the concept of object and visual perceptions. Therefore, despite their complex discussions on consciousness and unconsciousness, it is possible to identify correlations that, when combined, can substantially contribute to the concept of Intentionality of Information Seekers within the field of IS.

Miranda (2018) defines Intentionality as a characteristic of information, classifying it as a process, and from this understanding, it can be evaluated within information systems under the following variables: I) Intentionality: thoughts as beliefs about things; II) Consciousness: experience coupled with subjectivity; III) Privacy: mental states (unique and intimate); and IV) Directionality: continuity.

For the author, information possesses intentionality, from which meanings emerge. In this sense, it is suggested that studies related to information seekers in the IS field should extend beyond mapping search behavior in a digital information environment.

In conclusion, it can be inferred that within Information Science studies, the concepts of Intentionality, Representation, and Mediation are intertwined, and the combined theoretical contributions of each can enrich research on Information Findability, particularly concerning the design of digital information environment projects. The notion that users should participate throughout this entire process, not just in the system evaluation stage after implementation, is advocated here.

Practical Reflection

When discussing different forms of information representation, particularly within the IS field, we find examples of textual and visual elements that enhance information environments, either through their functionalities in interoperating systems or through the ability to standardize computational language models.

The IF attributes, previously presented as foundational for developing digital information environment projects, also assist in the implementation and evaluation of these spaces. In conjunction with these attributes, Vechiato and Vidotti (2014) propose a model and recommendations to facilitate their application in the various existing layers of environment construction.

Within the model, the Intentionality attribute is linked to two moments: information production and search. The authors establish and reaffirm the prevailing paradigm where information seekers are both producers and consumers of information. In this sense, the involvement of information seekers from the outset of digital information environment design can enrich and advance prior and subsequent stages of resource development needed for implementation. This participation can incorporate important aspects of their intentionality, potentially enhancing findability and, consequently, the environment's success.

Information Representation is supported by metadata within the realm of Information Science. According to Landshoff (2010), metadata qualifies information and describes a digital object. Thus, it is:

> [...] uma prática imprescindível para que os recursos sejam localizados. Para tanto, os metadados precisam ser adequados ao que se intenciona disponibilizar, no que se refere às suas características e especificidades. Por outro lado, é relevante certificar-se do uso adequado das estruturas de representação, visando favorecer a descoberta dos dados por máquinas. (Torino; Vidotti; Vechiato, 2020, p. 13)[37].

Metadata is one of the main pillars for the success of a digital informational environment – its application relates to the whole of a project, influencing all stages of operation and IF (search mechanism and/or interface). In this sense, Ferreira (2018, p. 136)[38] points out that "[...] interface é o primeiro contato do usuário com o ambiente e, sendo assim, deve estar programada para permitir experiências significativas"; urthermore, they say that the greater the specifications implemented in an environment, the greater the subject's level of satisfaction.

Given these statements, we can reflect on the applications of the Intentionality of information seekers through textual or even visual representations embodied in some IF attributes. Among them, we find affordances, which are:

> [...] possibilidades/pistas de ação e sua detecção depende de fatores cognitivos – experiências/vivências/memórias, competências, habilidades, isto é, a Intencionalidade do sujeito (Vechiato; Trindade 2020, p. 18)[39].

37 Translation: " [...] an essential practice for resources to be located. For this, the metadata needs to be adequate to what is intended to be made available, regarding its characteristics and specificities. On the other hand, it is relevant to ensure the proper use of representation structures, aiming to favor the discovery of data by machines" (Torino; Vidotti; Vechiato, 2020, p. 13, editorial translation).

38 Translation: "[...] the interface is the user's first contact with the environment and, therefore, must be programmed to allow for meaningful experiences" (Ferreira, 2018, p. 136, editorial translation).

39 Translation: "[...] possibilities/clues for action, and their detection depends on cognitive factors – experiences/memories, competencies, skills, that is, the Intentionality of the subject" (Vechiato; Trindade 2020, p. 18, editorial translation).

From the same perspective, we have the attribute of wayfinding, which consists of the spatial orientation of the individual in certain environments, which is instinctive to humans and establishes the decision-making of subjects (Miranda; Vechiato, 2017).

Thus, it is noted that wayfinding is linked to the attribute of affordances, as subjects "[...] enxergam e **atribuem** aos objetos **funções** mediante a sua Intencionalidade" (Vechiato; Trindade, 2020, p. 18, grifo nosso)[40]. We also have the attribute called folksonomy, a suitable resource for some types of environments. It allows for the application of user Intentionality by enabling them to assign meaning through the social classification of content available within the environment.

Among other resources related to the enrichment of textual representations, notably in search mechanisms, are applications related to the Semantic Web and Artificial Intelligence. These leverage techniques such as machine learning[41] and natural language processing, thus making the Information Retrieval process more semantic, intelligent, and aligned with user needs (Coneglian, 2020).

Searle, in some of his texts, discusses Artificial Intelligence and advocates for the superiority of the human mind in representation, particularly in its semantic capacity. His perspective can be understood through the analysis presented by Carvalho (2021, p. 15) on this topic:

> Searle nos lembra que a nossa mente não é um fenômeno biológico com apenas uma estrutura formal, mas também com um conteúdo semântico. Esse conteúdo semântico foi provavelmente desenvolvido por meio de nossa intencionalidade intrínseca e do *background*. [...] é necessário que esse computador digital possua de fato uma vida mental com as propriedades naturais e biológicas que nossas mentes apresentam, e não que apenas que ele simule ter algumas dessas propriedades mentais (Carvalho, 2021, p. 15)[42].

Nevertheless, semantic improvement within a digital information environment will increasingly facilitate user interaction, and Information Science, in conjunction with Computer Science, can develop studies and applications that enhance this resource to meet the ever-evolving information needs within the digital context.

In summary, Information Representation can be viewed as a cornerstone of Information Findability. Inherent to Information Representation is Intentionality; therefore, it is imperative that digital information environments utilize harmonized, structured, and enriched models, standards, and information resources to ensure Information Findability, thereby fostering information appropriation and the generation of new knowledge.

---

40 Translation: "[...] they see and attribute functions to objects through their Intentionality" (Vechiato; Trindade, 2020, p. 18, added emphasis).

41 "[...] The field of machine learning seeks to create softwares that learn from the experiences the system undergoes." (Coneglian, 2020, p. 92).

42 Translation: "Searle reminds us that our mind is not a biological phenomenon with only a formal structure, but also with semantic content. This semantic content was probably developed through our intrinsic intentionality and background. [...] it is necessary that this digital computer actually has a mental life with the natural and biological properties that our minds present, and not just that it simulates having some of these mental properties" (Carvalho, 2021, p. 15, editorial translation).

RESULTS

The paper addresses theoretical and practical reflections on the Theories of Representation and Intentionality. After presenting the discussions from both perspectives, **Table 3** seeks to present, concisely, the main points of these reflections that correspond to the results of the study.

Table 3 – Correlation between Representation Theory and Intentionality Theory

Results	
I	Intentionality is inherent to the concept of Representation and can be seen as a prior process, since Intentionality is formalized through representations;
II	The concept of Mediation is linked to both theories and is an important pillar to ensure Information Findability;
III	In Information Science, we can find the foundations of Representation Theory in a field of study known as Information Representation: there is an effort in the area to produce, consolidate, and standardize forms of representation; some examples are the studies on: thesauri, controlled vocabularies, ontologies, metadata markup language, etc;
IV	The attributes of Information Findability are fostered by three pillars: the Intentionality of Informational Subjects, the forms of Information Representation, and the processes of Information Mediation; and
V	The concept of communication can be seen as a common objective between the Theories of Representation and Intentionality in the context of Information Science. Thus, the correlations lie in the act of communicating and how this action is loaded with meanings.

Source: Created by the authors (2022).

Finally, the results presented in **Table 3** address the research problem of this study, which aimed to understand how the correlations between both theories could contribute to enhancing IF in digital information environments. These results achieve the proposed objective, presenting the positions of Representation Theory and Intentionality Theory within the Information Science landscape.

CONCLUSION

Reiterating the research objective, which was to identify the correlations between Representation Theory and Intentionality Theory to understand how their dialogue could enhance digital information environments from the perspective of Information Findability, it can be concluded that these correlations primarily relate to the theoretical-methodological foundations of the terms.

Studies on IF within Information Science are relevant due to the intensity with which the information phenomenon occurs in the digital realm. The concept encompasses foundations that can improve digital information environments by considering the cognitive background of information seekers.

The concept of IF is still undergoing consolidation within the field, but, as observed, it is supported by a network of well-defined concepts in Information Science, such as Information Representation and Information Mediation.

Finally, it is now necessary to continue studies addressing Intentionality Theory and, particularly, the formalization of the newly established attribute, Intentionality of Information Seekers, as a distinct area of study within Information Science. The literature review reveals a scarcity of developed works in this area, which are of paramount importance for solidifying the role of information seekers, who are contemporaneously involved in the entire process of info-communicational flow/mediation within the digital context.

REFERENCES

ANDRADE, C. B. The specificity of language in psychoanalysis. **Ágora**: estudos em teoria psicanalítica, Rio de Janeiro, v. 19, n. 2, p. 279-294, maio/ago. 2016. Available at: https://www.scielo.br/j/agora/a/9y9f8Z3jpC4fgBxBWSMwXHJ/?lang=en. Access on: 19 set. 2021.

ARNAO, M. A distinção entre representação de palavra e representação de coisa na obra freudiana: mudanças teóricas e desdobramentos filosóficos. **Ágora**: estudos em teoria psicanalítica, Rio de Janeiro, v. 11, n. 2, p. 187-201, jul./dez. 2008. Available at: https://doi.org/10.1590/S1516-14982008000200002. Access on: 19 set. 2021.

BRANDT, M. B.; VECHIATO, F. L.; VIDOTTI, S. A. B. G. Encontrabilidade da informação na Câmara dos Deputados. **Em Questão**, Porto Alegre, v. 24, n. 1, p. 41-64, 2018. Available at: http://www.seer.ufrgs.br/EmQuestao/article/view/71734/43507. Access on: 8 set. 2021.

CARMO, R.; ÁVILA ARAÚJO, C. A. Sujeito informacional, conceito em emergência: uma revisão teórico-conceitual de periódicos Ibero-Americanos. **Informação & amp; Sociedade: Estudos**, João Pessoa, v. 30, n. 1, p. 1-22, jan./mar. 2020. DOI 10.22478/ufpb.1809-4783.2020v30n1.43934. Available at: https://periodicos.ufpb.br/ojs2/index.php/ies/article/view/43934. Access on: 6 dez. 2023.

CARVALHO, D. U. S. **Os conceitos de representação em Schopenhauer**. 2013. 96 f. Dissertação (Mestrado em Filosofia) – Universidade Federal da Paraíba, João Pessoa, 2013. Available at: https://repositorio.ufpb.br/jspui/handle/tede/5636. Access on: 5 abr. 2023.

CARVALHO, J. M. Searle e os desafios da inteligência artificial (IA) forte. **Revista Reflexões**, Fortaleza, v. 10, n. 18, p. 1-16, jan./jun. 2021. Available at: https://revistareflexoes.com.br/wp-content/uploads/2021/03/1.2-NB-Joelma-Carvalho_Publica%C3%A7%C3%A3o.pdf. Access on: 20 set. 2021.

CASTRO, F. F. **Padrões de representação e descrição de recursos informacionais em bibliotecas digitais na perspectiva da ciência da informação**: uma abordagem do MarcOnt initiative na era da web semântica. 2008. 201 f. Dissertação (Mestrado em Ciência da Informação) – Faculdade de Filosofia e Ciências, Universidade Estadual Paulista – UNESP, Marília, 2008. Available at: http://hdl.handle.net/11449/93689. Access on: 5 set. 2021.

CONEGLIAN, C. S. **Recuperação da informação com abordagem semântica utilizando linguagem natural**: a inteligência artificial na ciência da informação. 2020. 195 f. Tese (Doutorado) – Universidade Estadual Paulista, Faculdade de Filosofia e Ciências de Marília, Marília, 2020. Available at: http://hdl.handle.net/11449/193051. Acesso em 26 set. 2021.

CUSTÓDIO, N.C.; VECHIATO, F.L. Mediação infocomunicacional no contexto da encontrabilidade da informação: uma análise do processo de autoarquivamento no repositório institucional da Universidade Federal do Rio

Grande do Norte. *In*: XIX Encontro Regional de Estudantes de Biblioteconomia, Documentação, Ciência e Gestão da Informação (EREBD). 19., 2016, João Pessoa. **Anais** [...]. João Pessoa: EREBD, 2016. Available at: http://www.ufpb.br/evento/index.php/erebd/xix/paper/view/4536. Access on: 13 set. 2021.

FERREIRA, A. M. J. F. C. **Contribuições da experiência do usuário para a arquitetura da informação**. 2018. 165 f. Tese (Doutorado) – Universidade Estadual Paulista, Faculdade de Filosofia e Ciências de Marília, São Paulo, 2018. Available at: http://hdl.handle.net/11449/157487. Access on: 27 set. 2021.

FIGUEIREDO, M. F. Pós-fenomenologia e Ciência da Informação: aportes epistêmicos para acesso ao conhecimento. **InCID**: Revista de Ciência da Informação e Documentação, Ribeirão Preto, v. 3, n. 1, p. 21-35, jan./jun. 2012. Available at: http://dx.doi.org/10.11606/issn.2178-2075.v3i1p21-35. Access on: 19 set. 2020.

FREUD, S. **Zur auffassung der aphasien**: eine kritische studie. Leipzig und Wien: Franz Deuticke, 1891.

HUSSERL, E. **A crise da humanidade europeia e a Filosofia**. Tradução de Urbano Zilles. 3. ed. Porto Alegre: EDIPUCRS, 2008.

HUSSERL, E. **Investigações para a Fenomenologia e a Teoria do Conhecimento**. Tradução de Pedro Alves e Carlos Aurélio Morujão. 1. ed. Rio de Janeiro: Forense Universitária, 2012. 472 p. ISBN 978-8530942427.

JODELET, D. Ciencias sociales y representaciones: estudio de los fenómenos representativos y de los procesos sociales. De lo local a lo global. **Revista Latinoamericana de metodología de las Ciencias Sociales**, v. 8, n. 2, p. 1-12, dic./mayo. 2018. Available at: https://www.relmecs.fahce.unlp.edu.ar/article/view/Relmecse041/10225. Access on: 5 abr. 2023.

JODELET, D. La representación social: fenómenos, concepto y teoría. *In*: **Pensamiento y vida social**. Barcelona: Paidós, p. 469-494, 1986. Disponível em https://www.researchgate.net/publication/327013694_La_representacion_social_fenomenos_concepto_y_teoria. Access on: 5 abr. 2023.

LANDSHOFF, R. **Findability**: elementos essenciais para as formas de encontro da informação em bibliotecas digitais. 2011. 130 f. Dissertação (Mestrado em Mídias Digitais) – Pontifícia Universidade Católica de São Paulo, São Paulo, 2011. Available at: https://tede2.pucsp.br/handle/handle/18089. Access on: 12 set. 2021.

LIMA, J. L.O.; ALVARES, L. Organização e representação da informação e do conhecimento. Organização da informação e do conhecimento: conceitos, subsídios interdisciplinares e aplicações. *In*: LIMA, J. L. O.; ALVARES, L. **Organização da Informação e do Conhecimento**. São Paulo: B4 Editores, v. 248, p. 21-48, 2012.

MAKOWIECKY, S. Representação: a palavra, a ideia, a coisa. **Cadernos de Pesquisa Interdisciplinar em Ciências Humanas**, Santa Catarina, v. 4, n. 57, p. 2-25, 2003. Available at: https://periodicos.ufsc.br/index.php/cadernosdepesquisa/article/view/2181. Access on: 16 set. 2021.

MARANDOLA JR, E. Fenomenologia e pós-fenomenologia: alternâncias e projeções do fazer geográfico humanista na geografia contemporânea. **Geograficidade**, v. 3, n. 2, p. 49-64, 2013.

MARANDOLA JR., E. Fenomenologia e pós-fenomenologia: alternâncias e projeções do fazer geográfico humanista na geografia contemporânea / Phenomenology and post-phenomenology: alternations and projections of the geographical humanist doing on contemporary geography. **Geograficidade**, v. 3, n. 2, p. 49-64, 26 jun. 2013. Available at: https://periodicos.uff.br/geograficidade/article/view/12864. Access on: 18 set. 2021.

MARCONDES, C. H. Representação e economia da informação. **Ciência da Informação**, Brasília, v. 30, n. 1, p. 610-70, jan./abr. 2001. Available at: https://doi.org/10.1590/S0100-19652001000100008. Access on: 6 set. 2021.

MASSONI, F. H.; LUIS, V. J. M. Ética e teoria das representações sociais: uma discussão a partir da ciência da informação. **Logeion**: filosofia da informação, Rio de Janeiro, v. 4, n. 1, p. 73-85, 2018. Available at: https://brapci.inf.br/index.php/res/download/43385. Access on: 28 set. 2021.

MIRANDA, E. B. S.; VECHIATO, F. L. Wayfinding em ambientes informacionais: proposta de recomendações para avaliação no contexto da encontrabilidade da informação. **Revista Informação na Sociedade Contemporânea**, Natal, v. 1, n. 3, p. 1-21, 2017. Available at: http://hdl.handle.net/20.500.11959/brapci/66018. Access on: 27 set. 2021.

MIRANDA, M. K. F. O. A teoria da intencionalidade e a informação: definições e propriedades para o fenômeno. In: ROJAS, M. A. R. (coord.). **La intencionalidad en la Ciencia de la Información Documental**. 1. ed. México: Universidad Nacional Autónoma de México. 2018. 172 p. Available at: http://ru.iibi.unam.mx/jspui/handle/IIBI_UNAM/L156. Access on: 20 set. 2021.

MIRANDA, M.K.F O. **O acesso à informação no paradigma pós-custodial**: da aplicação da intencionalidade para findability. Orientadora: Fernanda Ribeiro. 2010. 353 f. Tese (Doutorado em Informação e Comunicação em Plataformas Digitais) – Faculdade de Letras, Universidade do Porto, Porto, 2010. Available at: https://hdl.handle.net/10216/50422. Access on: 20 set. 2021.

NOVELLINO, M. S. F. A linguagem como meio de representação ou de comunicação da informação. **Perspectivas em ciência da informação**, Belo Horizonte, v. 3, n. 2, jul./dez. 1998. Available at: https://periodicos.ufmg.br/index.php/pci/article/view/22325. Access on: 12 set. 2021.

OLIVEIRA, H. P. C. **Arquitetura da informação pervasiva: contribuições conceituais**. Orientadora: Silvana Aparecida Borsetti Gregorio Vidotti. 2014. 202 f. Tese (Doutorado) – Universidade Estadual Paulista, Faculdade de Filosofia e Ciências de Marília, São Paulo, 2014. Available at: https://repositorio.unesp.br/handle/11449/110387. Access on: 16 set. 2021.

PERES, R. S.; CAROPRESO, F.; SIMANKE, R. T. A noção de representação em psicanálise: da metapsicologia à psicossomática. **Psicologia Clínica**, Rio de Janeiro, v. 27, n. 1, p. 161-174, 2015. ISSN 0103-5665. Available at: https://www.scielo.br/j/pc/a/VB6MLrtHnJwNJ4yz8bTLn4p/?format=pdf&lang=pt. Access on: 12 set. 2021.

PRADO, M. A. R. a fenomenologia da informação: reflexões essenciais sobre a matriz do conhecimento. **Revista de Informação**, [*s. l.*], v. 14, n. 4, ago. 2013. Available at: http://hdl.handle.net/20.500.11959/brapci/7878. Access on: 28 set. 2020.

ROA-MARTÍNEZ, S. M. **Da information findability à image findability**: aportes da polirrepresentação, recuperação e comportamento de busca. Orientadora: Silvana Aparecida Borsetti Gregorio Vidotti. 2019. 235 f. Tese (Doutorado em Ciência da Informação) – Faculdade de Filosofia e Ciências, Universidade Estadual Paulista, Marília, São Paulo, 2019. Available at: http://hdl.handle.net/11449/182465. Access on: 25 set. 2021.

SANCHEZ; F. A.; VIDOTI, S. A. B. G.; VECHIATO, F. L. Contribuições da Intencionalidade no contexto da Encontrabilidade da Informação. *In*: ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 21., 2021, Rio de Janeiro, RJ. **Anais** [...] Rio de Janeiro: UFRJ. Available at: https://enancib.ancib.org/index.php/enancib/xxienancib/paper/view/513. Access on: 18 set. 2021.

SCHOPPENHAUER, A. **O mundo como vontade e como representação**. Tradução: Jair Barboza. São Paulo: UNESP, 2005.

SCHOPPENHAUER, A. **On the fourfold root of the principle of sufficente reason**. Tradução: E. F. J. Payne. 6. ed. Illinois: Open Court, 1995.

SEARLE, J. R. **Intencionalidade**. Tradução: Julio Fischer e Tomás Rosa Bueno. 2. ed. Cidade: Martins Fontes, 2002. 394 p.

SILVA, A. M. **A informação**: da compreensão do fenómeno e construção do objecto científico. Porto: Ed. Afrontamento, 2006. 176 p.

SOKOLOWSKI, R. **Introdução à Fenomenologia**. 4. ed. São Paulo: Edições Loyola, 2004. 248 p.

SOUSA, J. L.; RAMALHO, R. A. Um estudo das contribuições de Schopenhauer para a Ciência da Informação: o mundo como vontade e representação. **Informação & Informação**, Londrina, v. 24, n. 1, p. 131-146, 2019. Available at: https://brapci.inf.br/index.php/res/download/110887. Access on: 15 set. 2021.

TORINO, E.; VIDOTTI, S. A. B. G.; VECHIATO, F. L. Contribuições do atributo metadados para a encontrabilidade da informação. **Em Questão**, Porto Alegre, v. 26, n. 2, p. 437-457, maio/ago. 2020. Available at: https://seer.ufrgs.br/EmQuestao/article/view/93072. Access on: 27 set. 2021.

VECHIATO, F. L. **Encontrabilidade da informação: contributo para uma conceituação no campo da Ciência da Informação**. Orientadora: Silvana Aparecida Borsetti Gregorio Vidotti. 2013. 206 f. Tese (doutorado) – Universidade Estadual Paulista, Faculdade de Filosofia e Ciências de Marília, São Paulo, 2013. Available at: http://hdl.handle.net/11449/103365. Access on: 21 set. 2021.

VECHIATO, F. L.; TRINDADE, A. S. C. E. Encontrabilidade da informação em ambientes informacionais: diálogo teórico entre os conceitos Intencionalidade e affordances. **Prisma.Com**, n. 42, p. 3-20, 2020. ISSN: 1646 – 3153. Available at: http://aleph.letras.up.pt/index.php/prismacom/article/view/6809. Access on: 18 set. 2021.

VECHIATO, L. F.; OLIVEIRA H. P. C.; VIDOTTI, S. A. B. G. Arquitetura da informação pervasiva e encontrabilidade da informação: instrumento para a avaliação de ambientes informacionais híbridos. *In*: ENCONTRO NACIONAL DE PESQUISA EM CIÊNCIA DA INFORMAÇÃO, 17., 2016, Salvador. **Anais** [...]. Salvador: UFBA. ISSN: 2177-3688. 2016. p. 3.768-3.787. Available at: https://bit.ly/30UfY3p. Access on: 7 set. 2021.

VECHIATO, L. F.; VIDOTTI, S. A. B. G. **Encontrabilidade da informação**. São Paulo: Cultura Acadêmica, 2014. ISBN 9788579835865. Available at: http://hdl.handle.net/11449/126218. Access on: 08 set. 2021.

The flow of information in the creation of a microlearning on circular economy

Felipe Lopes Roberto
Information Manager, Universidade Federal do Paraná (UFPR), Curitiba, Paraná, Brazil.
Master program student in Information Management, Universidade Federal do Paraná, (UFPR), Curitiba, Paraná, Brazil.
https://lattes.cnpq.br/7307148430332267

Maria do Carmo Duarte Freitas
Civil Engineer, Universidade Federal do Paraná, (UFPR), Curitiba, Paraná, Brazil.
Full Professor, Universidade Federal do Paraná, (UFPR), Curitiba, Paraná, Brazil.
http://lattes.cnpq.br/1740734674821323

Antonio Hélio Junqueira
Agricultural Engineer, Universidade Federal do Paraná, (UFPR), Curitiba, Paraná, Brazil.
Postdoctoral fellow, Universidade Federal do Paraná, (UFPR), Curitiba, Paraná, Brazil.
http://lattes.cnpq.br/0541755519500306

Submitted on: 10/27/2022. Approved on: 04/10/2023. Published on: 06/21/2024.

ABSTRACT

Introduction: The area of education is important for a Circular Economy, as the transition to circular models requires individuals and organizations that learn to innovate and put into practice what they have learned in the real world. This area, from elementary school to graduate school, plays a vital role in ensuring that students of all ages are equipped with the key skills and knowledge to execute circular thinking in their careers. **Objective:** Map the information flow stages present in the MOOC production process on Circular Economy. **Methodology:** This research is characterized as exploratory in terms of its objectives and analyzes the flow of information in the process of creating an informational product with regard to procedures. **Results:** This research showed that an activity of an interdisciplinary nature, such as Information Management - which evolves over time, mainly due to technological innovations - contributed to mapping the stages of needs, obtaining, treatment, distribution, use, storage and disposal of information from the information flow within the process of developing an information product – in this case, the IEC MOOC. **Conclusion:** Associated with the concepts of information architecture, information design and information ergonomics, GI helped in the structuring, organization and presentation of educational information, optimizing the transmission of knowledge and user experience.

Keywords: information management; information architecture; informational product; microlearning; information flow.

INTRODUCTION

In a society marked by the strategic value of information and knowledge, issues related to Information Management (IM) in education become frequent. In this scenario, studies such as that of Roque and Costa (2006) highlight the value of IM for the organization of educational environments, in particular, by supporting the decision-making process, in the design of information products and in the implementation of innovation processes in multidisciplinary spaces (Roque; Costa, 2006).

The Ellen MacArthur Foundation is committed to the relevance of the education sector in disseminating topics such as Circular Economy, since the transition to circular production models requires individuals and organizations to learn to innovate and put into practice actions that aim to improve the future of the next generations. According to the Foundation, the educational segment, from primary to graduate school, plays a vital role in ensuring that students of all ages are prepared with key skills and knowledge to execute circular thinking in their careers (Ellen Macarthur Foundation, 2022).

The circular production model is presented as a proposal to protect the environment from pollution and promote sustainable development. Circular ideas drive the efficient use of resources and reduce waste production. Circular Economy seeks to maximize the use of resources and avoid the generation of waste, thus, environmental degradation is minimized with the advantage of not presenting social limitations, in addition to favoring economic growth and technological progress (Molina-Moreno *et al*. , 2017).

In contrast to the growth of the industrial production system and the continuous consumerism encouraged by society, it demonstrates a connection between the environment and its exploitation. Due to highly polluting habits and patterns, society inherits several environmental implications. The consequences of these ways of life and economic production include climate change, greenhouse effect, water scarcity, ocean pollution, natural disasters, among other phenomena that point to our descent into an unsustainable community (Sales *et al*., 2019).

The linear economy production model will reach its limits, as it disregards the finitude of material and energy resources. This model accelerates environmental degradation, generated by the environmentally inappropriate disposal of waste, as well as increasing competition for *commodities*, raising prices and market instability (Gonçalves; Barroso, 2019). Topics such as the destruction of ecosystems and the unlimited use of natural resources are present in various discussions across different regions of the world. Excessive consumption and the search for meeting personal needs have taken precedence over imperatives such as environmental preservation and awareness, present in international treaties that aim to preserve life on the planet. Given these circumstances, a new point of view is presented, a proposal for changes in global production and consumption patterns: practices based on Circular Economy (CE) (Gonçalves *et al*., 2021).

In its composition, Circular Economy (CE) consists of the processes of recycling and reusing products aimed at avoiding waste production. Based on the principles of reusing, repairing, reconditioning, remanufacturing and recycling, CE considers that products should undergo sub-processes and, therefore, be used again (Sales *et al*., 2019).

Organizations and companies are gradually proving the possibilities that adopting Circular Economy provides, and moving forward in the initiation of sustainable practices. However, industry and technological innovation are incapable of driving fundamental systemic changes for today's economic model to achieve true transformation. Effective changes presume a paradigm shift from individual behaviors to cultural adoption of CE principles. This way, education plays an important role in instigating new perspectives for society and the economy, with regard to sustainability and environmentally-friendly growth (Ludwig, 2020).

Therefore, one of the strategies for attracting students and managers interested in more sustainable practices is developing Massive Open Online Courses (MOOCs) (Gonçalves; Gonçalves, 2014). MOOCs[1] emerge as an opportunity for the evolution and construction of knowledge, modifying teaching and learning environments, as they demand a different behavior from educational institutions and their professionals. On account of the number of students, MOOCs are characterized as a potential field of research for the study, creation of resources and more flexible and interactive teaching activities, as well as new evaluation methodologies (Artigas, 2016).

Given this context, an activity with interdisciplinary nature such as Information Management (IM), which evolves over time, mainly due to technological innovations, helps Circular Economy by means of the development of an informational product. IM acts as a set of processes for identifying informational needs and mapping formal information flows, also promoting an information sharing culture. It also encourages internal communication and the use of information and communication technologies in institutions, in addition to the technical processing of information, handling, analysis, organization, storage and sharing of necessary information (Valentim, 2008).

Considering the above, the research question of this paper is as follows: How does Information Management contribute to the dissemination of concepts and information related to the transition from linear to circular economy? In response to this question, the aim is to map the stages of the information flow present in the MOOCs production process on Circular Economy.

Information management and information flow

It all begins with understanding what Information Management is. Second term information must be understood, organized, processed and shared efficiently, in order to demonstrate to organizations how essential the use of internal and external indicators is, in order to measure their management and the challenges they face in the markets. Assimilating information as such helps ensure that the parts that make up an organization are constantly

1 Translation: Massive Open Online Courses.

aligned to overcome its challenges. Valentim (2002) explains that information is understood as a propagation path, that information technologies structure the storage, processing and access of this asset.

The definition of Information Management proposed by Detlor (2010) refers to the command or management of information and how it is constituted, gathered, established, grouped and shared with the aim of enabling access, chaining and using satisfactory and decisive information through people and organizations. In an organizational environment, Araújo Filho (2020) considers that Information Management plans what information the organization must gather, how it will be stored, the methods for its organization and instruments for disseminating the gathered information. The author explains that, in order to gather information, one must attribute meaning and relevance to the investigated data. Consequently, this information will modify the actors' thoughts and attitudes, while knowledge is related to the work and manipulation of information by means of experiences, values and other knowledge present in the mentality of subjects.

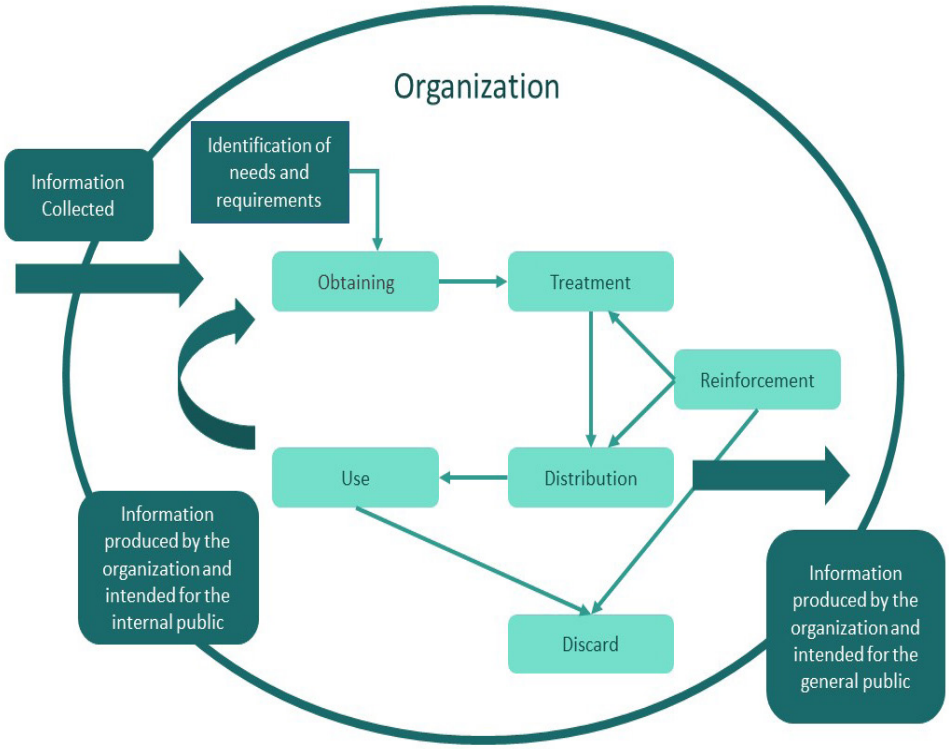
For Duarte *et al.,* (2020), Information Management aims to identify, select, prospect, organize, represent and disseminate information in different contexts, ranging from environments with lower complexities to more complex ones. On the other hand, he adds that knowledge management aims to encourage a culture of collaboration between people, intensifying the creation of a promising environment (physical or virtual) for sharing and generating knowledge in numerous organizational spheres, among other spaces.

Information Management requires the organization of systematized and structured procedures, steps or flows, correlated to the people responsible for their management, aiming to gather the desired results. Information flows provide the implementation of the stages of gathering, processing, storing, distributing, disseminating and using information at the organizational level (Vital; Floriani; Varvakis, 2010).

Araújo *et al*., (2017) emphasize that information flows are present in the most varied contemporary social contexts and that information and communication technology (ICT), from its massification in these contexts, allowed the optimization of processes related to the production and dissemination of information in different arenas. Authors Porter and Millar (2009) add that ICT promotes informational changes: on the one hand, it can lead to the excessive production of information, but, on the other, it proves to be a tool for better practices and results in the processes of searching, selecting, processing, storing, disseminating and using information.

To analyze the flow of information in developing an information product (*MOOC*), Beal's (2008) information flow representation model was taken into account, which highlights it in a scenario gathering and producing information, as illustrated in **Figure 1**.

FIGURE 1 – Information flow representation model



Source: Beal (2008, p. 29).

In this model, information is initially seen from the perspective of information collection carried out externally, which means that this information is outside the organizational environment. In a second and third step, respectively, the information produced by the organization is shared with the internal and external public, aiming to meet their needs.

The first stage is related to the development of informational products, which is referred to as the *identification of the necessary requirements and needs* for using information and are specifically oriented towards each group and individuals that make up the organization (Beal, 2008).

In the second stage, the *acquisition* of information is evidenced and the activities of creating, receiving and gathering information are carried out, originating from external or internal sources, in any media or format (Beal, 2008).

In the third stage, the *processing* of information is characterized by making information more accessible to users through its processing via the organization, formatting, structuring, classification, analysis, synthesis and presentation, according to Beal (2008).

The fourth stage is associated with the distribution of information in relation to user needs, being it shared with the internal and external users of the organization. Regarding internal distribution, Beal (2008) reports that depending on the size of the organization's communication network, the internal distribution of information process will become more efficient, increasing the possibility of its usability in processes and decisions.

Beal (2008) explains that the fifth stage of the information flow is the *use* of information. In this stage, the combinations of information and the emergence of new knowledge are essential, which promote the feeding back of the corporate information cycle, in a continuous process of learning and growth.

The next stage of the information flow is the *storage* of information, which Beal (2008) considers a process of conserving data and information, allowing its use and reuse by users inside and outside the organization.

The information disposal stage allows the organization to eliminate unusable information, contributing to providing space and agility for the information in use. This process helps to improve Information Management (Beal, 2008).

The next section will describe the characteristics of informational product.

Informational product

In order to understand what constitutes an informational and information product, it is essential to reflect on these two components – product and information (as previously explained). The concept of product is diverse, but it generally includes goods and services. The most important attributes of a product are tangibility, the ability to be stored, production not simultaneous to consumption, low level of contact with the consumer, transportability and evidence of quality (Silva; Santos; Freitas, 2008).

According to Silva, Santos and Freitas (2008), information product is the tangible result of the stages of Information Management, that is, the collection, analysis, processing, dissemination and storage that result in advantages by means of its use, aiming to meet the investigated demands. Informational product is characterized as the content introduced into the information product, exposing a tangible or intangible good. In other words, it is what is most central, the most important characteristic of an information product.

Castells (1999) lists the particularities of a successful informative product in the information society:

a) it adds value by including innovation in the process and product;

b) innovation is only concrete when it results from investments in research and application in certain context needs;

c) it adds automated tasks, resulting in more efficient execution, granting human time for adaptation tasks, generating feedback in the system;

d) Product content makes the decision-making process more flexible and provides the aggregation of all components of the production process.

Galvão (1999) explains that informational products contain different attributes than those of the production of traditional goods and services. Among the aspects listed are:

a) Unlike traditional goods, an informational product is not composed of tangible properties, in addition to being entirely disassociated in a unique, particular way;

b) unlike traditional services, the provision of these products eliminates interaction between supplier and consumer;

c) for consumers, the value of informational products is not associated with their tangible qualities, but rather with their informational, educational, cultural or entertainment content;

d) unlike traditional goods and services, cultural and informational products are easily replicated and at a reasonably low value;

e) an informational product is not used in the same way as a traditional product or service. Software or audiovisual products are used several times without losing their original value;

f) the intangible particularities of informational or cultural products make the modes of production and distribution different from those related to the production and distribution of traditional goods and services. The holders of property rights over those works are the only ones allowed to legally transact them. Costs related to the acquisition of rights are generally significant, and expenses related to their distribution are incidental; and,

g) distributors of informational products are able to add value to the distribution procedure.

Silva, Santos and Freitas (2008) consider information products to be highly valued due to the knowledge embedded in them, which originates from the information collected and stored, or information regarding each customer's needs and desires. Both types of information are applied to adapt the characteristics of a product to the observed preferences. When classifying information products, Silva, Santos and Freitas (2008) noted that products arise as a result of services, in the same way that services give rise to other products, and that the main distinction between products and services is the participation of customers in the service development stages.

The purpose is understanding the process of structuring an information product as a Massive Open Online Course, highlighting that its delivery and use will be associated with a service – learning platform. In this case, more sustainable strategies, techniques and technologies on Circular Economy will be presented; the next section will bring concepts about MOOC.

Massive Open Online Courses

Massive Open Online Courses are free online courses, which have interactive participation, in a broad manner and with free access via the web (Santos, 2017). The main characteristics of MOOCs are related to their open access, the possibility of gradually increasing the number of students, as well as monitoring their performance by means of activities that seek to verify the level of learning and asynchronous participation, that is, the period in which

the course is offered. MOOCs are delivered by means of structured platforms with the aim of encouraging excessive simultaneous access, standardizing how activities, the verification of learning, as well as the presentation of content and forums are conducted (Santos, 2017).

In **Table 1**, we have Clark's taxonomy (2013) with 8 types of MOOCs: *TransferMOOCs, MadeMOOCs, SynchMOOCs, AsynchMOOCs, AdaptativeMOOCs, GroupMOOCs, ConectivistMOOCS and MiniMOOCSs*. MOOCs are divided into two categories: x- MOOCs and c- MOOCs. X-MOOCs are similar to in-person classes, in which the teacher plays a central role in teaching. While in c-MOOCs, students develop the activities themselves, posting reflections on blogs and platforms, and sharing them with other class members (Hayes, 2015).

Table 1 – Types of moocs and their characteristics

Type of MOOC	Characteristics
TransferMOOCs	TransferMOOCs collect existing courses and allocate them to a MOOC platform, under the pedagogical assumption that they are coordinated by the teachers, and many are dependent on an institution's name to attract students.
MadeMOOCs	MadeMOOCs seek to be more innovative and sophisticated. They use more formal and quality-focused methods to develop more complex and challenging materials and activities: problem solving and different levels of interactive experiences based on sophisticated software. Peer assignments and evaluation also characterize this type of MOOC.
SynchMOOCs	Synchronous MOOCs have pre-established start and end dates and course evaluations. Consequently, they are based on the academic calendar defined by the institution.
AsynchMOOCs	Unlike the synchronous ones, asynchronous MOOCs are flexible in terms of beginning, end and evaluation – they tend not to set dates or deadlines activity delivery. The possibility of carrying out tasks within the period defined by the student is one of the pedagogical advantages of asynchronous MOOCs, as they visibly work better in different time zones.
Adaptatives MOOCs	Adaptive MOOCs use adaptive algorithms aimed at delivering personalized learning experiences, based on dynamic evaluation and course data collection. These MOOCs have prerequisite networks and help students through diverse and personalized content.
GroupMOOCs	They are aimed at the collaboration between small groups.
Connectivist MOOCS	They are characterized by the spirit of collaboration. They use content that is available free of charge on the web, and part of the material is produced, remixed and made available by its participants throughout the course by means of activities such as posts, blogs or discussion forums, visual aids, audios and videos.
MiniMOOCSs	Associated with more traditional universities, they are short in duration and amount of work, ranging from one day to one week

Source: Clark (2013)

There are structural limitations in MOOCs for the application of revolutionary learning, with fundamental knowledge and skills for the digital age. Due to the recent use of MOOCs, their strengths and weaknesses are notable, however, practices are becoming innovative and gaining relevant space in higher education (Bates, 2019). The MOOC strengths are listed below:

a) They provide free-of-charge quality materials validated by universities around the world to anyone who has a computer and internet connection;

b) They provide access to high-quality materials, especially in developing countries. However, in order to carry out MOOCs satisfactorily, adaptation and substantial investment in local support and partnerships are essential;

c) They are important for the prosperity of basic conceptual learning, as well as the generation of online communities with similar objectives or the same practice;

d) They are a differential training and continuing education method;

e) They drive conventional Higher Education Institutions (HEIs) to re-evaluate their methods for open and online learning;

f) They expand the brand and status of institutions, paving the way for public experience in some academic areas;

g) They eliminate, through automation and/or peer communication, the cost and variables linked to offering support and quality evaluation for higher education students.

Bates (2019) also adds the weaknesses (W) and challenges (C):

a) it is difficult to visualize how public HEIs are able to create sustainable business models for MOOCs (W);

b) they awaken the interest of people with a high level of education, instead of expanding access (C);

c) they have limited competence to enhance high-level academic learning, or high-level intellectual capabilities essential in a knowledge-based society (C);

d) evaluation of the highest levels of continuous learning, given that a large proportion of MOOC providers do not accept their own MOOCs for credit (W);

e) Copyright and temporality restrictions limit the reuse of materials as Open Educational Resources for MOOCs (W).

The next section will describe the methods applied for this research.

METHODS

This is an exploratory research in terms of its objectives and it analyzes the flow of information in the process of creating an informational product with regard to procedures. Exploratory research is conducted faced with a problem or question, which are usually subjects with a low number of previous studies in that area. To this end, it is not limited to testing or confirming a specific hypothesis; in reality, new discoveries occur. Exploratory

research determines which existing theories or concepts are invested in a given problem or whether theories need to be updated and concepts need to be created (Collins; Hussey, 2005; Gil, 1999).

The literature review technique was employed as a way of gathering information regarding Circular Economy metrics, guidelines and good practices, as well as means to evaluate the success of MOOCs with actions provided for in Educational Marketing. These analyzes will lead to the achievement of the proposed general objective, with a strategy to guide the development of an informational product.

To this end, a questionnaire was applied and helped to gather information regarding the creativity and clarity criteria of the proposal; innovation, social contribution and sustainable development; methodological quality; coherence of the proposal and formal aspects of microlearning. The questionnaire included the participation of teachers and students of areas such as Information Management and others related to circular economy. The results found are important for capturing positive and negative aspects about the course structure, and for demonstrating the experts' perspective regarding the knowledge acquired by students.

Tool ATLAS.ti was used, which is considered a form of processing, organizing, classifying, analyzing and presenting, for analyzing information related to the opinions of experts who participated in the questionnaire.

RESULT ANALYSIS AND DISCUSSION

The Information Management perspective is detailed in the search to identify the information flow stages – about the process of creating microlearning about Circular Economy. This study will present the stages of information needs, gathering, processing, distribution, use, storage and disposal – in the same way as Beal's (2008) information flow representation model, from information gathering to production.

a) Need for information

The first stage presented was the identification of the necessary needs and requirements for using information, which aims to identify information needs to then develop informational products specifically oriented to each group and individuals that make up the organization. At this stage, it was defined that the target audience would be Information Management students and professionals, as well as the general community who were interested in more sustainable strategies, techniques and technologies applied to the business environment. Therefore, to meet the informational needs of these audiences, it was determined that Circular Economy concepts should be presented, relating them to different social spheres; the environmental impacts associated with waste dumping into the environment; the different strategies and

technologies for reusing waste, the incorporation of Circular Economy in professional, academic and citizen practice; and current linear economic models, from the perspective of related environmental impacts.

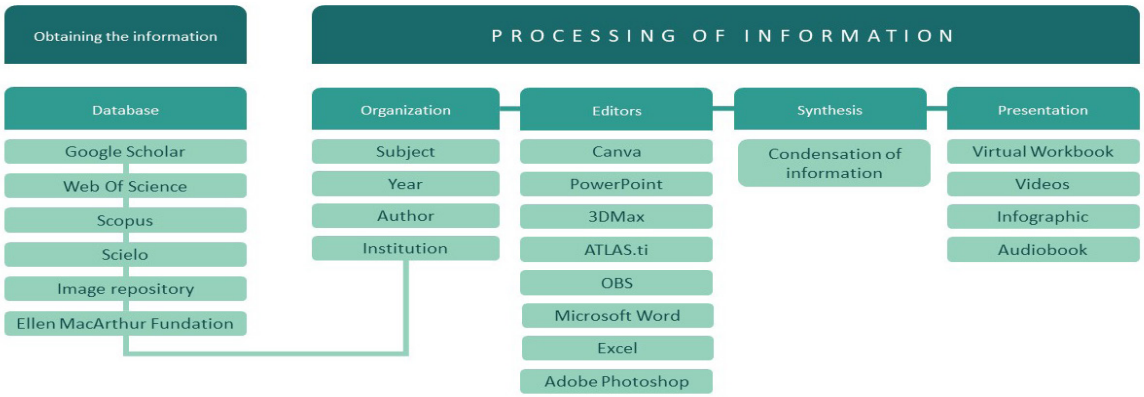
b) Gathering information

In the information gathering stage, queries in databases Google Scholar, Web of Science, Scopus, Scielo were necessary, among other databases available in CAPES journals to gather information related to the course subjects. It was also defined that term search would be conducted in English and Portuguese, within the period between 2008 and 2022. Another means of gathering information employed by the author was a questionnaire to validate the MOOC. This stage also involved the analysis and disposal of information, in order to select the most relevant documents for the target audience.

c) Processing information

In the third stage – processing – the tools that would enable the organization, formatting, structuring and presentation of this information were defined. Aiming to achieve the best results, the author applied Information Architecture and Information Design principles during the material development process. In order to format text and data, record videos and build material layout, several tools were used to assist the researcher in the creation process.

Figure 2 – Tools for processing course information



Source: Systematized by the author (2022).

Tools Microsoft Word and Excel were used to format text and data. For video recording and editing, Open Broadcaster Software (OBS) was employed. With Microsoft PowerPoint it was possible to organize and build video layout. In developing the layout and booklet

illustrations, tools Canva, 3DMax and Photoshop were used. Course materials were prepared in PDF, PNG, JPGE, MP4 and MP3 formats. Content classification and organization followed the order of the subjects to be covered in the produced course.

For course validation, ATLAS.ti tool was adopted, which is considered a form of processing, organizing, classifying, analyzing and presenting information related to expert opinions regarding the ICE course. With this tool, it was possible to identify course strengths and weaknesses based on the analysis of the opinions of experts who participated in the MOOC evaluation.

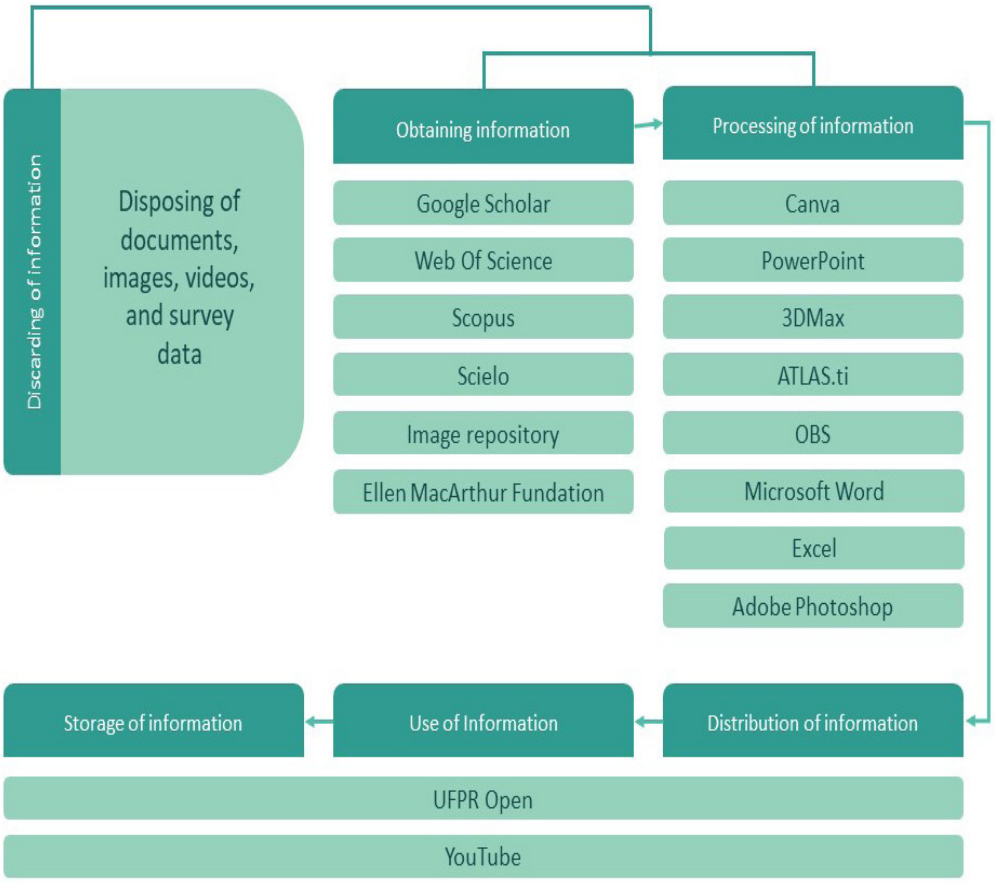
d) Distributing information

Information distribution takes place from the moment the course is available on the university's Open platform for society as a whole. For the distribution of information to happen effectively, defining strategies assisted by Information and Communication Technologies are necessary to publicize Massive Open Online Course Introduction to Circular Economy on different social media, in order to prospect professionals interested in techniques and methodologies that promote sustainability in organizations.After launching the course, ensuring that the target audience has access to information regarding Circular Economy, these participants would have interactive classes on the selected topics, with available and easily accessible bibliography, as well as complementary material to optimize the understanding of the exposed content. After course completion, it is believed that students are able to apply the concepts of Circular Economy in different work environments.

e) Storing information

In the information storage stage, it was necessary to make a request to the Coordination for the Integration of Distance Education Policies (CIPEAD) to store the course. After approval, the MOOC will be stored on websitehttps://ufpraberta.ufpr.br/ along with the other courses offered by the institution.Throughout the conception of the MOOC, information was mainly disposed in the first stages of development. From the moment the appropriate documents were selected for preparing the material, an assessment was carried out regarding the content of these files and, after analysis, documents that were not relevant to this project were excluded. To this end, it was determined that, at first, the title of the document would be read, then the summary analyzed and, finally, the documents read in full, with the purpose of selecting the most important parts to be used in the materials.

FIGURE 3 – Technologies and information flow in creating the mooc



Source: Systematized by the author (2022).

In the results analysis stage, the information was also disposed of, as some respondents confused the ICE course proposal with a subject that was being offered during the same period of questionnaire application.

CONCLUSIONS

This research showed that an interdisciplinary activity, such as Information Management – which evolves over time, mainly due to technological innovations – contributed to mapping the stages of needs, gathering, processing, distributing, using, storing and disposing of information from the informational flow within the process of developing an informational product – in this case, MOOC ICE. Associated with the concepts of information architecture and information design, IM helped in the structuring, organization and presentation of educational information, optimizing the transmission of knowledge and user experience.

This research brings contributions in the academic-scientific scope by sharing the methods, strategies and educational practices applied in microlearning. It offers a conceptual basis for discussions related to Circular Economy (CE) within the Information Management (IM)

research community, based on the analysis of the information flow stages in the process of developing a course aiming to present solutions in production processes and environmentally-sustainable consumption.

It makes a social contribution since the information product, validated by experts and approved by CIPEAD, will be available to the entire society via UFPR Aberta – a platform for free open courses.

For the business environment, this research contributes as knowledge for applying Circular Economy principles can be applied to organizations, promoting innovation and the creation of more sustainable strategies, techniques and technologies for reusing waste.

It is also expected that future work will contribute to the dissemination of Circular Economy principles. The importance of actions that promote the democratization of scientific information is highlighted in this research, especially for studies that suggest practices for sustainable development.

REFERENCES

ARAÚJO FILHO, G. C.A gestão do conhecimento e a tecnologia da informação no melhoramento da performance da organização. **Revista Científica Multidisciplinar Núcleo do Conhecimento**, [*s. l.*], v. 16, n. 10, p. 34-50, out. 2020. DOI: 10.32749/nucleodoconhecimento.com.br/administracao/performance-da-organizacao.

ARAÚJO, W. C. O.; SILVA, E. L.; VARVAKIS, G. Fluxos de informação em projetos de inovação: estudo em três organizações. **Perspectivas em Ciência da Informação**, Belo Horizonte, v. 22, n. 1, p. 57-79, 2017. DOI: https://doi.org/10.1590/1981-5344/2601.

ARTIGAS, J. R. **O uso do MOOC para o aprimoramento da escrita do Trabalho de Conclusão de Curso** – TCC. Orientador: Dilmeire Sant'Anna Ramos Vosgerau. 2016. Dissertação (Mestrado em Educação) – Pontifícia Universidade Católica do Paraná, Curitiba, 2016. Disponível em: http://www.biblioteca.pucpr.br/pergamum/biblioteca/img.phparquivo=/000059/000059ae.pdf. Access on: 16 jan. 2022.

BATES, T. What's right and what's wrong about coursera-style MOOCs. **EdTech in the Wild**: critical blog posts. [S. l.], 2019. Site. Disponível em: https://edtechbooks.org/wild/mooc_right_wrong. Access on: 28 jul. 2022.

BEAL, A. **Segurança da informação**: princípios e as melhores práticas para a proteção dos ativos de informações nas organizações. São Paulo: Atlas, 2008.

CASTELLS, M. **A sociedade em rede**. Tradução: Roneide Vennancio Majer. 2. ed. São Paulo: Paz e Terra, 1999.

CLARK, D. **MOOCs**: taxonomy of 8 types of MOOC. [*s. l.: s. n.*], 2013. Site. Disponível em: Access on:

COLLINS, J.; HUSSEY, R. **Pesquisa em Administração**: um guia prático para alunos de graduação e pós-graduação. 2. ed. Porto Alegre: Bookman, 2004.

DETLOR, B. Information management. **International Journal of Information Management**, [*s. l.*], v. 30, p. 103-108, 2010. Disponível em: https://www.sciencedirect.com/science/article/pii/S0268401209001510. Access on: 2 mai. 2019.

DUARTE, E. N.; FEITOZA, R. A. B.; LIMA, A. R. P. Tendências inovadoras da gestão da informação e do conhecimento na produção científica da ciência da informação. **P2P e Inovação**, Rio de Janeiro, v. 7, n. 1, p. 166-185, 2020.

ELLEN MACARTHUR FOUNDATION (EMF). **Education and learning**. [*s. l.*], 2022. Site. Disponível em: https://ellenmacarthurfoundation.org/resources/education-and-learning/circular-economy-courses. Access on: 16 jan. 2022.

GALVÃO, A. P. **Da convergência tecnológica à convergência empresarial**: o audiovisual como espaço de acumulação na era da digitalização. 1999. Tese (Doutorado) – Universidade Federal do Rio de Janeiro, Rio de Janeiro, 1999.

GIL, A. C. **Métodos e técnicas de pesquisa social**. São Paulo: Atlas, 1999.

GONÇALVES, S. C.; TAGLIAFERRO, E. R.; LIMA, L. D. S. C.; KOZUSNY-ANDREANI, D. I. Economia circular: análise e aplicabilidade nas organizações sob a perspectiva da teoria dos stakeholders. **Multitemas**, [*s. l.*], p. 21-48, 2021.

GONÇALVES, T. M.; BARROSO, A. F. D. F. A economia circular como alternativa à economia linear. In: SIMPROD, 11., 2019, Aracaju. **Anais** [...]. Aracaju: UFSE, 2019.

GONÇALVES, B.; GONÇALVES, V. MOOC: uma estratégia de captação de alunos?. **Revista Multimédia de Investigação em Educação**, [*s. l.*], n. 1, 2014.

HAYES, S. **MOOCs and quality**: a review of the recent literature. Gloucester: QAA, 2015. Disponível em: https://pure.aston.ac.uk/ws/files/18622357/MOOCs_and_quality_a_review_of_the_recent_literature.pdf. Access on: 24 fev. 2020.

LUDWIG, V. **Transition to circular economy**: the role of education from youth to higher education. European Commission. [*s. l.*], 2020. Site. Disponível em: https://epale.ec.europa.eu/en/blog/transition-circular-economy-role-education-youth-higher-education. Access on: 16 jan. 2022.

MOLINA-MORENO, V. LEYVA-DÍAZ, J. C.; LLORENS-MONTES F. J.; CORTÉS-GARCÍA, F. J. Design of indicators of circular economy as instruments for the evaluation of sustainability and efficiency in wastewater from pig farming industry. **Water**, [*s. l.*], n. 9, 2017. Disponível em: https://www.mdpi.com/2073-4441/9/9/653. Access on: 25 jul. 2021.

PORTER, M. E.; MILLAR, V. E. Como a informação proporciona vantagem competitiva. *In*: PORTER, M. E. **Competição**. Rio de Janeiro: Elsevier, 2009. p. 73-96.

ROQUE, A.; COSTA, J. A. A gestão da informação no contexto da gestão escolar. **Revista Linhas**, Florianópolis, v. 7, n. 2, 2006. Disponível em: https://www.revistas.udesc.br/index.php/linhas/article/view/1332. Access on: 27 jul. 2022.

SALES, G. F. ROSA, T. O.; FARIA, T. L.; PEDRUSSI, P. C.; REINALDA, B. P. Desenvolvimento da economia circular no Brasil: a aplicabilidade na indústria e nas demais organizações. *In*: CONGRESSO SUL-AMERICANO DE RESÍDUOS SÓLIDOS E SUSTENTABILIDADE, 2., 2019, Foz do Iguaçu. **Anais** [...]. [*s. l.*]: IBEAS, 2019. Disponível em: http://www.ibeas.org.br/conresol/conresol2019/I-093.pdf. Access on: 20 abr. 2021.

SANTOS, L. R. N. **Gestão da informação científica aberta**: um estudo aplicado a vídeo científico em eventos. 2017. 130 f. Dissertação (Mestrado em Ciência, Gestão e Tecnologia da Informação) – Universidade Federal do Paraná, Curitiba, 2017. Disponível em: https://acervodigital.ufpr.br/handle/1884/47494. Access on: 24 fev. 2020.

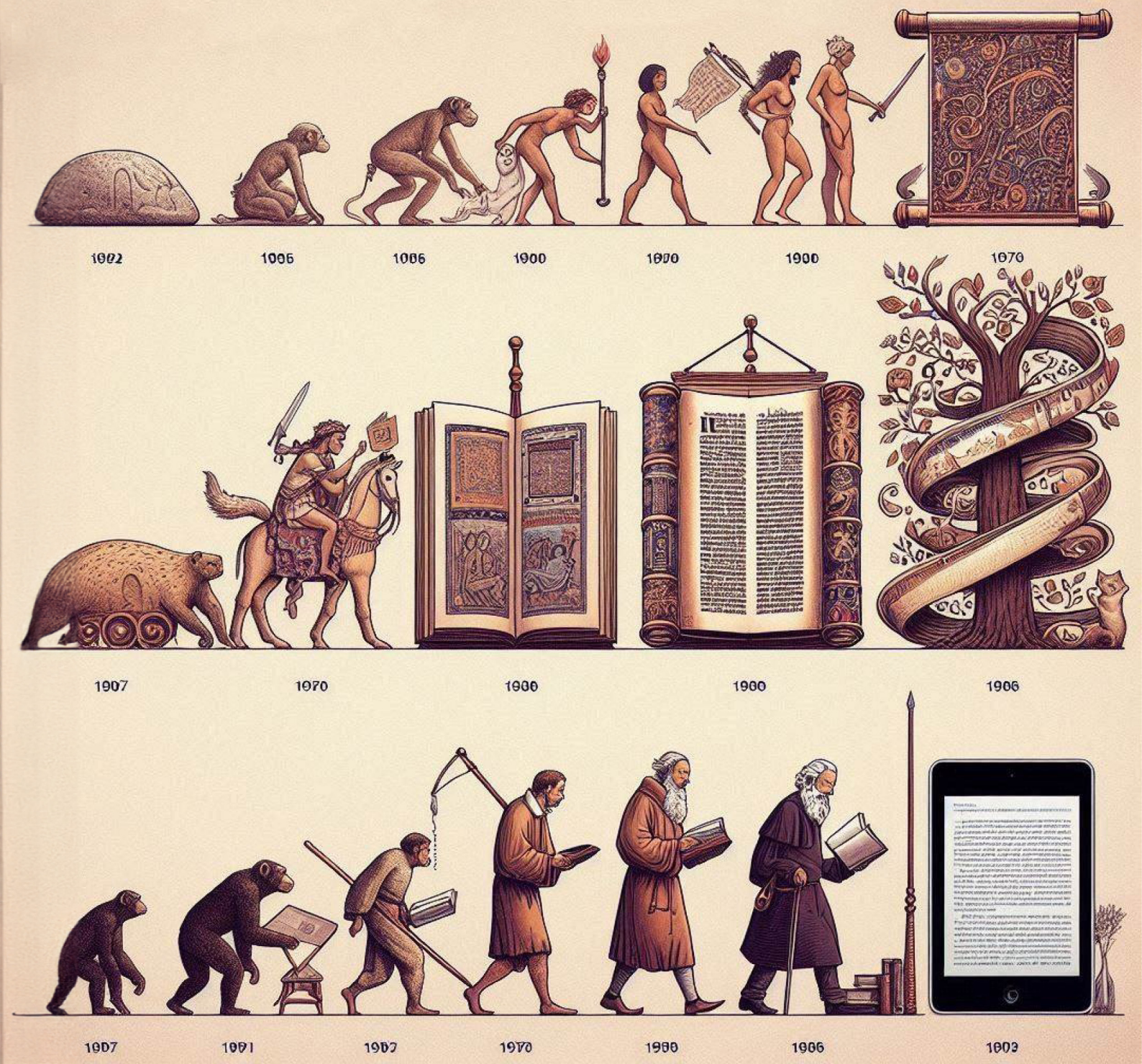
SILVA, R.; SANTOS, L.; FREITAS, M. Reflexão teórica e conceitual sobre produto informacional e produto de informação. *In*: SEMANA DE ENGENHARIA DE PRODUÇÃO SULAMERICANA, 8., 2008, Bento Gonçalves. **Anais** [...]. [*s. l.: s. n.*], 2008.

VALENTIM, M. L. P. Inteligência competitiva em organizações: dado, informação e conhecimento. **DataGramaZero** – Revista de Ciência da Informação, [*s. l.*], v. 3, n. 4, 2002. Disponível em: http://www.brapci.inf.br/index.php/article/view/0000001053/6a50751d6d811772f23ef7de3623bcd2. Access on: 19 mai. 2019.

VALENTIM, M. L. P. Gestão da informação e gestão do conhecimento em ambientes organizacionais: conceitos e compreensões. **Tendências da Pesquisa Brasileira em Ciência da Informação**, Brasília, v. 1, n. 1, p. 1-16, 2008.

VITAL, L. P., FLORIANI, V. M.; VARVAKIS, G. Gerenciamento do fluxo de informação como suporte ao processo de tomada de decisão: revisão. **Informação & Informação**, v. 15, n. 1, p. 85-103, 2010.

Literature Review



Digital transformation in the public sphere: a bibliometric analysis

Wanderson Aparecido da Silva Alves
Master in Governance, Technology and Innovation, Universidade Católica de Brasília (UCB), Brasília, DF, Brasil.
Client Success Partner Manager, Eletrobras, Brasília, DF, Brazil.
https://www.linkedin.com/in/wanderson-alves-aaa049144/

Eduardo Amadeu Dutra Moresi
PhD in Information Science, Universidade de Brasília (UnB), Brasília, DF, Brazil.
Professor, Universidade Católica de Brasília (UCB), Brasília, DF, Brazil.
http://lattes.cnpq.br/1088020888142000

Ana Paula Bernardi da Silva
PhD in Electrical Engineering, Universidade de Brasília (UnB), Brasília, DF, Brazil.
Professor, Universidade Católica de Brasília (UCB), Brasília, DF, Brazil.
http://lattes.cnpq.br/2644093939475294

Helga Cristina Hedler
PhD in Social, Work and Organizational Psychology, Universidade de Brasília (UnB), Brasília, DF, Brazil.
Professor, Universidade Católica de Brasília (UCB), Brasília, DF, Brazil.
http://lattes.cnpq.br/9878306773047270

Submitted on: 05/19/2022. Approved on: 01/23/2024. Published on: 06/21/2024.

ABSTRACT

This study addresses the significant impact of technology on the growth and prominence of contemporary organizations, examining the relationship between digital transformation and business sustainability. The research highlights the importance of digital adaptations to maintain relevance in the global market. The main focus is on conducting a bibliometric analysis of digital transformation, identifying emerging themes that contribute to the valorization of organizations. The adopted methodology consists of a literature review, using the Scopus database and tools such as VOSviewer and Gephi for network analysis of keyword co-occurrence, co-citation of cited references, bibliographic coupling of documents, and identification of emerging trends. Additionally, content analysis is employed for a more detailed examination of the identified themes. The results indicate that the effectiveness of digital transformation in an organization is intrinsically linked to its level of maturity in electronic governance. Furthermore, it is evident that the adoption of an IT governance framework is crucial for a successful implementation of digital transformation.

Keywords: e-governance; e-government; Information technology governance; bibliometric analysis.

INTRODUCTION

Digital transformation represents a process of fundamental structural changes in organizations, in which the preponderant challenge lies not only in technology, but mainly in human adaptation. This phenomenon is characterized by its high complexity and potential to fully affect corporations. In the context of strategic decisions, companies are compelled to meticulously evaluate the costs and benefits of the various digital transformation options, as well as the return on investment of these initiatives (Yucel, 2018).

The COVID-19 pandemic gave rise to an increased gap between organizations previously prepared for digital transformation and those that had not yet integrated such practices into their business models. Furthermore, the pandemic highlighted the responsiveness of governments in a global context. Recent studies point to a direct relationship between digital transformation and the success of both companies and governments around the world (Tabar *et al*., 2021; Su *et al*., 2022).

Research on digital transformation has addressed different perspectives: web-enabled supply chain management (Ranganathan; Teo; Dhaliwal, 2011); the application of new technologies in the industry 4.0 manufacturing environment (Gökalp *et al*., 2017); the consumption and transformation of IT governance (Gregory *et al*., 2018); the transformation of electronic government in Canada for the digital age (Roy, 2006); the oil and natural gas companies' delay in the digitization process compared to companies in the banking and retail sectors (Kohli; Johnson, 2011); the transformation of the customer-supplier relationship in digital services (Kamalaldin *et al*., 2020); the proposal of a holistic and structured form of process automation using robots (Hofmann *et al*., 2020); a new paradigm that is being designed to reshape global health services (Anwar *et al*., 2015); an online survey conducted with European IT executives about their concerns, spending, investments, cloud usage, security, workforce, reporting relationships and other matters of importance (Kappelman *et al*., 2019).

More recently, Alenizi and Al-karawi (2022) presented the different characteristics of the barriers that obstruct the adoption and use of cloud computing in the public area of Kuwait Laufer *et al*., (2021) verify the assumptions of the education startup community (edtech) about digital education improving access, learning and collaboration in higher education. Gruchmann and Bischoff (2021) found that blockchain technology is promoting significant transformation in logistics, creating a complex environment that challenges business changes. Hognogi *et al*., (2021) presented a bibliometric study on the areas of application of unmanned aircraft systems and geographic information system technologies aimed at their use by local public authorities. Tabar *et al*., (2021) analyzed the impact of COVID-19 on the reliability of the Information and Communication Technologies (ICT) infrastructure to support the demand of users' transition to online. Alalwan *et al*., (2021) studied the effect of digital transformation on B2B relationships in the Arab-Asian region during the COVID-19 pandemic. Zeng *et al*., (2021) found a change in behavior as a terrestrial information system was adopted in China, to examine why users would switch from the traditional paper-based work pattern to the digital

one. Sandvik (2021) presented a study on the digital transformation of healthcare governance, including discussions of its legal, ethical and technical properties, as well as more detailed investigations of the surveillance implications and the effectiveness of national initiatives. Leão and Silva (2021) conducted investigations into the repercussions of digital transformation on the competitive advantages of business organizations. The research focused on the influence of digital transformation on the competitiveness of commercial entities, with an emphasis on aspects such as innovation, efficiency, cost reduction and effects on global value chains, covering specialization, geographic reach, governance and updating. Deja *et al*., (2021) investigated digital transformation from the perspectives on the results of academic library science in information literacy. The concepts of information literacy and digital literacy related to academic library science used as a basis for self-efficacy and empowerment to achieve individual success during digital changes in the academic community were addressed.

It was identified that the dimensions of electronic government, as well as corporate electronic governance and Information Technology, emerge as critical aspects for the implementation and consolidation of digital transformation in government and corporate entities. In this context, the research in focus articulates the following scientific question: what is the conceptual structure of digital transformation in the public realm? To address this issue, a bibliometric analysis of the works published in Scopus database was conducted. This investigation involved the application of keyword co-occurrence analysis techniques, co-citation of references and bibliographic coupling of documents. Additionally, a thorough textual analysis of the most significant documents identified was performed.

METHODS

The methodology of this work is organized into three items: bibliometrics concepts; data collection and analysis and research refinement.

Bibliometrics

In general, bibliometrics is the application of mathematical and statistical methods to books and other means of written communication (Pritchard, 1969), covering books and publications in general. Bibliometrics statistically analyzes numbers of publications and citations, as well as the relationships between publications to systematize a field of research (Ellegaard; Wallin, 2015; Kücher; Feldbauer-Durstmüller, 2019; Zupic; Čater, 2015). Scientific mapping, as a bibliographic method, visually represents statistically significant links between publications to draw content-related conclusions. In this research, three types of mappings were applied: co-occurrence of keywords; co-citation of cited references and bibliographic coupling of documents. Word co-occurrence analysis is an analysis technique that uses words in documents to establish relationships and build a conceptual structure of the domain (Callon *et al*., 1983). The idea underlying the method is that when words frequently co-occur

in documents, it means that the concepts are closely related. This semantic map helps to understand its cognitive structure (Börner *et al*., 2003). Word co-occurrence analysis can be applied to document titles, keywords, abstracts or full texts. Analysis unit is a concept, not a document, author or journal. In some cases, keywords are restricted to a single word, but in others they also include compound terms, according to the level of depth at which the search is at. The number of co-occurrences of two words corresponds to the number of publications in which both occur simultaneously in the title, abstract or list of keywords (Van Eck; Waltman, 2014).

Although there is general consensus in analyzing citation patterns to detect emerging domains of research, the type of citation differs across research. There are three definitions of citation (Small *et al*., 1997): direct, co-citation (Small, 1973) and bibliographic coupling (Kessler, 1963). Most bibliometric studies provide a direct citation analysis of the documents retrieved in a bibliographic search on a given research field, usually in the form of top-N lists of the most cited studies, authors or journals in the examined field (Zupic; Čater, 2015). Direct citations are used as a measure of influence. If an article is heavily cited, it is considered important. This proposition is based on the assumption that authors cite documents that they consider important for their work. Citation analysis provides information about the relative influence of publications, but it lacks the ability to identify relationships between documents (Üsdiken; Pasadeos, 1995).

Co-citation analysis uses the citation count of two references by a third to construct measures of similarity between documents, authors or journals (Mccain; Lynn, 1990). Co-citation is defined as the frequency with which two units are cited together (Small, 1973). The greater the number of documents in which two publications are cited concomitantly, the stronger the co-citation relationship between them (Small; Griffith, 1974) and the greater the probability that their content is related. Different types of co-citation can be used, depending on the analysis unit: documents (Raghuram *et al*., 2010); authors (White; Mccain, 1998) and periodicals (Mccain, 1991). Co-citation connects documents, authors or journals according to how writers use them. This is a rigorous grouping principle performed repeatedly by subject-matter experts who cite publications that they consider valuable and/or interesting. Because the publication process is time-consuming, the co-citation image reflects the condition of the field some time ago, not necessarily how it appears now or how it could appear tomorrow. It is a dynamic image that changes over time. When examined over time, co-citations are also useful in detecting a shift in paradigms and schools of thought (Pasadeos *et al*., 1998).

In addition, it considers that the basic literature represents the cores of theories and methods and the articles cited describe the research fronts in thematic domains in the period investigated. In short, co-citation analysis is seen as a way of identifying high-density areas in a citation network by means of the grouping of highly cited documents, constituting the research fronts of a thematic domain (Garfield; Ahlgren, 1988).

Bibliographic coupling uses the number of references shared by two documents as a measure of the similarity between them. The more the bibliographies of two articles

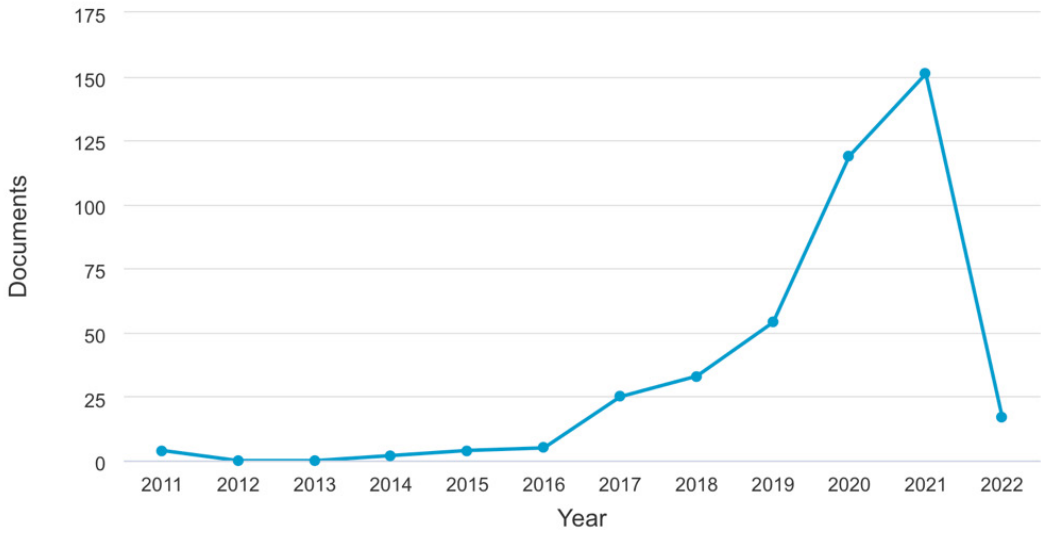
overlap, the stronger their connection (Zupic; Čater, 2015). The number of references shared between two documents is static over time (i.e., the relationship between two documents does not matter when the analysis is conducted), as the number of references within the article is unchanged, while the relationship based on co-citation develops with citation patterns. As citation habits change, bibliographic coupling is best accomplished within a limited time frame (Glänzel; Thijs, 2011). It is better to analyze publications from the same time period, that is, it is illogical to couple a publication issued in 1964 with a publication issued in 2012. A bibliographic coupling connection is established by the authors of the articles in focus, while a co-citation connection is established by the authors who are citing the works examined.

DATA COLLECTION AND ANALYSIS

To collect data, a search was conducted in Scopus database using search expression: digital transformation" AND ("governance" OR "it governance" OR "data governance"). The result retrieved 420 references, in the 2011-2022 period, limited to the types of documents published in journals or conferences. **Figure 1** shows the evolution of the researched topic. It is observed that the peak was in 2021, with 152 documents. Another point to highlight is that the oldest documents are from 2011. The metadata was exported in CSV format to be analyzed following approaches suggested by Moresi, Pinho and Costa (2022).

In this sense, this work adopts a bibliometric approach moving towards scientific mapping using network analysis techniques on metadata retrieved from the bibliographic research. Network analysis methods are best known for their application in social environments (social network analysis) where they are applied to the study of relationships between a set of actors (Borgatti, Everett; Freeman, 2002). For network analysis, the methods published by Newman *et al*., (2009), van Eck and Waltman (2014), and Waltman, van Eck and Noyons (2010) were used.

Figure 1 – Evolution of the research topic



Source: Search in Scopus database (2022).

A bibliometric network consists of graphs that comprise: nodes (units of analysis) and edges (types of analysis). Examples of nodes are publications, journals, researchers, countries, organizations or keywords. Edges indicate relationships between pairs of nodes. In this work, keyword co-occurrence, co-citation and bibliographic coupling networks were analyzed.

After the bibliographic research, the following steps were followed: choice of units of analysis – authors' keywords, documents or cited references; choice of type of analysis - networks of co-occurrence of keywords, co-citations of cited references and bibliographic coupling of documents; choice of VOSViewer software (Van Eck; Waltman, 2022) to generate co-occurrence networks of authors' keywords and document co-citations; preparation of the VOSviewer thesaurus to control vocabulary and standardize bibliographic references; obtaining the authors' keyword co-occurrence networks, from software Gephi (Bastian *et al*., 2009), for calculating network analysis metrics – average degree, modularity classes, eigenvector centrality; refinement of the search based on the analysis of the edges of the co-occurrence network imported by Gephi, elaboration of a new search expression, query to Scopus database and retrieval of the metadata of the result; from the metadata of the research result after refinement, networks of authors' keywords, document citations, co-citations of cited references and bibliographic coupling of documents were obtained, with vocabulary control and bibliographic reference normalization; calculation of network metrics using Gephi software – average degree, modularity classes and eigenvector centrality; identification of the most relevant keywords; identification of research fronts based on co-citation networks of cited references and bibliographic coupling.

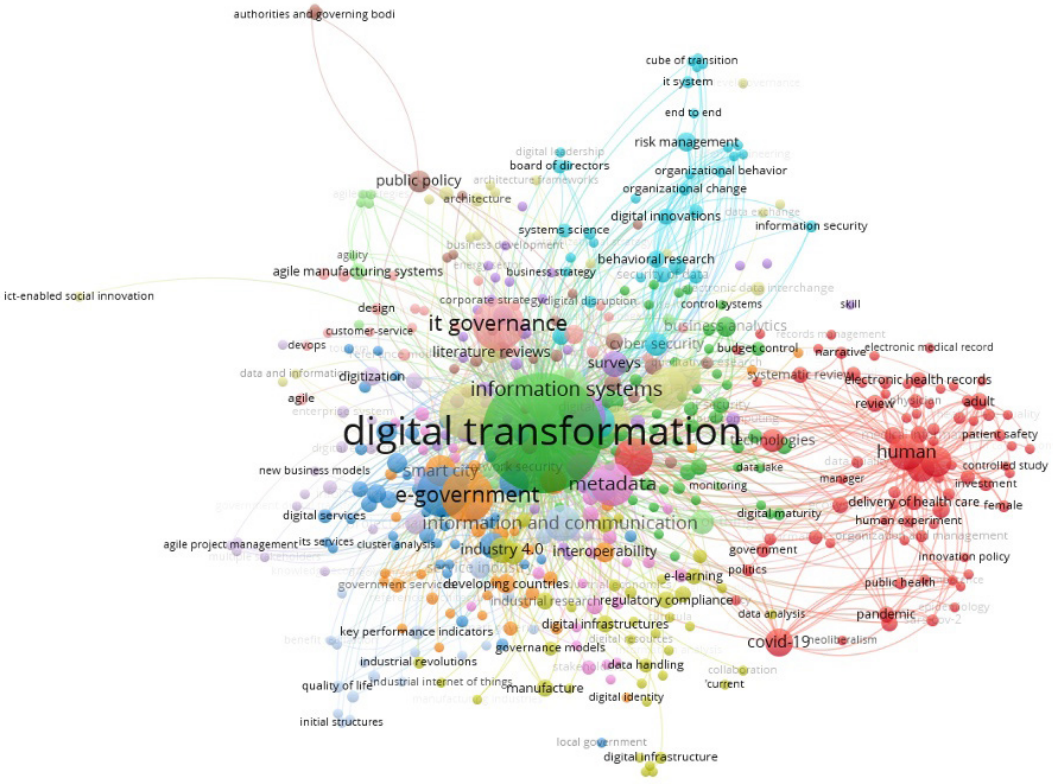
At last, the most relevant articles from the bibliographic research were selected and the textual data was analyzed using Iramuteq, which is a textual analysis software, which is anchored to statistical program R and generates data, from texts (text corpora) and tables.

Textual analysis is a flexible methodology that can meet the unique needs of research questions and adopted strategies, using a set of techniques and approaches to analyze texts (White; Marsh, 2006).

Research refinement

To refine the research, the framework of Moresi and Pinho (2021) was followed. Initially, the metadata of the documents retrieved in the bibliographic search were imported by VOSviewer (Van Eck; Waltman, 2022). The authors' keyword co-occurrence network was obtained, with a minimum of two occurrences for each word, resulting in a graph with 601 nodes, 18 communities and 8,430 edges. VOSviewer allows one to control vocabulary by creating a TXT file called thesaurus. The authors' keyword co-occurrence network including the thesaurus, with at least two occurrences, resulted in a graph with 493 nodes, 14 communities and 6,344 edges, which is presented in **Figure 2**.

Figure 2 – Authors' keyword co-occurrence network



Source: Generated by the authors using software VOSviewer (2022).

The network was saved in GML format and imported by Gephi. After calculating the metrics of the authors' keyword co-occurrence network, the Data Laboratory and edges

option were selected. **Table 1** shows the selection of the 14 edges with the highest weights. Since the network is undirected, the source and destination nodes have no direction. They only represent the co-occurrences of the respective keywords.

Table 1 - Main edges of the authors' keyword co-occurrence network

Origin	Destination	Weight
350–digital transformation	667–it governance	28.0
350–digital transformation	395–e-governance	24.0
350–digital transformation	398–e-government	21.0
350–digital transformation	904–public governance	16.0
237–data analytics	350–digital transformation	13.0
398–e-government	904–public governance	10.0
213–covid-19	350–digital transformation	8.0
395–e-governance	398–e-government	8.0
395–e-governance	1006–smart city	8.0

Source: Generated by the authors using software Gephi (2022).

Subsequently, a new search expression was built combining the keywords of one edge with logical operator AND. This step was performed recursively, where the new search expression was consulted in the bibliographic database and the number of documents retrieved was identified. Each new pair of keywords was combined using logical OR operator, as shown in **Table 2**, and queried in the bibliographic search database. The research ended with saturation in 2015 documents.

Table 2 – Results of the bibliographic search by edge weight

Index	Search expression	Number of Documents
#1	("digital transformation" AND "it governance")	46
#2	#1 OR ("digital transformation" AND " e-governance")	75
#3	#2 OR ("digital transformation" AND "e- government")	247
#4	#3 OR ("digital transformation" AND "public governance")	252
#5	#4 OR ("data analytics" AND "digital transformation")	538
#6	#5 OR ("e-government" AND "public governance")	582
#7	#6 OR ("covid-19" AND "digital transformation")	1223
#8	#7 OR ("e-governance" AND "e-government")	2167
#9	#8 OR ("e-governance" AND "smart city")	2245

Source: Scopus search result (2022).

However, the document type filter was applied and articles in journals, conferences and reviews were selected, resulting in 2015 documents, from the 2001-2022 period. The most cited articles presented studies on: the recognition of electronic government as a means to transform public governance (Teo *et al*., 2008); the new face of electronic government in the transformation of society (Thomas; Streib, 2003); improve the relationship between citizens and public authorities (Evans; Yen, 2006); the evolution of portals at the municipal level as a means for more interactions, participation and collaboration (Sandoval-Almazan; Gil-Garcia, 2012); a retrospective of twelve e-gov internship models (Lee, 2010); the significant transformation of business and operational processes in organizations during the COVID-19 pandemic (Dwivedi *et al*., 2020); the real meaning of smart cities with the use of information and communication technologies to solve local issues from local economy and transport to quality of life and electronic governance (Martinez-Balleste *et al*., 2013); open government, under President Obama, and its relationship with electronic democracy (Harrison *et al*., 2012); the COVID-19 pandemic has led many countries to suspend teaching activities. In the university environment, the urgency of transforming in-person into online classes has become acceptable (García-Peñalvo *et al*., 2020); e-gov and electronic governance in North America and Europe (Marche; Mcniven, 2003); a methodology to ensure excellence in electronic governance implementations (Saxena, 2005).

More recently, Han and Trimi (2022) presented a study on a data science platform to improve the collaboration of small and medium-sized companies by means of Industry 4.0. Yurkevich, Stepanovskaya and Kryukova (2022) described information support mechanisms for the digital transformation of space complexes based on the concept of socio-cyber-physical self-organization. Elgazzar, El-Shahawy, and Senousy (2022) explored the role of digital transformation in increasing business resilience to the COVID-19 pandemic. Gunduz, Demir and Paksoy (2021) cited the combination of supply chain management functions with smart and sustainable tools. Pizzi *et al*., (2021) presented an assessment of the impacts of digital transformation on internal auditing. Sharma, Mishra and Mishra (2021) studied the factors that determine the satisfaction of social entrepreneurs in electronic government services, mentioning the importance of electronic governance channels in facilitating the delivery of services to citizens. Tangi *et al*., (2021) analyzed the transformation of digital government, citing technologies that are transforming the public sector by affecting applications, processes, culture, structure and responsibilities and tasks of civil servants. Kyrychenko, Yakubovskiy and Rodionova (2020) published a study on the digital transformation of oil refining in Ukraine, addressing the digitization process and its role in providing competitiveness to the industry in conditions of technological change. Soussan and Trovati (2020) analyzed the misuse of social media data, particularly as a source of misinformation and the misuse of data from these platforms.

RESULT ANALYSIS AND DISCUSSION

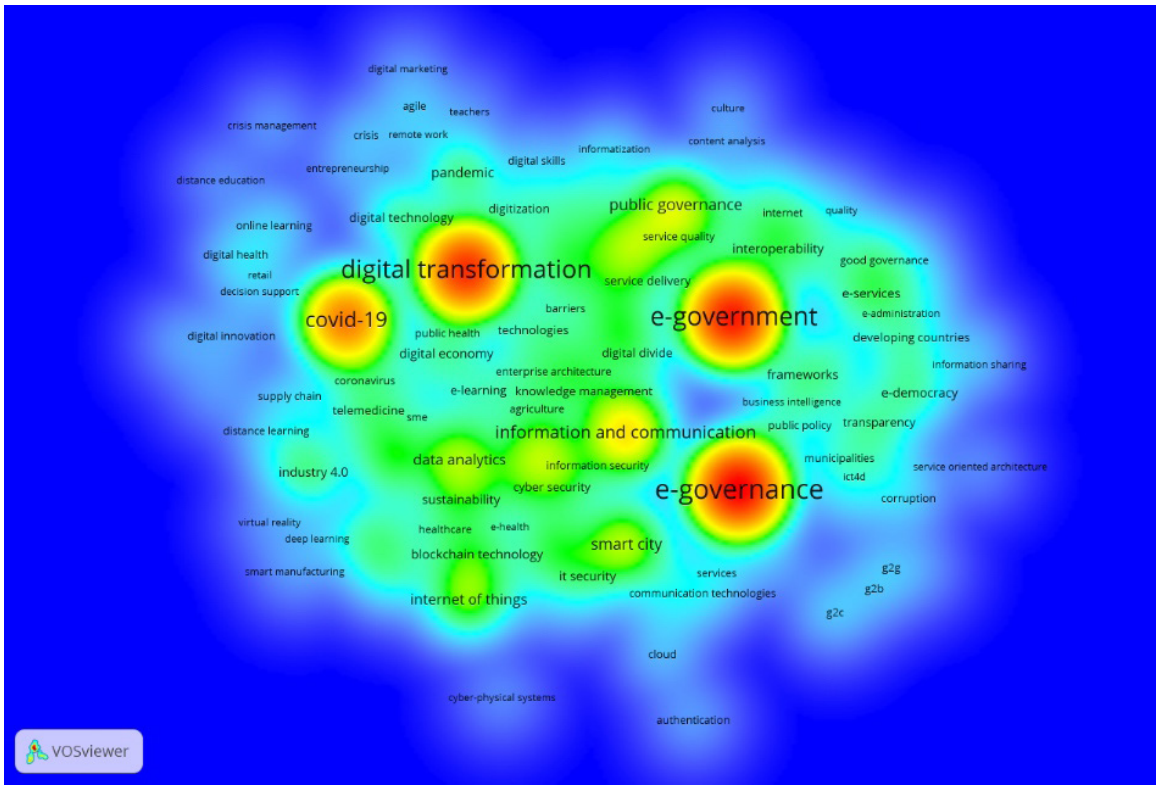
The research results present the co-occurrence networks of authors' keywords, co-citation of cited references and bibliographic coupling of documents.

Keyword co-ocurrence network

The metadata from the refined bibliographic search was imported into VOSviewer (Van Eck; Waltman, 2014) and the option for the co-occurrence of authors' keywords in each publication was selected. Without vocabulary control, with a minimum of five occurrences for each pair of keywords, the co-occurrence network resulted in 234 nodes, 13 communities and 2,492 edges. The thesaurus was created to control the vocabulary and a new network was generated, resulting in 173 nodes, 12 communities and 1,578 edges.

Figure 3 presents a view of the density map of the keyword co-occurrence network. It is noted that the following keywords stand out on the network: *digital transformation, e-governance, e-government,* covid-19, *it governance, public governance, smart city*, big data, among others. This result is coherent due to the construction of the search expression. On the other hand, there are peripheral topics that can be considered as research opportunities, for example: digital twins, decision support, e-democracy, telemedicine, enterprise architecture, e-business, remote work, etc. However, visual scanning does not allow emerging keywords to be identified with greater precision. It is necessary to calculate network analysis metrics for such identification.

FIGURE 3 – View of the authors' keyword co-occurrence network after search refinement



Source: Generated by the authors using software VOSviewer (2022).

To deepen data analysis, network analysis metrics were calculated using Gephi application (Bastian *et al*., 2009). The average degree was calculated, which determines the number of connections that, on average, the nodes in a network have (Newman, 2010); modularity, which measures the strength of the network's division into communities (Newman *et al*., 2009; Blondel *et al*., 2008); and eigenvector centrality, which uses unique eigenvalues from the adjacency matrix and measures the influence of each node (Newman *et al*., 2009; Ruhnau, 2000). Gephi has a data laboratory feature, which allows one to extract information about network metrics. **TABLE 3** presents the keywords with eigenvector centrality greater than 0.4000, that is, those with the greatest influence on the network. The result shows that the topic is recent. Only three keywords have an average year between 2014 and 2016.

Table 3 – Keywords with the highest eigenvector centralities

Keywords	Average Year	Degree	Eigenvector centrality
e-government	2014,925	134	1,000
e-governance	2015,139	132	0,999
digital transformation	2020,475	121	0,942
covid-19	2020,844	90	0,762
information and communication technology	2015,865	78	0,712
smart city	2018,693	58	0,570
big data	2019,047	53	0,559
public governance	2017,026	56	0,554
artificial intelligence	2020,447	50	0,533
data analytics	2019,875	50	0,523
internet of things	2019,661	47	0,503
innovations	2018,737	41	0,459
cloud computing	2017,514	40	0,440
machine learning	2019,929	40	0,412

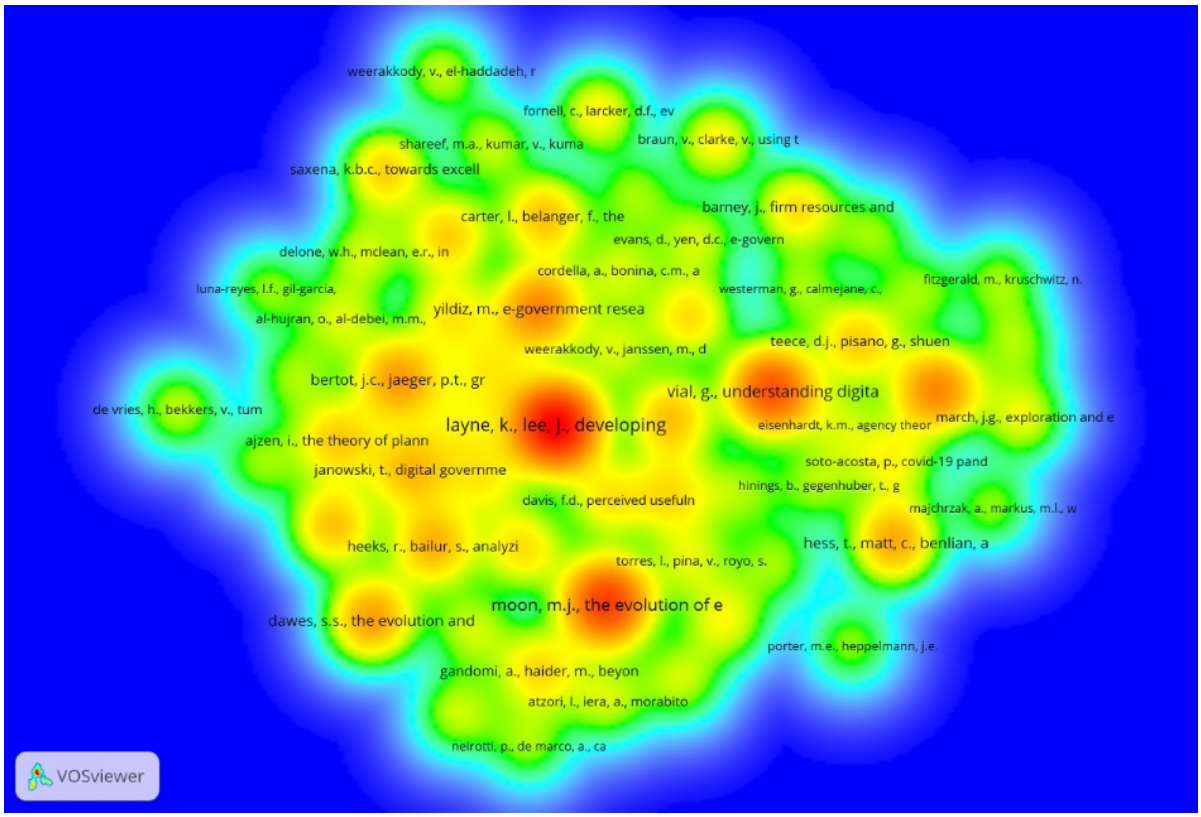
Source: Generated by the authors using software Gephi (2022).

Co-citation network of cited references

Document co-citation network was generated using software VOSviewer (Van Eck; Waltman, 2022). The metadata was imported by VOSviewer and the document co-citation option was selected. VOSviewer has the option, for this type of network, of using a thesaurus file to normalize bibliographic references, eliminating duplicate records, and making the result more accurate. Without the use of the bibliographic references thesaurus file, with a minimum of five co-citations for each document, a co-citation network was obtained with 63 nodes, 6 communities and 365 edges. With the inclusion of the reference thesaurus, the resulting network now has 61 nodes, 6 communities and 363 edges, which is shown in **Figure 4**.

The graph was exported into Gephi (Bastian *et al*., 2009), where the following network metrics were calculated: average degree; modularity class and eigenvector centrality. Based on the calculated metrics, the documents were listed in descending order, according to eigenvector centrality, to identify the most influential references. **Table 4** presents the 10 documents with the highest eigenvector centralities.

Figure 4 – View of the co-citation network of cited references



Source: Generated by the authors using software VOSviewer (2022).

The co-citation network analysis result showed that the most influential articles addressed electronic government. This result is coherent, considering that the most influential keyword in the co-occurrence network is e-government, with degree 134 in a graph with 173 nodes.

Layne and Lee (2001) cited electronic government experiences and presented a series of challenges for public officials. West (2004) assessed the consequences of electronic government for service delivery and democratic responsiveness. Yildiz (2007) reported on the lack of definition of the concept of electronic government and the excessive simplification of development processes in complex political and institutional environments, in addition to methodological limitations. Moon (2002) concluded that electronic government can excel in future governance despite widely shared barriers and legal issues to progress. Bertot *et al*., (2010) reported that governments have worked to increase openness and transparency in their actions and how information and communications technologies (ICTs) are seen as a convenient and cost-effective means of promote openness and transparency and reduce corruption. Andersen and Henriksen (2006) proposed the reorientation of electronic government maturity models focusing on IT applications to improve core activities and bring end users as key stakeholders for future investments. Heeks and Bailur (2007) conduct a content analysis to understand the rapid growth in the volume of research production on electronic government. Coursey and Norris (2008) presented research on the old regulatory models that are used by electronic government. Ebrahim and Irani (2005) proposed an architectural

structure integrated with IT infrastructure with business process management in public sector organizations aiming to improve decision making and competitive advantage with the adoption of electronic government. Weerakkody *et al*., (2011) highlighted the findings of electronic government-induced business process reengineering movement in the public sector.

Table 4 – Articles with the highest eigenvector centrality of the co-citation network of cited references

Document	Topic	Degree	Eigenvector centrality
Layne; Lee (2001)	e-government	32	1,000
West (2004)	digital government	27	0,926
Yildiz (2007)	e-government	25	0,820
Moon (2002)	e-government	23	0,763
Bertot *et al*. (2010)	e-government	24	0,741
Andersen; Henriksen (2006)	e-government	20	0,686
Heeks; Bailur (2007)	e-government	19	0,676
Coursey; Norris (2008)	e-government	18	0,669
Ebrahim; Irani (2005)	government data processing	20	0,657
Weerakkody *et al*. (2011)	e-government	19	0,647

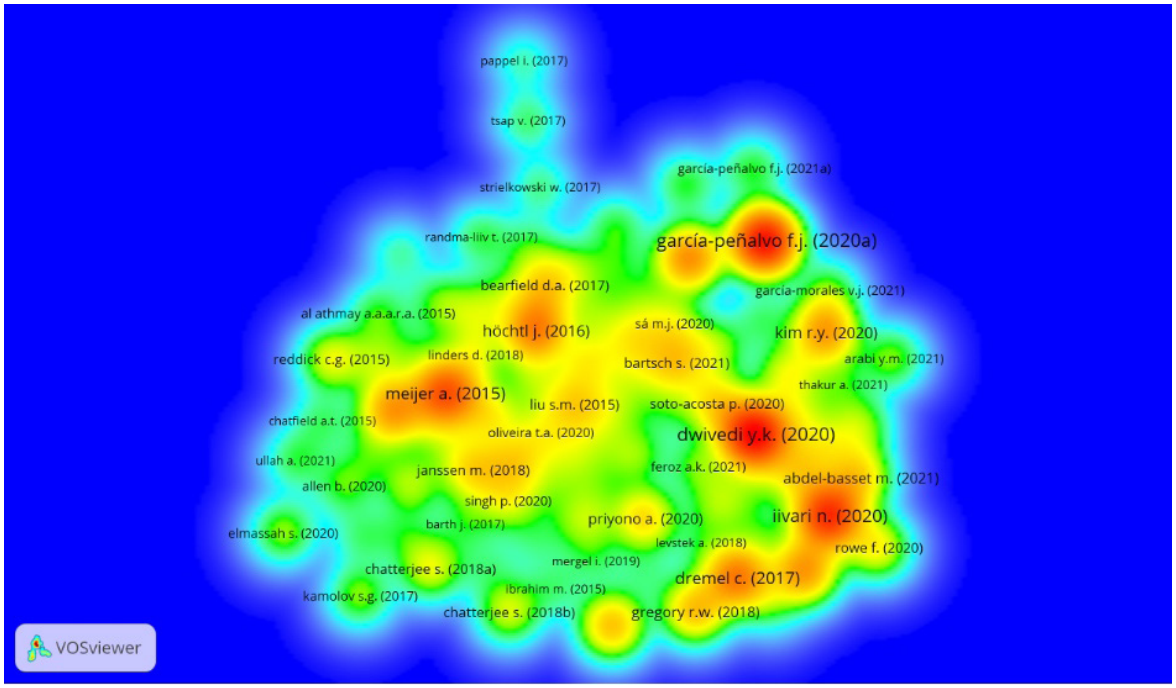
Source: Generated by the authors using software Gephi (2022).

Bibliographic document coupling network

Continuing with research refinement, 1,590 documents were retrieved on Scopus platform, within the period from 2015 to 2022. The bibliographic document coupling network was generated using software VOSviewer (Van Eck; Waltman, 2022). Metadata was imported by VOSviewer, the bibliographic document coupling option and a minimum of 15 documents in common were selected. The resulting network has 92 nodes, 13 communities and 247 edges, which is shown in **Figure 5**.

The graph was exported into Gephi (Bastian *et al*., 2009, to calculate network metrics: average degree; modularity class and eigenvector centrality. **Table 5** presents the 10 documents with the highest eigenvector centralities.

Figure 5 – View of the bibliographic document coupling network



Source: Generated by the authors using software VOSviewer (2022).

The bibliographic coupling analysis result reveals that the central theme of digital transformation is e-government , evidenced by the 10 most influential articles. Pereira *et al*., (2018) provided information on the definitions and relationships between smart governance and concepts such as smart and electronic government, in the context of smart cities. Janssen and Helbig (2018) looked at how advances in information and communication technologies (ICTs) continued to have an impact on the ways in which policymakers and citizens interact. Chatfield and Reddick (2016) presented a theory-building case study that identified the preceding conditions required for implementing smart cities. Linders *et al*., (2018) addressed the efficiency gains by the Taiwanese government from electronic government and ways to explore how to leverage IT innovations beyond efficiency to also change the way the government delivers services and solves public issues.

Allen *et al*., (2020) assessed the performance of services provided using digital technology in smart cities relating citizen-government collaboration. Reddick *et al*., (2015) examined public opinion regarding the mass surveillance programs of the National Security Agency of the United States of America. Lee-Geiller; Lee (2019) investigated the multidimensional features that allow government websites to fulfill their promises and concluded that the study contributed to the literature by extending the scope of analyzing electronic government websites beyond the issue of citizen acceptance and highlighting their engagement. Chatfield and Reddick (2015) investigated disaster risk communications during the February 2014 eruptions of Mount Sinabung in Indonesia. They critically assessed government-to-citizen unidirectional communications, through electronic government websites and Twitter, and citizen multidirectional communications.

Table 5 – Articles with the highest eigenvector centrality of the bibliographic document coupling network

Document	Topic	Degree	Eigenvector centrality
Pereira *et al*. (2018)	smart governance	19	1,000
Janssen; Helbig (2018)	e-government	15	0,821
Chatfield; Reddick (2016)	smart city	15	0,812
Linders *et al*. (2018)	e-government	14	0,804
Allen *et al*. (2020)	smart city	11	0,681
Reddick *et al*. (2015)	e-government	9	0,639
Lee-Geiller; Lee (2019)	e-government	14	0,633
Chatfield; Reddick (2015)	e-government	10	0,630
Nielsen (2016)	e-government	12	0,623
McNutt *et al*. (2016)	e-government	11	0,584

Source: Generated by the authors using software Gephi (2022).

Nielsen (2016) presented a study on three gaps in electronic government: which variables positively affect the use of electronic services and whether these correlations are statistically proven; the degree to which governance and cooperation models ensure the successful provision and use of e-services, and the existing stage models for charting electronic government progress. McNutt *et al*., (2016) presented results of an exploratory study on the adoption of technology by local governments in the United States with elements that include open data, ICT-related innovations and their limits. The authors suggested that long-term commitment to citizen engagement in government data and community size are important predictors of adoption.

Analysis of textual data

A corpus was prepared with the 40 articles identified as most relevant to the research and the textual data was analyzed using software Iramuteq. After loading the text corpus, a classic textual statistical analysis of the corpus, was conducted, in which: 40 texts, 2,984 occurrences, 741 forms, and of these, 442 were unique forms (hapax), with 14.81% occurrences and 59.65% forms. The average number of occurrences per text was 75%.

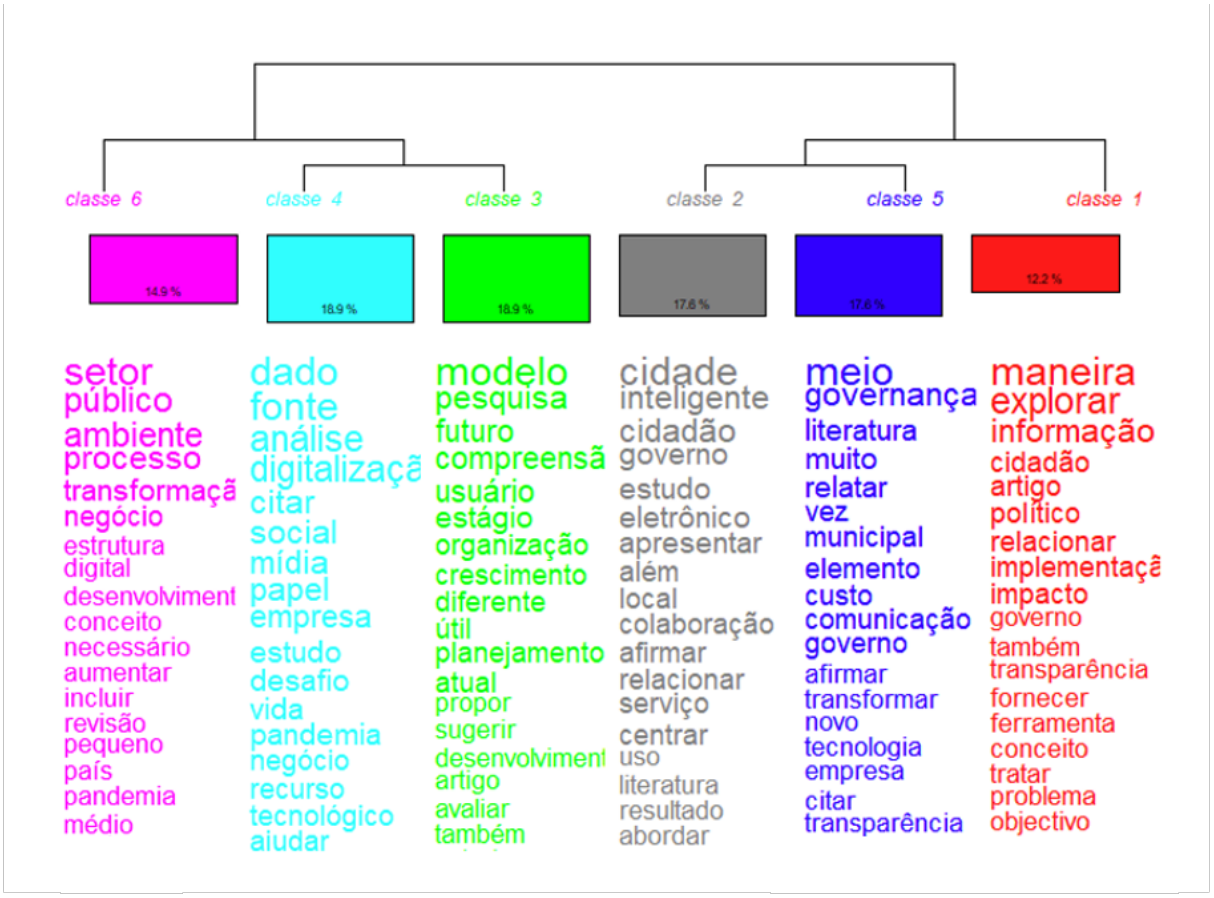
Aiming to deepen the textual analysis of the content, Specificity and Factorial Correspondence Analyses (FCA) were performed, in addition to classification using the Reinert method (Loubère; Ratinaud, 2014). **Figure 6** presents the dendrogram with the textual classes identified (Camargo; Justo, 2013). The generated classes were considered the categories to be interpreted in the textual data analysis. Thus, in this analytical stage

led by the researcher, the materials generated by Iramuteq, together with the reading and understanding of the summaries by the researcher, helped to build an understanding of the data from which inferences were generated.

It is possible to observe that six classes were identified from the corpus, and were grouped into two distinct sub corpora. Classes 6, 4 and 3 are more closely related in one group, while classes 2, 5 and 1 are in the second group.

Identified class 1 was grouped by proximity to classes 2 and 5, containing 12.1% of the corpus. From such grouping, the following name was assigned to class 1: and transparency of relationships between governments and citizens. The following narrative was obtained from the selected words: information exploration aiming to reduce the impacts of implementing electronic governments with returns for citizens. This narrative is confirmed by the text segments generated by Iramuteq, as shown in figure 6.

FIGURE 6 – Dendrogram with the textual classes identified

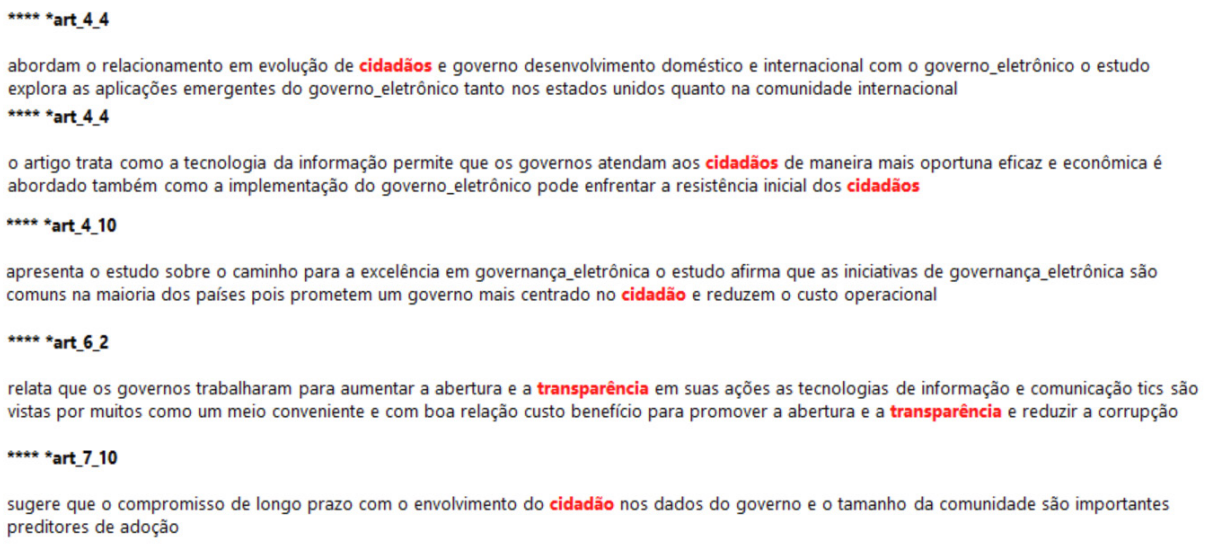


Source: Generated by the authors using software Iramuteq (2022).

Identified class 2 was grouped by proximity to class 5, containing 17.6% of the *corpus*. From such grouping, the following name was assigned to class 2: Smart Cities formed by electronic governments and citizens. According to the words selected by Iramuteq for class 2, it was possible to build the following narrative: smart cities demonstrate results of electronic

government collaboration for the provision of citizen-centered services. This narrative was confirmed and verified by the text sequences generated. Some text segments confirming the proposed narrative were highlighted, as shown in **Figure 7**.

Figure 7 – Class 1 – transparent relationships between governments and citizens – Verification of interpretation by segments of texts generated by Iramuteq



Source: Generated by the authors using software Iramuteq (2022).

Figure 8 – Class 2 – Smart cities with citizens and electronic government – Verification of interpretation by text segments generated by Iramuteq

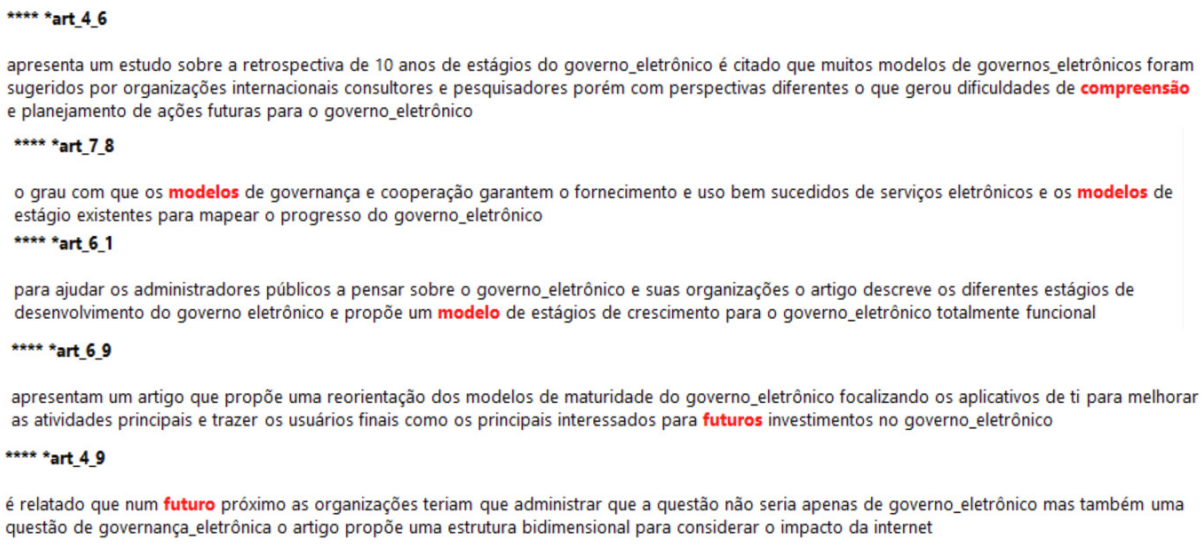
Source: Generated by the authors using software Iramuteq (2022).

Class 3 was formed with 18.90% of the *corpus*. According to the dendrogram, class 3 was identified and grouped together with classes 4 and 6. However, a direct relationship of

proximity is perceived with a subgroup formed with class 4, thus standing further away from class 6. From the analysis of the generated dendrogram, the name of class 3 was defined as: electronic government models and future stages.

According to the words automatically selected by Iramuteq for class 3, the following narrative was constructed: understanding electronic government models, their different stages and planning for the future development of organizations. Research suggests that it is useful to pay attention to users who consume government services on the internet. Some text segments automatically generated by Iramuteq from the analyzed corpus were highlighted to confirm the proposed narrative, as shown in **Figure 9**.

Figure 9 – Class 3 – electronic government models and future stages – Verification of interpretation by text segments generated by Iramuteq



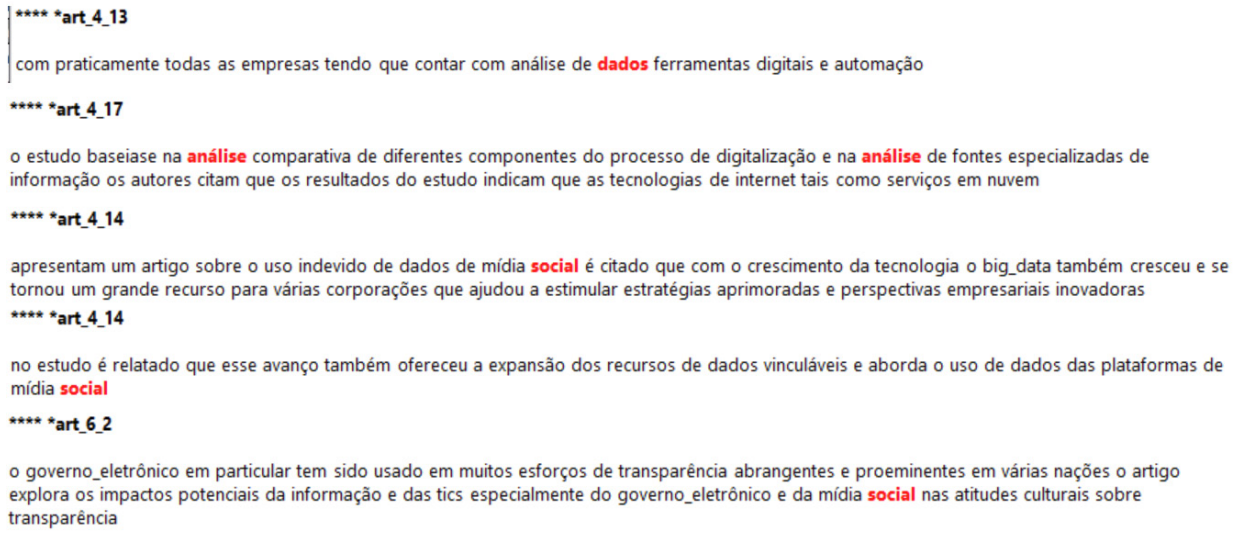
Source: Generated by the authors using software Iramuteq (2022).

Class 4 is directly related to class 3 also with 18.90% of the *corpus* and these two related to class 6. From the analysis of the generated dendrogram, the name of class 4 was defined as: technological data analysis. In assessing the words automatically selected by Iramuteq for class 4, the following narrative was built: analyses in data sources, including social media, identify important challenges and aids for company business processes. The text sequences automatically generated by Iramuteq, and verification of the agreement analysis with some highlighted words from class 4 corroborate the narrative presented. Some examples were listed to confirm the proposed narrative, as shown in **Figure 10**.

Class 5 has 17.60% of the corpus and appears in the second grouping where classes 1 and 2 are also present. Class 5 is directly related to class 2 through subgrouping. From the analysis of the generated dendrogram, the name defined for class 5 was: Technology, Governance and Communication. For class 5, the following narrative was built: the technological

transformation of the government involves communication and governance as fundamental elements of transparency. Some examples were listed to confirm the proposed narrative, as shown in **Figure 11**.

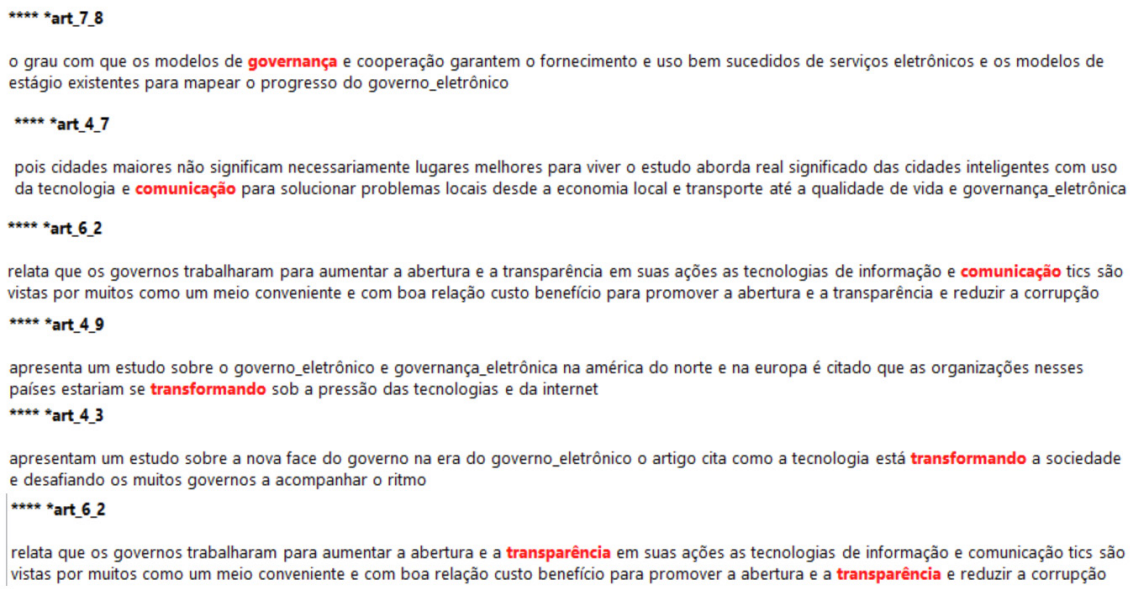
Figure 10 – Class 4 – Analysis of technological data – Verification of interpretation by text segments generated by Iramuteq



Source: Generated by the authors using software Iramuteq (2022).

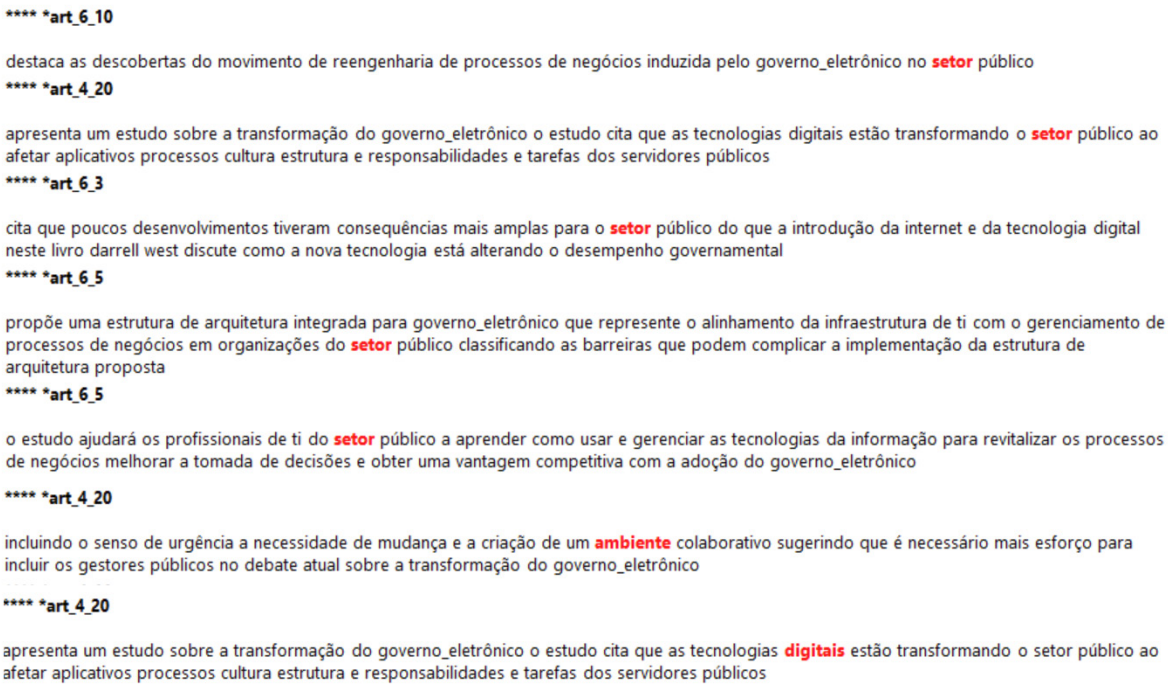
Class 6 is the last class identified by Iramuteq. It has 14.90% of the corpus and appears in the first grouping where classes 3 and 4 are located. From the analysis of the generated dendrogram, the name defined for class 6 was: Public Sector, changing environment. For class 6, the following narrative was created: digital transformation is changing the public sector environment and enabling the consolidation of electronic governments, despite the limitations and lack of clarity in objectives. Some examples were listed to confirm the proposed narrative for class 6, as shown in **Figure 12**.

FIGURE 11 – Class 5 – Technology, Governance and Communication – Verification of interpretation by segments of texts generated by Iramuteq



Source: Generated by the authors using software Iramuteq (2022).

FIGURE 12 – Class 6 – Public Sector, changing environment – Verification of interpretation by segments of texts generated by Iramuteq.



Source: Generated by the authors using software Iramuteq, (2022).

CONCLUSIONS

The present study, focused on digital transformation in the public realm and based on an extensive bibliometric analysis, brought to light vital aspects for understanding and effectively implementing this transformation in government and corporate contexts. The conducted analysis, using Scopus database and tools such as VOSviewer and Gephi, allowed one to identify that electronic governance, both at corporate and governmental levels, together with Information Technology (IT) governance, are fundamental pillars for the adoption and consolidation of digital transformation.

It was notable that, despite the growing relevance of electronic government and electronic governance, these topics presented less visibility in the most recent articles. However, the provision of online services and the potential of digital transformation for organizations and governments remain primary focuses of study.

In relation to the research question, it was identified that the conceptual structure of digital transformation involves multiple interconnected layers, centered on electronic governance, information technology and digital participation. This structure is supported by three fundamental pillars: technological infrastructure, which includes cloud computing, big data, and analytics solutions; electronic governance, which covers policies and practices for effective IT management in public and corporate organizations; and organizational culture, which emphasizes adaptation and continuous innovation in response to technological changes.

The conceptual framework is dynamic, reflecting the constant evolution of ICTs and the emerging needs of organizations and governments. Furthermore, the framework addresses the importance of interaction between different stakeholders, including citizens, companies and government institutions, to promote an inclusive and efficient digital transformation. Thus, the conceptual structure of digital transformation in the public realm is characterized by its complexity, multidimensionality and adaptability, aiming to achieve efficient governance, improved public services and greater citizen participation in the digital era.

The results highlight that success in implementing digital transformation does not lie exclusively within technology, but within efficient governance. The need to adopt frameworks suitable for the effective implementation of digital transformation was constant in the analyzed studies. Furthermore, the advancement of Information and Communication Technologies (ICTs) has been a fundamental driver for the growth and sustainability of corporations from different segments.

At last, it should be noted that digital transformation is a transversal phenomenon, influencing several corporate and government sectors globally, with different stages of implementation and maturity. The research points to the essentiality of robust electronic governance, associated with smart governments, as the key to success towards digital transformation.

REFERENCES

ALALWAN, A. A.; BAABDULLAH, A. M.; DWIVEDI, Y. K.; RANA, N. P.; LAL, B. RAMAN, R. Et-moone and marketing relationship governance: the effect of digital transformation and ICT during the COVID-19 pandemic. **Industrial Marketing Management**, Bradford, n. 98, p. 241–254, 2021.

ALENIZI, A. S.; AL-KARAWI, K. A. Cloud Computing Adoption-Based Digital Open Government Services: Challenges and Barriers. **Lecture Notes in Networks and Systems**, [*s. l.*], n. 216, p. 149–160, 2022.

ALLEN, B.; TAMINDAEL, L. E.; BICKERTON, S. H.; CHO, W. Does citizen coproduction lead to better urban services in smart cities projects? An empirical study on e-participation in a mobile big data platform. **Government Information Quarterly**, [*s. l.*], v. 37, n. 1, p. 101412, Jan. 2020.

ANDERSEN, K. V.; HENRIKSEN, H. Z. E-government maturity models: Extension of the Layne and Lee model. **Government Information Quarterly**, Copenhage, v. 23, n. 2, p. 236–248, 2006.

ANWAR, M.; JOSHI, J.; TAN, J. Anytime, anywhere access to secure, privacy-aware healthcare services: Issues, approaches and challenges. **Health Policy and Technology**, [*s. l.*], v. 4, n. 4, p. 299–311, 2015.

BASTIAN, M.; HEYMANN, S.; JACOMY, M. Gephi: an open source software for exploring and manipulating networks. **Proceedings of the International AAAI Conference on Web and Social Media**, [*s. l.*], v. 3, n. 1, p. 361-362, 2009. DOI: 10.1609/icwsm.v3i1.13937.

BERTOT, J. C.; JAEGER, P. T.; GRIMES, J. M. Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. **Government Information Quarterly**, Washington, v. 27, n. 3, p. 264–271, 2010.

BLONDEL, V. D.; GUILLAUME, J.-L.; LAMBIOTTE, R.; LEFEBVRE, E. Fast unfolding of communities in large networks. **Journal of Statistical Mechanics**: theory and experiment, [*s. l.*], v. 2008, n. 10, p. P10008, 2008.

BORGATTI, S. P.; EVERETT, M. G.; FREEMAN, L. C. Ucinet 6 for Windows: software for social network analysis. **Connections**, Harvard, v. 15, n. 1/2, 2002.

BÖRNER, K.; CHEN, C.; BOYACK, K. W. **Visualizing knowledge domains**. *In*: Annual review of information science and technology, v. 45, n. 1, p. 179–255, Jan. 2003.

CALLON, M.; COURTIAL, J. P.; TURNER, W. A.; BAUIN, S. From translations to problematic networks: an introduction to co-word analysis. **Social Science Information**, [*s. l.*], v. 22, n. 2, p. 191–235, 1983.

CAMARGO, B. V.; JUSTO, A. M. IRAMUTEQ: um software gratuito para análise de dados textuais. **Temas em Psicologia**, [*s. l.*], v. 21, n. 2, p. 513-518, 2013.

CHATFIELD, A. T.; REDDICK, C. G. Understanding Risk Communication Gaps through E-Government Website and Twitter Hashtag Content Analyses: the case of Indonesia's Mt. Sinabung Eruption. **Journal of Homeland Security and Emergency Management**, Wollongong, v. 12, n. 2, p. 351–385, 2015.

CHATFIELD, A. T.; REDDICK, C. G. Smart City Implementation Through Shared Vision of Social Innovation for Environmental Sustainability: a case study of Kitakyushu, Japan. **Social Science Computer Review**, [*s. l.*], v. 34, n. 6, p. 757–773, 2016.

COURSEY, D.; NORRIS, D. F. Models of E-Government: are they correct? an empirical assessment. **Public Administration Review**, [*s. l.*], v. 68, n. 3, p. 523–536, 2008.

DEJA, M.; RAK, D.; BELL, B. Digital transformation readiness: perspectives on academia and library outcomes in information literacy. **Journal of Academic Librarianship**, [*s. l.*], v. 47, n. 5, 2021.

DWIVEDI, Y. K.; HUGHES, D. L.; COOMBS, C.; CONSTANTIOU, J.; DUAN, Y.; EDWARDS, J. S.; GUPTA, B.; LAL, B.; MISRA, S.; PRASHANT, P.; RAMAN, R.; RANA, N. P.; SHARMA, S. K.; UPADHYAY, N. Impact of COVID-19 pandemic on information management research and practice: transforming education, work and life. **International Journal of Information Management**, [*s. l.*], n. 55, p. 102211, 2020.

EBRAHIM, Z.; IRANI, Z. E-government adoption: architecture and barriers. **Business Process Management Journal**, [*s. l.*], v. 11, n. 5, p. 589–611, 2005. DOI: 10.1108/14637150510619902.

ELGAZZAR, Y.; EL-SHAHAWY, R.; SENOUSY, Y. The Role of Digital Transformation in Enhancing Business Resilience with Pandemic of COVID-19. *In*: Magdi, D.A., Helmy, Y.K., Mamdouh, M., Joshi, A. (ed.). **Digital Transformation Technology**. Lecture Notes in Networks and Systems. Singapore: Springer, 2022. v. 224. p. 323–333. DOI: 10.1007/978-981-16-2275-5_20.

ELLEGAARD, O.; WALLIN, J. A. The bibliometric analysis of scholarly production: How great is the impact? **Scientometrics**, [*s. l.*], v. 105, n. 3, p. 1809–1831, 2015.

EVANS, D.; YEN, D. C. E-Government: evolving relationship of citizens and government, domestic, and international development. **Government Information Quarterly**, [*s. l.*], v. 23, n. 2, p. 207–235, 2006. DOI: 10.1016/j.giq.2005.11.004.

GARCÍA-PEÑALVO, F. J.; CORELL, A.; ABELLA-GARCÍA, V.; GRANDE, M. Online assessment in higher education in the time of COVID-19. **Education in the Knowledge Society**, [*s. l.*], v. 19, p. 12-1/12-26, 2020. DOI: https://doi.org/10.14201/eks.23013.

GARFIELD, J.; AHLGREN, A. Difficulties in learning basic concepts in probability and statistics: implications for research. **Journal for Research in Mathematics Education**, [*s. l.*], v. 19, n. 1, p. 44–63, 1988. DOI: http://dx.doi.org/10.2307/749110.

GLÄNZEL, W.; THIJS, B. Using 'core documents' for detecting and labelling new emerging topics. **Scientometrics**, [*s. l.*], v. 91, n. 2, p. 399–416, 2011. DOI: https://doi.org/10.1007/s11192-011-0591-7.

GÖKALP, E.; ŞENER, U.; EREN, P. E. Development of an assessment model for industry 4.0: Industry 4.0-MM. **Communications in Computer and Information Science**, [*s. l.*], n. 770, p. 128–142, 2017. DOI: 10.1007/978-3-319-67383-7_10.

GREGORY, R. W.; KAGANER, E.; HENFRIDSSON, O.; RUCH, T. J. It consumerization and the transformation of it governance. **MIS Quarterly**: Management Information Systems, [*s. l.*], v. 42, n. 4, p. 1225–1253, 2018. DOI: 10.25300/MISQ/2018/13703.

GRUCHMANN, T.; BISCHOFF, O. Blockchain-driven handling of digital freight information: A tensions perspective. **Logistics Research**, [*s. l.*], v. 14, n. 3, p. 1-16, 2021. DOI: 10.23773/2021_3.

GUNDUZ, M. A.; DEMIR, S.; PAKSOY, T. Matching functions of supply chain management with smart and sustainable Tools: a novel hybrid BWM-QFD based method. **Computers and Industrial Engineering**, [*s. l.*], v. 162, p. 107676, 2021. DOI: https://doi.org/10.1016/j.cie.2021.107676.

HAN, H.; TRIMI, S. Towards a data science platform for improving SME collaboration through Industry 4.0 technologies. **Technological Forecasting and Social Change**, [*s. l.*], v. 174, p. 121242, Jan. 2022. DOI: https://doi.org/10.1016/j.techfore.2021.121242.

HARRISON, T. M.; GUERRERO, S.; BURKE, G. B.; COOK, M. E., CRESSWELL, A. M.; HELBIG, N.; HRDINOV, J.; PARDO, T. A. Open government and e-government: Democratic challenges from a public value perspective. **Information Polity**, [*s. l.*], v. 17, n. 2, p. 83–97, 2012.

HEEKS, R.; BAILUR, S. Analyzing e-government research: perspectives, philosophies, theories, methods, and practice. **Government Information Quarterly**, Manchester, v. 24, n. 2, p. 243–265, 2007.

HOFMANN, P.; SAMP, C.; URBACH, N. Robotic process automation. **Electronic Markets**, [*s. l.*], v. 30, n. 1, p. 99–106, 2020. DOI: 10.1007/s12525-019-00365-8.

HOGNOGI, G.-G.; POP, A.-M.; MARIAN-POTRA, A.-C.; SOMEȘFĂLEAN, T. The role of UAS–GIS in digital Era governance: a systematic literature review. **Sustainability**, Switzerland, v. 13, n. 19, 2021. DOI: https://doi.org/10.3390/su131911097.

JANSSEN, M.; HELBIG, N. Innovating and changing the policy-cycle: policy-makers be prepared! **Government Information Quarterly**, [*s. l.*], v. 35, n. 4, p. S99–S105, 2018. DOI: https://doi.org/10.1016/j.giq.2015.11.009. Supplement.

KAMALALDIN, A.; LINDE, L.; SJÖDIN, D.; PARIDA, V. Transforming provider-customer relationships in digital servitization: a relational view on digitalization. **Industrial Marketing Management**, [*s. l.*], v. 89, p. 306–325, 2020. DOI: https://doi.org/10.1016/j.indmarman.2020.02.004.

KAPPELMAN, L.; JOHNSON, V.; TORRES, R.; MAURER, C.; MCLEAN, E. A study of information systems issues, practices, and leadership in Europe. **European Journal of Information Systems**, [*s. l.*], v. 28, n. 1, p. 26–42, 2019. DOI: 10.1080/0960085X.2018.1497929.

KESSLER, M. M. Bibliographic coupling between scientific papers. **American Documentation**, [*s. l.*], v. 14, n. 1, p. 10–25, 1963. DOI: https://doi.org/10.1002/.

KOHLI, R.; JOHNSON, S. Digital transformation in latecomer industries: CIO and CEO leadership lessons from Encana Oil & Gas (USA) Inc. **MIS Quarterly Executive**, [*s. l.*], v. 10, n. 4, p. 141–156, 2011.

KÜCHER, A.; FELDBAUER-DURSTMÜLLER, B. Organizational failure and decline: a bibliometric study of the scientific frontend. **Journal of Business Research**, [*s. l.*], n. 98, p. 503–516, 2019. DOI: 10.1016/j.jbusres.2018.05.017.

KYRYCHENKO, M.; YAKUBOVSKIY, S.; RODIONOVA, T. Digital Transformation of the Oil Refining Sector in Ukraine. *In*: 2020 IEEE International Conference on Problems of Info communications, 2020, Kharkiv. **Conference** […]. Kharkiv: IEEE. 2020. p. 733-736. DOI: 10.1109/PICST51311.2020.9468064.

LAUFER, M.; LEISER, A.; DEACON, B.; BRICHAMBAUT, P. P.; FECHER, B.; KOBSDA, C.; HESSE F. Digital higher education: a divider or bridge builder? Leadership perspectives on edtech in a COVID-19 reality. **International Journal of Educational Technology in Higher Education**, [*s. l.*], v. 18, n. 1, 2021. DOI: 10.1186/s41239-021-00287-6.

LAYNE, K.; LEE, J. Developing fully functional E-government: a four stage model. **Government Information Quarterly**, [*s. l.*], v. 18, n. 2, p. 122–136, 2001.

LEÃO, P.; SILVA, M. M. Impacts of digital transformation on firms' competitive advantages: a systematic literature review. **Strategic Change**, [*s. l.*], v. 30, n. 5, p. 421–441, 2021. DOI: 10.1002/jsc.2459.

LEE, J. 10 year retrospect on stage models of e-Government: a qualitative meta-synthesis. **Government Information Quarterly**, [*s. l.*], v. 27, n. 3, p. 220–230, 2010. DOI: 10.1016/j.giq.2009.12.009.

LEE-GEILLER, S.; LEE, T. D. Using government websites to enhance democratic E-governance: a conceptual model for evaluation. **Government Information Quarterly**, [*s. l.*], v. 36, n. 2, p. 208–225, 2019. DOI: 10.1016/j.giq.2019.01.003.

LINDERS, D.; LIAO, C. Z.-P.; WANG, C.-M. Proactive e-Governance: flipping the service delivery model from pull to push in Taiwan. **Government Information Quarterly**, [*s. l.*], v. 35, n. 4, p. S68–S76, 2018. Supplement. DOI: 10.1016/j.giq.2015.08.004.

LOUBÈRE, L.; RATINAUD, P. **Documentation IRaMuTeQ**. [*s. l.*]: IRaMuTeQ, 2014. Available at: http://www.iramuteq.org/documentation/fichiers/documentation_19_02_2014.pdf. Access on: 5 set. 2021.

MARCHE, S.; MCNIVEN, J. D. E-government and e-governance: the future isn't what it used to be. **Canadian Journal of Administrative Sciences**, [*s. l.*], v. 20, n. 1, p. 74–86, 2003. DOI: 10.1111/j.1936-4490.2003.tb00306.x.

MARTINEZ-BALLESTE, A.; PEREZ-MARTINEZ, P.; SOLANAS, A. The pursuit of citizens' privacy: a privacy-aware smart city is possible. **IEEE Communications Magazine**, [*s. l.*], v. 51, n. 6, p. 136–141, 2013.

MCCAIN, K. W. Communication, competition, and secrecy: the production and dissemination of research-related information in genetics. **Science, Technology, & Human Values**, [*s. l.*], v. 16, n. 4, p. 491–516, 1991. DOI: 10.1177/016224399101600404.

MCCAIN, N. L.; LYNN, M. R. Meta-Analysis of a Narrative Review: studies evaluating patient teaching. **Western Journal of Nursing Research**, [*s. l.*], v. 12, n. 3, p. 347–358, 1990.

MCNUTT, J. G.; JUSTICE, J. B.; MELITSKI, J. M.; AHN, M. J.; SIDDIQUI, S. R.; CARTER, D. T.; Kline, A. D. The diffusion of civic technology and open government in the United States. **Information Polity,** [*s. l.*], v. 21, n. 2, p. 153–170, 2016.

MOON, M. J. The Evolution of E-Government among Municipalities: Rhetoric or Reality? **Public Administration Review**, [*s. l.*], v. 62, n. 4, p. 424–433, July/Aug. 2002.

MORESI, E. A. D.; PINHO, I. Proposta de abordagem para refinamento de pesquisa bibliográfica. **New Trends in Qualitative Research**, Portugal, v. 9, p. 11–20, 2021. DOI: 10.36367/ntqr.9.2021.11-20.

MORESI, E. A. D., PINHO, I., Costa, A. P. How to operate literature review through qualitative and quantitative analysis integration? *In*: COSTA, A. P., MOREIRA, A., SÁNCHEZGÓMEZ, M. C., WA-MBALEKA, S. (ed.). **Computer Supported Qualitative Research. WCQR 2022. Lecture Notes in Networks and Systems**. [*s. l.*]: Springer, n. 466, p. 194-210.

NEWMAN, M. **Networks**: an introduction. Oxford: Oxford University Press, 2009.

NEWMAN, Y. C.; AGYIN-BIRIKORANG, S.; ADJEI, M. B.; SCHOLBERG, M. L.; SILVEIRA, J. M. B.; VENDRAMINI, J. E.; RECHCIGL, L. E.; SOLLENBERGER, CHRYSOSTOME, M. Enhancing Phosphorus Phytoremedation Potential of Two Warm-Season Perennial Grasses with Nitrogen Fertilization. **Agronomy Journal**, [*s. l.*], v. 101, n. 6, p. 1345–1351, 2009.

NIELSEN, M. M. E-governance and stage models: analysis of identified models and selected Eurasian experiences in digitising citizen service delivery. **Electronic Government, an International Journal**, [*s. l.*], v. 12, n. 2, p. 107–141, 2016.

PASADEOS, Y.; PHELPS, J.; KIM, B.-H. Disciplinary Impact of Advertising Scholars: temporal comparisons of influential authors, works and research networks. **Journal of Advertising**, [*s. l.*], v. 27, n. 4, p. 53–70, 1998.

PEREIRA, G. V.; PARYCEK, P.; FALCO, E.; KLEINHANS, R. Smart governance in the context of smart cities: a literature review. **Information Polity**, [*s. l.*], v. 23, n. 2, p. 143–162, 2018. DOI: 10.3233/IP-170067.

PRITCHARD, R. D. Equity theory: A review and critique. **Organizational Behavior and Human Performance**, [*s. l.*], v. 4, n. 2, p. 176–211, 1969. DOI: 10.1016/0030-5073(69)90005-1.

PIZZI, S.; VENTURELLI, A.; VARIALE, M.; MACARIO, G. P. Assessing the impacts of digital transformation on internal auditing: A bibliometric analysis. **Technology in Society**, v. 67, 101738, 2021.

RAGHURAM, S.; TUERTSCHER, P.; GARUD, R. Research Note: mapping the field of virtual work–a cocitation analysis. **Information Systems Research**, [*s. l.*], v. 21, n. 4, p. 983–999, 2010. DOI: https://doi.org/10.1287/isre.1080.0227.

RANGANATHAN, C.; TEO, T. S. H.; DHALIWAL, J. Web-enabled supply chain management: Key antecedents and performance impacts. **International Journal of Information Management**, [*s. l.*], v. 31, n. 6, p. 533–545, 2011.

REDDICK, C. G.; CHATFIELD, A. T.; JARAMILLO, P. A. Public opinion on National Security Agency surveillance programs: a multi-method approach. **Government Information Quarterly**, [*s. l.*], v. 32, n. 2, p. 129–141, Apr. 2015.

ROY, J. **E-government in Canada**: transformation for the digital age. Ottawa: University of Ottawa Press, 2006.

RUHNAU, B. Eigenvector-centrality: a node-centrality? **Social Networks**, [*s. l.*], v. 22, n. 4, p. 357–365, 2000.

SANDOVAL-ALMAZAN, R.; GIL-GARCIA, J. R. Are government internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-government among municipalities. **Government Information Quarterly**, [*s. l.*], v. 29, p. S72–S81, Jan. 2012. Supplemet 1.

SANDVIK, K. B. The Norwegian COVID-19 Tracing App Experiment: lessons for governance and civic activism. **IEEE Technology and Society Magazine,** [*s. l.*], v. 40, n. 3, p. 66–73, 2021.

SAXENA, K. B. C. Towards excellence in e-governance. **International Journal of Public Sector Management**, [*s. l.*], v. 18, n. 6, p. 498–513, 2005. DOI 10.1108/09513550510616733.

SHARMA, R.; MISHRA, R.; MISHRA, A. Determinants of satisfaction among social entrepreneurs in e-Government services. **International Journal of Information Management**, [*s. l.*], v. 60, p. 102386, Oct. 2021. DOI: https://doi.org/10.1016/j.ijinfomgt.2021.102386

SMALL, G. W.; RABINS, P. V.; BARRY, P. P.; BUCKHOLTZ, N. S.; DEKOSKY, S. T.; FERRIS, S. H.; FINKEL, S. I.; GWYTHER, L. P.; KHACHATURIAN, Z. S.; LEBOWITZ, B. D.; MCRAE, T. D.; MORRIS, J. C.; OAKLEY, F.; SCHNEIDER, L. S.; STREIM, J. E.; SUNDERLAND, T.; TERI, L. A.; TUNE, E. L. Diagnosis and Treatment of Alzheimer Disease and Related Disorders: consensus statement of the American Association for Geriatric Psychiatry, the Alzheimer's Association, and the American Geriatrics Society. **JAMA**, [*s. l.*], v. 278, n. 16, p. 1363–1371, 1997.

SMALL, H. Co-citation in the scientific literature: a new measure of the relationship between two documents. **Journal of the American Society for Information Science**, [*s. l.*], v. 24, n. 4, p. 265–269, July/Aug. 1973.

SMALL, H.; GRIFFITH, B. C. The Structure of Scientific Literatures I: identifying and graphing specialties. **Science Studies**, [*s. l.*], v. 4, n. 1, p. 17-40, 1974.

SOUSSAN, T.; TROVATI, M. Sentiment urgency emotion conversion over time for business intelligence. **International Journal of Web Information Systems**, [*s. l.*], v. 16, n. 5, p. 519-528, Oct. 2020. DOI: https://doi.org/10.1108/IJWIS-08-2020-0049.

SU, R.; OBRENOVIC, B.; DU, J.; GODINIC, D.; KHUDAYKULOV, A. COVID-19 Pandemic Implications for Corporate Sustainability and Society: A Literature Review. **International Journal of Environmental Research and Public Health**, [*s. l.*], v. 19, p. 1-23, Jan. 2022. DOI: https://doi.org/10.3390/ijerph19031592.

TABAR, S.; SHARMA, S.; VOLKMAN, D.; LEE, H. Analyzing the network readiness index in the United States to assess ICT infrastructure in handling crises like COVID-19. **International Journal of Electronic Government Research (IJEGR)**, [*s. l.*], v. 17, n. 4, p. 1–14, 2021. DOI: 10.4018/IJEGR.2021100101.

TANGI, L.; JANSSEN, M.; BENEDETTI, M.; NOCI, G. Digital government transformation: a structural equation modelling analysis of driving and impeding factors. **International Journal of Information Management**, [*s. l.*], v. 60, p. 102356, 2021. DOI: https://doi.org/10.1016/j.ijinfomgt.2021.102356.

TEO, T. S. H.; SRIVASTAVA, S. C.; JIANG, L. Trust and electronic government success: an empirical study. **Journal of Management Information Systems**, [*s. l.*], v. 25, n. 3, p. 99–132, 2008.

THOMAS, J. C.; STREIB, G. The new face of government: citizen-initiated contacts in the era of E-Government. **Journal of Public Administration Research and Theory**, [*s. l.*], v. 13, n. 1, p. 83–102, 2003.

ÜSDIKEN, B.; PASADEOS, Y. Organizational Analysis in North America and Europe: a comparison of co-citation networks. **Organization Studies**, [*s. l.*], v. 16, n. 3, p. 503–526, 1995.

VAN ECK, N. J.; WALTMAN, L. Visualizing bibliometric networks. In: Ding, Y., Rousseau, R., Wolfram, D. (eds.). **Measuring scholarly impact**: methods and practice. New York: Springer, 2014. p 285–320.

VAN ECK, N. J.; WALTMAN, L. **VOSviewer manual**. Leiden: Universiteit Leiden, 2022.

WALTMAN, L.; VAN ECK, N. J.; NOYONS, E. C. M. A unified approach to mapping and clustering of bibliometric networks. **Journal of Informetrics**, [*s. l.*], v. 4, n. 4, p. 629-635, Out. 2010.

WEERAKKODY, V.; JANSSEN, M.; DWIVEDI, Y. K. Transformational change and business process reengineering (BPR): lessons from the British and Dutch public sector. **Government Information Quarterly**, [*s. l.*], v. 28, n. 3, p. 320–328, July. 2011.

WEST, D. M. E-Government and the Transformation of Service Delivery and Citizen Attitudes. **Public Administration Review**, [*s. l.*], v. 64, n. 1, p. 15–27, Feb. 2004.

WHITE, M. D.; MARSH, E. E. Content analysis: a flexible methodology. **Library Trends**, [*s. l.*], v. 55, n. 1, p. 22-45, 2006.

WHITE, H. D.; MCCAIN, K. W. Visualizing a discipline: an author co-citation analysis of information science, 1972–1995. **Journal of the American Society for Information Science**, [*s. l.*], v. 49, n. 4, p. 327–355, 1998.

YILDIZ, M. E-government research: reviewing the literature, limitations, and ways forward. **Government Information Quarterly**, [*s. l.*], v. 24, n. 3, p. 646–665, July. 2007.

YUCEL, S. Estimating the benefits, drawbacks and risk of digital transformation strategy. *In*: 2018 International Conference on Computational Science and Computational Intelligence (CSCI), 2018, Las Vegas. **Anais** […]. Las Vegas: IEEE, 2008. p. 233-238.

YURKEVICH, E. V.; STEPANOVSKAYA, I. A.; KRYUKOVA, L. N. Mechanisms of Information Support for the Digital Transformation of Space Complexes Based on the Concept of Socio-cyber-physical Self-organization.

In: **Proceedings of the Fifth International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'21)**. [*s. l.*]: Springer Link, 2022, v. 330, p. 629-637. DOI: https://doi.org/10.1007/978-3-030-87178-9_62.

ZENG, Z.; LI, S.; LIAN, J.-W.; ZENG, Z.; LI, S.; LIAN, J.-W.; LI, J., CHEN, T., LI, Y. Switching behavior in the adoption of a land information system in China: a perspective of the push–pull–mooring framework. **Land Use Policy,** [*s. l.*], v. 109, Oct. p. 2021.

ZUPIC, I.; ČATER, T. Bibliometric methods in management and organization. **Organizational Research Methods**, [*s. l.*], v. 18, n. 3, p. 429–472, 2015.