Open Access Repositories in Serbia

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Abstract: Created from the need to store and use deposited digital information, Open Access repositories provide access to digital content from anywhere at any time. They also provide full open access to all deposited content. Open Access repositories in Serbia have been present since 2012. When the Repository of the University of Belgrade was established, until today when institutional digital repositories are rapidly developing. In this paper we have presented the growth and development of Open Access Repositories in Serbia. Data on active Open Access Repositories in Serbia were obtained by searching the ROAR and Open DOAR services. By searching the contents of the Open DOAR Directory on the Internet, we obtained various statistical data (type of software, language representation, subject and increase in the number of repositories), which we analyzed in this paper. We have also presented three most important aggregators of scientific literature in Serbia (doiSerbia, Sc Index and DoiFil) that provide complete open access to all content without restrictions. Their development has improved scientific publishing in Serbia and improved the visibility of national publishing scientific production at the global level.

Keywords: Open Access, Repositories, Serbia, doiSerbia, Repository of the University of Belgrade, ROAR, OpenDOAR

1. Introduction

The Internet has increased the amount of scientific information in digital form and open access, which has led to an increase in the speed of information flow and a change in communication channels. Scientific monographs, which were once the primary carriers of scientific information, are being replaced by scientific journals and collections of papers from scientific conferences. Today,

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the latest scientific findings are published in these journals, which quickly find their way to researchers who use them as a reference. DOI label has become indispensable in modern digital publishing. As a unique alphanumeric string, it is assigned to an individual object (article, paper in a collection, monograph, chapter in a monograph) in digital form, and connects the user with the digital version of the document on the Internet (Djokovic, 2020, 451). DOI is a new system for identifying digital objects on the Internet that can be compared to a signature (a placemark on a shelf) in traditional libraries. Linking metadata about individual objects in digital form is done through specialized agencies that operate within the International DOI Foundation (https://www.doi.org/registration_agencies.htm), such as CrossRef, DataCite, EIDR and others.

With the sharp increase in the number of scientific information in digital form and open access, there was a need for their organization and classification, which would enable faster insight into their content and facilitate their search. There was a need to create different digital archives in which to store information of different content and purpose. Digital archives are a kind of digital repositories in which digital content is in completely open access and is accessible to everyone is easily and quickly collected and archived. Their existence facilitates the process of searching for relevant scientific information. In addition, it significantly affects the visibility of scientific papers. Increasing the visibility of scientific results has a positive effect on the higher citation and scientific reputation of authors, but also on the institutions in which authors are employed. Digital repositories aim to increase the visibility of results and therefore contribute to greater visibility and citation.

The introduction and development of digital archives in Serbia began in 2005 with the establishment of the doiSerbia digital repository. In the last few years, the establishment of institutional repositories has accelerated the progress. The credit for the progress in this area in Serbia belongs to libraries, both national and faculty and special.

2. Repositories

There are numerous attempts to define the term "repository". According to Pinfield “A repository may be defined as a set of systems and services which facilitates the ingest, storage, management, retrieval, display, and reuse of digital objects. Repositories may be set up by institutions, subject communities, research funders, or other groups. They may provide access to a variety of digital objects, including peer-reviewed journal articles, book chapters, theses, datasets, learning objects, or rich media files.” (2009, 165). Pinfield’s definition combines all the reasons for establishing a repository by emphasizing the ease of entering and storing various types of data, including scientific articles, chapters in scientific monographs, doctoral dissertations, and other digital objects. It also highlights the many possibilities for searching and displaying data and is the first to define the existence of different types of repositories depending on the founder.

According to Iris Xie & Krystyna K. Matusiak "Digital repositories are information systems that ingest, store, manage, preserve, and provide access to digital content. Digital repositories are a relatively new phenomenon that emerged in the early 2000s" (2016, 255).

Repositories store different types of digital content, either originally digital or subsequently digitized. They can be divided into institutional, those that contain works that were created as a result of the work of an institution (e.g.university) and thematic, those that contain works from a certain area. According to Clifford Lynch, institutional repositories represent "a set of services that a university offers to members of its community for the management and dissemination of digital materials created by the institution and its community members" (2003: 238). These are digital materials in open access that are intended primarily for the academic population, professors, students and researchers. They are created with the financial help of the parent institution. The existence of said materials helps the improvement of the institution as well as the personal advancement of the researchers and the employed teachers. In addition, access to scientists' complete bibliographies provides insights into their work.
Some of the most important advantages of institutional repositories are reflected in:

- Increased visibility of the institution at the global level;
- Open access to relevant published scientific research papers;
- Open access to relevant unpublished materials.

Nowadays, there are numerous institutional repositories in the world, whose presence and searchability have been improved by the platforms: The Directory of Open Access Repositories (OpenDOAR) and the Registry of Open Access Repositories (ROAR), which collect metadata from thousands of repositories around the world. To include institutional repositories in the international infrastructure, compliance with the Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH) is required, which means depositing metadata following the XML Dublin Core format or some other compatible XML format. OAI-PMH was developed with the encouragement of the Open Access Initiative which promotes and develops the interoperability of digital repositories in to facilitate and increase the efficiency of dissemination of their content (Xie I. & Matusiak K. K., 2016, 174).

3. Open Access

Open access is free, unrestricted online access to scientific papers, primarily academic articles, books and dissertations. The certain number of scientists reacted to the monopoly of publishers that published research results in journals that require subscriptions. According to Filipi Matutinović "Open access means that every user who has access to the Internet anywhere in the world has the right to read, download, store, print and use digital content of papers published in open access, obligated only to cite them correctly" (2014, 75).

The first definition of open access can be found in the Budapest Declaration of 2002. The Declaration aims to make scientific research texts, which authors provide to readers and publishers without any compensation, publicly available. The Budapest Initiative advocates free distribution of scientific literature in electronic journals and free and unrestricted access to all scientists without restrictions. “By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited” (*Budapest Open Access Initiative*). The initiative came to life thanks to the support and encouragement of numerous universities, libraries and associations to embrace open access as a means to advance their goals. As one of the means to improve open access, the Budapest Declaration recommends the greater use of institutional repositories with fully open access to self-archiving content. Scientists are allowed to independently archive their work and thus make it publicly available to the wider scientific community. The Budapest Declaration also recommends launching a new generation of electronic journals with completely open and free access to all content.

The Budapest Declaration was followed by the Berlin Declaration signed on October 22, 2003. The Berlin Declaration also promotes the Internet as an important tool in disseminating and storing information. In addition to the already mentioned scientific research tools, Berlin Declaration expands the scope of knowledge and includes cultural heritage stored in archives, museums and libraries. The signatories of this declaration advocate that the results of the works be publicly available to all, under the principles of open access and include original results of scientific research, with raw data and metadata, images, sources, which is initially achieved through the active use of institutional repositories. (*Open Access to Knowledge in the Science and Humanities*).

The University of Belgrade was the first Serbian institution to support and sign the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. This was done by the rector of the University of Belgrade on November 11, 2011, and the University has officially joined the Berlin Process. The signing of the Berlin Declaration expressed interest in further promoting open access, which can be achieved by encouraging researchers to publish papers according to the principles of open access and in the equal evaluation of open access publications and traditional printed publications. Shortly, after the signing of the Berlin Declaration, the University of Belgrade launched its Digital Repository at the University Library „Svetozar Markovic“ in Belgrade. *The University of Belgrade digital repository of doctoral dissertations* is part of

the Phaidra repository designed for indexing and archiving doctoral dissertations defended at the universities of the Western Balkans. The central server is located within the University Library "Svetozar Markovic", coordinating the entire project. (https://phaidrabg.bg.ac.rs/).
A repository of doctoral dissertations "E-thesis" was formed within the Phaidra system (http://eteze.bg.ac.rs/), as a local repository of doctoral dissertations. As mentioned before, the launch of this repository followed shortly after the signing of the Berlin Declaration by the Rector of the University of Belgrade. “Phaidra repository at the University library“ Svetozar Markovic ”is established accordingly to the Berlin Declaration. The Rector encouraged professors, researchers and others to publish their scientific work in this repository. They were also encouraged to publish in the journals which allow its authors to archive the version of their papers in the institutional repository ”(Stolic… et al, 2012, 7). A total of 7906 doctoral dissertations have been registered in the repository so far. Doctoral dissertations in the local E-thesis repository are available in completely open access, while their use and citation are regulated by CC licenses.

A total of 674 universities and scientific institutions from all over the world have signed Berlin Declaration so far, seven of them based in the Republic of Serbia. After the University of Belgrade, Berlin Declaration was signed, in chronological order, by the following universities and scientific institutions from the Republic of Serbia:

University of Belgrade	**11.11.2011.**
University of Niš	14.02.2012.
Serbian Academy of Sciences and Arts (SASA)	20.09.2013.
Univerity of Novi Sad	14.02.2017.
University of Kragujevac	5.10.2017.
University of Arts in Belgrade	30.10.2017.
State University of Novi Pazar	20.12.2017.

Table 1: Berlin Declaration Signatories for Serbia

The Bethesda Statement on Open Access Publishing was adopted in Maryland in 2003. Bethesda Statement indicates that moving towards free and open access can reduce the costs of individual research. Libraries and publishers can significantly speed up the transition process, i.e. the transition to open access. This is finally confirmed by the latest document "Plan S", which proposes acceleration measures for the complete transition to the publication of scientific literature in the open approach. “Plan S requires that recipients of research funding from cOAlition S organisations make the resulting publications available immediately (without embargoes) and under open licences, either in quality Open Access platforms or journals or through immediate deposit in open repositories that fulfil the necessary conditions” (Plan S).

4. Open Access Possibilities

There are two possibilities for publishing scientific papers in open access:

- Self-archiving of scientific papers in institutional repositories with open access:
- Publishing in OA journals.

There are also several types of open access that are very often supplemented by new variant forms. Most scientific papers are published in green, gold and platinum open access, while hybrid open access is most often intended for commercial publishers.

Green Open Access refers to the deposit of papers in repositories or other open archives. These are most often pre-print versions of papers or papers after the embargo period has expired.

Golden Open Access refers to the publication of papers in open access with CC licenses. All publication costs are covered by the author or the institution where the author is employed.

Platinum Open Access does not charge publication costs from the author or the institution because the costs are covered through donations, subsidies, projects, etc. Most titles of scientific journals from Serbia are published in Platinum Open Access.

Hybrid Open Access are journals that charge for subscribing and downloading articles.

5. Open Access Repositories in Serbia

As we mentioned before, the first digital repository with open access in Serbia was opened in the University Library "Svetozar Markovic" in 2013, shortly after the signing of the Berlin Declaration. This was followed by the opening of numerous repositories in different institutions, on different platforms, using different types of software.

For the purposes of our work, we used the data obtained on the Internet by searching ROAR (Registry of Open Access Repositories) and the Open DOAR (Directory of Open Access Repositories) serviceces. We presented and analyzed the obtained data according to certain criteria in the paper.

By searching the Registry of Open Access Repositories-ROAR, 32 digital repositories appear to be registered in Serbia. This Register is maintained by the University of Southampton based on independent registration of individual repositories. There are currently 4725 repositories from around the world in the Registry and search is possible by country, type of software they use or type of repository. The results can be sorted according to different criteria (name, number of data, activities…). For each repository, you can get the name, a brief description of the repository, the name of the publisher and its Internet address.

Open DOAR is the global Directory of Open Access Repositories. It has registered repositories that provide open access to sources and information from around the world. It was launched in 2005 by a joint project of the University of

Nottingham and Lund. It currently has 5,618 registered repositories from around the world and 39 repositories from Serbia. Data on registered repositories can be obtained by searching by the name of the country or software used by the repository. The resulting list is arranged in alphabetical order according to the name of the repository, along with information about the software and the type of repository.

The Open DOAR Directory also offers a graphical overview of statistical data on the type of software used, the representation of the language of papers deposited in repositories, the objects represented as well as statistical data on the increase in the number of repositories from Serbia in this Register.

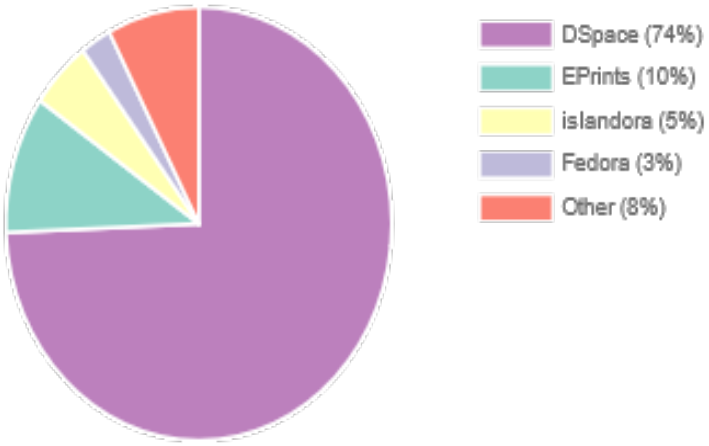

Figure 1: Software Platforms Overview (*Open DOAR*)

According to available data, most institutional repositories in Serbia have been created on the DSpace platform. That is a total of 29 institutional repositories on the DSpace platform (74%). In addition to the DSpace platform, EPrints, Iceland, Fedora and other unknown platforms are used with a much smaller number of repositories created.

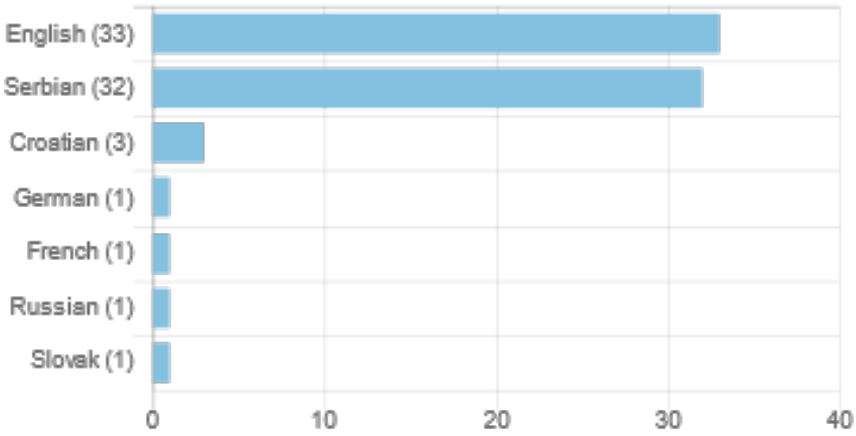

Figure 2: Language of Content (*Open DOAR*)

The largest percentage of papers is in English (33%), only one minor percentage of papers are in Serbian (32%), while the other languages are also stunted: Croatian, German, French, Russian and Slovak.

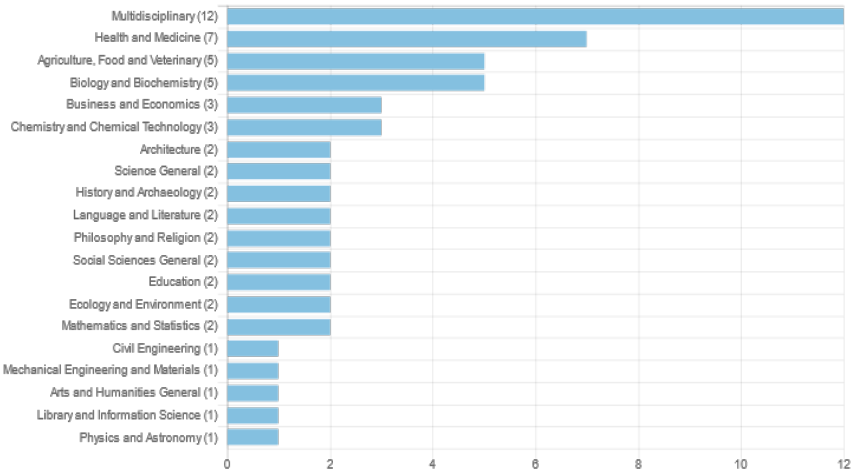

Figure 3: Subject of Content (*Open DOAR*)

From the areas represented, the most numerous are multidisciplinary repositories, followed by areas that include health and medicine, then agriculture, veterinary medicine, biology, etc.

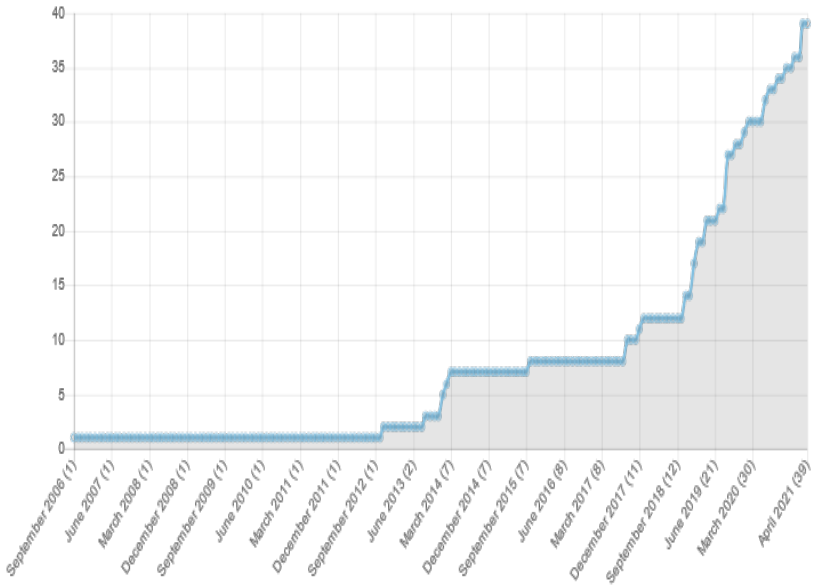

Figure 4: Growth of OpenDOAR (Open DOAR)

The chart, recording an increase in the number of repositories in Serbia, shows a slight increase in registered repositories since 2013. when the University of Belgrade signed Berlin Declaration. The sharp increase in the number of repositories has been recorded since September 2018. until today. The tendencies in our country suggest that, shortly, this number can be expected to double in a short period. A large number of institutions are working on setting up their repositories and their registration within the Open DOAR service is in progress.

6. Repository Software

Digital repositories are multiplying rapidly and the most common question that arises during their formation is which platform they will use to store and use data. There are numerous platforms in the world, some of them created exclusively for creating digital repositories, while others are designed to support digital libraries. Both are used equally and meet the requirements set before them. When choosing a platform, there are certain issues important for the institutions. Institutions require that the platform has: a stable infrastructure, affordable font and design, the ability to provide feedback to those who work in the system, interoperability, etc. With cheap or completely free installation and available customer support, archiving digital formats has become much easier. The benefits of digital archives have been recognized by most countries in the world. Numerous studies have shown that Dspace, Eprints and Fedora are the worldwide used archives.

Based on the analysis of represented repositories in Serbia, the DSpace platform is the most represented, while EPrints, Iceland and Fedora platforms are slightly less represented.
DSpace was created in 2002. as an open system free of charge for institutions around the world. Today, it is the most widely used platform for this type of digital repository. It is adapted to each scientific community to advance scientific work in each segment.
EPrints is free software, developed by the University of Southampton in 2000. It is one of the oldest platforms of its kind and the second most used in the world, after DSpace. DSpace is most widely used in libraries across the United States, and Eprints is most prevalent in libraries in Europe and Australia.
Fedora is open-source software that has applications in a large number of digital libraries, institutional repositories and digital archives. It represents the basic architecture of the system for creating a repository while providing the core for its creation. As an open-source system, Fedora provides a range of supporting services and applications such as search, for example. This software is dominant in the creation of digital collections and repositories, in the field of digital protection and document management.
Islandora is an open-source software created to manage digital collections in repositories. It was originally developed by the University of Prince Edward Island's Robertson Library, but is now widespread around the world. Flexible free software that allows you to work with a large number of data types (https://islandora.ca).

7. Open Access Aggregators in Serbia

In addition to the repositories that use the described platforms, there are several aggregators in Serbia with open access to journals, articles in serial and monograph publication and other results of scientific research. The most important are:

- DoiSerbia - the repository of articles from journals assigned DOI number;
- SCIndex - Serbian citation index;
- DoiFil - the repository of journal articles the DOI number is assigned at the Faculty of Philology, University of Belgrade.

The doiSerbia is a digital archive that contains articles from scientific journals in Serbia to which doi labels are assigned and registered in the National Library of Serbia. It is the largest aggregator of the latest scientific literature in Serbia, which enables completely open access to all articles that are deposited in it. Major world publishers independently assign doi labels for their publications, while in Serbia the competent ministry in 2005 entrusted this work to the National Library of Serbia (doiSerbia). Through cooperation with publishers of scientific journals, the National Library of Serbia began the process of assigning doi labels and maintaining access pages to texts from journals. From the small number of journals at the beginning, it has reached today's 66 titles. The

DoiSerbia system has significantly improved domestic publishing and influenced the better ranking of domestic scientific journals in influential citation databases. Since it has been working on the principle of fully open access from the beginning, DoiSerbia is the repository with the largest number of scientific papers in open access in Serbia. The number of full-text papers currently available to us through the DoiSerbia service is 47327 (DoiSerbia / Facts 5.4.2021).

SCIndex - Serbian citation index is a database in which domestic scientific journals are indexed. This database offers metadata, citation information and full texts of articles from journals indexed in ScIndex. ScIndex also assigns doi labels and maintains access pages to texts from indexed journals. Scindex currently indexes 276 titles of domestic scientific journals. In addition to accessibility and searchability, Scindex also provides editorial boards with scientific journals to help control the quality of articles and performs bibliometric analysis. It is produced and maintained by the Center for Evaluation in Education and Science (CEON / CEES), based in Belgrade.(http://scindeks.ceon.rs/)

DoiFil repository was launched in 2016 at the Faculty of Philology, University of Belgrade. The goal of starting the repository was to assign doi numbers to articles in journals and collections of papers published by the Faculty of Philology. The interest of the Faculty of Philology, as the publisher of a large number of scientific journals and collections of papers, was to improve access to its publishing production and increase the visibility and citation of its publications on a global level (Utvić, Škorić, 2017, 76). The interests of the Faculty began to be realized by launching the doiFil repository when assigning doi numbers to individual articles began to increase the visibility and citation of papers. At the same time, journals published by the Faculty began to refer to influential databases relevant to philology. The repository is available at the link http://doi.fil.bg.ac.rs/index.php?l=en with 4561 articles in completely open access archived so far. Presently, the DoiFil repository goes beyond the framework of philological disciplines and refers to 38 titles of scientific journals and 102 titles of collections of papers from various disciplines. Today, it is no longer focused only on the field of philology, but also refers to scientific journals of other publishers.

Doiserbia, *ScIndex* and *DoiFil* are the three largest and most visited aggregators of scientific information in Serbia because they provide access to the latest papers from journals and monographs of various publishers from Serbia in a completely open approach.

8. Conclusions

Open access and rapid exchange of scientific information are imperatives of scientific and academic publishing everywhere in the world. The launch of a

large number of institutional and thematic repositories that provide open access to all deposited data proves the point. Thanks to open and fast access to data, the exchange of scientific information is increasing, which contributes to better dissemination, visibility and evaluation of scientific information.
Repositories provide better visibility of results in academic circles. They increase the visibility of the individual, their citation, and thus increase the visibility of the institution on the world academic network. Expanding the repository network is a priority of every academic community because, in addition to the numerous opportunities they provide, they also provide insight into the entire scientific production. Their development and constant upgrading are inevitable if we want to keep up with the latest achievements. Although repositories have been developing in Serbia since 2005, it can be said that the construction of these systems is still in its infancy. Given the fact that the academic community in Serbia has insisted on launching various types of repositories in recent years, it can be expected that there will be more and more of them in the future and that the figures shown will double or triple in a very short period.

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