PROPOSAL FOR THE CREATION OF AN OPEN DATA NETWORK IN BRAZILIAN RESEARCH

PROPOSTA DE CRIAÇÃO DE UMA REDE DE DADOS
ABERTOS DA PESQUISA BRASILEIRA

PROPUESTA DE CREACIÓN DE UNA RED DE DATOS ABIERTOS
DE LA INVESTIGACIÓN BRASILEÑA

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JITA: IM. Open data

RESUMO: Aborda os dados de pesquisa resultantes de investigações realizadas em instituições de ensino e pesquisa brasileiras e a necessidade de torná-los públicos, por meio do acesso aberto em repositórios, a fim de validar os resultados obtidos e publicados, como também para impulsionar novas pesquisas e socializar o conhecimento. Tem como objetivo explorar o cenário nacional e internacional e apresentar o planejamento de uma investigação que busca uma solução tecnológica para efetivar o acesso aberto a dados de pesquisa (AADP) dentro de uma perspectiva nacional. Propõe uma metodologia dividida em cinco etapas: identificação de práticas de AADP em instituições brasileiras; mapeamento dos usuários de AADP e suas necessidades; proposta de um portal web para reunir a comunidade nacional em AADP; levantamento dos serviços e soluções tecnológicas para o compartilhamento de dados de pesquisa existentes no cenário internacional; proposição de recomendações para o apoio a criação de repositórios de dados de pesquisa em instituições nacionais e a sua agregação a uma rede de pesquisa em AADP. Como resultado, traz iniciativas e estratégias internacionais para levar a cabo a criação de repositórios de dados de pesquisa, assim como para criar comunidades de práticas em torno do assunto. Recomenda que a proposta seja constituída de três vertentes, a fim de apoiar a criação de repositórios de dados de pesquisa em instituições nacionais e a sua agregação a uma rede de pesquisa em AADP.

PALAVRAS-CHAVE: Acesso aberto. Dados de pesquisa. Repositórios.

ABSTRACT: It addresses research data resulting from research carried out in Brazilian teaching and research institutions and the need to make it public, through open access in repositories, in order to validate the results obtained and published, as well as to foster new research and socialize the knowledge. It aims to explore the national and international scenario and present the planning of an investigation that seeks a technological solution to effect open access to research data (AADP) from a national perspective. It proposes a methodology divided into five stages: identification of AADP practices in Brazilian institutions; mapping of AADP users and their needs; proposal of a web portal to bring together the national community in AADP; survey of services and technological solutions for the sharing of research data on the international scene; proposing recommendations to support the creation of repositories of research data in national institutions and their aggregation into a research network in AADP. As a result, it brings international initiatives and strategies to undertake the creation of research data repositories, as well as to create communities of practice around the subject. It recommends that the proposal be made up of three strands, in order to support the creation of research data repositories in national institutions and their aggregation into a research network in AADP.

KEYWORDS: Open access. Research data. Repositories.

RESUMEN: Aborda los datos científicos resultantes de investigaciones realizadas en instituciones de enseñanza e investigación brasileñas y la necesidad de hacerlos públicos, a través del acceso abierto en repositorios, a fin de validar los resultados obtenidos y publicados, así como para estimular nuevas investigaciones y socializar el conocimiento. Tiene como objetivo explorar el escenario nacional e internacional y presentar un plan de investigación que busca una solución tecnológica para el acceso abierto a datos de investigación (AADP) dentro de una perspectiva nacional. Propone una metodología dividida en cinco etapas: identificación de prácticas de AADP en instituciones brasileñas; mapeo de los usuarios de AADP y sus necesidades; propuesta de un portal web para reunir la comunidad nacional en AADP; el levantamiento de los servicios y soluciones tecnológicas para el intercambio de datos de investigación existentes en el escenario internacional; propuesta de recomendaciones para el apoyo a la creación de repositorios de datos de investigación en instituciones nacionales y su agregación a una red de investigación en AADP. Como resultado, presenta iniciativas y estrategias internacionales para llevar a cabo la creación de repositorios de datos de investigación, así como para crear comunidades de prácticas alrededor del tema. Recomienda que la propuesta esté constituida por tres vertientes con el fin de apoyar la creación de repositorios de datos de investigación en instituciones nacionales y su agregación a una red de investigación en AADP.

PALABRAS CLAVE: Acceso abierto. Datos de investigación. Repositorios.

1 INTRODUCTION

The dissemination of research data is essential to validate the obtained and published research results, as well as to promote data reuse, stimulate new researches, and socialize the knowledge. In this context, research data repositories assume the role of providing efficient search engines and value-added services for the production of knowledge.

The research data repositories play a vital role in the preservation, integrity, and dissemination of research data. In addition, a network of repositories can generate connections between communities, increasing interfaces for connecting data sources from different disciplines, stored in specific or multidisciplinary repositories.

Currently, the Brazil plays an active role in the construction of institutional repositories, which ate those that store the scientific production of institutions. LUME, the institutional repository of UFRGS, is a reference in the national scope. The IBICT have encouraging and promoting the growing of communities that have as target supporting de development of institutional repositories. Brazil, however, does not have yet constructed a structure to support the development of research data repositories. Furthermore, there isn´t a national plan for the implementation of a network that brings together the knowledge and the practices of individuals and institutions to promote open data in the Brazilian research.

The objective of this article is to explore the national and international scenario and present the planning of an investigation on finding a technological solution to carry out Open Access to Research Data (OARD) in a national perspective. The specific objectives the investigation are: a) Identify OARD practices in Brazilian institutions; b) Identify OARD users and their needs; c) Propose a web portal to bring together the national community in OARD; d) Identify services and technological solutions for research data sharing, in the international scenario; e) Propose recommendations to support the creation of research data repositories in national institutions and their aggregation into a OARD research network in.

We emphasize that this work is in progress and its results are not conclusive. This investigation attends the Invitation Letter of 01/2017, authored by RNP and IBICT, for the formation of RDP Brazil group of study.

2 BACKGROUND AND CONTEXT OF THE STUDY

The work presented here is the result of a partnership between the Universidade Federal do Rio Grande do Sul (UFRGS) and the Universidade Federal do Rio Grande (FURG). In this partnership, the members of UFRGS are the Centro de Documentação e Acervo Digital de Pesquisa (CEDAP) and the Centro de Processamento e Dados (CPD) of the University. The Research Group of Information Management of the FURG Centro de Ciências Computacionais (C3) is the member of FURG.

CEDAP is an auxiliary unit of FABICO/UFRGS, established in 2012, according to the UFRGS Statute. The Center aims to support scientific, technological, artistic and cultural research, through the curation of research data (digitized or born digital), in order to allow data reuse, validation of research results, preservation of research memory, and the appliance of research data experiences in teaching and for the public good. It supports research data curation over the active stages of the research data lifecycle (such as data planning, data collection and data organization), and it provides resources for the dissemination and the long-term storage of data (research data repository). CEDAP offers digitizing services in an interdisciplinary way, involving Information Science, Communication and Computer Science. It develops research projects, participates in networks, stimulates scientific production and promotes the sharing and the dissemination of new knowledge.

CEDAP observes and study the open innovation process, since it treats Research and Development (R&D) as an open system, it assumes that useful knowledge must be widely distributed and it explores both internal and external ideas. To support this, it develops an environment based on collaborative work, where knowledge and practices in research data are acquired and socialized through a wiki system. Bodies of knowledge and conceptual models are adopted as base to represent acquired knowledge, practices and processes, as reported by Rocha and Caregnato (2015), Rocha (2016), Pavão, Caregnato and Rocha (2016) and Rocha, Caregnato and Gabriel (2017).

In 2018, CEDAP is implementing and beginning the operation of its research data repository (which uses Dspace software), considering the data repository as the final part of a chain of actions of the whole research data life cycle. This life cycle involves researchers in the elaboration of their research data management plans, data collecting and organizing, as well as storing data for short and long term in trusted repository.

The CPD is responsible to provide Information Technology and Communication services, to support UFRGS activities of teaching, researching and community interactions. CPD, as manager of LUME repository, is reference in the management of institutional repositories.

The LUME management team has experience in defining an organizational infrastructure for institutionalizing and managing the repository. This includes establishing policies for the creation and management of digital collections; implementing, customizing and operating with high availability the DSpace Software; and developing software extensions for sharing theses and dissertations with the Brazilian Library of Theses and Dissertations (BDTD), the Brazilian Open Access Scientific Publications Portal (OASISBr) and the Open Access Scientific Repository of Portugal (RCAAP).

LUME promotes institutional visibility and contributes to the positioning of UFRGS in the Webometrics Ranking of World Universities. UFRGS currently occupies the 2nd position

in Brazil, the 2nd position in Latin America, the 42nd position in the general classification (considering 2,284 thematic and institutional repositories) and the 35th position in the general classification of institutional repositories. Since its implementation, in January 2008, 7,461,253 downloads of scientific production were made, five million in the 2014-2016 triennium. The number of accesses and downloads allows to know the impact and the extent of use of the documents deposited in the Repository. Additional, LUME supports decision-making information to higher organizational levels of the University. It allows funding agencies to verify the results of their investments in projects and research programs. For end users, LUME is an essential source of information, to be used in research cycle. For authors, it offers information of the use of their production.

The Centro de Ciências Computacionais (C3) is one of the thirteen academic units that constitute FURG. It supports teaching, research and extension activities in the areas of Computer Science, Automation, Information Technology and Scientific Computation. Currently, C3 is responsible for three undergraduate courses: Computer Engineering, Automation Engineering and Bachelor of Information Systems. C3 offers four *lato sensu* postgraduate specialization courses: Web Applications, Information and Communication Technologies in Education, Automation Engineering and Instrumentation and Electrical Engineering. The Research Group on Information Management works together with the Post-Graduate Program in Computing. The group is coordinated by Professor Eduardo Nunes Borges and develops research activities related to the collection, extraction, visualization, retrieval and recommendation of information, which involves knowledge, techniques, and research in heterogeneous and distributed information, approximate queries, metadata, information retrieval, and knowledge discovery.

In summary, the team is composed of experts in Information Science and Computer Science, dealing with publication of digital research results and research data sharing, considering all areas of knowledge.

3 MATERIALS AND METHODS

The work is planned to be carried out in five stages, one for each specific objective, employing specific methods and techniques for each of them.

The first step of the work consists of identifying OARD practices in Brazilian institutions. It is a documentary research, which uses *Research Data Repositories Information* (Re3data) as documental source. Re3data is a directory that includes a detailed description of digital repositories, such as identification, type, context, content and features. The first step also conducts a survey for identifying the experiences of national scientific community in OARD, considering all areas of knowledge. The survey also identifies alternative solutions and practices to store and disseminate research data; demands for storing

RDBCI: Revista Digital Biblioteconomia e Ciência da Informação
RDBCI : Digital Journal of Library and Information Science

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of data into repositories; and potential interest of researches in participating in an AADP initiative for building repositories.

The second step consists of identifying the AADP users and their needs, by questioning the Brazilian scientific community using an electronic survey. Its target is to identify perceptions, attitudes, experiences, informal practices and needs of the Brazilian community for the availability, management, open access and reuse of research data.

The step, still involves electronic survey the community using a questionnaire, and then, to make up interviews to the survey respondents who demonstrate interests of participating in the study. The interviews are focused on deeply identifying users' needs of delimited areas of knowledge, since cultural and epistemological practices vary in different scientific communities.

The third step consists of proposing a web portal to bring together the national community in OARD. Technologically, the achieving of this step is based on the use a stable, secure and remotely managed software, known as Content Management System (CMS).

In addition, to perform the requirement on bringing to the portal the effective participation of the people, the development of site involves information architecture techniques. So that, the way of content distribution can be achieved.

The fourth step consists in identifying services and technological solutions for research data sharing, in the international scenario, by means of a comparative analysis of existing services and technological solutions for data sharing.

The study is carried out by a bibliographical and documentary research, exploring sources such as scientific publications in proceedings and periodicals, as well as technical documentation, recommendations, standards and strategies, published in sites related to on sharing research data. It also explores the use of research data services offered on websites.

The fifth step, and the last, consists of formulating recommendations to support the creation of research data repositories in national institutions, and the creation of a network that aggregates these repositories. These recommendations are achieved considering the requirements, functionalities and technologies identified in the previous steps, juxtaposing the creation of a network of people and knowledge in OARD.

4 PARTIAL RESULTS AND DISCUSSION

To identify OARD practices in Brazilian institutions, we point out some international initiatives that map and name OARD repositories. Research Data Repositories Information (Re3data) is an international directory that includes a detailed description of main existent

repositories, such as repositories types, contexts, contents and characteristics. This uses Re3data work to identify Brazilian repositories of research data, as there is no national research data repository.

In an initial search on Re3data, we identify only seven Brazilian repositories. Furthermore, half of these repositories are results of international cooperation. Considering this low result, it is necessary to implement other information mechanisms to identify existing initiatives in Brazil.

An alternative way to get the information for the study is directly surveying the interested public. The potential users of Brazilian OARD services are all researchers. The target community includes those researchers who have already been involved on research data management processes, engaged on making available, accessible and reusable the results of the national science. It also includes researchers who still do not know the dimensions of the question and its possible consequences. It is also necessary to consider the researchers of the major areas of knowledge, which are defined by the CNPq as Exact and Earth Sciences; Biological Sciences; Engineering; Health Sciences; Applied Social Sciences; Human Sciences; Linguistics, Literature and Arts.

This survey allows us to identify the experiences in OARD repositories in universities and research centers, as well as it may reveal alternative solutions and practices in storage and dissemination of research data. Additionally, it allows us to verify the demands for storing data in repositories, and potential users interested in participating in an initiative of construction of OARD repositories.

In order to achieve this survey, the characteristics for identifying practices in OARD are: a) scope (national or international cooperation), b) thematic areas of scope, c) type of repository (thematic, institutional, other), d) number (f) data format, (g) interoperability and metadata standards, (h) software used, applications and interfaces, i) existence of a research life cycle.

Regarding to bring together, in a web portal, the national community interested in OARD, we verity that the use of information and communication technologies makes it feasible, simple and effective. The technological solution proposed for the construction of the web portal is to use a Content Management System (CMS).

These CMS systems allow managers to have full autonomy over the content, to monitor the evolution of the presence of site on the Internet, and to dismiss third-party assistance needs for CMS maintenance (GALIANO et al., 2007). Using CMS makes the publishing of the content more agile, as well as it allows CMS managers to delegate, to users, activities regarding to their profile maintenance. CMSs only require user experience in text editing.

CMSs also allow the customization of the visual interface of the site, as well as the use of plugins. Another advantage of using CMSs is the possibility of developing new plugins to explore the portal community experience, such as a plug in for the management of Working Groups (WGs), and user membership.

WordPress, Joomla, and Drupal are the most-known CMS systems available for free use, and they are those that involve the largest communities of developers. These systems allow managers to use a lot of free configuring templates, as well as numerous plugins that can be freely incorporated, which streamlines the portal building process

The minimum technical requirements for these CMS are: Apache Server (mod_mysql, mod_xml and mod_zlib), 4 or 8 Gigabytes of memory, PHP language, MySQL (recommended) or PostGreSQL database management system (DBMS), disk space of 500 MBytes, and Internet access with a domain or subdomain name.

It is also necessary to define the information architecture and content organization. The basic aspects are: a) provide governance information; b) provide access to scientific, professional, student and institutional communities; c) provide information about the structure, organization and publication rules of each group; d) provide a documentation area containing publications, normative documents, among others; and e) provide an area for communications, including news and events. These requirements are based on characteristics of the Research Data Alliance (RDA) portal (THE RESEARCH DATA ALLIANCE, 2017).

The portal should be able to monitor visitors and content accesses, to allow the identification of its major demands, as well as it may allow periodical generation of reports to support the management staff. The portal is available at https://dadosdepesquisa.rnp.br hosted within the RNP servers.

In our the first studies of the international scenario, we identify the existence of national research data services, especially the Dutch Data Archiving and Networked Services (DANS[1]), which encourages researchers to make their digital research data and related results accessible, interoperable and reusable. DANS offers an expert advice and certified services since 2005. It also provides the National Academic Research and Collaboration Information System (NARCIS), a national portal for those who are seeking information about researchers and their works.

In this scenario, we observe the collaborative initiative that involves Monash University, Australian National University, Commonwealth Scientific, and Industrial Research Organization (CSIRO). It develops the Australian National Data Service (ANDS[2]), which aims to make research data assets more valuable to researchers and to research

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[1] https://dans.knaw.nl/en
[2] http://www.ands.org.au/

institutes. ANDS was established in 2008, and its main product is Research Data Australia (RDA), where people can find, access and reuse research data.

In United Kingdom, the UK Research Data Discovery Service (Alpha[3]) is a pilot search service involving UK repositories. This initiative is sponsored by JIST, an organization that provides shared digital infrastructure to UK universities (BEAGRIE, 2004).

Results of these initiatives assist governments to define policies and strategies for research data sharing and managing. These policies and strategies are elaborated by working groups supported by government agencies, such as the Research Data Strategy Working Group (2011), of Canada, Interagency Working Group on Digital Data (2009), of United States, and by the European Community (European Union, 2010).

Considering open access research data initiatives, several proposals are observed, each one with their own ways of achieving their targets, such as: the model for data description and dissemination of Data Documentation Initiative (DDI[4]); the Data Description Registry Interoperability Model (DDRI[5]), developed by the Research Data Alliance (RDA[6]) to interconnect data sets; and data lifecycle models: Digital Curation Center Life Cycle (DCC[7]), UK Data Archive[8] (Institute for Social Research-ICPSR[9]), Data Observation Network for Earth (DataONE[10]).

Considering the international scenario, we observe and point out to be deeply studied: the DSpace[11] and Dataverse[12] repository software, the DataCite[13] servisse for data Citation, and the pilot projects EUDAT[14] e RD-Switchboard[15].

Considering guidelines and best practices recommendations for the implementation of research data services, we consider to be deeply studied those which were created by OCLC

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[3] http://ckan.data.alpha.jisc.ac.uk/dataset

[4] DDI - Data Documentation Initiative DDI-Lifecycle - http://www.ddialliance.org/Specification/DDI-Lifecycle/3.2/

[5] DDRI - Data Description Registry Interoperability Model - http://dx.doi.org/10.15497/RDA00003

[6] RDA - Research Data Alliance - https://www.rd-alliance.org/

[7] Digital Curation Centre Life Cycle - http://www.dcc.ac.uk/resources/curation-lifecycle-model

[8] http://www.data-archive.ac.uk/create-manage/life-cycle

[9] ICPSR Institute for Social Research - http://www.icpsr.umich.edu/icpsrweb/content/deposit/guide/#cycle

[10] DataONE - Data Observation Network for Earth - https://www.dataone.org/data-life-cycle

[11] DSpace - http://www.dspace.org/

[12] Dataverse - Ambiente computacional aberto para armazenamento, preservação, compartilhamento e análise de dados - http://dataverse.org/

[13] DataCite - Organização não lucrativa que provém identificadores persistentes para dados da pesquisa. https://www.datacite.org/index.html

[14] EUDAT - Projeto Europeu patrocinado pelo programa Horizon 2020 para prover infraestrutura de serviços computacionais para gerenciar dados de pesquisa dispersos em centros de dados e repositórios europeus. https://www.eudat.eu/

[15] RD-Switchboard - Projeto que visa criar infraestrutura conectar várias fontes de dados, composto pela Australian National Data Service (ANDS) e administrado pelo grupo de trabalho Data Description Registry Interoperability (DDRI) da Aliança RDA. Switchboard. http://www.rd-switchboard.org/

(ERWAY et al., 2016), EDUCASE (FARY, 2013), JISC, Institute for Social Research repository (AUSTIN, 2010) and by the Data Share project (GREEN; MACDONALD, RICE, 2009).

In order to design the project solution, we plan first characterize the agents involved in the promotion of research data sharing, considering aspects such as: their objectives (to promote, to standardize, to use, to share, among others), their nature (project, organization, association or alliance), their organizational operating strategy (through committees, groups), their funders, and their strategies to promote the sharing of research data (architectures, models, standards, guides, pilot projects, services, support to the development of data services, etc.).

Next, we plan to identify the main services for research data sharing, considering their objectives, technological solutions, architectures, standards, software, and the way in which these services are related to the agents that promote the data sharing.

Then, we plan to compare and analyze the services, to identify those that meet the needs, the requirements and the features raised for OARD users, considering aspects of international services.

We also plan to compare and analyze the technological solutions adopted to implement the identified services, considering aspects such as: innovation, use of practices and platforms similar on those used in national repositories, use of standards, possibility of forming international data access networks, support and participation of actors and international initiatives that promote the sharing of data, etc.

Finally, we plan identify viabilities, strategies and useful adaptations for the use of OARD services in national scope.

5 FINAL CONSIDERATIONS

We envisage that the recommendations for a proposal to support the creation of research data repositories in national institutions and the aggregation of these repositories in an OARD network should be posted in three parts.

The first part (step 3 of this work) is the implementation of a web portal, to bring together the community which is interested in the theme, and to discus individual and collective needs regarding to store research data. It also deals to the creation of working groups engaged to the formulation of policies, guidelines and standards for the construction and the implementation of OARD repositories. A portal plays a fundamental role since it promotes a wide interaction involving the scientific community.

The second part aims to develop a methodology that allows the implementation of one more prototype of OARD repositories, covering thematic or whole knowledge areas. It comprises the choice of the software, considering results obtained in step 4, and to document e publish de achieved solution in the web portal. The software requirements involve the use of ultimate metadata standards, in order to best represent research data, as well as the development of software code to perform necessary adaptions and requirements. This part also deals with testing this methodology by implementing it in one or more institutions.

The third and final part involves the development of a prototype to aggregate the data from OARD repositories, using   OAI-PMH protocol or similar. This allows collecting and gathering metadata in a single database. It is also useful librarian techniques for information retrieval, such as authority and subject control.

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