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Preparing teachers for crowdsourced language learning

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ABSTRACT: Crowdsourcing is among the most popular language learning tools, like Duolingo and Busuu, attracting millions of users worldwide. Its wide acceptance and the necessity to immediately switch to online techniques due to Covid-19 pandemic encourage the inclusion of crowd-oriented features into traditional language courses. The addition of new methodologies changes the role of language teachers from conventional lecturers to proactive coaches of their students. Such a dramatic shift is never painless. Therefore, it must be done skilfully, ethically and equitably. Based on the discussion of each of these points and strategies to successfully manage change, a framework for teacher preparation has been developed. It is enhanced with exact examples of teaching procedures intended to put the new knowledge into practice. Implementation of proposed six activities of teacher training sequence enables enhancing of teachers' learning and teaching activities through crowdsourcing.

KEYWORDS: Crowdsourcing for education, teacher training, language learning, online learning and teaching.

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1 Introduction

The emergence of advanced technologies in the field of first and second language (L2) education has led in the past to different kinds of challenges that teachers had to face in the teaching process. Perhaps one of the most common challenges is to keep up with the technical development and the level of

expected digital literacy (Lotherington and Jenson, 2011). The connection between these two is very important because it reflexes possible differences in the use and application of various L2 tools. The most recent technical developments in this area often include artificial intelligence, social networking, the collection of user data, and most recently, crowdsourcing.

Crowdsourcing is a technology mediated form of collecting, creating and distributing data. This method became widely recognized after Jeff Howe (2006) Howe (2006) published his chapter on crowdsourcing in Wired Magazine. The importance of crowdsourcing was linked with the creation of Wikipedia and online-learning communities (Corneli and Mikroyannidis, 2012). More recent examples of crowdsourcing and education are linked with the mobile applications (Corneli and Mikroyannidis, 2012), such as Duolingo and Busuu, in which the translation part is crowdsourced by its users. Crowdsourcing also supports multilingual language learning (Garcia, 2013) by, for example, providing information about vocabulary and sentence structure that can be used in the field of Natural Language Processing (NLP) (Wang et al., 2013).

The first association of crowdsourcing and language learning is, however, with Duolingo (Garcia, 2013). Initially introduced by Von Ahn (Garcia, 2013) as a project targeting to translate all the Web contents into many languages, it became a pool of currently 36 language courses intended for English speakers.¹ These courses are “made by the people” and enable more than 100 million learners to discover the secrets of foreign languages. Almost simultaneously, the project Xpress intended for learning colloquial expressions was launched by Chang et al. (2013) from the University of Michigan but, unlike Duolingo, it did not attract a great attention. Another project in which a large number of crowds became interested was the online experiment on word knowledge in Dutch, which involved nearly 300 000 participants who helped to determine the word prevalence frequency, i.e. how many people know some word (Keuleers et al., 2015). If language content is crowdsourced in an open-source online tool by various content providers, such as language teachers and instructors, and becomes openly available, it may not only be used for language learning, but also to “transform traditional educational institutions” by defining and conceptualizing “crowdsourcing for education”. (Prester et al., 2019; Jiang et al., 2018)

The necessity to find an alternative methodology intended for second language learning and acquisition is the direct consequence of Covid-19 pandemic. Almost everywhere worldwide, traditional language courses were re-

¹ Duolingo courses.

placed by various online or remote activities instantaneously. This immediate switch to completely new approach disabled the steady adaptation to innovations and resulted in the teachers' developing the so-called resistance to novelty. This resistance can even be compared to a biological immunity resulting in indolent teachers who are completely indifferent to any methodological change or innovation (Hiver and Dörnyei, 2017). An aggravating problem when switching to online classes is the resistance of older people towards digital technology (Comunello et al., 2017). Skaalvik et al. (2016) hypothesis that teachers' possible lack of motivation due to stress and workload is the greatest obstacle for adopting novelties in teaching was recently proved realistic. Namely, many teachers demonstrated a low motivation to transform their habits and refused to shift from traditional to remote learning caused by the Covid-19 pandemic. Teachers' unions supported their demands and discouraged online learning². On a contrary, European Commission decided to encourage the use of online teaching and learning, emphasising the necessity of careful thinking about all the consequences of transposing the teaching style to technological devices (EPALE, 2020).

Sudden forced alteration immediately triggered many safety and privacy concerns of the popular communication tools, such as Zoom, which was banned by many companies, government agencies and educational institutions.³ Crowdsourcing at current stage of its development can be perceived as a complementary and innovative approach, which can generate some additional negative experiences caused by the lack of knowledge and making them aware of certain possible consequences unethical use of data could have. In this regard, privacy concerns (Yu, 2016), data breaches (Edwards et al., 2016), intellectual property infringements (Bettig, 2018), and in some cases even life-threatening behaviour in the form of cyberbullying (Aboujaoude et al., 2015) can occur. This means that apart from changing the teaching style, teachers and learners need to take into consideration the ethical norms into the teaching process and consequently add to their digital competence.

It seems that more experienced users are aware of the ethical challenges the new technologies bring (Madary and Metzinger, 2016) but both the teachers and the academic administration possess a lack of ethical competence when novel educational trends are introduced (Catacutan and de Guzman, 2015). The EU has also only very recently established a completely new set of regulations in the area of data protection (EC, 2016), network and information security (NIS, 2016), and intellectual property rights (DSM, 2019)

² FUREY: Teachers' union discouraging online learning

³ Who has banned Zoom?

in order to answer the aforementioned concerns. They considerably affect the transfer from in-class to remote teaching and learning. However, their impact will be crucial if some schools decide to start using new technologies with crowd-oriented language learning. During this digital change, teachers will have to become familiar with the technological devices and their management, but also with the ethical considerations of using crowdsourced data from various users on the Internet. This may improve their open and active participation and collaboration that does not violate the ethical norms.

One solution to overcome the gap between the strict EU directives and people’s unawareness about ethical issues in language learning applications with crowdsourcing techniques is to re-educate teachers (Arhar Holdt et al., 2020) and similarly include this process in the education of new teachers at universities. For this reason, establishing a sound framework for increasing the ethical awareness of issues related to the creation and use of online content may be an effective solution. The following section suggests the five challenging focus areas for organizing teacher training intended to enhance the ethical awareness as a ground for implementation of crowdsourcing in language learning. Then, the paper recalls the general strategies of introducing change in education. It is followed by the framework how to introduce crowdsourcing in language learning illustrated by examples of class activities. The paper concludes with an overview of proposed recommendations for implementation and future work.

2 Focus areas for building the base for adopting crowdsourcing in language learning

Teachers are the backbone of educational system, and their role is crucial for the effective students’ learning. In the recent decades, they have been confronted to many initiatives, aiming to successfully prepare students for the new job demands and new types of work. Although majority of them were acquainted with some basics of online teaching, they presented much reluctance to digital innovative approaches because they had known how to teach effectively without digital technology. The sudden alteration to complete online learning methodology showed that it is necessary for teachers to constantly develop their competences to be able to adapt them when the circumstances require such change. The following five challenging focus areas illustrate the gaps in the basic teachers’ knowledge:

2.1 Lack of digital competence

Digital competence is considered one of the crucial abilities in the 21st century, which enables the acquisition of the remaining seven competences, such as language, mathematics, cultural awareness, as well as learning to learn (Ferrari, 2012). But according to OECD Teaching and Learning International Survey TALIS (OECD, 2020), teachers feel that technological skill is one of the skills they are most lacking, which is in tune with the fact that 44% of EU citizens have low or no (19%) digital skills. The digital competences are the major goal of the huge European project framework DigComp.⁴ The framework identifies five crucial areas: information and data literacy, communication and collaboration, digital content creation, safety and problem solving. The project is extended with the DigCompEdu background framework intended to educators (Redecker et al., 2017). Although already very moderate, around 35% of teachers “believe they are good role models for use of technology” (Instefjord and Munthe, 2017). This personal opinion should be taken carefully, because the survey done with 174 preservice teachers showed that they usually overestimate their digital competence (Maderick et al., 2016). This is rather bad news. However, the online test created by the Center for Digital Dannelsen, Denmark, offers more optimistic results varying from 49% in the area of programming, up to 74% in self-service.⁵ Although some teachers may be computer literate what they lack most are the pedagogical digital skills, which refer to the effective use of technology in the teaching profession. Lack of the abovementioned competences can compromise the use of crowdsourcing in language learning and teaching.

2.2 Resistance to novelty

As already mentioned in the introduction of this paper, teachers, particularly the more experienced and the more mature become immune to novelty and tend to keep their working habits unchanged (Hiver and Dörnyei, 2017). In spite of all the expectation of policy makers that the implementation of digital technologies will improve teaching and learning, it seems that the final effect is minimal (Howard and Mozejko, 2015). Furthermore, many teachers, including the truly dedicated ones simply refused to adopt new learning as they are convinced that their current knowledge of materials, aids and methods was sufficient for effective professional activity (Powell and

⁴ DigComp.

⁵ Online test created by the Center for Digital Dannelsen.

Kusuma-Powell, 2015). Therefore, there must be an organized effort based on “adaptive ways of working” and mutual collaboration, to overcome the tendency of preserving the status quo (Kunnari and Ilomäki, 2016).

Training and retraining require change, which is hard for the subjects of change, particularly adults. Young people develop own theories about the world (Gardner, 2006). Below the age of 15 people easily change their mind-sets (Piaget and Mussen, 1983). Later any change is difficult and takes place slowly. What is more important, adults tend to come back to their previous opinions (Gardner, 2006). The change may affect only oneself. Thus, there is a need for creating an environment in which people may want to change (Easen, 1985; Lamie, 2005). The old observation by Machiavelli (1513/1969) says that an innovator meets strong opponents in all people who benefited from old settings and only weak supporters who expect to defend the innovation as people do not believe in new things unless they see them work. It is still true. People in general do not want to overcome their comfort-zone so teachers’ attitude to the variety of innovatory approaches which firstly make more troubles than benefits can be, to some extent, understandable.

2.3 Teachers’ awareness of ethical challenges

Another prerequisite for the effective introduction of the novel methodology is the level of ethical awareness among the teachers (Chou and Chen, 2016). Many examples show that it is not satisfactory. Ethics is not obligatory in all teacher training programmes, if so it refers to essential human values, which, as many cultural phenomena are taken for granted (for example: various aspects of social interactions, such as forms of address and politeness rules are governed by ethical principles; the perception and construction of human dignity also involves ethical aspects). A broad concept of ethical issues in the digital context referred to new technologies is usually limited to basic aspects of internet safety. For instance, teachers are asked to support the controversial initiative Bring your own device (BYOD), which causes serious privacy and security risks among K-12 children (Ghosh et al., 2013). They have not oppressed the unwanted and illegal collection of various personal data, which are being shared with third parties (Peddy, 2017). School teachers are not immune to stolen laptops (Wakeling et al., 2017), phishing and malware attacks (Leukfeldt et al., 2017), social engineering scams (Meinert, 2016), and even cyberbullying (Kopecký and Szotkowski, 2017). Finally, they sometimes tolerate plagiarism (Canzonetta and Kannan, 2016). Teachers are

rarely aware of how legal policies e.g. General Data Protection Regulation (GDPR) affect their teaching context and are not aware of bad practices of certain platforms which violate the established rules (see point 5 below). All these unethical procedures should be revealed and discussed by teachers so that they can avoid or prevent them as much as possible.

2.4 Deficiency of motivation to transform teaching habits

The teachers' reluctance to novelty discussed above is enhanced by persistent teachers' burnout, which is one of the major reasons for lack of motivation and job satisfaction among teachers (Skaalvik et al., 2016). There are many examples indicating that "many teachers face occupational stress and burnout", and that the rate of these problems is very high (Oberle and Schonert-Reichl, 2016). It also affects students' quality motivation (Shen et al., 2015). Therefore, a serious effort should be made to convince the teachers to implement the three recommended rules:

- to be ready for "continued learning and satisfaction with learning",
- to wish to increase their intellectual development, and
- to be adequately rewarded for the self-development (Nicholls, 2017).

As Lamie (2005) claims, change requires clear aim. It responds to solving specific problems, but usually it creates even more problems due to destruction of previous patterns and procedures. It is focused on its actors – that is teachers in our case. Change is part of a complex system so many institutions, organizations, and societies are affected by any change. It is also part of social and economic context. It refers to personal attitudes and beliefs which evoke strong emotions. Finally, change is a process which requires training, practice, and time.

2.5 Non-compliance of crowdsourcing in education with EU regulations

Last, but not the least is the non-compliance of crowd-oriented education with the new EU legislation. The most infamous crowdsourcing platform that considerably violates the regulations is Mechanical Turk (MTurk). MTurk privacy notice from 2017⁶ is not adjusted to General Data Protection Regulation GDPR⁷ and it does not obey the rights of data subject including the

⁶ MTurk privacy notice from 2017.

⁷ GDPR.

Article 85, which protects the “processing and freedom of expression and information”. Additionally, there is an obvious incompatibility of some crowdsourcing platforms with the Directive on security of network and information systems, the so called NIS Directive (NIS, 2016). Namely, the amount of malware attacks toward the educational web resource is increasing (Kupreev et al., 2018). Crowdsourcing platforms are additionally vulnerable, because they, such as the MTurk, contain unpatched and vulnerable browser plugins (Kanich et al., 2011). Each platform should be used responsibly, so its creators must envisage all the prospective incompatibilities with the current legislation, and do the best to avoid any of them. There are no indications to crowdsourcing in the European key documents such as Council conclusions on the role of early childhood education and primary education in fostering creativity, innovation and digital competence.⁸ Although a lot of European documents articulate clearly the need for improving teachers digital competence and the need to accept the change, their willingness to adopt such approaches is far from satisfactory.

This section presented some of the most important obstacles of online learning and teaching. They will be considerably amplified if crowdsourcing is adopted as a complementary educational approach adding a variety to teaching practice (Zdravkova, 2020). In order to adjust teachers’ routine towards an effective crowd-oriented education, new approaches should be implemented. They are explained in more details in the next section in line with the framework for intended teacher retraining.

3 Approaches to prepare teachers for crowdsourcing in language learning

Prior to introducing new learning and teaching methodologies, it is inevitable to carefully set up the scene, based on previous experience. Teachers generally do not know much about the use of crowdsourcing in language teaching and learning, but they want to learn and they need practical tasks ready for their classes. (Arhar Holdt et al., 2020). There are various strategies for bringing about successful implementation. The most important for an effective shift are the following three strategies:

1. Power-coercive strategy

It requires political, economic, and even moral sanctions. There are examples of its implementation (Kennedy, 1986; Goh, 1999; Lamie, 2005)

⁸ Digital competence.

but people may have hostile attitudes towards it and it blocks teachers' creativity.

2. Rational-empirical strategy

It assumes that people are rational and when the benefits of change are explained to them they will adopt the change (Lamie, 2005). It may encounter less resistance than the power-coercive one.

3. Normative-re-educative strategy

It is focussed on the individual who is not perceived as a passive receiver of information and knowledge. It usually takes place with the presence of a consultant and facilitator. This role involves not only possessing knowledge, but also ability to convince that all goes smoothly and the people do not feel threatened and devaluated. The individual must take an active part in their own change. They need to change if they want it (Lamie, 2005). The generic strategies can be applied to the specific context in which crowdsourcing is introduced.

3.1 Framework of teacher preparation to implement crowdsourcing in language learning

Covid-19 triggered the first strategy as teachers and students all over the world have been forced to start online teaching. On the one hand, this strategy may result in a rapid increase of digital competences of teachers. For some teachers, the techniques of teaching online invented under pressure may not be effective. As a result, this strategy may produce a hostile attitude towards the use of digital technology in education. But the main educational trend does not cover advanced innovative approaches such as crowdsourcing, which has been introduced to the discussion among pioneers and teacher trainees recently, because the majority of the teachers are covering and catching up with the basics only. The frontrunners of digital education who have managed to acquire digital teaching skills earlier are much better prepared for the recent challenges. Even in the era of such intensive change they are able to creatively utilize the opportunities for the implementation of various techniques, including crowdsourcing as new approaches in education.

Although the use of crowdsourcing is not even recommended by any curriculum for teaching, studies have shown that some pioneer language teachers have already started experimenting with crowdsourcing (Arhar Holdt et al., 2020). The mainstream lags behind waiting either for policy regulations or strong convincing effects of this approach. Having in mind the strategic areas presented in Section 2, putting crowdsourcing in practice may be a

part of the suggested framework for retraining teachers as professional development of teachers is perceived here holistically. The role of the teachers’ vision of themselves and its impact on their motivation to teach (Dörnyei and Kubanyova, 2014) are emphasised in the framework, which follows the normative re-educative strategy in which the individuals take an active part in their own change. Educational challenges stemming from the COVID-19 pandemic indicate the need of future-oriented approaches within this strategy. Involving teachers may include the following activities with direct reference to what has been presented above. The teacher training sequence goes throughout three stages:

Stage one: Setting the scene (teacher training sequence) The main goal of this stage is to create an ethically sound environment for practicing crowdsourcing in language learning. As it was stated above, the ethical issues are most essential in approaching it. It consists of six activities, in which each activity triggers the following one (Figure 1).

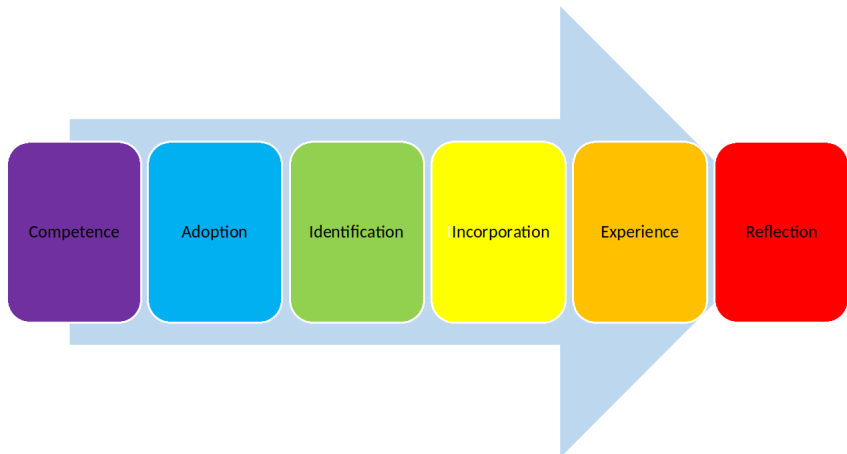


Figure 1. Six activities of teacher training sequence

The only actors of the stage one are the teachers, who will in perspective conduct language learning. Summed up briefly, teachers should:

- Become familiar with the existing crowdsourcing platforms for language learning – this raises their digital competence. They reflect on their current understanding of a good teacher in terms of the content they teach, their teaching methods and techniques. They create a vision of a role-model teacher who is technically savvy, aware of crowdsourcing platforms, and is able to use them ethically.
- Be encouraged to use the platforms for their own learning, which may reduce the resistance to novelty. They are also reminded that any curriculum is broad enough to allow them to adopt new innovative practices. They reflect on what crowdsourcing adds to the teaching content they work on everyday basis.
- Be given hints how to identify ethical or non-ethical practices in the platforms they are familiar with which raises their awareness of the importance of ethical issues in the use of such platforms. They recognize why ethical use of Information and Communication Technologies and especially crowdsourcing platforms make them better teachers.
- Be encouraged to incorporate crowdsourcing techniques in their own teaching, which may motivate them to change their teaching habits. They reflect on how crowdsourcing techniques enlarge their professional digital competence.
- Learn how GDPR influence their profession. They relate the formal regulations to ethical values that set the background of the teaching profession.
- Be encouraged to reflect on the crowdsourcing practices in language learning, identify their benefits and risks. They redefine their vision of a good teacher in a social and digital environment. They evaluate to what extent they have reached the goal set at the beginning.

Stage two: Sparkling creative tension through networking of in-service teachers and trainers

The need to re-envision own teaching occurs in the profession quite often. New posts, new opportunities require that teachers act accordingly. When they face a discrepancy between their vision and reality, they may feel uneasy but this tension may motivate them to transform.

This creative tension (Dörnyei and Kubanyova, 2014) may be generated through peer observation, self-observations, collecting student feedback, action research or focus group discussions and interviews. Thus, encouraging networking and sharing good practice examples by the pioneers as well as

offering them recognition, on any institutional digital infrastructure or social media, may trigger this creative tension. This way others may observe the examples and identify their relevance to their teaching context.

The crowdsourced collection of good practices may serve as referential materials for novices. In-service teacher training centres may facilitate this process by offering short courses or presentations tailored to the target group of teachers as the institutions respond to the needs of teachers which mirror the needs and practices adopted by their learners. What is more, via networking the teacher trainers build communities of practice who share similar ideas and concerns.

Stage three: Dissemination

Pioneers who disseminate the idea of crowdsourcing in their teaching contexts, e.g. among student teachers, colleagues, via professional conferences and publications, can be role-models. They may facilitate self-reflection in themselves and encourage others to reflect on their teaching practice, for example, by sharing videos made in their classes and sharing their students’ feedback.

A group of collaborating teachers creates an encouraging environment for action research and discussions. International collaboration can also generate a creative tension. A Safer Internet Day within eTwinning programme, described in more detail later in the text, is an example of such collaboration.

Each of the recommended three stages is equally important to enable the inclusion of crowdsourcing as a complementary model for language learning.

4 Examples of teaching procedures

Teachers learn best when they are able to put the new knowledge into practice. The following examples of teaching procedures may help participants of a teacher training session to bridge the gap between theory and daily activities. Having in mind the current situation with pandemic, all of them can be applied in both face to face and online teaching environments.

4.1 Examples of teaching procedures are based on materials for reading, listening and speaking

With reference to raising technical awareness, language teachers may use texts on crowdsourcing as teaching materials including the ethical issues involved in the process. Learners may develop reading and listening skills in

a foreign language while working on written texts related to crowdsourcing or while watching videos. Then, they may speak about the topic, share their own experiences, write answers to quizzes or prepare their own quizzes. Finally, they may mediate the information into their first language or practice multimodal translation by presenting an infographic on a selected issue, justifying orally their selection.

While preparing a lesson for their learners, teachers raise their own awareness and develop digital competence and literacy (check points 1, 2, 3 of the list above). To be able to select appropriate materials to their learners regarding their age, needs, and prior knowledge, teachers need to learn more and develop professional teaching competences.

An exemplary teaching sequence for reading comprehension and practicing speaking can include: asking pre-reading comprehension questions for a selected text to raise interest and motivation of learners, explaining key words to facilitate comprehension or letting learners guess the meaning from context. Learners read the text and answer the questions. They do some vocabulary activities prepared in advance by the teacher depending on the age and interests of the learners. Then, they relate the knowledge to their own experiences, revise grammar by asking their colleagues questions about their experience.

An exemplary teaching sequence for listening comprehension and practicing speaking may include: brainstorming the topic with learners by checking their prior knowledge, playing a video on the topic, asking comprehension questions to the video, relating the content to their own experiences, asking colleagues about their experience.

4.2 Examples of teaching procedures based on tools

Teacher introduces one of the tools like: Duolingo for schools, Buusu, Memrise, Writeandimprove, Speakandimprove, or any other, as they appear and disappear quite fast, depending on the needs of the learners. They should emphasise the importance of ethical issues. For at least intermediate language learners, Busuu and Memrise can be used for general language and for practicing specialist language. Cambridge University initiatives Writeandimprove and Speakandimprove.com refer to the development of productive skills with reference to Cambridge Exams. It is hard to create an evaluative list of tools which may be used because each tool evolves rapidly – functionalities are updated, moved or withdrawn. After the presentation of the tool a teacher trainee needs to refer the content and functionalities of the tool to her or

his teaching context. Moreover, tools appear or disappear, thus the trainer’s responsibility is to acquaint trainees with the resources available at the moment of training.

4.3 Example of collaborative raising the ethical awareness of teachers and learners

A short international project on Safer Internet Day within eTwinning programme can be a motivational factor to introduce this topic into teachers’ own lessons. Last Safer Internet Day was celebrated on the 11th of February 2020.⁹ More than 170 countries jointly discussed the topic “Together for a better Internet”, especially caring for children and young people. One of the lessons learned is that Learners should be informed about whom they may address in case of risk, so that escalation of cyber violence can be prevented. Another suggestion from this event is that learners may respond and mediate the content of the rules how to behave safely in the digital environment into their first language in order to practice mediation competence and experience translating in classes.

4.4 Examples based on writing or speaking tasks

Teachers may involve written interactive activities with the use of Squiffy or TADS (Text Adventure Development System) for a school newspaper or debates on the importance of ethical awareness in the use of crowdsourcing materials for language learning.

Such simple activities may trigger interest and encourage further steps in the professional development. The following websites in English may be recommended for a start, but every teacher may need to find resources appropriate to the needs of their learners.

To sum up, when it comes to crowdsourcing techniques in language education there are some initiatives such as Duolingo, which was presented above, and Kahoot, where a crowd of teachers prepares materials for their learners, with the latter being especially recommended for lower levels. Both services are used by teachers and innovators either in classes or as extra activities as an attempt to introduce gamification approaches to teaching. The services for at least intermediate learners are mentioned above. KhanAcademy and Wikipedia embrace more general educational topics. Their content may serve

⁹ [Safer Internet Day](#).

for language lessons as it is available in various languages. Storybird aims at improving writing and Flocabulary helps to learn English vocabulary in the context of rap music. At this moment only teacher pioneers explore these resources.

5 Discussion, recommendations and future work

The suggested framework and examples of procedures may be generally applied in pre-service teacher training with all necessary modifications. Young future teachers are computer literate to a greater extent than in-service teachers. What they need is to develop their pedagogical-digital skills. They are not resistant to novelty at this stage of professional development as there are so many new perspectives of teaching. They do not have to reshape their teaching habits because they are still in the process of building them. With all this in mind, it is highly recommended that ethical awareness in the context of crowdsourcing and other digital tools is part of their training. However, preparing a language teacher involves so many psychological, pedagogical, methodological, and content-related issues, including social interactions with the community and cultural values, that ethical reflection on the use of digital materials, tools, and data protection of stakeholders may seem to be of little value for the trainees.

Although the use of crowdsourcing in language education seems to be beyond the main interest of educators now, Covid-19 lockdown demonstrates clearly that teachers and educational policy makers, as people who are responsible for shaping the future, should be frontrunners of educational change despite the surrounding obstacles. The most effective way to prepare teachers to challenges they might face in the future is to do it through ongoing teacher training open to digital novelties, research findings, and professional networking. The use of crowdsourcing as a means of professional teacher training may be a good solution in the future. The current daily online activities focused on helping and supporting teachers who had lagged behind and had not acquired the basics of online teaching before the pandemic, should not hinder the visionary thinking of all education stakeholders about innovative teaching including crowdsourcing among others. All in all, being able to use a variety of techniques including crowdsourcing ones, allows teachers to respond to learners' needs, motivate them and prevent demotivating attitudes.

To conclude, taking into consideration that a) there are no policy documents that impose the use of crowdsourcing techniques for language learn-

ing, and b) there are some official curricular requirements to teach about ethics in the digital environment, there is a need for further development in this area to build awareness and disseminate the importance of such issues among teachers and policy makers. As a revolution in education is being experienced now, the actual progress may involve encouraging evolutionary change by building teachers' awareness and willingness to include the topics into their practice.

There are many voices expressing the need of preparing a variety of materials tailored for teachers that enable the practical use of crowdsourcing in language teaching and learning. There is a need for further work that presents the teacher's perspective on the use of such resources in practice, as for example the use of Duolingo (Grygo and Gajek, 2019). With the online revolution, teachers will need to be guided to innovative pedagogical approaches and techniques. Otherwise, they may easily tend to get back to the past practices.

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Changing the role of the librarian – from a cataloguer to an educator

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ABSTRACT: Libraries in the modern world are becoming places for collecting and exchanging information based on advanced information and communication technologies and tools. Accordingly, the role of the traditional librarian has changed significantly, from a cataloger of analog documents, through a librarian who deals with metadata, to lecturer and educator. This paper presents the way librarians transfer the knowledge to their colleagues and thus transform from librarians-catalogers into educators. The role of librarian educator is given through the example of accredited professional development programs for librarians, organized and held by librarians-catalogers from the University Library “Svetoazar Marković” in Belgrade. The paper also analyzes anonymous surveys of participants in accredited seminars, which indicate that the success of one seminar depends primarily on two factors: up-to-date topic and interactivity.

KEYWORDS: librarian-cataloger, educator, accredited seminars, academic librarians, University Library “Svetoazar Marković”, professional development.

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1 Introduction

The impression of the librarian and his character, in the local or academic community, throughout history has been subject to the stereotypical images that the librarian is a silent, strict but kind, conservatively dressed person

whose only job is organizing books on shelves and whose work is not attractive, dynamic or interesting. Individual and team engagement of librarians in daily work as well as working within professional associations and organizations, contributes to the strengthening of the role of librarians and suppression of stereotypes in the public (Јаћимовић и Петровић, 2014, 65).

Based on this thesis, we observe a change of the traditional role of librarians. Mainly thanks to public appearances, independent education in terms of new technologies and skills, publishing professional and scientific papers and transferring their knowledge at seminars, lectures and conferences, librarians are upgrading their primary role and become educators of their fellow librarians and interested individuals – students, experts, museologists, archivists and researchers close to the field of librarianship and informatics.

The concept of a librarian who has more responsibilities as well as the fact that librarian has no longer only one, clearly conceived scope is in line with the above (Shank et al., 2011, 108). The traditional functions of the academic library and the role of the academic librarian have been redesigned (e.g. monographs cataloging includes electronic editions cataloging), some functions have been discontinued (e.g. printing, maintenance and often the use of the card catalogue has been stopped), and some functions have been combined in new ways (e. g. card catalogs and certain parts of library collections have been digitized and therefore available on the web).

Libraries today, as places for information aggregation, publishing publications, lecturing, places where research and development projects are carried out are becoming the main advocates of information accessibility policy (Neal, 2010). In modern times, in addition to the knowledge acquired during university studies and professional librarian exam, the librarian must constantly improve and upgrade knowledge, which means possession of skills in new communication technologies, use of web 2.0 tools and expansion of library resources (Shank et al., 2011, 109).

The main job of the librarian-cataloger, which referred to the cataloging and classification of monographic and serial publications, non-book and other analog materials, moved primarily to cataloging electronic sources, and then to creating repositories and digital libraries and assigning metadata to digital objects stored in them. Assigning metadata to digital objects is basically close to cataloging analog documents. “Well-trained catalogers of analog objects very quickly become proficient in the technique of assigning metadata to digital objects” (Тртовач, 2016, 43). However, regardless of this fact, most librarians need support when working with metadata, so the workshops and lectures related to this topic are organized.

However, based on their abilities, librarians-catalogers, especially in academic libraries, transform their activities in the direction of taking care of data, their organization and visibility. Accordingly, the thesis is that one of the roles of librarians is to deal with the life cycle of information sources (Rice and Southall, 2016, 1). Catalogers need to be aware that information mediums and sources are changing and accordingly their traditional job needs to be transformed. Changing the job and scope of the cataloger implies constant training, improvement and education because academic librarians who deal with data (data librarian) are expected more than before to be supportive in research processes during various phases of research (Rice and Southall, 2016, 87).

Through all these activities, self-education and training, the librarian builds a professional identity and puts himself in a position to cross the determined framework which is traditionally given to him and become primarily an educator of his fellow librarians, but also others who have interest in new technologies and development of library and information profession. It was pointed out in (McGuinness, 2011) that librarians who deal with teaching should pay attention to how important their role is and what it implies. It is based on issues of trust and motivation of the audience, successful communication with new persons, building of professional identity and identifying the need for education and learning. These postulates apply to lecturers from all fields, but they are also a starting point from where librarians should build their role as lecturers and knowledge transmitters (Reale, 2018, 9).

In 2013, the library community in our country recognized the need for mandatory continuous professional training of employees in library and information sciences, so the largest libraries and professional associations got involved in selection and organisation of accredited seminars – National Library of Serbia,¹ Matica Srpska Library,² University Library „Svetozar Marković“,³ Serbian Library Association,⁴ Parent Library Community of Serbia⁵ and Serbian Academic Library Association.^{6,7}

¹ National Library of Serbia

² Matica Srpska Library

³ University Library „Svetozar Marković“

⁴ Serbian Library Association

⁵ Parent Library Community of Serbia

⁶ Serbian Academic Library Association

⁷ Details of this program in the section Accredited seminars for continuing professional development

The case study in this paper is based on the experience of the librarians-catalogers from the Library Materials Cataloguing Department of the University Library “Svetozar Marković” in Belgrade, who have come a long way from traditional librarians to educators. The experience is based on dozens of lectures, courses, accredited seminars and workshops for which librarians-cataloguers had to transform their traditional work and improve their knowledge, interests and skills in terms of modern Information and communications technology, as well as the ability to transfer knowledge to related audience.

2 Historical overview

By the Statute of the University of Belgrade in 1974, the University Library became the co-ordinating library for all libraries of the University of Belgrade (Petrović i Bulatović, 2019, 96), and with the adoption of the *Serbian Library Act – Закон о библиотечкој делатности Србије* (Република Србија, 1977) it extended the functions of the co-ordinating library to all academic libraries in Central Serbia. One of the basic functions of the co-ordinating library is to take care of staff training. *Work reports of the University Library – Извештају о раду Универзитетске библиотеке* during the seventies of the 20th century clearly show Library’s commitment for continuing professional development of employees and also the aspiration to educate librarians from its surroundings, primarily librarians employed at the University of Belgrade. During the year 1977, five professional lectures were organized and one seminar on publication accessioning was prepared in order to improve library services (Универзитетска библиотека „Светозар Марковић”, 1978).

Also, the *Belgrade Academic Library Association (Zajednica biblioteka Univerziteta u Beogradu)* was founded in 1976 in order to improve the coordination of all libraries at the University, and was soon joined by other academic libraries in Serbia. In 1992, this organization grew into the *Serbian Academic Library Association (Zajednica biblioteka univerziteta u Srbiji – ZBUS)*, with its headquarters in the University Library “Svetozar Marković”, within which the permanent education of librarians is marked as one of the basic goals.

Over the years, the Library, in accordance with its legal obligations, has undertaken the obligation to organize and conduct various forms of professional development of librarians employed in all academic institutions. Today, according to the *Decision – Решење* based on the *Serbian Library Act* –

Закон о библиотечко-информационој делатности, the University Library “Svetozar Marković” in Belgrade performs parent functions for all university libraries, academic libraries and libraries of scientific research institutes and institutions on the territory of central Serbia (Република Србија, 2012). Back in 2003, the Library, within its *Statute – Статут*, in Article 10, prescribed the obligation to organize continuous professional development for its library staff (Универзитетска библиотека „Светозар Марковић”, 2003).

In the past two decades, the Library has organized various trainings for employees in academic and special libraries (in the form of lectures, workshops, seminars, etc.), covering all important segments of work in the library, from cataloguing rules, new formats for processing library materials to usage of different electronic services.

Establishing unique national bibliographic-information system COBISS.SR⁸ in 2003 represents a turning point in the development of Serbian librarianship which at the same time caused many changes in the segment of education of professional library staff in Serbia. Namely, to work within the COBISS software package, which is in the base of this system, it is necessary to have a license that is issued in accordance with the *Rules for issuing the permission for shared cataloguing – Правилник о издавању лиценце за узајамну каталогизацију* (Република Србија, 2009). In short, this working license implies attending a five-day course and creating 30 bibliographic records and related authority records. At the beginning, during 2003 and 2004, in order to help faculty libraries, which were joining the shared cataloguing system, University library “Svetozar Marković”, as their main coordinating library, organized series of courses and workshops, offering expert consultations when moving to a new way of working since a high degree of irregularities in the cataloguing of publications was observed, which arose mainly as a result of the differences between the card catalogue and electronic catalogue, as well as insufficient knowledge of cataloguing rules. The mentioned training was led by librarians from the Library Materials Cataloguing Department of the University Library, and librarians who attended these courses were very satisfied with the opportunity to eliminate doubts through direct communication and improve their task performance in the system.

As one of the founders of the unique bibliographic-information system of the Republic of Serbia, the Library, in addition to education, is also involved in licensing for work in shared cataloguing system COBISS.SR. The members of the *Commission for issuing licenses for shared cataloguing sys-*

⁸ COBISS.SR

tem – Комисија за лиценце за узајамну каталогизацију are representatives elected from employees in the National Library of Serbia, the Matica Srpska Library and the University Library “Svetozar Marković”. Also, licensed lecturers on given courses for work in the COBISS.SR shared cataloguing system come from these three main institutions. Librarians from the Library Materials Cataloguing Department of the University Library have been engaged both as lecturers and members of the Commission.

At the same time, striving to be at the service to librarians in its network, the Library continuously monitors new technologies and holds workshops and lectures on available electronic resources: on the KoBSON portal, on non-commercial and commercial sources of information, citation managers, etc. which is all led by librarians from the Scientific Information and Education Department. With its overall engagement in the field of lifelong learning, the Library has unequivocally become a leader in the field of education of library staff in Serbia.

3 Professional Development Programs

However, until the enactment of the Serbian Library Act – *Закон о библиотечко-информационој делатности* (Република Србија, 2011) and the Rules on Continuing Professional Development in Library and Information Science – *Правилник о сталном стручном усавршавању у библиотечко-информационој делатности* (Република Србија, 2013), there was no obligation for employees in library and information science to upgrade their professional tasks performances.

For the first time, mentioned *Rules* within the library-information science, define, in addition to the methods of accreditation of the professional training program, the obligation of continuous professional training of employees on an annual level in duration of no less than six working hours.

The accreditation of the program is conducted by the National Library of Serbia on the proposition of *Commission for Accreditation of Continuing Professional Development Programs* (Комисија за акредитацију програма сталног стручног усавршавања) formed by the CEO of the National Library of Serbia. The Commission consists of representatives from the National Library of Serbia, Matica Srpska Library, University Library “Svetozar Marković”, Serbian Library Association, Parent Library Community of Serbia and Serbian Academic Library Association.

Programs are proposed through a competition announced by the National Library of Serbia every September, and all resources needed to run the pro-

gram are provided by the library in which the proposer of the program is employed.

It is important to point out that Article 6 of the mentioned rules also envisages the holding of remote seminars, which enables the realization of seminars during various emergency situations. However, this right was not exercised in 2020 because of the COVID-19 pandemic. In July 2020 the National Library of Serbia decided to extend the deadline for all seminars accredited for 2020 to the next year, so they are valid until the end of 2021. If the situation is unfavorable during 2021, each program will be hold remotely, if the program plan does not foresee practical work.

The first competition for accreditation of continuing professional development seminars was conducted in September 2013, when 31 programs were offered and 24 were selected. Over the years, the number of proposed programs has declined slightly, and the number of participants, according to available statistics, varies and moves in the range of two to three thousand (Бегенишић, 2018, 137).

4 University Library “Svetozar Marković” Contribution

In accordance with its obligations and goals, University Library “Svetozar Marković” immediately after the adoption of the Rules in 2013 joined the process of education of employees in library and information services and accredited the first in a series of education programs. By 2020, the Library had accredited a total of 30 programs. The number of accredited programs for the specified period, as well as the number of programs accredited by the Library is shown in Table 1, while the names of accredited programs are shown in Table 2.

Bearing in mind that employees in public libraries also apply as program participants, the University Library “Svetozar Marković” designs programs that are not too closely related to a specialized group of attendees, i.e. employees in the academic libraries network, but are also interesting to employees from public libraries (Поповић и др., 2019, 36). Education programs are created by librarians, experts in a particular field, at the initiative of the administration or on their own initiative, proposing topics from their field of work. Librarians from different sectors of the Library are often teamed up in creation of certain programs and some programs were implemented at the initiative of the University Library in cooperation with librarians from other

Program Accreditation Year	Total Number of Accredited Programs	Number of accredited programs in the University Library “Svetozar Marković”
2013/2014	24	1
2014/2015	26	4
2015/2016	16	5
2016/2017	18	5
2017/2018	14	5
2018/2019	14	5
2019/2020	10	5

Table 1. Information on accredited programs in the University Library “Svetozar Marković” for the period 2013-2020

libraries. In the period from 2013 to 2020, 3035 participants attended the accredited programs in the University Library. Overall, the most successful and most visited were: *Copyright in the Field of Library and Information Services*⁹, *Wiki-Librarian*¹⁰ and *Democratization of Digitization in Libraries*¹¹. The number of participants per accredited seminar is shown in Table 2.

In addition, during 2018, experts from the Library Materials Cataloguing Department of the University Library “Svetozar Marković” were involved in the accredited program of the Institute of Information Sciences (IZUM)¹² under the name *Education for Library Cataloguing in COBISS.SR System* (*Образовање библиотекара на рад у систему COBISS.SR*) organized by the National Library of Serbia when as licensed lecturers held 14 separate courses entitled *Transition to COBISS3 / Cataloguing with normative control of authority headings* (*Прелазак на COBISS3/Каталогизацију са нормативном контролом*). In that way, about 250 librarians employed in the academic libraries network of Serbia gained the required license for further work in the shared cataloging system COBISS.SR.

⁹ The program is led by librarians from the Scientific Information and Education Department and Library Materials Cataloguing Department.

¹⁰ The program is led by librarians from the Scientific Information and Education Department and Library Materials Cataloguing Department.

¹¹ The program is led by librarians from the Library Materials Cataloguing Department.

¹² **Institute of Information Sciences (IZUM)**

Nr.	Year of Accreditation Program	Name of Accredited Program	Number of Participants
1	2013/2014	Information Literacy in Libraries: commercial and non-commercial electronic information sources	221
2	2014/2015	Metadata in Contemporary Librarianship	71
3	2014/2015	Wiki-Librarian	77
4	2014/2015	Google for Librarians	213
5	2014/2015	Digital Marketing Culture	59
6	2015/2016	Linked Open Data and Bibframe: new forms of metadata organization in librarianship	249
7	2015/2016	Bibliometrics and Scientific Journals	179
8	2015/2016	Wiki-Librarian	81
9	2015/2016	Copyright in the Field of Library and Information Science	337
10	2015/2016	Digital Storytelling and Social Media	44
11	2016/2017	RDA and BIBFRAME: a bibliographic description for the 21 st century	54
12	2016/2017	Wiki-Librarian	90
13	2016/2017	Bibliographic Tools: EndNote and Mendeley	35
14	2016/2017	Multimedia in Librarianship	46
15	2016/2017	Copyright in the Field of Library and Information Science : the notion of plagiarism and violation of rights	123
17	2017/2018	Wiki-Librarian	50
18	2017/2018	New Media in Libraries	15
19	2017/2018	Digital Repositories in the Field of Library and Information Science	130
20	2017/2018	RDA and BIBFRAME: a bibliographic description for the 21 st century	41
21	2018/2019	Wiki-Librarian	60

22	2018/2019	Communication on the Internet: open science in the service of society	60
23	2018/2019	Copyright in the Field of Library and Information Science: authorship and internet	140
24	2018/2019	Democratization of Digitization in Libraries	388
25	2018/2019	Ресурси интернета за боље друштво: отворена наука: документи и извори	140
26	2019/2020	Wiki-Librarian	-
27	2019/2020	Democratization of Digitization in Libraries	-
28	2019/2020	Communication on the Internet: open science in the service of society	-
29	2019/2020	Copyright in the Field of Library and Information Science: authorship and internet	-
30	2019/2020	Searchable Digital Collections – building and search: theoretical and practical approach	-

Table 2. List of accredited programs organized by the University Library “Svetoazar Marković” for the period 2013-2020

5 Library Materials Cataloguing Department Activity

Digitization of library material became one of basic tasks in libraries, and appearance of digital documents led to the digital libraries creation. Therefore, librarians trained to work in dynamic and complex digital environment are becoming an imperative of modern librarianship. Librarians from Library Materials Cataloguing Department found that accredited programs were a chance for the library and information staff to get introduced to new technologies, formats and standards for digital document processing.

Librarians from Library Great Materials Cataloguing Department realized first accredited course in 2014, *Metadata in Contemporary Librarianship*. The great interest in course motivated librarians from this Department to continue with accredited programs in the following years. So far, four programs were very successfully realized, out of which two had to be accredited twice because of the great interest:

- *Metadata in Contemporary Librarianship* (accredited in 2014, realized in 2015);
- *Linked Open Data and Bibframe: new forms of metadata organization in librarianship* (accredited in 2015, realized in 2016);

- *RDA and BIBFRAME: a bibliographic description for the 21st century* (accredited in 2016 and in 2017, realized in 2017 and in 2018);
- *Democratization of Digitization in Libraries* (accredited in 2018 and in 2019, realized in 2019).

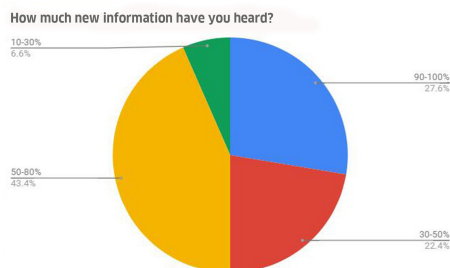


Figure 1. Content analysis of the course *Metadata in Contemporary Librarianship*.

Courses evaluation is done through electronic surveys. After the course is ended, all the participants get anonymous survey with carefully composed questions via email. All the participants need to fulfill the survey in a few days and send it back to the lecturers. So far, all surveys were prepared using Google Forms¹³ which enables automatic preparation of tables with participant's answers, and is very useful for quick and easy sorting and data analyzing.

After very successful realization of course *Metadata in Contemporary Librarianship* during 2015, the survey answers of participants were very useful for preparation of the next course. On the question "How many new information have you heard" only 6.6% of participants said that they heard less than 30% (Figure 1); on the question "How do you evaluate the course" even 67.1% of participants said "Useful in every sense" (Figure 2); in the part "Your suggestions and comments" the most comments were like: "More seminars with this topic" or "Lecturers and information from this course justify my expectations".

The answers in the survey show that the name of the course *Linked Open Data and Bibframe: new forms of metadata organization in librarianship* was appropriate. 45.9% of participants answered that they were not familiar

¹³ Google Forms

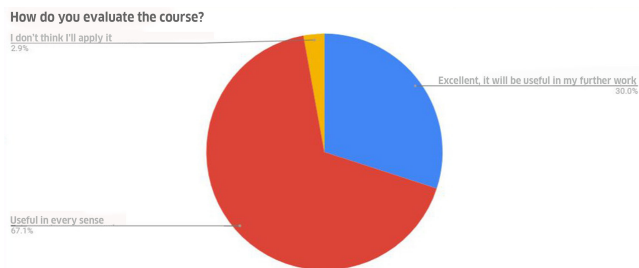


Figure 2. Evaluation of the course *Metadata in Contemporary Librarianship*.

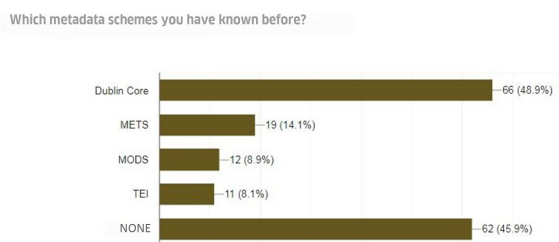


Figure 3. Content analysis of the course *Linked Open Data and Bibframe*.

with metadata schema introduced in the course (Figure 3), and only one participant answered that course was unnecessary (Figure 4). In the part “Your suggestions and comments” many comments were like: “Expect further cooperation! All the best in your work! Until the next meeting!”, “Libraries do not have a future without digitization. More courses like this. Thanks!”, “Nicely explained. I enjoyed.”, “Expect cooperation in the future! Lots of success in the work! All the best!”.

How do you evaluate the course?

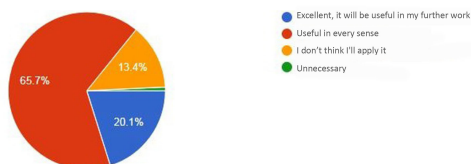


Figure 4. Evaluation of the course *Linked Open Data and Bibframe*.

RDA and BIBFRAME: a bibliographic description for the 21st century course evaluation confirmed that it is necessary to organize courses on similar topics. Only 13% of participants heard about the RDA standard before (Figure 5), and all the participants in this course gained more than 30% of new information (Figure 6). This shows that the topic of the course is original and up-to-date. Among the comments of the participants we may single out the following: “Course topic is very innovative, popular and practical for libraries”, “More courses with similar topic are necessary. I suggest more courses outside of Belgrade.”

Thanks to the cooperation with partner institution from European Union, especially Digitisation and Digital Preservation group (DEA group) at University of Innsbruck, Machine learning technology for handwritten manuscripts is from 2016 available at University Library “Svetozar Marković” in Belgrade. The digitization process of handwritten documents is rapidly developing, so we figured that it is necessary to organize a course in this topic for librarians from national, university and public libraries. The course *Democratization of Digitization in Libraries* was accredited in 2018. The participants were introduced to new free of charge tools for handwritten documents scanning and its transcription with a goal to create their auto-

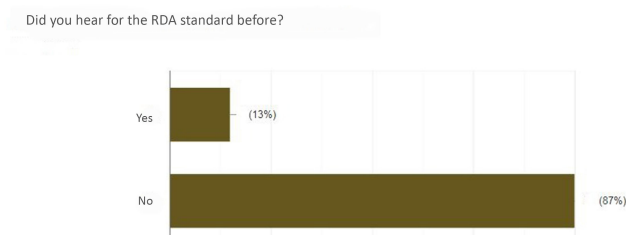


Figure 5. Already introduced to new cataloguing standards.

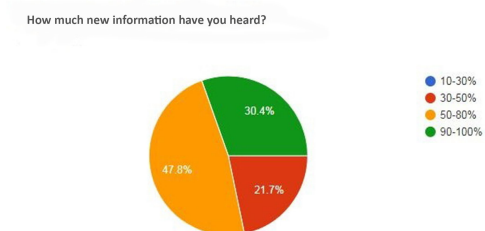


Figure 6. Evaluation of the course *RDA and Bibframe*.

matic transcription and full text search using new technologies within this course.

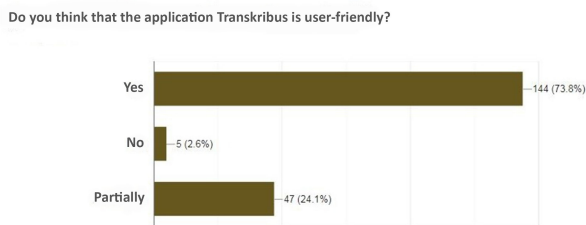


Figure 7. Tools characteristics evaluation in the course *Democratization of Digitization in Libraries*.

Survey results show that librarians think that new tools are easy to use, that they can be installed in their libraries and that librarians are willing to use them in everyday work. Evaluation of participants regarding course characteristics, its usage and the whole course realization are presented in the figures 7, 8 and 9.

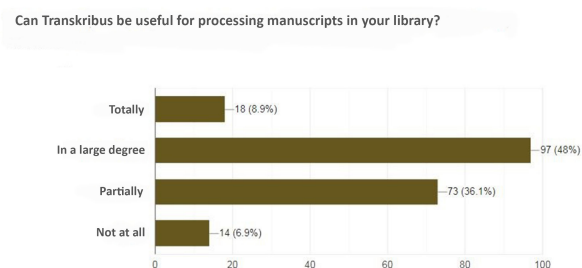


Figure 8. Evaluation of tools use value in the course *Democratization of Digitization in Libraries*.

The best indicator that a course was successful is that in the survey there were no answers indicating that a course was unnecessary. On the contrary, participants comments were like: “The course is very informative”,

“All information were useful, we will use them in our library”, “More courses with similar topic are necessary. This is the best way to introduce librarians to the news in our profession, in order to improve our professional presence on the scientific and cultural scene today”, “Great team. I enjoyed and enriched myself with new knowledge”; “The lecture was interesting, easy to understand and very applicable in practice. You have shattered the myth of digitization for many colleagues. Thank you! Best regards!”, “A very interesting and educational course, with excellent lecturers. Thank you and best regards!”, “The course is useful in terms of getting acquainted with new possibilities and techniques of working on the processing of library materials. I am satisfied with the course and the lecturers. I look forward to seeing you again and future cooperation with you and your institution! Best regards!”.

How do you evaluate the course?



Figure 9. Evaluation of the course *Democratization of Digitization in Libraries*.

Due to the great interest of librarian colleagues from all over Serbia, as well as due to the new functionalities of the program content, which in the meantime have become available to us, the course was accredited in 2020 as well. However, due to the COVID-19 virus pandemic, there were no possibilities to realize this program in 2020. It is planned to hold it in 2021, if the epidemiological situation allows. There is no possibility to hold the program as an online course since the program is designed as a workshop.

6 Conclusion

The experience of librarians-catalogers from the Library Materials Cataloguing Department of the University Library “Svetozar Marković” shows that individual education, intellectual curiosity and training could bring to building of a prominent professional identity. This identity involves adequate

lecturer skills that enable the retention of the audience's attention, successful transfer of knowledge and the motivation of colleagues for new jobs. Also, based on the analyzed answers in the surveys, it is clear that the participants have a strong need to gain and improve additional skills, knowledge and competencies.

Based on the experience in the preparation and holding of accredited programs, we can conclude that the success of one course depends primarily on two factors: up-to-date topic and interactivity. If we exclude courses that provide the necessary licenses for enabling further work in the bibliographic information system, we can say that a successful course is the one that covers topics that are not part of traditional education, offers plenty of new information necessary in everyday work, shows the horizon of the librarianship worldwide and our place within; and, at the same time, that takes place through practical exercises, in an atmosphere of dialogue and exchange of opinions (Figure 10).

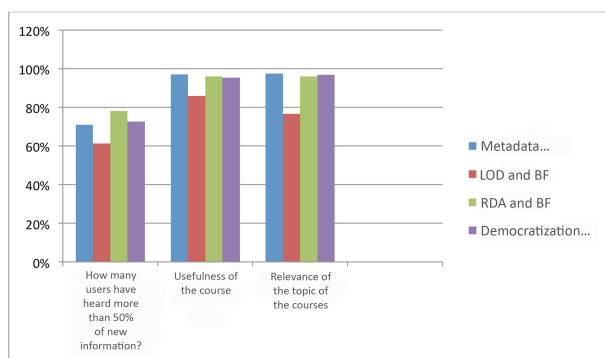


Figure 10. Comparative view of innovation, usefulness and relevance of the topics of the courses held by the Library Materials Cataloguing Department

Accredited programs have become a traditional meeting place for librarians, a training ground for exchanging ideas and a podium for finding partners for some of the future projects in the field of library and information science. The diversity and topicality of themes offered to the library community on the one hand, and the attendance of certain seminars on the other, speak a lot about the commitment of librarians-educators and also about the desire

to acquire new knowledge and skills by librarians-attendees. Also, some accredited programs have been repeated over the years due to the continuing interest of the participants and the impossibility to organize attendance for all interested persons during one year. We have the opinion that, although legally framed and mandatory, this type of education is currently the best possible method of professional development easily available to all employees in the field of library and information science.

In addition, stepping in the role of a lecturer at accredited seminars, courses and workshops, the traditional librarian separates from the stereotypical image and indicates that his work is very modern, attractive, dynamic and interesting.

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The future of science – Open Science and Open Data

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ABSTRACT: The development of ICT brings many changes in different fields of life –health care, education, economy, science. Opening of the resources that could be helpful to the society becomes a priority in the developed countries. With digital technologies and the Internet, Open Science is at its highest level. This term refers to opening of the scientific results, so the academic community can use it as a support in some further scientific research. The countries of the European Union are united in the process of adopting the legalisation about Open Science, as well as the non - European Union countries. Open Science is an umbrella term which includes Open Reviews, Open Access, Open Data etc. This paper presents definitions and benefits of Open Science, as well as the possibilities of access and use of Open Data, one of the most current representative of this movement.

KEYWORDS: Open Science, Open Data, Open Access, digital archives.

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1 Introduction

The possibility of access to results of scientific work is one of the basic pillars of science. The use of ICT and digitization has made it possible to share scientific materials and information with the academic community. The concept of Open Science emerged with the first science journals in the late 16th and at the beginning of the 17th century (David, 2008). At that time, researchers recognized the necessity of accessing the discoveries of other researchers and the possibilities offered by providing access to their own scientific works, all with the aim of sharing scientific opinions and ideas.

The term “Open Science” can be defined as a transformation of science – from the closed and traditional study to opening, sharing, and digitization; also, Open Science is becoming an obligatory part and a necessity in scientific work. According to Maurer, Open Science emphasizes complete, accurate, and timely publishing of scientific results. Maurer also notes that there is no restriction of access and that the transparency of information increases (Maurer, 2003). This movement is encouraged by the changes in ICT that transformed society – its economy, health care, and science. The very idea of Open Science is actually a systematical change in the implementation of scientific research in the last 50 years – the transition from the regular practice of scientific publishing to sharing and using all available materials and knowledge (European Commission, 2016). According to Burgelman et al. (2019), an early and well-known example of Open Science, dating from the pre-Internet era, is the Human Genome Project from 1990. The data on the human genome were widely shared among the scientific community during the project while a moratorium on publishing kept encouraging optimal collaboration. Due to this open science practice, researchers were able to decode the human genome in less than 15 years.

2 Open Science

According to one definition, Open Science represents the making of the scientific process completely available to the scientific community, through free access to methodology, data, and results of scientific work, publications, and articles and all other information obtained during the research process (Foster, 2017). This concept refers to the sharing of materials, in order to improve scientific work through transparency. Also, Open Science defines possibilities of cooperation between researchers, and within it, the scientific processes are available to others - under conditions that enable reuse of data and information. OECD defines Open Science as a possibility to make publicly funded data obtained via primary scientific research accessible for free or with minimal restrictions.¹ Open Science provides unlimited open access to research results, thus making the scientific processes more efficient, transparent, and adaptable to different social challenges. One of its main goals is the transformation of science through the use of different digital tools, in order to make research more global, creative, and bring it closer to society (European Commission, 2019).

¹ OECD Science, Technology and Industry Scoreboard 2015., accessed 9.5.2020.

As early as 2012, European Commission encouraged all EU member states to ensure open access to the results of publicly funded research, in order to improve scientific research and strengthen the knowledge-based economy (European Commission, 2018). By forming the OpenAire initiative, which entails support for the open science practices as well as technical support for infrastructure based on availability, the EU provided the necessary support to the quality development of the availability of scientific works. The chief commitment of OpenAire is to make publicly funded research available. The vital part of this initiative is the National Open Access Desks (NOADs) network, which consists of local experts, aimed at adopting Open Science practices, and bringing the concept closer to the country's scientific community.²

Despite all benefits of open science practices, there are still some conflicting views on the distribution of scientific results. Namely, although many believe that the possibility of free access to scientific materials could improve science, others are convinced that sharing results without a fee is not recommendable. For example, many publishers charge access to scientific papers published in their journals. This became a very popular topic in the last couple of years, mostly because many universities, faculties, and institutions are canceling their annual subscriptions to the biggest publishers. For example, the University of California canceled its annual subscription to *Elsevier* in July last year, believing that the activities of the world's largest publishers have created a monopoly in science. Advocating the principles of Open Science, the University in California is not the only to have given up on paying large annual membership fees (Resnick and Belluz, 2019).

Anyhow, Open Science is frequently defined as an umbrella term that denotes various movements aiming to remove the barriers for sharing any kind of output, resources, methods or tools, at any stage of the research process (Foster, 2017). Today, it is a generally accepted fact that allowing access to research results contributes to innovation and more efficient scientific practice in both public and private sector, and at the same time, it provides great support to policy-makers. Document *Open Innovation, Open Science, Open to the world* (European Commission, 2016) foresees that by 2030, Open Science will become the base of scientific work offering a range of unlimited opportunities for research in various scientific fields around the world.

² Open AireNOAD, accessed 3.5.2020.

3 Open Science in Serbia

Recognizing the main benefits arising from open science practices, countries around the world are adopting legal norms to regulate this movement in different areas of operation. In July 2018, the Ministry of Education, Science and Technological Development of the Republic of Serbia adopted the Open Science Platform. This document is based on principles of Open Science defined by the European Commission, which were incorporated in the proposal of the action plan for the implementation of the Strategy of Scientific and Technological Development of the Republic of Serbia from 2016 to 2020.³

The Platform also defines Open Access to scientific publications as a person's right to use the content without paying a fee - while being obliged to cite the source of the information. In addition to the obligatory Open Access to scientific publications, the Platform provides proposals for Open Access to primary data. Also, the Platform states that the clauses from the document do not refer to data that the scientific organization marks as confidential; as well as data that are considered to be a business secret or part of intellectual property. The Ministry of Education, Science and Technological Development of the Republic of Serbia recommends Open Access to data immediately after the results are published, whenever there are no legal or ethical restrictions to do so.

4 Open Data

Most scientific disciplines used empirical research methods based on the collecting and processing of different types of data. In recent years, the data were mostly stored in the computers belonging to research team members or one of the portable devices. Due to inadequate storage, the data would usually be lost after some time. Encouraged by the Open Science movement, the scientific community recognized the necessity to open access to data collected during research.

Open data is defined as online, free of charge, accessible data that can be used, reused, and distributed, provided that the primary data source is adequately cited (Foster, 2017). Open data usually refers to the process of depositing collected empirical data in institutional or thematic repositories, in order to ensure their storage and reuse (Смедеревац и др., 2020). According to the Open Data Handbook, these data may be used and redistributed

³ Open Science Platform (2018), accessed 13.5.2020.

by any user free of charge, while adhering to copyright principles. The creators are governments and public administrations, whereby accessibility and transparency are encouraged via open data access.

Another large contributor is the scientific community itself. According to OECD, open data represent the equal access to data of every member of the research community. Also, Open Access should be simple, timely, and available online.⁴ In order for the research data to be considered open, there must be no barriers to using, sharing, and reusing data. Because of this, we could definitely say that open data contributes to all areas of modern society.

Research conducted within the field of social sciences and humanities sometimes involves a lengthy and costly process of surveys, interviews, focus groups, and data anonymization. With open data, scientific research becomes more transparent, the diversity of ideas and opinions is encouraged, and new research is promoted. According to (Смедеревац и др., 2020), the process of data collecting had been an invisible activity for a long time, therefore, responsibility toward data was not part of academic skills and activities that were passed down from one generation of scientists to another.

The answer to the question „why do we need open data access“ is very simple – by ensuring data accessibility that does not jeopardize the privacy of individuals, the valuable resources that reduce costs and time are enabled. With it, scientific research rises to a higher level and provides a wide range of opportunities – data support new scientific research, improve the economy, etc. If science is considered as a public good, then it is clear why Open Science and open data are a necessity.

Despite all the benefits of open data, many scientists remain very skeptical. There are various attitudes among them – that their data are not good enough to be open and shared, that others would not be interested in their data. There is also fear of possible misuse, but also a lack of information on how the data can be processed and openly accessed. It is encouraging that exhaustive work is being done to popularize the open data concept and maximize protection – datasets can have an identification number (usually DOI), data can be adequately cited and protected by licenses; some journals only publish datasets.

Fienberg (1994) listed the benefits of open access to data:

- Scientific research becomes available, with an effective self-correcting factor

⁴ OECD (2007): Principles and Guidelines for Access to Research Data from Public Funding.

- Diversity of ideas and opinions are encouraged because researchers have access to the same data and they have an opportunity to analyze each other’s data
- Promotes new research and allows testing of new or alternative methods; there are numerous examples of data being used in a way that the original researchers did not anticipate
- Provides good materials in the teaching process; secondary data are extremely valuable for teachers who have access to quality data through the digital archive which they can use in their work with students
- The costs are reduced by avoiding duplication during data collecting. According to [Bradić-Martinović et al. \(2018\)](#), some datasets, such as General Social Survey and the National Election Studies, were used as a resource in thousands of scientific papers whereby the authors did not have to set aside time and money to collect data. The advantage of these datasets essentially comes down to the fact that collecting the same data twice becomes needless.

Funders of research projects insist on open access to data collected during research. One of them is *Horizon 2020* which insists on all research funded by them being made publicly available. European Commission believes that the information and data financed from public funds should be publicly available and provide benefits for the European scientific community, but also to all stakeholders in the process of global progress. *Horizon 2020* has a legal framework for Open Access as well as a set of instructions the project team must follow during research.

Also, it is important to note that not all data can be open data. Some data contain very sensitive information, and even with anonymization, the surveyed individuals or entities would not be fully protected. These data are called sensitive data and they are usually subject to special processing and storage. Access to these data is most often made possible by signing a contract with the institution that owns the data, through which the individual undertakes to use data exclusively for scientific purposes. In most cases, access to these data is possible from special computers found in the secured rooms of institutions that are under constant surveillance.

5 Where should Open Data be stored?

The answer to the question “where should open data be stored” imposed itself a few years ago. Numerous online services, such as Cloud systems, provide

the possibility to easily store datasets online. Although they are easy to use, the lack of IT support and the possibility of abuse show that these services are not the best choice. Digital data archives have been established as a permanent software solution, which facilitates the storing of these formats. Digital data archives are considered very cost-effective due to their self-sustainability. With data sharing and open data, digital archives became the key places to keep data secure and accessible. The connection between archives and data is explained by the fact that archives would not fulfill their basic function without data, and on the other hand, open data would not be sustainable without archives. Digital data archives support open data, open access, and open science, and at the same time, protect sensitive and personal data. To ensure this, many institutions use *Creative Commons Licenses* for data stored in digital archives. With these free licenses, copyright holders are clearly defined, which ensures legal access, and the archives precisely record to whom the data belong to.

6 Where should data be stored – state in the world and Serbia

Many developed countries throughout Europe have had national data centers for many years now, such as Social Science Data Archive from Slovenia, or UK Data Archive. Experts in different areas in the process of collecting, storing data, and open data processes are at service to the researchers in the field of social sciences and humanities, where they provide answers to various questions, but also promote open science and open data.

Researchers in Serbia are still not aware of the possibilities of open data access, even though project backers insist on open data. Experts from our country are working intensively on promoting this movement by organizing workshops and seminars so that the academic community can recognize the benefits of open science and open data.

Established in 2014, Data Center Serbia for Social Sciences is at the disposal of all researchers in Serbia. In November 2018, the Ministry of Education, Science and Technological Development of the Republic of Serbia provided necessary support to the Center, turning it into a national service provider for scientific data archiving, and Serbia thus became an equal member of the Consortium of European Social Science Data Archives – CESSDA

Eric.⁵ Center promotes Open Science and open data while also respecting all legal provisions.

In the upcoming period, the academic community of Serbia will be forced to fully comply with the concept of Open Science and open data in segments where it has not been done so far. This will be one of many conditions for participating in projects funded by the European Union, but also for the purpose of harmonization of scientific work with Europe.

7 Conclusion

The inclination toward open data and the availability of science has existed for several centuries, therefore, the need to fully adopt and adapt this practice in the era of modern technologies is not surprising. Open science pushes all boundaries in the scientific work and unites researchers from the same or similar fields of research. There are still some doubts that open science is not necessarily a good thing, and there is some resistance to it – many researchers fear that the results of their work will be misused and that someone else may take credit for it. On the other hand, large publishers are not in favor of this movement because it would decrease their financial gain. However, software solutions that provide a high level of security, the use of licenses that provide protection, and legislation that defines copyright holders, refute these fears and theories of scientists. Although a novelty, open data has been gaining momentum in recent years. Europe is intensively working on introducing legislation that would remove all financial obstacles for publishing the results of scientific work. Although lagging behind Europe, Serbia is still on the right track, as proved by the Platform for Open Science from 2018, which encouraged many scientific organizations to become involved in the open data process. It is expected that the upcoming period will actually be a time of great changes in this field, which will mostly refer to the regulation of legal frameworks and requirements when it comes to the issue of open science in the Serbian academic community.

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⁵ Ministry of Education, Science and Technological Development of the RS, 2019

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Enlightenment spirit in the 21st century: hipertextual reached material of "Collected works of Dositej Obradović"

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ABSTRACT: University library „Svetozar Marković“ has been successfully cooperating for years with Foundation „Dositej Obradović“ from Belgrade. The main goal of this cooperation was to create searchable digital collection of Dositej Obradović's works as well as works about Dositej Obradović, so that different target groups (students, researchers, professors), interested in Dositej Obradović's life and work, would have all necessary literature for their research gathered at one place. Foundation „Dositej Obradović“ also published edition named "Collected works of Dositej Obradović" at 2007/2008 year. During implementation of the project this collection was processed using up-to-date technologies for text processing while librarians from University library created portal of Dositej Obradović's works. That portal is a part of the greater University library's digital collection.

KEYWORDS: Dositej Obradović, digital collections, annotation, XML, TEI, metadata, named entities

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1 Introduction

University library „Svetozar Marković“ has been successfully cooperating with Foundation „Dositej Obradović“¹ from Belgrade for years. The

¹ Foundation „Dositej Obradović“

main purpose of this cooperation was to create searchable digital collection of Dositej Obradović's works as well as works about Dositej Obradović so that different target groups (students, researchers, professors), interested in Dositej Obradović's life and work, would have gathered all necessary literature for their research at one place. Cooperation started in 2018 with project *Searchable collected works of Dositej Obradović: creating portal for review and unified search of digitized material published by Foundation „Dositej Obradović“*. The cooperation was continued also in 2019 with project *Collected works of Dositej Obradović for 21st century: multimedial complemented material published by Foundation „Dositej Obradović“*. Both projects were financially supported by Ministry of Culture and Information while the edition *Collected works of Dositej Obradović in six volumes* was used for their implementation. Dositej's works were popular during writer's life and they have experienced multiple editions (1870, 1902, 1932, 1953). The most famous and the almost completed among all are "Collected works" in three volumes which „Prosveta“ published in 1961 within the edition „Serbian writers" (editors Đuro Gavella, Jelena Šaulić, Borivoje Marinković) (Обрадовић, 1961). Scientific edition *Collected works of Dositej Obradović in six volumes* was prepared for anniversary *200 years since Dositej's arrival in Serbia* and The Government of the Republic of Serbia proclaimed year 2007 as „Dositej Obradović's year". Foundation „Dositej Obradović" started project of publishing scientific edition *Collected works of Dositej Obradović in six volumes* and the editors were: professor PhD Mirjana D. Stefanović, PhD Miodrag Maticki and professor PhD Dušan Ivanić. In six volumes they united all Dositej's works that were officially confirmed as completed, works attributed to this writer, even in cases that it is not completely confirmed, as well as his complete correspondence known by now (Обрадовић, 2007, 5-6). In addition to the works, editors also prepared annotations and comments which better explain less known terms, people and events mentioned in the texts, dictionary of less known words, registers of proper names and geopolitical names, registers of abbreviations and references, and complete bibliography about Dositej Obradović. „Collected works of Dositej Obradović in six volumes" contained the following six books:

1. First book – *Pismo Haralampiju i Život i priključenja* (ed. Mirjana D. Stefanović);
2. Second book – *Basne i dve pripovetke, Istina i prelest, Put u jedan dan* (ed. Miodrag Maticki);
3. Third book – *Sovjeti zdravago razuma, Slovo poučitelno gospodina Georgija Joakima Colikofera, Etika* (ed. Dušan Ivanić);

4. Fourth book – *Sobranije raznih naravoučiteljih vešter, Mezimac* (ed. D. Ivanić);
5. Fifth book – *Spisi iz Dalmacije, Propovedi i besede, Zapisi i beleške, Fragmenti iz Srbije* (ed. M. Maticki);
6. Sixth book – *Pesme, Pisma, Dokumenti* (prir. M. D. Stefanović).

For the implementation of the above-mentioned projects, the Foundation “Dositej Obradović” handed “Collected works” to University library “Svetozar Marković”. As the result, the project named *Collected works of Dositej Obradović in six volumes*² was developed.

2 Text processing

In order to prepare a digital collection available to the users and searchable by different parameters, all material must be in appropriate digital format, processed with up-to-date technologies for text processing. If material is not in digital format, which is very common, it is first necessary to scan it (Ikonov and Dobrova, 2008, 2), and then to convert the obtained images into machine-readable text using OCR software (Optical Character Recognition) (Триван, 2016, 105-107). However, if textual material is already in appropriate digital format, as it was in this case, scanning is not necessary, and the first step is text processing.³ At the beginning of the first project in 2018, University library „Svetozar Marković” was given material in digital format, in .docx. Scanning and OCR was not necessary, which was a significant timesaving, and the first step was text processing. Text processing had a couple of phases and a final product is material transformed in appropriate XML (Extensible Markup Language)⁴format (W3C, 2020a). Material in XML format which specifies encoding methods for machine-readable texts and embedded header (TEI Header) for defining metadata about describing material (TEI Consortium, 2020) was prepared according to Text Encoding Initiative (TEI)⁵ Guidelines. Creation of XML documents implies annotation of formal and structural characteristics of textual material, as well as indexing entities within text. This is important task so the material later

² *Collected works of Dositej Obradović*

³ The complete versions of „Collected works of Dositej Obradović” prepared for publishing were handed to University library “Svetozar Markovic” by Foundation “Dositej Obradovic”.

⁴ *Extensible Markup Language*

⁵ *Text Encoding Initiative*

can be searchable according to different parameters and it is also possible to link indexed entities with appropriate resources on internet. For Dositej Obradović's works, XML documents were prepared automatically. Textual material in .docx format is already compressed file. It is saved in XML format, which allows extraction in appropriate XML editor. In this case the XML editor named Oxygen XML Editor was used. Opening .docx file in this editor, it is exported in XML format and for further processing document.xml file is used. In Oxygen XML Editor there is an option DOCX TEI P5 which automatically transforms document.xml file in TEI/XML file (Figure 1). This TEI/XML files can be further processed. Librarians from University library used Oxygen XML Editor and the complete procedure was applied on Dositej Obradović's works which is explained in next sections.

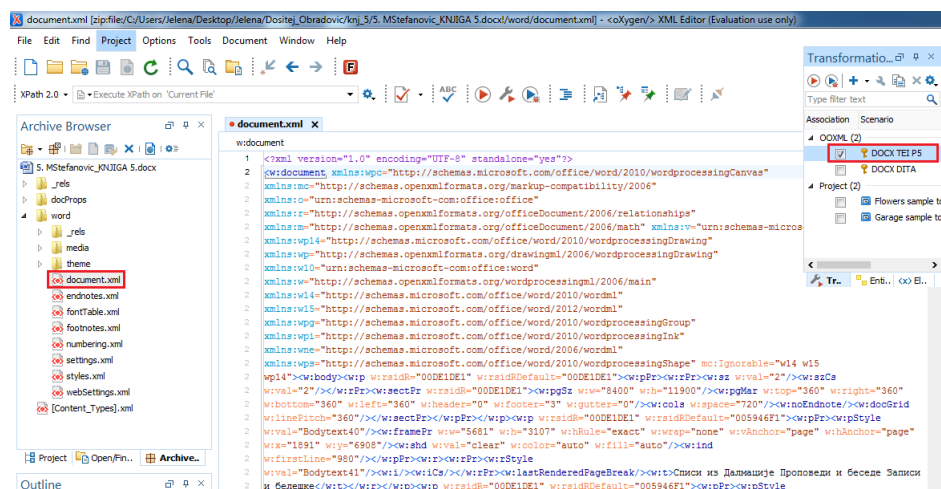


Figure 1. File document.xml for work *Spisi iz Dalmacije, Propovedi i besede, Zapiši i beleške, Fragmenti iz Srbije* and DOCX TEI P5 option

3 Annotation of formal characteristics

Annotation of formal characteristics implies metadata creation that “describes, explains, locates, or otherwise makes it easier to retrieve, use

or manage an information resource” (Hodž, 2004, 157) with “well defined semantics and structure” (Berners-Lee, 1997). The descriptive (bibliographical) and administrative metadata for Dositej Obradović’s works were created in the header of TEI/XML file (teiHeader) (Тртовац, 2016, 43-45). Descriptive (bibliographical) metadata can be divided into two groups: the first one that describes digital version of text (наслов/title, аутор/author, одговорност/respStmt и датум/date) and the second one that describes analog version of text (аутор/author, наслов/title, место издавања/pubPlace, издавач/publisher, датум/date и податак о едицији/series). Along with descriptive (bibliographical) metadata, there is also metadata about the license (administrative metadata) which defines permission for users regarding the usage of digital material (annotated with tag ref in the part publisher in publicationStmt). Figure 2 represents teiHeader example for work *Pismo Haralampiju i Život i priključenija*, while Figure 3 represents visual view for metadata from this header in the portal “Collected works of Dositej Obradović”.

```
<teiHeader>
  <fileDesc>
    <titles>
      <title>Писмо Харалампију, Живот и прикљученија: електронско издање</title>
    </titles>
    <author ref="viaf:76370256">Доситеј Обрадовић</author>
    <respStmt>
      <resp>Израда електронског издања</resp>
      <name>Универзитетска библиотека "Светозар Марковић"</name>
    </respStmt>
    </fileDesc>
    <edition>
      <edition><date>2019-10-15</date></edition>
    </edition>
    <publication>
      <publisher>
        <ref target="http://creativecommons.org/licenses/by-nc-sa/4.0/">Објављено под лиценцом Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International</ref>
      </publisher>
    </publication>
    <sourceDesc>
      <bibl type="copyText">
        <author>Доситеј Обрадовић</author>
        <title ref="CS0195-SR-ID:144066572">Писмо Харалампију, Живот и прикљученија: електронско издање</title>
        <pubPlace>Београд</pubPlace>
        <publisher>Задужбина Доситеј Обрадовић</publisher>
        <date>2007</date>
        <series n="1">Сабрана дела Доситеја Обрадовића</series>
        <idno type="wiki">https://sr.wikipedia.org/wiki/Доситеј_Обрадовић</idno>
        <idno type="viaf">https://viaf.org/viaf/76370256/#Обрадовић,_Доситеј,_1739-1811</idno>
      </bibl>
    </sourceDesc>
  </fileDesc>
</teiHeader>
```

Figure 2. Example for teiHeader for work *Pismo Haralampiju i Život i priključenija* in TEI/XML format

```

<teiHeader>
  <fileDesc>
    <titleStmt>
      <title>Писмо Харалампију, Живот и прикљученија: електронско издање</title>
      <author ref="viaf:76370256">Доситеј Обрадовић</author>
      <respStmt>
        <resp>Израда електронског издања</resp>
        <name>Универзитетска библиотека "Светозар Марковић"</name>
      </respStmt>
    </titleStmt>
    <editionStmt>
      <edition><date>2019-10-15</date></edition>
    </editionStmt>
    <publicationStmt>
      <publisher>
        <ref target="http://creativecommons.org/licenses/by-nc-sa/4.0/">Објављено под лиценцом Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International</ref>
      </publisher>
    </publicationStmt>
    <sourceDesc>
      <bibl type="copyText">
        <author>Доситеј Обрадовић</author>
        <title ref="COBISS-SR.ID:144066572">Писмо Харалампију, Живот и прикљученија: електронско издање</title>
        <pubPlace>Београд</pubPlace>
        <publisher>Задужбина Доситеј Обрадовић</publisher>
        <date>2007</date>
        <series n="1">Сабрана дела Доситеја Обрадовића</series>
        <idno type="wiki">https://sr.wikipedia.org/wiki/Доситеј_Обрадовић</idno>
        <idno type="viaf">https://viaf.org/viaf/76370256/#Обрадовић,_Доситеј_1739-1811</idno>
      </bibl>
    </sourceDesc>
  </fileDesc>
</teiHeader>

```

Figure 3. Visual view for metadata in the portal *Collected works of Dositej Obradović* for work *Pismo Haralampiju i Život i priključenija*

4 Annotation of structural characteristics

In addition to the annotation of formal characteristics, the annotation of their structural characteristics was also done for every work in the Collection. Annotation of structural characteristics implies tagging of logical text structures (text body, chapters, titles, paragraphs, sentences, words etc.) with appropriate XML tags and can be done automatically or manually. The edition “Collected works of Dositej Obradović” was mainly automatically annotated. After automatic transformation in TEI/XML file (described in the section Text processing), all necessary logical structures of texts were annotated: text body, chapters, head titles and paragraphs. Text body and paragraphs were annotated with appropriate XML tags directly, tag *<body>* for the text body and *<p>* for the paragraphs, and corrections were not necessary. However, chapters and their titles were also annotated, but with XML tags for paragraphs. According to TEI-Schema specification, the chapters are annotated with XML tag *<div>* while their titles are annotated with XML tag *<head>*, so the regular expressions are used for their correction.

Regular expression example:

Find:

```
<p rend=Heading #[0-9]+">
```

```
<anchor xml:id="bookmark[0-9]+">[([A-IIIa-III]+) ([a-III A-III]+)]+
```

```
</p>"
```

Replace:

```
<head style=text-align:center;" rend="italic">&1</head>"
```

To keep digital version identical to the analog as much as possible, with tags for heads, titles and paragraphs there are also attributes that define some content characteristics. For example:

Chapter annotation:

Example 1:

```
<div type="chapter">
```

```
<head style="text-align:center;">1.</head>
```

```
...</div>
```

Example 2:

```
<div type="chapter">
```

```
<head style="text-align:center;" rend="italic">Предисловије о  
баснах</head>.
```

```
...</div>
```

Example 3:

```
<div type="chapter" n="8[9]">
```

```
<head style="text-align:center;" rend="italic">8[9]</head>
```

```
<head style="text-align:center;" rend="italic">Лав и зец</head>
```

```
...</div>
```

In examples for chapter annotation one can see that there is always an attribute *type* with value "chapter" (examples 1, 2 and 3) alongside the tag <div>. Regarding chapter titles, which are positioned central in the original document, there is always an attribute style with the value "text-align:center;" (examples 1 and 3) alongside the tag <head>. Most of chapter titles are also italic, thus alongside an attribute style and tag <head>, there is also an attribute rend with the value "italic" (examples 2 and 3).

Paragraph annotation:

Example 4:

```
<p>[Писмо<rs type="person">Харалампију</rs>]<note>Овај рад  
Доситеј Обрадовића нема свој насловни лист. Због тога приређивач,  
према садржају и према адресату, насловљава текст и тај наслов ставља  
у угласте заграде. Текст је био штампан курзивом, као што је уобичајено  
било за предговоре. Овде су пагиновани листови, а не странице, и то  
звездицама, што је, такође, био обичај обележавања за предговоре. У  
науци постоје различита мишљења о том да ли је овај рад Доситејев
```

посебна библиографска јединица (Стефановић, 2007. И ту наведеној литератури; в. и Библиографија, 1990)... </p>

Example 5:

<p style="text-align:center;">ЉУБИМАЈА ЈУНОСТЕ,</p>

Example 6:

<p rend="italic">Здравствуй! Христос воскрес... </p>

Regarding paragraphs, tag <p> was almost without attributes (example 4). But there are some examples of paragraphs that are centered or italic, so it was necessary to annotate that characteristics. The central position of paragraph was annotated with attribute style and its value "text-align:center;" (example 5), while italic characteristic was annotated with attribute rend and its value "italic" (example 6), the same as with chapter titles. Tag <pb> with attribute n that annotates the number of pages was also used for pagination annotation, beside chapters and paragraphs. For example, <pb n="15"/> pagination was annotated in order to prepare the identical review of both TEI/XML file and the original document in the portal "Collected works of Dositej Obradović". Pagination annotation was also automatically done, using regular expression. Regarding annotation of logical text structures, the parts of text in foreign language, as well as highlighted parts of text: bold, italic, underlined, etc. were annotated in each text. For parts of text in foreign language the tag <foreign> with attribute xml:lang which value was ISO alpha-2 language code was used. For example, <foreign xml:lang="it">„Farina de diavolo va presto in semola</foreign>. Highlighted parts of text as bold, italic, underlined were annotated with tag <hi> with attribute rend which value depended on highlight characteristic (bold, italic, underlined). For example, <hi rend="bold">Кажеу да се чыде</hi>. It is important to say that highlighted parts of text were automatically annotated after transformation in TEI/XML file (explained in section Text processing).

5 Text annotation

5.1 Entity annotation with descriptive notes

Each work in *Collected works of Dositej Obradović* has a list of notes which represents very important part of this edition, at its end. These notes are very important for understanding and finding out more information about different entities in the texts: persons, geopolitical places, time periods, some titles, significant syntagmas, metaphors and verses. They help

researchers to find out more about persons that Dositej knew, the period of life he met them, their importance for his life and creativity, as well as more about certain geopolitical places he resided in during his life time. Thanks to the notes, researchers can also understand more easily the meaning of some syntagmas and metaphors that Dositej used in his writings. Notes are chronologically listed at the end of each work in edition, according to entities appearance in the text. Each item in the list contains the original entity form from the text and the explanation (note), as well as the number of pages by which the entity can be found in the text. The entity annotation with descriptive notes means that all entities from the list got their explanation in the text so that researchers, reading the text, instantly see the note and do not search for the explanation at the end of the work. Entity annotation was done manually with tag `<note>`. The note for entity “Здравствуй! Христос воскресе” in the work *Pismo Haralampiju i Život i priključenija* is represented in the Figure 4, while the annotations in TEI/XML format and visual view in the portal *Collected works of Dositej Obradović* are represented in the Figure 5 and Figure 6.

Христос воскресе (стр. 15) - Писмо је писано на Ускрс, како стоји и на његовом крају, 13. априла 1783.

Figure 4. Note for entity “Здравствуй! Христос воскресе” at the end of the text *Pismo Haralampiju i Život i priključenija*

```
<p rend="italic">
    Здравствуй! Христос
    воскресе.<note>Писмо је писано на Ускрс, како стоји и на његовом
    крају, 13. априла 1783. </note>.</p>
```

Figure 5. Entity annotation “Здравствуй! Христос воскресе” in TEI/XML file *Pismo Haralampiju i Život i priključenija*

5.2 Named entity annotation

Beside entity annotation with descriptive notes, the named entities such as proper names and geopolitical names were also annotated in the texts.

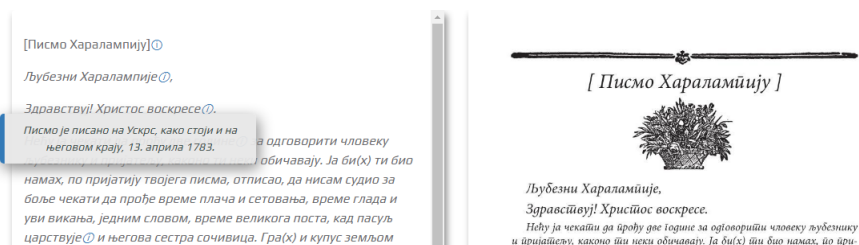


Figure 6. Visual view of entity annotation “Здравствуй! Христос воскрес” in the portal *Collected works of Dositej Obradović*

Named Entity Recognition (NER) is one of the technologies in information retrieval area (Chinchor and Robinson, 1997) and the leading subject in Natural Language Processing (NLP) form more than fifteen years (Vitas et al., 2007, 115-116) (Krstev et al., 2014). Named entity recognition means finding specific terms in the text and their classification in the categories (Андоновски, 2019, 124). Named Entity Recognition and their classification is important task for many scientific fields. Not only that it is one of five subtasks in information extraction in information retrieval area, but it is also important task in Natural Language Processing and machine translation within computational linguistics (Utvić, 2008, 2). Named entity annotation in edition “Collected works of Dositej Obradović” was done manually. The tag *<rs>*, attribute type with appropriate value, attribute *person* for proper names and attribute *place* for geopolitical terms were used for annotation. Figure 7 represents named entity annotation in work *Sobranije raznih naravoučitelних веšтеј, Mezimac* in TEI/XML file. In this example the named entities „Сократ”, „Софрониска”, „Фенарете”, „Атини” и „Христа”⁶ are annotated. The named entity „Атини” is geopolitical place in this example, which is the city of Athens, while other named entities are proper names. Named entity annotation enables precise retrieval by search engine of the portal. It is now also possible to link them with appropriate resources

⁶ Syntagma “469 година пре Христа” in Figure 7 is named entity classified as temporal expression. However, only proper and geopolitical names are annotated within the project described in this paper. This syntagma is not annotated as temporal expression and only name “Христ” is annotated as proper name. Temporal expressions will be annotated in the upcoming steps and this will be changed.

in Linked Open Data cloud such as authority files of proper names, authority files for geopolitical terms, proper ontology, etc. in Linked Open Data cloud (Berners-Lee, 2006; Radulovic et al., 2015; W3C, 2020b; Blaney, 2020).

```
<p><rs type="person">Сократ</rs>, син једног каменосеца именем
<rs type="person">Софрониска</rs> и једне жене званогене бабице, а
имени <rs type="person">Фемарете</rs>, родио се је у
<rs type="place">Атени</rs> 469 година пре
<rs type="person">Христа</rs>. Ипозетка научи занат
својега оца и историја чини воспоминаније о трима
ота|туана, које предавааху три грације и које су предивно
41 оделате биле. Види се од приуподобимава која је овај
преславни муж у своји разговори употребавао, да се он
имало није стидио свата свога родитеља и родитељице.
„Зачудо“, говораше он, „да један каменосецац</p>
```

Figure 7. Named entity annotation in work *Sobranije raznih naravoučitelnih veštje, Mezimac*, TEI/XML file

6 Linking metadata

Bibliographic metadata from the `teiHeader` of each document, which are author name and title, were linked with records of some appropriate resources on internet. Author name, Dositej Obradović, was linked with record about Dositej Obradović in Virtual International Authority File (VIAF)⁷, which is part of LOD cloud, as well as with web page about Dositej Obradović in Serbian Wikipedia. Title of each work was linked with appropriate record in electronic catalogue COBISS.SR.⁸ In mentioned databases each record has its identification number which is unique ID used for linking. ID number of records in VIAF and COBISS.SR are represented in `teiHeader` as value of attribute `ref` in tags `<author>` and `<title>`. Wikipedia link of the Dositej Obradović’s web page was represented in the tag `<idno>` and its attribute `type` with value „wiki” (Figure 8). In this way users can get more information about author and titles for their research. Bases VIAF and COBISS are important especially for library and information scientific community. VIAF is international authority file of proper names, organizations and titles, joint project of several national libraries. COBISS.SR is an electronic catalogue of The Republic of Serbia. These two bases are products of library and information science and are very important in this filed.

⁷ Virtual International Authority File

⁸ COBISS.SR

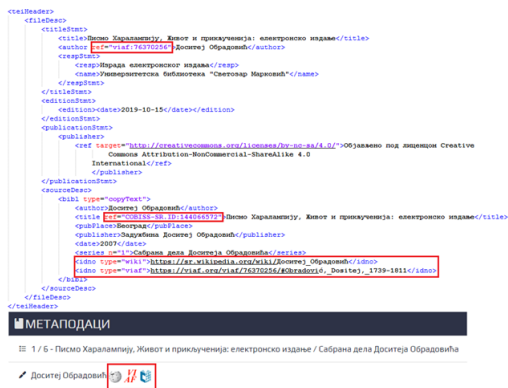


Figure 8. Note for entity “Здравствуй! Христос воскресе” at the end of the text *Pismo Haralampiju i Život i priključenija*

Authority files and electronic catalogues are among the most important resources in library and information science. Linking metadata with these resources points out their importance and impacts new technological possibilities that semantic web offers. On the other hand, they are important for libraries and librarians to see advantages of their use in information retrieval field. Richness of resources that already exists in libraries, as well as the creation of new ones are great starting point for implementing new technological possibilities of semantic web (Андоновски, 2019, 237-238). Knowledge bases, Wikipedia for example, give us interesting information about different entities and it can be starting point for some further research. For that reason, these bases are selected as the first resources to link metadata within.

7 Conclusion

After successful cooperation for years, Foundation “Dositej Obradović” and University library “Svetozar Marković” have continued their work in 2020 on new project *Bibliography about Dositej Obradović: bibliographic metadata annotation and their linking with important library and information resources in Linked Open Data cloud*. The aim of the project is to enrich digital collection in the portal *Collected works of Dositej Obradović* with a new textual corpus material, bibliographic material about Dositej Obradović and his

work. On the other hand, it is necessary to update technical characteristics of the portal so that the detailed annotation of bibliographic metadata and their linking with important library and information resources on internet can be successfully represented. In this way the creation of a big textual corpus about Dositej Obradović's life and work begins. The annotation of bibliographic metadata for each bibliography unit according to TEI Guidelines and their linking with appropriate library and information resources, authority databases and knowledge bases that are part of the Linked Open Data cloud are the special focus of the project. Having in mind that the textual corpus about Dositej Obradović and its works is huge, only a small part of it will be processed for the purposes of this project. The selected material will be also complemented with sub collection *Dositej Obradović* in the collection *Kritika (18. i 19. vek)* on the portal *Srpska književna kritika*⁹, also developed by University library “Svetozar Marković”.

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⁹ Српска књижевна критика, <https://kritika.unilib.rs/>. Потколекција „Доситеј Обрадовић“, <https://kritika.unilib.rs/en/islandora/object/kritika%3Adositej>

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CONOR.SR Authority File in the COBISS.SR Library System – current situation and perspective

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ABSTRACT: Authority control, as a process in which the unique form of authorized access point (authority headings) is determined and established, was developed in the seventies of the 20th century. However, this concept in Serbia began to develop late, in 2006 by establishing the basic principles of authority control. The selected solution refers only to libraries that work in the library information system COBISS.SR. The initial authority file was created in 2013 and the CONOR.SR was finally established in April 2019, and has been growing very rapidly ever since. Working with the new COBISS3/Cataloguing software with authority control undoubtedly improves the work process in the co-operative cataloguing system, but on the other hand, there are still inconsistency in work, deficiency of handbooks in libraries, insufficiency of education and professional conscience of librarians.

KEYWORDS: authority control, authority file for personal names, CONOR.SR, COBISS.SR, record editing.

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1 Introduction

Authority control as a process in which the unique (preferential) form of authorized access point (authority headings) is determined and established, and then used exclusively to mark a certain entity or concept, is an imperative of any well-organized library system. At the UNESCO conference in

1974, it was recommended that each national bibliographic agency should be responsible for establishing unique form of the author's name from their own country and create authority files for them, and for corporate bodies too (Којевић и др., 2011, 307). It is formulated that authority record, beside the authorized access point (authority headings), also contains variant access points – references from variant (non-preferential) to unique (preferential) determined form of authorized access point, references to related authorized access points, several types of notes and information on data sources.

The International Congress on National Bibliographies organized jointly by IFLA and UNESCO was held in 1977 and librarians from developed countries gave recommendations that “the national bibliographic agency should maintain an authority control system for national names, personal and corporate, and uniform titles, in accordance with international guidelines” (IFLA International office for UBC, 1979). The working groups that were formed on that occasion had specific tasks:

1. development of standards for data entry which resulted in manuals:
 - GARE – Guidelines for Authority and Reference Entries for printed and micro form in 1984;
 - GARR – Guidelines for Authority Records and References¹ for a much larger number of media in 2001;
2. development of UNIMARC format for authority files, which was realized through:
 - the formation of the Coordination Body in 1984, which included members of the IFLA Cataloguing Section;
 - the issuing of the first edition of UNIMARC/Authority Data in 1991;
3. development of methods for more efficient and successful exchange of authority data with end results:
 - linking all authority records;
 - availability of authority data of each national bibliographic agency on the Internet;
 - creating complex authority files as VIAF² and ISNI³.

2 Authority control principles in COBISS.SR system

Although the IFLA recommendations and instructions for the development of authority files were established in 1977 while the format UNIMARC/Authority data in 1991, in the Serbian library environment this

¹ GARR (Guidelines for Authority Records and References)

² VIAF (Virtual International Authority File)

³ ISNI (International Standard Name Identifier)

concept began to develop late, in January 2006 by establishing the basic principles of authority control, when at the initiative of the Virtual Library of Serbia (VBS), *Instructions for bibliographic records preparation regarding forming authority records for personal names – Uputstvo za pripremu bibliografskih zapisa za programsko kreiranje normativnih zapisa za lična imena* were made. Development authority file CONOR.SR project leaders were the National Library of Serbia, the Matica Srpska Library and the University Library "Svetozar Marković." The authority control project involved only those libraries which were part of the COBISS library information system,⁴ and the entire work was based on the continuous support of the Institute of Information Sciences (IZUM)⁵ from Maribor as an information service that deals with the maintenance and development of COBISS systems and services.

The first problems appeared when trying to determine the form of authorized access points, i.e. unique authority heading of the personal name as a starting point in work with authority files. The practice of creating authorized access points in catalogues, from card catalogues through electronic catalogues was different in different types of libraries in Serbia. National and public libraries in their author catalogues used the phonetic form of the author's personal name in Cyrillic script in the authorized access point. On the other hand, university, academic and other scientific libraries used the etymological, original, form of the author's personal name in Latin script in the author heading; or a transliterated, Latin form of the author's personal name which is originally written in Cyrillic script. At the meetings of the VBS Cataloguing Committee it wasn't possible to achieve a common approach or a concession from any side. The National Library of Serbia and the Matica Srpska Library could not accept the possibility that the determined form of personal name for foreign authors in the authorized access point should be in etymological form (Latin or Cyrillic script depending on the origin), and the University Library "Svetozar Marković" could not make concessions that the determined form of the personal name for Serbian authors should be in Cyrillic script, as a legitimate etymological form.

As a consequence, the Cataloguing Committee came to compromise solution to create parallel authorized access points in Cyrillic and Latin script in the authority record, which, proved by experience, was not a good solution.⁶ The UNIMARC format for authority data allows this possibility,

⁴ Hereinafter „COBISS.SR system“

⁵ IZUM (Institut informacijskih znanosti Univerze v Mariboru)

⁶ For more information, see the chapter The most frequently errors in CONOR.SR

since field 200 for the authorized access point is repeatable (IFLA, 2001, 69). The model of parallel authorized access points is also present in other data systems, but it is more often related to multilingual societies (e.g. the National Library and Archives of Canada use this model mainly in different bilingual etymological forms of corporate bodies in English and French). The possibility for this kind of authorized access point is also prescribed by the format for authority data COMARC/A (IZUM, 2020, 200-2) which is used in the COBISS system.

However, with this new approach in authority control in the COBISS.SR system, the previous regulations regarding phonetic or etymological authorized access point were abandoned, and parallel authorized access point in Cyrillic and Latin script as unique authorized access points for personal name were determined.

Inconsistency in the creation of parallel headings as authorized access points is reflected in following:

1. for Serbian authors, a pair of authorized access points for personal name consists of its Cyrillic and Latin form:
200 1 7cb – ćirilica – srpska aКараџић bВук Стефановић f1787-1864
200 1 7ba – latinica aKaradžić bVuk Stefanović f1787-1864
2. for foreign authors whose names are originally written in Latin, a pair of authorized access points for personal name consists of its phonetic Cyrillic and etymological Latin form:
200 1 7cb – ćirilica – srpska aИго bВиктор f1802-1885
200 1 7ba – latinica aHugo bVictor f1802-1885
3. for foreign authors whose names are originally written in Cyrillic, a pair of authorized access points for personal name consists of its etymological Cyrillic and transliterated Latin form:
200 1 7ca – ćirilica – nije specifikovana aГорький bМаксим f1868-1936
200 1 7ba – latinica aGor'kij bMaksim f1868-1936

Regardless of the inconsistencies, at the end of 2008, at the meeting of the VBS Cataloguing Committee, this decision was finally accepted by all members. Relatively soon achieved solution was incorporated in the Serbian Authority File, and the initial authority file CONOR.SR was formed (Савић, 2017, 103). Perhaps, one of the reasons for impulsive acceptance of this solution and starting on cataloguing with authority control is the desire of the Serbian library community to keep pace with the librarianship of developed countries, since the existence of authority file is a prerequisite for linking data from local and union catalogues in the Linked Open Data Cloud (Пуцаревић и Фурунџић, 2019, 116).

3 Creating CONOR.SR

The formation of the authority file CONOR.SR had several phases. First, in the period from 2008 to 2010, the chief cataloguers from the National Library of Serbia, the Matica Srpska Library and the University Library "Svetozar Marković" edited and marked appropriate bibliographic records for the initial authority file. By this action, they created the database (implemented in 2013) which consisted of about 54,000 bibliographic records that had necessary data for authors entered in fields 700 and 701 (surname, name, year of birth, as well as the researcher's code if it is assigned to the author).

Within the next phase the project had envisaged editing every record in the authority file, before connecting with bibliographic records which implies data checking, data adding and deleting duplicates. The data editing in the authority records is possible even after connecting with bibliographic records, but deleting duplicate records is not possible, because the bibliographic record would be left without heading i.e. authorized access points.

For that cause, a Chief redactor team of six members was formed, and it consisted of two redactors from every mentioned institution. The tasks of this team were to make a work plan, determine the principles of editing, divide the work and create instructions for editing the authority file CONOR.SR (Савић, 2017, 106). The plan consists of the following activities:

- the redactors of records created for Serbian authors are librarians from the National Library of Serbia and the Matica Srpska Library;
- the redactors of records created for members of national minorities are the librarians from the Matica Srpska Library;
- the redactors of the records created for Serbian researchers and foreign authors are the librarians from the University Library "Svetozar Marković".

However, although the *Instruction for Editing Initial CONOR.SR – Uputstvo za redigovanje pripremne baze CONOR.SR* was made and the number of redactors was increased from the initial 6 to 23, editing of all records was not completed until the installation of the COBISS software for authority control due to insufficiency of human resources in the mentioned institutions. Namely, for the authority file redactors, this is just one in a series of tasks they deal with on a daily base, so it was not possible to perform editing the whole corpus of records in initial CONOR.SR.

The Chief redactor team estimated that it should be switched to the cataloguing with authority control in the COBISS.SR system, although editing in the initial CONOR.SR was not finished. Primarily they had in mind huge period of time which has elapsed since tagging records (from 2008 to 2010) and their implementation in CONOR.SR database (2013), and finally the need to standardize cataloguing processes for libraries within the system. The team was coordinated by Milorad Vučković, head of the Center for Co-operative Cataloguing of the Republic of Serbia at the National Library of Serbia, and based on his enthusiasm and knowledge, and with the professional support of members of the Cataloguing Committee, a decision to switch to cataloguing with authority control was made in 2017.

In order to implement cataloguing with authority control, in 2018 it was necessary to educate about 850 librarians from Serbia (who at that time had a license for co-operative cataloguing in the COBISS system) to use the new software COBISS3/Cataloguing with authority control.

4 Education of librarians

The education of librarians for working with software and applications in the COBISS system is extremely centralized and is held in the National Library of Serbia for librarians from Serbia and its Province Kosovo and Metohija, while in the Matica Srpska Library in Novi Sad for librarians from the Province of Vojvodina. However, due to the large number of course participants and the short period of time a partially decentralized model was created at the insistence of Milorad Vučković, colleague who coordinated the entire project on behalf of VBS, with the support of Gordana Mazić, CONOR.SR contact person from IZUM.

Nine librarians, members of the Chief redactor team (two members from each institution and additional three members from the Center for Co-Operative Cataloguing of Republic of Serbia) acquired the permit (license) for holding the *Transition to COBISS3/Cataloguing with authority control* one-day course. That created the conditions for the education of librarians from academic libraries in Serbia by lecturers from the University Library “Svetozar Marković” in Belgrade.⁷

These one-day courses which provide license to create basic authority records were held in the period from June to December 2018 for 747 participants. The education was conducted in libraries throughout Serbia in order

⁷ The authors of this paper are lecturers on the course and members of the Chief Redactor Team for authority control.

to perform the job efficiently in a short period of time, and to reduce travel costs to a minimum. Lecturers from the University Library in Belgrade held courses in 14 terms for about 250 librarians from academic libraries in the University Library "Svetozar Marković" premises, but also in the University Library Kragujevac and the University Library "Nikola Tesla" in Niš for librarians from their branch libraries.

Librarians who successfully finished the course and gained the license to create basic authority records were given access to the CONOR.SR test authority file where they could check the acquired knowledge, determine what they have learned and face doubts, and also resolve them with lecturers. At the end of 2018, the most experienced librarians who successfully worked in CONOR.SR attended the course *Use of COBISS3/Cataloguing – Updating CONOR* and gained privileges for editing and updating those records.

Until April 2019, CONOR.SR had functioned as an independent database and the bibliographic records from the COBIB.SR database were not yet linked to the records from the CONOR.SR database. The records editing continued as a priority job for all redactors in every mentioned library. Special emphasis was placed on editing and deleting duplicates, while after connecting those two databases, that would no longer be possible. Librarians-redactors from the University Library "Svetozar Marković" focused on determination of duplicates for Serbian researchers as well as on standardization and editing of the records by consulting the database E-CRIS.SR⁸ and the websites of the institutions in which the researchers are employed.

Initial linking of authority records and bibliographic records in the COBISS.SR production databases is carried out in April 2019, when the CONOR.SR database was integrated into COBISS.

5 Quality control of authority records

As the CONOR.SR database is the same and unique for the entire COBISS.SR system (there are no local CONOR databases), the Joint VBS Commission for Cataloguing and Classification held a meeting in April 2019 to discuss the issue of editing new records created after linking the databases as well as the switching on cataloguing with authority control.

It was agreed that each of the three mentioned libraries should edit records created within their institution while also conducting the quality control of authority records created by librarians from their branch libraries.

⁸ E-CRIS.SR(Current Research Information System in Serbia)

Thus, the redactors from the University Library “Svetozar Marković” were given the task to check the quality of authority records created by librarians from academic libraries in Serbia.

Quality control of records is very important and necessary because, according to the data from the CONOR.SR database, only during May 2019, 11,729 records were created, and during 2019 a total of 73,456 records were created. During 2020, the database increased by another 48,687 records.⁹ Including the records from the initial authority file CONOR.SR, today we have about 170,000 records¹⁰ whilst the authority file is increasing every day. The editing of each individual record is too extensive, even an impossible task for redactors. Quality control is performed by reviewing the records of the individual creator and by identifying errors. The errors and deviations from the determined rules and instructions are pointed out to librarians by e-mail and consequently a correction of the record is requested according to the given recommendations.

Only two chief cataloguers from the University Library “Svetozar Marković” in Belgrade are conducting quality control of records in the entire network of 250 librarians from academic libraries from the area of central Serbia. Since the concept of decentralization is the only sustainable one in this situation, it was agreed that the university libraries in Kragujevac and Niš would delegate chief cataloguers for authority records created in their branch libraries. The model is already functioning successfully in the University Library of Kragujevac and will soon be established in the University Library in Niš.

6 The most frequent errors in CONOR.SR

A lot of time passed from the beginning of the education for working with the new concept of cataloguing with authority control in the form of a one-day course attended by the participants (June-December 2018) to the final connection of the bibliographic base and authority file in the COBISS.SR system (April 2019). Although the CONOR.SR test database had been formed after the given courses, only the most diligent and responsible librarians have been working in it. This is the main reason why numerous errors in authority data records occurred during the transition to the new way of cataloguing.

⁹ Given data on the 8th October 2020.

¹⁰ Given data on the 9th October 2020.

Several major problems and errors regarding work process were noticed during the examination of the authority records created by librarians employed in academic libraries.

The main problem is that librarians did not clearly understand how the system works. Namely, they often didn't understand that a bibliographic record is a record for a publication that is being catalogued, and that authority record is a record for a person who has a certain responsibility in that publication (e.g. an author in that publication, who may be an editor, translator etc. in another publication). Relying on traditional work and linear cataloguing, librarians often made the mistake of making a separate authority record for each responsibility that a person (entity) had.

Another problem is that librarians from academic libraries are used to forming a Latin etymological or transliterated authorized access point (authority headings) in their bibliographic records, so they often forget to enter a parallel form of authorized access point on Cyrillic script in field 200 of the CONOR.SR.

Also, in the bibliographic records created in academic libraries in the field 001\$7, the defined script of catalogue is ba-Latin script. So, it is a common mistake for librarians to form biographical details or activity notes about the entity in the field 340\$a and general cataloguer's note in 830\$a in Latin instead in Cyrillic script.

The next mistake is reflection of the superficial approach of librarians and their work by habit and automatism in the process of determining the authorized access point. For Serbian authors, a pair of authorized access points in fields 200 is consisted of parallel forms in Cyrillic and Latin script:

2001 7cb – ćirilica - srpska aЦрњански bМилош f1893-1977

2001 7ba – latinica aCrnjanski bMiloš f1893-1977

By the same principle, librarians make the mistake when forming the pairs of authorized access points for foreign authors which are originally written in Latin script:

2001 7cb – ćirilica - srpska aВайлд bОскар f1854-1900

2001 7ba – latinica aVajld bOskar f1854-1900

instead of properly formed pair of authorized access points:

2001 7cb – ćirilica - srpska aВайлд bОскар f1854-1900

2001 7ba – latinica aWilde bOscar f1854-1900

The biggest problem and the largest number of errors occurred in the process of creation pairs of authorized access points in field 200 for authors who are originally written in foreign Cyrillic scripts (Russian, Bulgarian, Northern Macedonian, Ukrainian, Belarusian, etc.). Following the rule that,

as in the previous examples, one form of name always appears in Serbian Cyrillic, librarians often make a mistake and form a pair of authorized access points in this way:

2001 7cb – ćirilica – srpska aДостојевски bФјодор Михајлович f1821-1881

2001 7ba – latinica aDostoevskij bFedor Mihajlovič f1821-1881

instead of properly formed pair of authorized access points:

2001 7ca – ćirilica – nije specifikovana aДостоевский bФедор Михайлович f1821-1881

2001 7ba – latinica aDostoevskij bFedor Mihajlovič f1821-1881

Additionally, the redactors noticed that many librarians do not have the basic cataloguing knowledge, which is necessary when forming authorized access point, i.e. the unique forms of the personal name. In many cases, the correct form of the personal name could be made simply consulting the still valid cataloguing rules *Pravilnik i priručnik za izradbu abecednih kataloga* written by Eva Verona, which librarians did not take into consideration. On the one hand, the problem exists due to insufficient responsibility, knowledge and focus of librarians on the cataloguing process, while on the other hand, many libraries did not have the necessary cataloguing manuals and handbooks in their fund.

Based on the identified errors, it was also noticed that many academic librarians do not perform a detailed search of the electronic catalogue CO-BIB.SR and recommended databases VIAF and ISNI in order to determine proper form of personal name, year of birth and variant forms of a personal name. So, basically, here lies the main reason for creation duplicate records or records of insufficient quality.

The following remarks are sent by e-mail to only one cataloguer in the system. They are chosen because they illustrate the most frequent mistakes made by cataloguers in the process of creating authority data records. It is easy to conclude how extensive and demanding the work of authority record redactor is:

1. Enter the language code of entity in the field 101\$a.
2. Enter the code for nationality of entity in field 102\$a.
3. Enter the gender code of entity in the field 120\$a.
4. Enter the subject heading code in the field 106\$a; if the year of birth of entity is known, the code is 0; and, if not, the code is 1.
5. Enter the year of birth of entity in the field 190\$a, and the year of death in the field 191\$a, since you have already entered those years in the field 200\$f.

6. Resolve double-barrelled surname as a variant authorized access point in the field 400.
7. Always enter in Cyrillic script notes in the field 340\$a.
8. Enter notes about current job and entity position (director, manager, etc.) in the field 830\$a and also always use Cyrillic script.
9. The form of the note in the field 340\$a for university professors would be e.g. Professor at the Faculty of Law, University of Belgrade. If one entity is employed at several faculties, it is enough to enter the note Doctor of juridical science, university professor.

7 Improving the work of cataloguers

Since all redactors in the COBISS.SR system have similar problems when dealing with authority records, there was a need to set a meeting for members of the Chief redactor team for authority file and representatives from the Center for Co-Operative Cataloguing of the Republic of Serbia. The goal was to improve the work processes in the system and the quality of authority data records. The meeting was held in December 2019, and as a result of the agreement reached, instruction with examples for creating records in the CONOR.SR was made. Our colleagues from the Center for Co-Operative Cataloguing of the Republic of Serbia distributed the instructions to all librarians who have the privilege for creating basic authority records.¹¹

- Excerpt from the book *Правонис српског језика* by Mitar Pešikan, Jovan Jerković and Mate Pižurica published 2019, regarding transcription and phonetization of personal names on foreign languages;
- The book *A new transcription dictionary of English personal names* – *Нови транскрипциони речник енглеских личних имена* by Tvrtko Prčić published 1998;
- Few chapters of a book *Pravilnik i priručnik za izradbu abecednih kataloga. Dio 1, Odrednice i redalice* by Eva Verona published 1986, related to the creation of authorized access point (authority headings) and the transliteration of foreign Cyrillic alphabets.

The authority records editing and giving consultations by e-mail has been continued in order to improve the quality of records in the authority file. The mentioned model of decentralization of records editing seems to be

¹¹ Updates related with working process in authority file CONOR.SR could be found on web portal [Virtuelna biblioteka Srbije – edukacija](#).

the only possible and sustainable solution for the situation in which there are numerous cataloguers who create records and a small number of redactors who maintain the authority file CONOR.SR.

The decentralization would mean that each parent library in the CO-BISS.SR system should delegate one chief cataloguer who would edit the records created in libraries from their area (e.g. the Parent Library “Ljubomir Nenadović” in Valjevo would be responsible for authority records created in libraries of Kolubara District). In academic libraries, university libraries in Kragujevac and Niš would edit authority records created in libraries from their universities. The faculties that have several libraries in their organizational structure would also delegate one chief cataloguer for authority records (e.g. Faculty of Philosophy and Faculty of Philology, University of Belgrade). The University Library in Belgrade would continue its previous activities, and the National Library of Serbia and the Matica Srpska Library would perform a detailed editing of authority records created in their institutions.

8 Conclusion

The implementation and development of the authority file for personal names CONOR.SR is a huge step forward in the cataloguing process in the CO-BISS.SR system. The authority record for a concrete person (entity) is created only once, and then used whenever it is necessary to connect that entity with the appropriate bibliographic record, because the authority file is mutual for all libraries in the system. The CONOR.SR already contains over 173,000 records and continues to grow, while 785 librarians create new authority records on a daily base. This undoubtedly speeds up the process of working in the system of co-operative cataloguing. On the other hand, inconsistency in work, deficiency of handbooks in libraries, insufficiency of education and professional conscience of librarians lead to insufficient quality of authority records. The small number of CONOR.SR chief cataloguers cannot correct every incorrect record and mark every duplicate record in the system. The work is spontaneous to some extent, mistakes are corrected when they are accidentally noticed, but such a way of working is not sustainable.

The system solution for overcoming this problem requires a modification of working process and approach, starting from the level of knowledge required for passing the professional library exam, through giving and revoking licenses and privileges for co-operative cataloguing, to a decentralized approach in editing records in the authority file CONOR.SR.

The initial steps have been taken. Communication with librarians in the system is generally good, and workflow instructions and handbooks are provided to anyone who deals with authority records. This is the base for improving the quality of records that are going to be created in the future. We also have the opinion that a perfect system does not exist, but also its quality and functionality should not depend on enthusiasm of several individuals and on spontaneous approach. Therefore, we hope that communication and cooperation between the members of the Chief redactor team and the Center for Co-Operative Cataloguing of the Republic of Serbia will be even better, and implementation of the proposed solutions on decentralized record editing in CONOR.SR will be adopted, as logical, systematic and responsible solution for maintenance of the normative database in the best possible quality.

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Library as the center of a scientific research institution

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ABSTRACT: On the example of the “Ivo Andrić” Library of the Andrić Institute in Višegrad, we are considering the ways in which libraries and the professional staff employed in them can contribute to the improvement of the scientific and teaching activities of the institution. The librarian, the only employee in the library, in addition to the work in the library and information activities, also performs other tasks that directly help the development of the home institution. With the usage of modern technologies in the library business and the wide range of services it offers to its users, the library is becoming the center of a scientific research institution.

KEYWORDS: The Andrić Institute in Višegrad, “Ivo Andrić” Library, one-person library, library in a scientific research institution.

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1 Introduction

After completing the studies of library and information science, graduate librarians and information professionals are trained to work in all types of libraries. In this paper, we deal with special libraries that are located at scientific research institutions, in the case of a particular library. Special libraries are established at other institutions with the aim of “serving special, closed groups of users, related to a particular institution of which it is a part, and in order to meet the spiritual needs of employed professionals” (Вранеш and Марковић, 2008). Jelena Dobrilović Dragović states that “a special library exists as a special unit within an organization that does not have library goals” (Добриловић Драговић, 2016). Special libraries are often libraries

with one employee (Живановић, 2017). The term "one-person library" is used by John Feather and Paul Sturges to refer to an individual-run library or information service, often with little or no help from another person, and states that as many as 95% of special libraries are in fact one-person libraries (Feather and Sturges, 2003).

In a library with one employee, the librarian performs all the tasks necessary for its functioning: procurement and physical accommodation of materials, cataloguing and classification of the library fund, work with users, which includes borrowing and deleveraging, providing assistance in finding information, including assistance in scientific research, production of different types of bibliographies, public relation, compiling reports and plans, performing administrative tasks and more. The librarian should also have good organizational and communication skills and understand the importance of maintaining contact with other colleagues, both from their profession and within the institution where the library is located.

The role of a librarian employed in a special library at a scientific research institution is to maintain good relations with the parent institution, active participation in performing scientific and teaching activities of the institution, responding to user needs for information, continuous professional development and monitoring modern trends in library and information activities. In order to help improvement of the home institution, and thanks to the knowledge and skills acquired during their studies, graduate librarians-information professionals employed in libraries at scientific research institutions also perform other types of work. In this paper, we try to show the example of the "Ivo Andrić" Library of the Andrić Institute in Višegrad and the ways in which the library and the librarian can contribute to the improvement of scientific and teaching activities of the Institute.

2 The Andrić Institute in Višegrad

The Andrić Institute in Višegrad was founded on June 28, 2013, as an institution whose subject is scientific research work in the field of social sciences and humanities. Its founders are the Government of the Republic of Srpska and the Government of the Republic of Serbia, which makes it the only scientific institution founded by these two countries. The mission of the Andrić Institute is based on promoting the ideas and thoughts of Nobel laureate Ivo Andrić with the basic goal of promoting cultural, artistic and scientific development and encouraging young people to study significant problems in the field of science and art. The Institute bases its work on

the principles of ethics, multiculturalism, publicity of action, responsibility, cooperation, tolerance and respect for diversity.¹

The Andrić Institute organizes its scientific and educational activities through four departments: the Department of History, the Department of Literature, the Department of Serbian Language and the Department of Film and Media. Within the Andrić Institute, there are also the “Petar Lubarda” Gallery and the “Ivo Andrić” Library, which with their work, together with the mentioned departments, contribute to the development of the Institute not only as a scientific and educational, but also as a cultural institution.

The Andrić Institute conducts its scientific research work through research projects, scientific conferences, seminars, lectures, workshops and publishing activities². Since its founding in 2013 until today, the Institute has held more than 30 scientific conferences, 20 scientific lectures, 6 documentaries and about 20 art exhibitions, several round tables, workshops and seminars. In addition, the development of international cooperation is supported and encouraged, so participants in scientific and educational contents are scientists and researchers from various parts of the world. That, on the one hand, allows the general public to get acquainted with their latest scientific research, and on the other, the lecturers themselves, during their stay at the Andrić Institute, get directly acquainted with its mission and convey the story of it to the world.

In addition to scientific research work as a primary activity, the Andrić Institute also conducts teaching activities by organizing the Summer School “Andrić Academy”. The summer school is organized by the Department of Literature with the aim of providing additional education to young researchers, as well as dialogue and exchange of experiences among themselves and with lecturers. The topics of the summer schools held so far were: “The World War I in literature” (2014), “Cultures in meeting” (2015), “Cultural memory” (2016), “Ivo Andrić in our time” (2017), “Literature about the Great War” (2018) and “Contemporary novel” (2019). Participants in the summer school can be students of philological sciences of all levels of study from the Republic of Srpska and the Republic of Serbia.

Another successful type of engagement of the Andrić Institute in teaching activities is a three-day seminar on “Individual and group work in the school library” intended for librarians employed in school libraries in the Republic of Srpska, which was held in November 2014. By organizing this seminar and

¹ [the Andrić Institute](#), accessed 30.08.2020.

² More detailed information about the held scientific gatherings, lectures and other activities can be seen on the web presentation of [the Andrić Institute](#)

enabling professional development of librarians, the Institute has shown that it understands the importance of the development of the library profession and its willingness to provide support to this process.

3 "Ivo Andrić" Library of the Andrić Institute

Together with the founding of the Andrić Institute, the Institute library was founded and it was named the "Ivo Andrić" Library. During its establishment, the following goals were set (Станчић, 2018):

- forming of the fund in accordance with the needs of the Andrić Institute
- providing access to library and information materials for scientific and educational purposes
- providing support to users during scientific research work: assisting in research, finding and evaluating information; education on the use of electronic sources of information, etc.
- supporting the process of lifelong learning
- formation of a reference collection
- organizing various cultural activities.

The "Ivo Andrić" Library is a library with one employee³. By performing various work tasks, the librarian of this library successfully realizes the set goals of work defined during its establishment. In addition to library and information tasks related to the library itself, the librarian performs other tasks directly related to the work of the Institute, such as participation in the organization of scientific conferences, seminars, summer schools, preparation of publications for publishing, cooperation with other institutions and other, which will be discussed in the following sections.

The users of the library are employees and associates of the Andrić Institute, scientists and researchers in the field that are the subject of the Institute's work, students of social sciences and humanities of all levels of study, students of the Summer School "Academy Andrić". The library of the Andrić Institute offers the following services to its users:

- assistance in searching the fund
- assistance in scientific research work

³ The librarian at the "Ivo Andrić" Library received his education in the first, second and third cycle of studies in library and information science at the Faculty of Philology, University of Belgrade, and she is currently a senior librarian.

- use of literature in the library reading room and outside
- electronic catalogue search.

The fund of the “Ivo Andrić” Library is formed in accordance with the needs of the parent institution. It consists of monographic and serial publications from scientific fields that fall within the scope of work of the Andrić Institute, mostly literature from the field of literature, history, linguistics, art, as well as a significant reference collection. Significant parts of the fund are scientific publications of the Institute itself, which are collected, processed, stored and given for use. The library fund has about 8000 publications, out of which over 6000 have been processed in the electronic catalogue and made available for use. The plan is to process the rest of the fund in the next period and make it available to users. The collection is freely accessible, publications are arranged according to the UDC system, and the library also has a reading room with computers intended for users. The idea of multiculturalism and international cooperation represented by the Andrić Institute is also reflected in the library’s holdings: in addition to literature in Serbian, the library also contains literature in English, Russian, Spanish, Italian, Slovak, Japanese, Chinese, German and other languages.

The library fund is increased mainly by gifts from individuals and institutions. Most of the books arrived at the library thanks to the Selective Procurement Department of the National Library of Serbia, but also as gifts from other institutions, such as the Faculty of Philology, University of Belgrade, the Film Center Serbia and the Faculty of Philosophy, University of Banja Luka. Also, after the book fair held in Andrićgrad, in which the Andrić Institute is the organizer of the accompanying program, a large number of publishing houses and individuals donate their editions to the library of the Andrić Institute. Gifts to the library often come from individuals, authors themselves or admirers of the written word.

4 The role of librarian in improving the scientific and teaching activities of the Andrić Institute

In the previous section of the paper, we stated what is meant by activities related to the scientific research and teaching activities of the Andrić Institute and presented the “Ivo Andrić” Library. Further in the paper, we want to point out the ways the library and the librarian employed in it contribute to the development and improvement of the mentioned activities.

4.1 Work in the COBISS system

The systematic filling out of the fund achieves the formation of a library of a special type that will be in accordance with the needs of the parent institution and its users. Since March 2015, the "Ivo Andrić" Library has been a part of the COBISS system⁴, which has enabled the implementation of an electronic catalogue in the Library. The electronic catalogue, which has been formed over the years, is a unique information tool on the library fund that provides information on available literature, enables electronic borrowing of publications and interlibrary loan with libraries across the country. On the web presentation of the Andrić Institute, there is a page with information about the library and a link to the electronic catalogue, which enables users who are not able to physically visit the Andrić Institute to be informed about the library, its fund and services it offers.⁵

After the implementation of the electronic catalogue, the librarian of this institution attended courses that enabled obtaining a license to work in different segments in the system (permission for mutual cataloguing A, permission for mutual cataloguing of serial publications, integrative sources, continuous sources and non-book material). From obtaining the license until the end of 2019, 6099 titles were entered in the electronic catalogue of the library.⁶ Bibliographic units are entered continuously in accordance with the allocation of the necessary work licenses to the employed librarian.

Year	Fund growth in the COBISS system
2015.	10
2016.	1818
2017.	2123
2018.	1137
2019.	1012

Table 1. Overview of the growth of the fund of the "Ivo Andrić" Library since the implementation of the electronic cataloguing system

⁴ Statistical data relating to the period from 2015 to 2018 can be found in (Станчић, 2018)

⁵ The Andrić Institute, accessed 30.08.2020.

⁶ Statistical data are available in the document "Bibliographic databases and fund data", accessed 30.08.2020.

In addition to the basic licenses that enable the processing of bibliographic units from the library, the librarian also has a license from the course *Use of software COBISS3 / Cataloguing – advanced*, which includes the possibility of analytical processing of articles from proceedings and publications that are published continuously. That enabled the processing of articles published in proceedings of conferences held at the Andrić Institute. Articles from the proceedings processed in this way are also visible in the mutual catalogue, so users can get acquainted with the content of the proceedings or get additional information about individual works even before borrowing a book from one of the libraries.

4.2 Organization of scientific conferences

Since its founding in 2013, over 30 scientific gatherings have been held at the Andrić Institute. Here are just a few of them: Scientific conference “Serbian Literature and the World War I” (2014), Scientific conference “About Branko Ćopić” (2014), Scientific conference “About Petar Kočić” (2014), Scientific conference “Marking 1914 in 2015” (2015), International scientific conference “Bridge in literature, history and cinematography” (2016), Scientific conference “Pages of the history of Serbian-Russian relations in the 19th and 20th centuries” (2017), Scientific conference “Dream of the City” (2017, 2018, 2019), International scientific conference “Serbian Poets” (2018), International scientific conference “Years that changed the world. The World War I in history and historiography” (2018), Scientific conference “Ivo Andrić and the Serbian language” (2018), Scientific conference “Current issues of Serbian spelling” (2018), Scientific conference “Language, literature, music: poetry and music of Bora Đorđević” (2018), International scientific conference “Literature in translation” (2019), International scientific conference “Andrić and European literature” (2019), Scientific conference “Current issues of phonetics and phonology of the Serbian language” (2019), Scientific conference “Serbian literature as the basis of the Serbian language” (2019), Scientific conference “Literary works of Matija Bećković in poetic and stylistic analyses” (2019), Scientific conference “Literary works of Goran Petrović” (2019), Scientific conference “Poetic intertwining of Andrić’s and Selimović’s prose” (2020).

In addition to scientific conferences, about twenty scientific lectures were held, out of which a dozen lectures within the cycle “Serbian 20th century” during 2019. Some of the lecturers were prof. Dr. Slobodan Antoniće (lecture “Two centuries of elections in Serbia”), Emir Kusturica (“Peter Handke

– Apostle of Truth”), prof. Dr. Milo Lompar (“Serbian Modernists”), prof. Dr. Jovan Dušanić (“Economic review of the margins of the Serbian 20th century”), Dr. Borivoje Milošević (“Orthodoxy in Bosnia and Herzegovina from the new Patriarchate of Peć until 1918”) and others. In addition to the mentioned scientific gatherings and lectures, six documentaries and about twenty art exhibitions and several workshops and seminars were held.

The librarian of the “Ivo Andrić” Library participates in the organization of scientific conferences held at the Institute. That implies communication with participants regarding the organization of the conference and collecting papers for publishing proceedings of abstracts and papers. The library premises are often used as a venue for scientific gatherings, and the participants of the gatherings borrow from the literature needed for research or presentation. Scientific gatherings are accompanied by the publication of proceedings of abstracts and papers, and the holding of scientific gatherings results in the enrichment of the publishing activities of the Institute with new titles.

4.3 Publishing activity

With the publication of the book “Beseda” by Matija Bećković in co-publishing with the publisher “Štampar Makarije”, the Andrić Institute started publishing in 2013. Since 2014, the Institute has been publishing independent publications, and over the years it has established cooperation with other publishers. Through its publishing activities, the Andrić Institute includes topics from various scientific fields: language, history, literature, and one part includes the publication of literature that has been translated from other languages. The librarian also participates in publishing activities, performing mainly proofreading tasks, and thus directly participates in the preparation of books for publishing. For the sake of better information, in the proceedings of conferences and in some monographic publications, name registers are made, which are also prepared by the librarian of the Andrić Institute.

In addition to the aforementioned jobs, the librarian also keeps records of the scientific work of the parent institution. As a result, in 2019, a bibliography of the Andrić Institute was published in the journal LIK(Станчић, 2019)⁷. Proceedings and journals are processed analytically in the bibliography, down to the level of individual papers. In order to increase the level of information, the following indexes are given at the end of the bibliography:

⁷ LIK, accessed 26.10.2020.

name, chronological and title index. The publication of this bibliography enabled the general public to be informed about the publishing activities of the Andrić Institute, and researchers were given the opportunity to obtain information about the literature. Authors of papers in proceeding published by the Andrić Institute can easily find bibliographic data of their works.

The Andrić Institute presented and still represents its publishing activity at book fairs in Banja Luka, Belgrade, Novi Sad, Moscow and Andrićgrad, and it has received some significant awards there, such as:

1. award of the International Book Fair in Moscow for the best design for the book “Sidi Abdallah: Ratni dnevnik Miodraga V. Petrovića” (Вранеш and Марковић, 2008) in 2015,
2. the “Moštanica” award of the Book Fair in Banja Luka for the reprint edition of the magazine “Ideje” (edited by Milivoj Nenin and Gorana Raičević) in 2017, and
3. award of the Novi Sad Fair for the entire publishing activity in 2018.

These awards represent recognitions for the previous scientific research work of the Andrić Institute and its associates.

4.4 Cooperation with other institutions of science, culture and education

Over the years, the Andrić Institute has established and still maintains the cooperation with many institutions of science, education and culture at the national and international level and its library has contributed to increasing that number.

At the national level, the Institute cooperates with the National and University Library of the Republic of Srpska. Cooperation with this institution is reflected primarily in activities related to publishing (submission of CIP, ISBN number and mandatory copy), work in the COBISS system, inter-library loan and more. At the international level, the Institute cooperates with the National Library of Serbia in terms of procurement of publications for the library fund, organizing expert visits of colleagues from the National Library of Serbia to the Institute's library, by submitting its publications through a mandatory copy of publications.⁸ The local obligatory copy is

⁸ Since its founders are the Government of the Republika of Srpska and the Government of the Republic of Serbia, the Andrić Institute is obliged to respect the law, i.e. the rulebook on submitting a mandatory copy of publications in both countries.

delivered to the Public Library "Ivo Andrić" in Višegrad. The obligatory academic copy is delivered to the University Library "Svetozar Marković" in Belgrade, so the editions of the Andrić Institute are also available to local professors, students and researchers.

Thanks to the cooperation of the librarian of the Andrić Institute and the Association of Librarians of the Republic of Srpska, in June 2019, the 23rd Meetings of Librarians of the Republika Srpska were held at the Andrić Institute. The Andrić Institute, in the role of the host, presented its activities, and ceded its premises to librarians from all over the country.

By opening the library for use, the Institute is cooperating with professors and students of primary and secondary schools from Višegrad and the surrounding area, with professors, researchers and students of faculties in the Republic of Srpska and the Republic of Serbia.

4.5 Interlibrary loan

The "Ivo Andrić" Library is also active in the interlibrary loan system. Interlibrary loan applications from other libraries arrive several times a year. If it is determined that the requested publication exists in the library of the Andrić Institute, colleagues from other libraries send a request by e-mail for the publication. The requested publication is delivered to the library that sent the request, and it forwards it to the user. After use the publication is returned to the fund the same way.

In this way, cooperation with other libraries and scientific institutions is established and maintained, and at the same time the promotion of the "Ivo Andrić" Library and the Andrić Institute itself is carried out. Through a direct conversation with the users, we learned that they were pleasantly surprised by the information that the book they had been searching for a long time could be found in the library of the Andrić Institute. As a reason for that surprise, they stated that they did not expect such a "young" library to have such a rich and high-quality fund.

5 Conclusion

A well-equipped library, its rich fund, and a capable, motivated and organized librarian give maximum support to the implementation of scientific research activities of the institution in which they are located. With the use

of modern technologies in the library business and the wide range of services it offers to its users, the library can and should become the center of a scientific research institution.

The Andrić's institute strives to include the Serbian language, literature, history in its scientific activities, and as a result of these efforts, there are results of the work of its departments of History, Serbian Language, Literature and Film and Media. Through the work of the "Petar Lubarda" Gallery and the "Ivo Andrić" Library, the scientific activity of the Institute is deepened in both art and librarianship. The library supports the scientific (and teaching) activities of the Andrić Institute through its activities: business automation, fund formation and providing services to users, as well as cooperation with other scientific, educational and cultural institutions.

The librarian with her constant professional training, library management, filling in the electronic catalogue, making the current bibliography of the Institute and participating in other activities gives her contribution to the development of the Andrić Institute as a scientific institution that is already recognized in the Serbian-speaking area and beyond.

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Institutional repository of the Mathematical Institute SANU

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ABSTRACT: The Mathematical Institute SANU joined the world of institutional repositories by establishing a digital database of scientific research papers of the Institute's associates, which was built on the open source platform DSpace-CRIS, a combination of classic repository functionalities and advanced options offered by the CRIS information system. The aim of this paper is to present these functionalities through all phases of successful establishment and maintenance of the repository. Since the beginning of March 2020, over 3000 works have been deposited in the repository, and in that way everyone has been able to see the results of research in various fields of mathematics, mechanics and computer science.

KEYWORDS: institutional repository, MISANU, DSpace-CRIS, scientific research production, open access.

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1 Introduction

Since the adoption of the *Budapest Open Access Initiative*¹ on February 14, 2002, there has been talk of establishing digital archives on the standards defined by the *Open Archives Initiative*. The Initiative recommends depositing the papers by self-archiving² in digital archives so that the results of the research are accessible to everyone, without any compensation, except the one that includes access to the Internet. Digital archives later grew into digital

¹ *Budapest Open Access Initiative*, accessed 20. September 2020.

² Self-archiving means that authors themselves archive the papers in the repository.

repositories, which are mainly divided into *institutional* (multidisciplinary, most often used at universities and institutes), *thematic* (dedicated to one area) and *national* (Брзуловић-Станисављевић, 2012, 254).

However, Abby Colbridge (Colbridge, 2010, 7) distinguishes between digital and institutional repositories, noting that institutional repositories are "libraries of digital objects and associated metadata" created within a single institution. She further emphasizes that the term *institutional repository* is used to differentiate between systems and services for collecting and disseminating scientific research content (peer-reviewed articles, dissertations) from those that support other types of digital objects (audio, video, digitized photographs or images of artwork).

The advantages of institutional repositories are undoubtedly great. They increase the visibility of the institution on a global level, enabling open access to scientific research, and are also suitable for storing other institutional content. From a technical point of view, as databases, "repositories go beyond the function of storage and provide quality mechanisms for finding, exchanging and reusing materials" (Брзуловић-Станисављевић, 2012, 255).

The University of Belgrade signed the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (Берлинска декларација, 2011) in 2011, and with implementation of the Tempus project 2010-2011 "New Library Services at Western Balkan universities", whose coordinator is the University library "Svetozar Marković", the Digital repository PHAIDRA³ was established on the software platform *Fedora*, which stores production of the University of Belgrade. In 2012, it became mandatory to deposit doctoral dissertations defended in universities in Belgrade, Niš and Kragujevac, which are searchable in e-Theses⁴ section and in the repository. At the end of 2015, the Ministry of Education, Science and Technological Development established the National Repository of Dissertations in Serbia - NaRDuS,⁵ which provides open access to doctoral dissertations and evaluation reports of commissions from all universities in Serbia.

It took five years from the establishment of the first repository at the level of the University - PHAIDRA to the introduction of principles of Open Science in Serbia. In 2016, the University of Novi Sad became the coordinator of the BE-OPEN project⁶ (Boosting Engagement of Serbian Universities in Open Science) which is funded under the Erasmus+ (Capacity Build-

³ Digital repository PHAIDRA

⁴ e-Theses

⁵ NaRDuS

⁶ BE-OPEN

ing in Higher Education action) of the EU program. The main goal of the BE-OPEN project was to implement the principles of Open Science at universities in Serbia. Within this project, repositories have been established for five state universities: University of Novi Sad, University of Niš, University of Kragujevac, State University of Novi Pazar and University of Arts in Belgrade⁷.

In the same year, 2016, in the journal *Scientific Data* requirements for adequate treatment of research data, better known as FAIR (*F*indable, *A*ccessible, *I*nteroperable, *R*eusable) principles⁸ were published. According to FAIR principles, in order for data to be findable, they must be equipped with a unique identifier, to be described by detailed metadata that are searchable in repositories. Accessibility of data implies that they can be retrieved via identifiers with a standardized communication protocol. Metadata interoperability is achieved by using a language that is globally understandable and in line with the FAIR vocabulary, and by referring to other metadata, all with the aim of better information exchange. Adequate and relevant description of metadata achieves reusability. These principles apply to data, metadata and infrastructure and imply that open access repositories comply with them.

In 2018, the Ministry of Education, Science and Technological Development adopted the Platform for Open Science (Платформа, 2018) which prescribes the mandatory depositing of metadata of scientific research publications in the appropriate institutional, thematic or national repository, and applies to all institutions involved in scientific research.⁹ In accordance with the guidelines of this Platform, University of Belgrade Computer Center - RCUB¹⁰ has adapted software platform DSpace (Rajović, Kosanović and Ševkušić, 2018) and developed additional external applications to facilitate establishment and maintenance of repositories, and offers them as services to all institutions that have accepted cooperation with them.

At the beginning of March 2020, Mathematical Institute SANU (MIS-ANU) started establishing a digital database of scientific research papers.

⁷ University of Novi Sad Repository, University of Niš Repository, University of Kragujevac Digital Archive, State University of Novi Pazar Repository) and University of Arts in Belgrade Repository

⁸ FAIR principles, accessed 20. Sept. 2020.

⁹ For more information on the Platform and BE-OPEN project see Адабић and Гордић (2018)

¹⁰ RCUB repozitorizacija

The MISANU repository,¹¹ as an institutional repository, collects, stores and disseminates results of scientific research of employees. It was established with the desire of the institution that these researches become more accessible and visible to the scientific-research community. Papers that are deposited are of different content: journal articles, conference papers and contributions, editorials, monographs and chapters in monographs, patents, technical reports, master's and doctoral theses in all fields of mathematics, mechanics and computer science. Unlike the most similar institutional repositories, the MISANU repository was established independently within the institution. The repository can be accessed by anyone, without restrictions, and the records of the papers contain metadata. Access to the full text of the papers is provided through the publisher's website, via DOI numbers, for papers published in Open Access, or through the Academic Network of Serbia via KoBSON. Papers that are not equipped with a DOI number, and are published in open access or in public domain, are assigned URL links to the full text.

2 Technical aspect of building the repository

In the Registry of Open Access Repositories¹² there are slightly more than 4.300 repositories from all over the world. Most of them are based on DSpace platform (48%), followed by EPrints (16%) and Bepress (11%). DSpace is the most common platform and according to data available from the Directory of Open Access Repositories,¹³ where the share of DSpace in total number, of about 5.500 repositories, is 39%.

In the process of selecting software for the MISANU repository, several criteria have been set for the software solution to meet, and these are: that the software is free and open source, that development is still active, that the software has been in use long enough and that there is evidence of successful implementation. DSpace meets all the above requirements, and the team of the Mathematical institute in charge of establishing repository, also had positive experiences with DSpace in building and maintaining the digital library of the Faculty of Mathematics¹⁴. The MISANU repository is based

¹¹ The MISANU repository

¹² ROAR - Registry of Open Access Repositories, accessed on 20 September 2020.

¹³ OpenDOAR - Directory of Open Access Repositories, accessed on 20 September 2020.

¹⁴ Digital library of the Faculty of Mathematics

on the DSpace-CRIS platform,¹⁵ which is an upgrade of the DSpace solution. The upgrade includes CRIS (Current Research Information System) module related to research activity, so that in addition to data on publications, it is possible to keep records of other entities: projects, researcher profiles, organizations, etc.

Figure 1. shows the architecture of the DSpace-CRIS system.¹⁶ System components can be organized in three layers. The highest, application layer consists of components that enable adequate communication with the system. These include: web user interface (WebUI-JSPUI), OAI-PMH and Solr interfaces. The WebUI-JSPUI allows users to access the content of the repository and its administration. The OAI-PMH interface allows access and retrieval of metadata about publications. The Solr web interface is only available to the administrators who can only access it on the same machine on which it is installed. It provides insight into the details of the configuration of the Solr index, and allows you to run queries and analyze the results in order to adequately adjust the Solr configuration.¹⁷

The business logic layer contains components that deal with managing the content of the repository, users (e-people), authorization and workflow. It consists of several logical units related to the main functions of the system, namely: management of entered metadata, management of the import process, management of user accounts, user authentication and authorization, management of the system for assigning unique item identifiers Handle,¹⁸ Lucene search and managing Solr search indexes.

The lowest layer is the storage layer related to data storage, where metadata about publications and other entities (researchers, projects, etc.) are stored in a relational database PostgreSQL, and the digital versions of documents are stored in the appropriate location on the server. Regarding the database model, the tables can be grouped into several units: tables related to hierarchical organization of the repository (tables for communities, collections, and community-community, community-collection and collection-item relations), tables with data about users and user groups, tables in which metadata about publications are stored, tables containing data on digital documents, tables with data on Handle and DOI identifiers, as well as a group of tables related to CRIS entities (researcher profiles, projects, etc.).

¹⁵ [DSpace-CRIS](#)

¹⁶ For details on system organization see [DSpace-CRIS system](#)

¹⁷ Overview of the Solr Admin UI [Overview of the Solr Admin UI](#)

¹⁸ [Handle system](#)

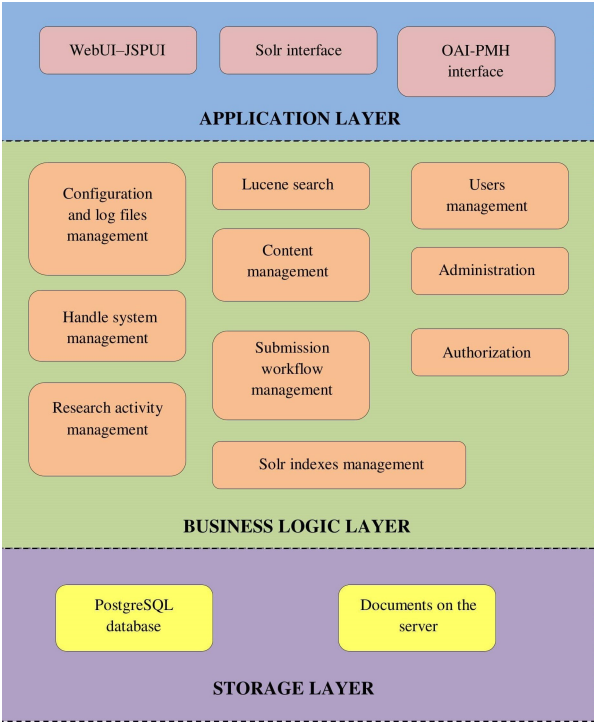


Figure 1. Three-layer architecture of the DSpace-CRIS platform

A detailed description of database model is available in the official documentation of DSpace platform.¹⁹

The first step in setting up the repository involved installing DSpace-CRIS version 5.10 and making some adjustments and changes to the software itself. The changes were related to the design itself and certain functional adjustments: new search filters were added, a new search type was defined and the way of displaying search results was changed. The design is in line with the visual appearance of the official website of the institution²⁰, where it was important that the choice of color palette, font and logo clearly indicates that it is an institutional repository. Search filters have been updated and it is possible to search publications by DOI number, rank of scientific publication (M10, M20, M30, etc.), department²¹ and projects. The tabular presentation of search results is updated by column containing detailed data about journal/monograph/proceedings in which the paper was published, as well as a column containing the publication rank. This presentation, in addition to being more informative, can also be useful for export of papers data. The display of publications in search results has been changed so the publications are sorted by issue date, and the most recent ones are displayed first. As the default search singles out only papers in journals, the search for all publications in repository is defined instead, regardless of the type (journal article, conference paper presentation, patent, thesis, etc.). As there was restriction that the project coordinator could only be researcher of the Institute, a new field was added for the name and surname of the project coordinator, in addition to the already existing field for the researcher identifier. The source code has been changed so that non-researcher project coordinator is listed in the table showing all projects.

After the above changes and system customization, the OAI-PMH server and web interface for communication with it were configured. In addition to metadata compliant with Dublin core, it is possible to acquire data compliant with several other schemes, e.g. METS, MODS и MARCXML. This meets technical standards that ensure interoperability and creates opportunities for the repository to be integrated into the existing international infrastructure.

¹⁹ The description is available at the link [DSpace Database Structure](#)

²⁰ [MISANU website](#)

²¹ Departments are organization units of the institute in which research is conducted in related areas. There are three departments at the Mathematical institute: the mathematics department, the mechanics department and the computer science department.

DSpace-CRIS allows, using special program scripts run by the administrator, to update data such as: number of Scopus citations for papers from repository, view statistics, collaboration networks for researcher, etc. In order to keep this data as up-to-date as possible, services are set up and have been configured to run update scripts periodically (once a day).

3 Depositing data into the repository

The inventory of scientific research papers of MISANU researchers began in the second half of 2019 for the purposes of accreditation of the Institute. Seven types of papers are defined based on the set of metadata that describes them: journal article, monograph, book chapter, conference paper, thesis (master and doctoral), technical report and patent. When defining the set of metadata for describing each of the listed type of papers, the BibTeX²² format served as a starting point. Each researcher submitted a list of his/her papers in the form of a Microsoft Excel spreadsheet. Since the researchers of the Institute have numerous co-authored papers, and in order to form a single list of papers, it was necessary to perform entity resolution with the aim of identifying and removing duplicate papers. The basis of entity resolution is to determine the distance or similarity between strings, for which some standard functions, i.e. distance measures, were used (Jaro-Winkler, Jaccard index). In this way, CSV files with a single list containing information about the papers were created and later used for batch import into the repository. Although the DSpace-CRIS platform has a built-in functionality for direct import from the Scopus²³ bibliographic and citation database, such a list of papers proved to be necessary, because a significant number of the papers is not indexed in Scopus. These are primarily conference papers and presentations, but also journal articles, as well as technical reports, patents and theses. There are several possible reasons why a journal article is not recorded in Scopus. The most common reason is that the journal itself is not referenced in this database. In addition, even when an article is published in a journal referenced in Scopus, it may be published in a period not covered by the database. This was the case with many articles published at the beginning of the 21st century and earlier. Several articles published in referenced journals and in the period covered in Scopus were erroneously missing. For each such article, a request for adding it was created, by filling in the appropriate form on the Scopus website.

²² BibTeX

²³ Scopus citation database

The process of adding data into the repository began by creating a researcher profile for each researcher and linking it with his/her Scopus identifier. This made it possible to easily import researcher's papers indexed in the Scopus database. The remaining papers were added using the DSpace-CRIS option for metadata batch import from CSV files. In addition to these two options, the DSpace-CRIS platform enables to add data for individual papers by: (a) manually filling out the form, (b) searching and retrieving information about the paper using one of the identifiers: PubMed ID, DOI, arXiv ID, Scopus ID, WOS ID (see Figure 2) or (c) importing data from a file of the appropriate format (BibTex, RIS, XML, etc.), which was created using bibliographic tools such as Zotero, Mendeley and EndNote, and containing information about the paper obtained from one of the citation databases. Each of the options described above is quite comfortable to use, but we believe that the average user would need a short training to be able to independently use it. Having this in mind, as well as the number of papers published, which in the last few years amounts to between 200 and 250 papers per year, the data entry task is assigned to the administrators.

The administrator of the repository can edit existing data about the publications. In this way, for example, a category is subsequently assigned to each paper. The data available through the KoBSON service (EleČas) were used, as well as the categorization of the national journals available on the website of the Ministry of Education, Science and Technological Development. Information about the categorization of other types of publications was provided by the researchers. In addition to the category of paper, information about the publisher, conference title, book series and project which funded the research published in the paper were added.

The MISANU repository contains data on more than 3000 publications authored by the researchers from the Institute. Most papers were published in scientific journals (over 2200 papers), followed by conference papers (over 900), books and book chapters (about 120), technical reports (59) and patents (10). In addition, the repository also contains data about magister's and master's theses and doctoral dissertations. Figure 3 shows the distribution of the publications by years (as of August 2020). The oldest paper in the repository was published in 1975 in the journal *Discrete Mathematics*.

In order to keep the data in the repository up-to-date and to continuously record newly published papers, the administrator is subscribed for Scopus alerts. The administrator receives, via e-mail, notifications containing information about newly indexed papers authored by the Institute's researchers. In order not to omit the papers published in the journals that are not indexed

▼ Search for identifier

Fill in publication identifiers (DOI is preferable) and then press “Search”. A list of all matching publications will be shown to you to select in order to proceed with the submission process.

PubMed ID:

PubMed

SCOPUS

e.g. 20524090

DOI (Digital Object Identifier):

PubMed

Crossref

Scopus

SCOPUS

e.g. 10.1021/ac0354342

10.1007/s00012-020-00673-7

ORCID ID:

id

e.g. 0000-0002-9029-1854

arXiv ID:

arXiv

e.g. arXiv:1302.1497

CiNii NAID:

CiNii

e.g. 110004744915

ISBN:

BVB

LIBRARY OF CONGRESS

e.g. 9781680502879, 0471578053

SCOPUS ID:

SCOPUS

e.g. 2-s2.0-0000000117

WOS ID:

e.g. WOS:000270372400005

Publication details

SCOPUS

Crossref

Title	On geometric posets and partial matroids
Author(s)	Šešelja, Branimir Slivková, Anna Tepavčević, Andreja
Publication date	2020-08-01
Abstract	© 2020. Springer Nature Switzerland AG. The aim of this paper is to extend the notions of geometric lattices, semimodularity and matroids in the framework of finite posets and related systems of sets. We define a geometric poset as one which is atomistic and which satisfies particular conditions connecting elements to atoms. Next, by using a suitable partial closure operator and the corresponding partial closure system, we define a partial matroid. We prove that the range of a partial matroid is a geometric poset under inclusion, and conversely, that every finite geometric poset is isomorphic to the range of a particular partial matroid. Finally, by introducing a new generalization of semimodularity from lattices to posets, we prove that a poset is geometric if and only if it is atomistic and semimodular.
DOI	10.1007/s00012-020-00673-7
Journal	Algebra Universalis
Volume	81
Issue	3
ISSN	00025240
Keywords	Centralized system Geometric posets Partial closure operator Partial closure system Semimodularity
Type	Article

Figure 2. Data import using a publication identifier.

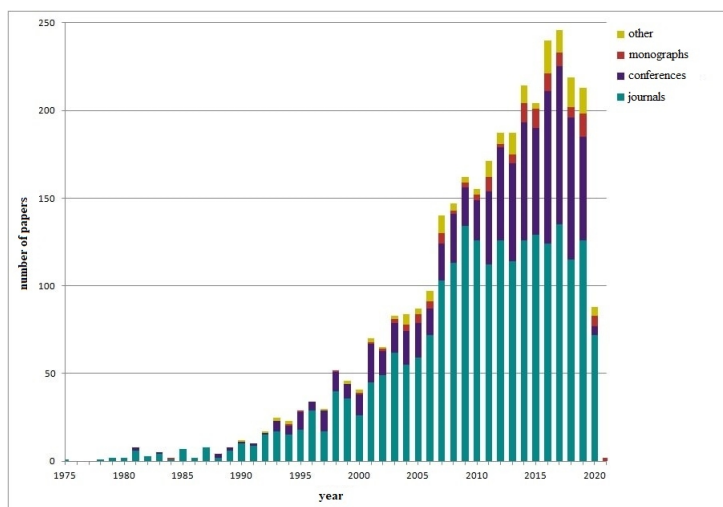


Figure 3. The number of papers in the MISANU repository by type and publication year (as of August 2020).

in the Scopus database, each researcher is obliged to periodically submit a list of new papers, which the administrator then enters into the repository.

4 Searching and browsing data in the repository

The DSpace-CRIS platform enables extensive search and browse of the imported data through the options available from the main menu: home page (*Home*), searching and browsing publications (*Research Outputs*), searching and browsing researchers' profiles (*Researchers*), searching and browsing the Institute departments (*Departments*), searching and browsing projects (*Projects*), and help page (*Help*).

The home page contains: the search box, basic information about recent submissions, and basic information about the repository papers most cited in the Scopus database (see Figure 4.)

Research Outputs option (see Figure 5.) enables searching and browsing papers by: department, author, title, type (journal article, conference paper, monograph, etc.), publication date and keywords. It is also possible to define more complex queries, i.e. different combinations of search queries by:

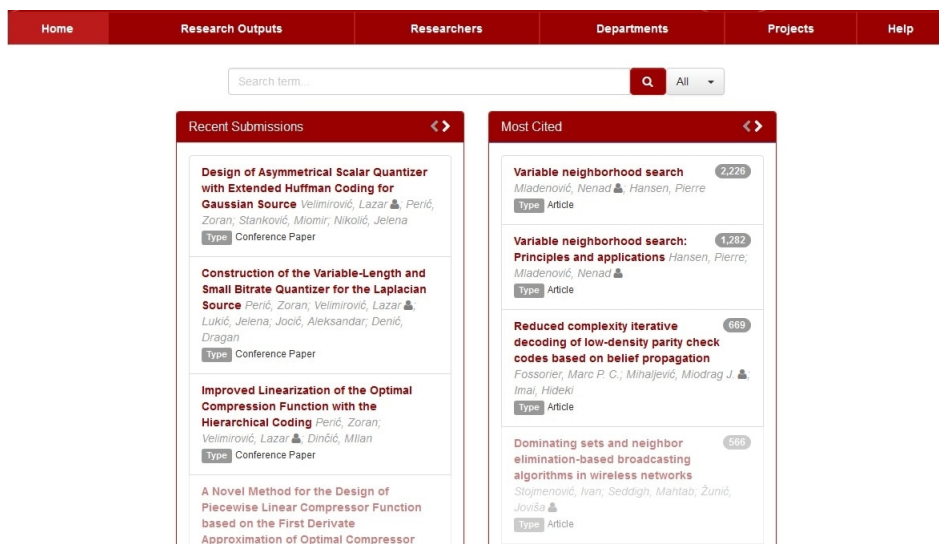


Figure 4. Home page.

title, author, journal in which a paper was published, keywords, publication date, type, DOI, category (according to the categorization of the Ministry of Education, Science and Technological Development), project and department. The third type of search provides a quick access via predefined filters (*Discover*) for authors, keywords, publication year, paper type and category.

When one of the available papers is selected, a page with information about that paper is displayed, which contains information about the authors, title of the paper, source in which the paper was published (journal, monograph, proceedings), publication date, category of the paper, DOI, abstract and keywords, publisher, project funding information. In addition to the basic information about the paper, bibliometrics data (citation count) is retrieved from the Scopus database. Also, the Dimensions and Altmetric services, as well as one of the largest, freely available bibliographic database – Google Scholar are integrated with the MISANU repository. Altmetric²⁴ offers a different approach to the analysis of the impact of scientific research, complementary to the traditional one, which implies the impact factor, h-index etc. Namely, in addition to tracking citations in the Web of Science,

²⁴ Altmetric

HomeResearch OutputsResearchersDepartmentsProjectsHelp

Browse

Department

Author

Title

Type

Issue Date

Subject

Search Research Outputs

All

Title

Author

Journal

Subject

Date Issued

Type

DOI

Rank

Project

Department

AND

AND

+

Reset

Search

Recent Submissions

Design of Asymmetrical Scalar Quantizer with Extended Huffman Coding for Gaussian Source Velimirović, Lazar ▲, Perić, Zoran, Stanković, Momir, Nikolić, Jelena
Type Conference Paper

Construction of the Variable-Length and Small Bitrate Quantizer for the Laplacian Source Perić, Zoran, Velimirović, Lazar ▲, Lukić, Jelena, Jocić, Aleksandar, Denić, Dragan
Type Conference Paper

Top Cited

Variable neighborhood search Madenović, Nenad ▲, Hansen, Pierre
Type Article 2,220

Variable neighborhood search: Principles and applications Hansen, Pierre, Madenović, Nenad ▲
Type Article 1,282

Discover

Author

Subject

Date issued

Type

Stević, Stevo	412	Product-type system Solvable in...	4	2020 - 2021	103	Article
Ognjanović, Zoran	239	Early vision Image processing ...	3	2010 - 2019	2063	
Mladenović, Nenad	226	Almost geodesic mapping General...	2	2000 - 2009	985	
Stanković, Radomir	176	Asymptotic periodicity Boundedn...	2	1990 - 1999	278	
Mihaljević, Miodrag J.	170	Axiomatization Completeness the...	2	1980 - 1989	49	
Todorčević, Stevo	147	Boundedness Difference equation...	2	1975 - 1979	4	
Tepešević, Andreja	121	Boundedness Difference equation...	2			
Novaković, Radeždar	117	Boundedness Difference equation...	2			2285

Figure 5. Research Outputs option for searching and browsing papers.

Scopus and CrossRef databases, Altmetric provides insight into citations in patents, using data from IIFI CLAIMS²⁵, in Wikipedia articles (currently only the English version), in Pubpeer и Publons platforms,²⁶ as well as mentions on social networks, media, blogs and platforms such as YouTube, Reddit and Stack Overflow. In order for the Altmetric statistics for a paper to be available, it is necessary that the paper be equipped with some of the persistent identifiers such as DOI or PubMed ID. Dimensions²⁷ on the other hand, focuses on the traditional metric principles used for scientific papers, i.e. on citation count. A paper must be assigned a DOI number in order for the citation information to be available. An illustrative example of displaying the information about a paper in the repository is given in Figure 6.

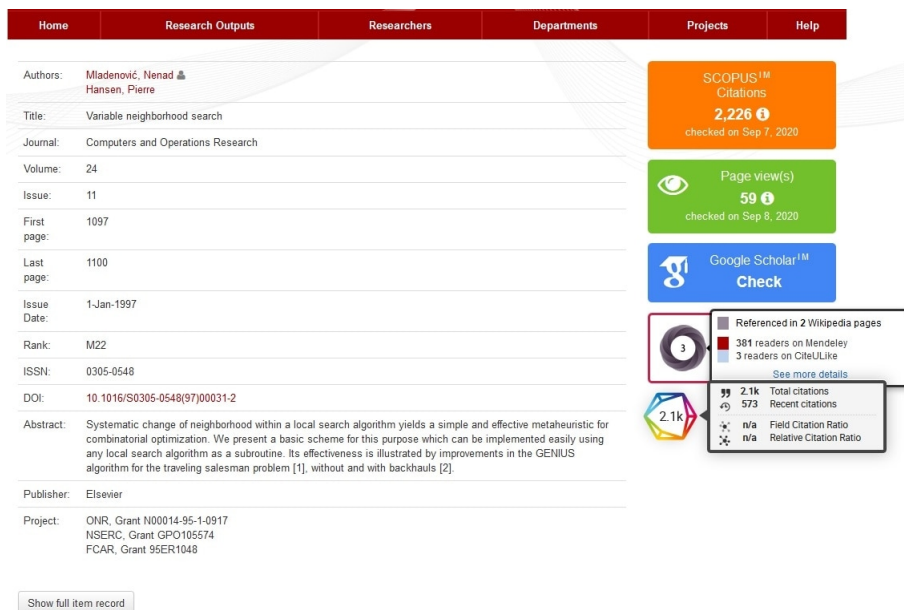


Figure 6. Primary information about a selected paper and related data obtained via integrated services: Scopus, Google Scholar, Altmetric and Dimensions.

²⁵ IIFI CLAIMS[®]

²⁶ Pubeer and Publons platforms

²⁷ Dimensions

In addition to metadata search, the DSpace-CRIS platform allows, with some additional setting, to search the full text of the papers. Pre-defined filters for transformation of the stored documents are used to extract full text and create search indexes. It is possible to search Adobe PDF (OCR-ed or text based), Microsoft Word, PowerPoint, PowerPoint XML or plain text documents. There are two filters for transforming PDF documents, one uses the Apache PDFBox processing library²⁸ and requires no additional settings, while the other requires the installation of external software XPDF Tools²⁹ and additional Java libraries. The advantage of the second option is better quality and faster document processing. As only metadata about publications is currently available in the repository, and not the full text, this functionality has not been used.

The DSpace-CRIS platform supports creation of researchers profiles (see Figure 7). The profile page provides information about: the papers authored by the selected researcher, the total number of citations and papers indexed in Scopus, as well as the projects the researcher has participated in. Researchers profiles are connected with Scopus Author IDs and ORCID numbers, and can also be linked to Web of Science ResearcherID. By editing a profile, it is possible to include information such as affiliation, title and research interests. The platform offers the possibility of importing photos and contact information, and there is a special section for biography. For each researcher, a collaboration network can be examined using the *Network Lab* option, which includes information about co-authored papers and research activities. All authors names are recorded in the form *Last name, First name* so that the system automatically recognizes as a single author even those authors for whom there is no associated researcher profile.

In addition to the data search and preview functionalities described above, which are available to all users, DSpace-CRIS also contains the administrators' module. The logged-in users with admin privileges have access to this module via the *Administer* option from the main menu. It is possible to edit the content of the repository (add/delete/modify collections and items, import metadata, batch import metadata, perform deduplication,³⁰ audit withdrawn and private records), work with the CRIS module (set the

²⁸ [The Apache PDFBox library](#)

²⁹ [External software XPDF Tools](#)

³⁰ Data deduplication is a technique for eliminating multiple copies of repeating data. The DSpace-CRIS platform has this functionality built-in, and the mechanism for duplicate detection is based on metadata (sub)fields matching. For more details, please see [DSpace Deduplication](#)

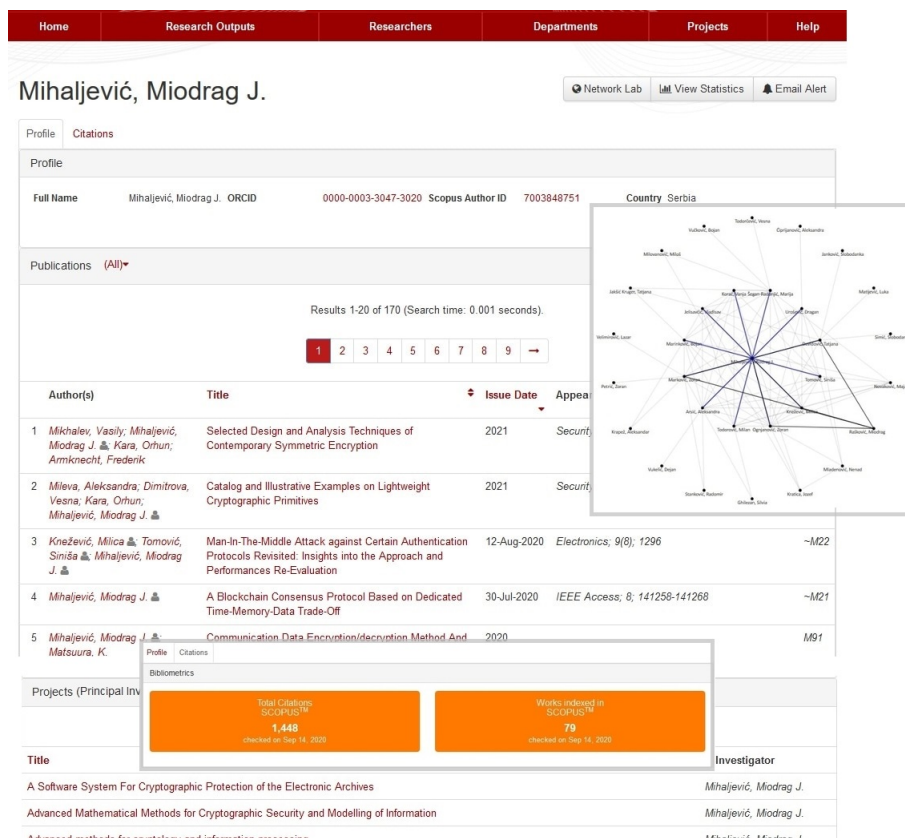


Figure 7. Preview of main information about a researcher, his/her cooperation network (co-authorship) using the *Network Lab* option and Scopus citations.

form layout for all entity types, add/delete/modify entities, as well as import and export data in the XLS format), control access rights (manage users and users groups, manage access to collections and items), view statistics (item view count, item download count, login statistics) and manage the main settings (metadata scheme, document upload format, license text).

5 Lessons learned and plans for further work

The work on the repository showed that repositories can be considered as special bibliographies in new, e-environment, while continuous data import enables insight into the activities of researchers and the impact of their works, and researchers profiles can be viewed as representative bio-bibliographies. Also, adding DOI numbers, links to full text and using tools for finding open access is crucial. Open access enables efficiency and effectiveness in research, and at the same time increases visibility, utilization and impact of the research.

Dspace-CRIS provides great options to customize the software for user requirements. Some of them aren't documented in detail, and it was necessary to study the source code of the application, and sometimes change the settings and observe how the change affects the behaviour of the application. In that process we learned more about the details of how the software solution works.

Plans for further work include the expansion of the system related to the data export adapted to the needs of both the Institute (for the purposes of the accreditation, project reports, etc.) and the researchers themselves (e.g. for the purposes of the title election). Another idea is to use the application to review the personnel data, which would be achieved by defining special fields in the data about researchers and other research entities for the purposes of keeping detailed records of research activities (such as contracts). By supplementing data in the researchers profiles, projects and departments, as well as by importing data on the Institutes's publications, it is planned to complete the repository.

6 Conclusion

The MISANU repository was established with the intention of gathering the scientific research activities of the Institute in one place, and presenting and promoting it to the interested public. Thanks to the engagement

of researchers employed at the Institute, the necessary information was collected, the repository was supplemented and in that way a quality retrospective presentation of the research results of the employees was achieved. By maintaining and improving the repository, an excellent basis is created for monitoring the future scientific production of the Institute, which is significantly increasing with online publishing and digitization.

The establishment of repositories usually takes place within the library, which is not surprising, since the libraries have always been considered a storage of relevant information. However, this also changes the role of librarians, which in a broader context means that they now also appear in a role of the information specialist. The increase of information available through the Internet due to mass growth of online publishing for librarianship implies additional education in the field of information literacy, and especially on the principles of Open Science³¹ and its aspects and practises, and this applies to both librarians and library users.

Attention should be drawn to the fact that regardless of the new functions of libraries and librarians brought by digitization process, the primary, traditional functions of collecting, storing, processing and making available analog publications should not be neglected.

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³¹ More information on Open Science, its principles and implementation can be found at Smederevac, Pajić, Radovanović, Gilezan, Čolović et al. (2020).

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Digital repository of the University of Belgrade – Faculty of Chemistry

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ABSTRACT: The paper presents the principles underlying the functions of the Cherry digital repository at the University of Belgrade – Faculty of Chemistry, and the Innovation Center, and explains why it was decided to use the DSpace software for the first repository of institution. Researchers’ questions were considered during procedures of depositing new items in Cherry, as well as the answers provided by librarians during administrative data control. The research part of this paper deals with the repository visit statistics based on Google Analytics and the conclusions that lead to the main goal – to increase the visibility and potential citations of research outputs.

KEYWORDS: Cherry, digital repository, open science, citation, Faculty of Chemistry, Library

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1 Introduction

The expansion of scholarly publishing in an electronic format has brought great changes and challenges in the 21st century. On the one hand, the complete change in the concept of the dissemination of scholarly papers has made the whole process easier due to the fact that electronic versions of papers are easier to distribute, but on the other hand, it has significantly limited the rights of authors and the balance regarding funding. The easier distribution of scholarly papers in an electronic format is sometimes merely an illusion because many publications are behind a paywall. In practice, the author of a paper often transfers copyright to the publisher by signing a

standard contract. As soon as the contract is signed by both parties, the publisher gains the right to determine the availability of the publication because the publisher has formally become the owner of the publication in question. The problems regarding publishing policies have been identified globally, and there seems to be only one solution – open science.

Librarians in the Republic of Serbia have been promoting open access to scholarly literature for many years. Specific guidelines for local publishers of scholarly journals were presented, among other things, within the project “Revisiting Open Access Journal Policies and Practices in Serbia”.¹ The project was implemented at the National Library of Serbia, and the results are presented in the study “Open Access Journals in Serbia: Policies and Practices”. There are about 400 active open access scholarly journals in Serbia². Most journals do not charge Article Processing Charges for publishing, and, at the same time, they do not deny access to the full text of articles. Keeping in mind the growing number of rules adopted in the context of open access to publications at the international level, local journals could become increasingly attractive to international authors thanks to the policy of openness. To achieve this, they should improve their visibility and efficiency on the World Wide Web. Most editors traditionally insist on having a print version of journal issues, but there are also those who make electronic versions available online. Journals that are published only electronically are rare in Serbia (Ševkušić et al., 2017). As far as international publishers are concerned, authors often face the inconvenience of transferring the copyright, while their publications are not publicly available. With the rise of digital repositories, authors have become aware of the importance of green open access as a legal model for presenting their scholarly work to the public. The green route, often referred to as the “self-archiving” route, entails authors submitting manuscripts to journals (subscription-based, gold open access, or hybrid open access) while retaining the right to deposit a version of their work to a digital open access repository (Fry et al., 2016). In order to ensure that self-archiving is carried out in line with legal regulations, the permission of the publisher, which often involves an embargo period, to deposit a specific version of the paper is required. By enabling open access to their papers, authors get the advantage of a greater visibility of their research,

¹ *Revisiting Open Access Journal Policies and Practices in Serbia*, (retrieved on November 17, 2020).

² Based on data collected by the Department for Scientific Information of the National Library of Serbia. The number is not precise due to changes in the editorial policies, which are not always duly notified.

which can be reflected in increased citation counts.³ The advantage of open access for the author’s institution is easier credibility and ethical correctness of scientific work. The openness of scientific results encourages critical attitudes and exchange of opinions, which is the starting point in seeking truth, as the only path to knowledge. This advantage was recognized by the University of Belgrade – Faculty of Chemistry, which established the Cherry (CHEmistry RepositoRY) institutional digital repository.

2 Open science and the role of the publisher

The Ministry of Education, Science and Technological Development (MESTD) allocates funds for subscriptions to international scholarly literature. The subscriptions cover about 35,000 journals and 180,000 books in the electronic format available through the services of the Serbian Library Consortium for Coordinated Acquisition (KoBSON) (Ђенадић et al., 2020). In addition to full-text databases, citation databases are also available to the research community in the Republic of Serbia. These valuable resources provide great opportunities for the successful research of individuals, but also for the overall success of science in Serbia, which is internationally recognized. The number of papers published by Serbian authors in the most influential international journals is also visible in the “Naši u WoS” database, maintained by the Department for Scientific Information at the National Library of Serbia. The name indicates that the database is created by selecting from the Web of Science only the papers by the authors affiliated with institutions from the Republic of Serbia. It offers bibliographic information about papers indexed in the Web of Science since 2000 to the present. Based on the statistical data for the 2000–2019 period, the number of published papers has increased by almost six times.⁴ The body of scientific information available in the electronic format to the Serbian research community is significant and the usage statistics show that the Kobson portal is highly important for users. The million-access number shows that the KoBSON portal is of great importance to users. At the same time, it indicates that no library, not even the largest in the world, could physically

³ The tables at the end of the paper indicate that the most visited publications in Cherry are available in open access. A large number of studies in the field of library and information science discuss the relationship between citation counts and access type.

⁴ The number of papers in 2000 was 1352, while it was 7868 in 2019. Naši u WoS, (retrieved on November 17, 2020).

serve such a large number of users (Тимотијевић et al., 2016). It should be kept in mind that KoBSON allows remote access only to the employees of public academic and research organizations, but not outside the borders of the Republic of Serbia.⁵ It is only when researchers cannot access their own publications, but would formally have to buy them, that they become aware that the institutional access provided in the Republic of Serbia is not free of charge, and that they have transferred their copyright to publishers who sell their outputs all over the world. In addition to the annual subscriptions paid through KoBSON, Article Processing Charges are to some degree paid from the public funds provided by the MESTD. To prevent the so-called double dipping and alleviate the burden on the budget for science, different models are being developed all over the world, which have been the subject of debates for many years. A group of publicly funded research organizations, with the support of the European Commission and the European Research Council, have launched an initiative to provide full and immediate open access to scientific publications beginning with 2021.⁶ The initiative cOAlition S was announced on September 4, 2018, with one clear goal – open science, expressed in ten principles:

1. Authors should retain copyright on their publications, which must be published under an open license such as Creative Commons;
2. Members of the coalition should establish strong criteria and requirements for compliant open access journals and platforms;
3. They should also provide incentives for the creation of compliant open access journals and platforms, if such do not yet exist;
4. Publication fees should be covered by the funders or universities, not individual researchers;
5. Such publication fees should be standardized and capped;
6. Universities, research organizations, and libraries should align their policies and strategies;
7. For books and monographs, the timeline may be extended beyond year 2021;
8. Open archives and repositories are acknowledged for their importance;
9. Hybrid open-access journals⁷ are not compliant with the key principle;

⁵ Students have access only from the public research organizations connected to the academic computer network (libraries, faculties, institutes).

⁶ cOAlition S, (retrieved on November 17, 2020).

⁷ Authors have the right to pay a fee for publishing open-access scientific papers in certain journals of commercial publishers, available only before subscription. These journals are called **hybrid journals**, (retrieved on November 17, 2020).

10. Members of the coalition should monitor and sanction non-compliance.

Joining international initiatives in this field, MESTD adopted the Open Science Platform⁸ which defines the rules and guidelines for Serbia, and is intended for all participants in publicly funded scientific research. The platform applies to the results of research projects and programs funded in whole or in part from the budget of the MESTD, Republic of Serbia. In this way, the obligation to deposit publications in repositories was introduced. The Platform also recommends open access to research data. After the adoption of the Platform on July 9, 2018, the process of establishing digital repositories that meet all technical requirements has been accelerated. This process has been particularly intensive in the institutions that have decided to cooperate with the University of Belgrade Computer Center.⁹ There are several reasons why institutions adopt the model developed by RCUB: in the process of establishing a repository all bibliographic metadata that can be harvested from other databases (as well as available full-text publications) are ingested in the repository; the repository is registered in relevant registries and communication with international aggregators is established to ensure visibility; special attention is paid to optimization for Google Scholar (Kosanović et al., 2020). Also, five common features, and perhaps most obvious, are that an institutional repository contains: digital content, community-driven and focused, institutionally supported, durable and permanent and accessible content (Gibbons, 2004).

The first faculty repository in Republic of Serbia developed by the University of Belgrade Computer Center (RCUB) is CHERRY (CHEmistry Repository), a joint repository of the University of Belgrade – Faculty of Chemistry and the Innovation Center. Powered by the DSpace software, where metadata is structured and compliant with the OAI-PMH (Open Archives Initiative-Protocol for Metadata Harvesting), Cherry meets all the technical requirements defined by the Open Science Platform. The main goal of the repository is to increase the visibility of research outputs and projects implemented by the institution, all in accordance with European and national open science guidelines. In addition to increased visibility, higher citation rates of deposited publications have been observed, which cannot be discussed in greater detail in the current phase of research. As a kind of virtual library, the repository collects monographs, scholarly papers, research data, doctoral theses, master’s theses and bachelor’s theses, as well as all other

⁸ Open Science Platform, (retrieved on November 17, 2020).

⁹ List of nineteen realized repositories, (retrieved on November 17, 2020)

documents that the academic staff and students want to share. An unusual request that was received was to enable the depositing of all issues of the student magazine Pozitron.¹⁰ When Cherry was established, the initial import by RCUB took 2599 records from the index databases, out of which 1804 were with the full text. Today, Cherry contains 4150 records, out of which 3540 are supplied with full-text files.¹¹ The goal is to supply each bibliographic record with the corresponding (full-text) file. New deposits without full text are discouraged, and the existing records are supplied with full-text files with the help of authors.

DSpace is an open-source software package that offers digital asset management tools. It is mainly used by academic and corporate non-profit organizations to create and manage their institutional repositories (Kurtz, 2010). The repositories powered by this most commonly used repository software account for 43% of all repositories registered in OpenDOAR¹² (Rajović et al., 2018). All library systems strive for universal interoperability in collecting and sharing metadata. The advantage of the system is mostly reflected in the open code, but also in the interoperability with other repositories, which is achieved due to the adherence to compatible metadata standards and OAI-PMH. Once metadata for a particular object is entered in the repository it should be easily searchable, accessible, readable and portable. Open access platforms adopt OAI-PMH as a standard in communication and a key to interoperability. In the case of Cherry, this means that once deposited, metadata is easily distributed to various platforms, such as Google Scholar, BASE, CORE, OpenAIRE, WorldCat and Unpaywall. Once the repository is registered with aggregators as a data provider, the metadata will be automatically harvested and displayed on other portals in relatively regular time intervals. Currently, only CORE downloads open access full texts from repositories, along with metadata. This is a principle that enables greater visibility of scientific results. Cherry is also registered in registers of open access repositories – OpenDOAR¹³ provides information on sites that fully embrace open access to fulltext resources that are of use to academic researchers (Kruesi et al., 2019) and in ROAR¹⁴ which also contains thousands

¹⁰ Pozitron, (retrieved on November 17, 2020)

¹¹ Between November 28, 2018 when Cherry was established, and November 17, 2020.

¹² Insight into the current usage statistics is available on the website: Statistics of DSpace open-source software package using, (retrieved on November 17, 2020)

¹³ OpenDOAR, (retrieved on November 17, 2020)

¹⁴ ROAR, (retrieved on November 17, 2020)

of active repositories of different software, from different geographical areas. DSpace is a complex system with three interfaces, which are user-friendly: one for repository administrators, the second for depositors, and the third for end users who search for information.

3 Structure of users and administrative part of CHERRY software

The availability of the interface in English and Serbian (Cyrillic and Latin) with a short description and instructions for users¹⁵, and this is the first thing to notice on the home page of the Cherry repository. The search of works is performed by the institution within which the collections are located. The University of Belgrade – Faculty of Chemistry currently has six collections (Publications, Supplementary Data, Doctoral theses, Master’s theses, Bachelor’s theses and the Pozitron magazine), and the Innovation Center has two (Publications and Supplementary Data). It is possible to choose and arrange collections differently in accordance with the needs of the Faculty. Within each collection, search is narrowed by applying filters (publication year, document type, record version, publication rank in the national evaluation system, or subject). Search can also be performed by author name (by entering the last name and then the first name), and there is simple and advanced search for specific terms, or by keywords. The main feature of the search engine is the ability to search full-text files, in addition to metadata fields. The depositor’s and administrator’s interfaces in Cherry are basically similar, but the administrator has greater privileges in the following functions:

1. **Collection organization and layout** - ability to check and verify deposits, control access to full text and metadata, organization and deletion collections;
2. **User management** - manage user groups, all employees at the University of Belgrade – Faculty of Chemistry and the Innovation Center may register. After initiating the registration process, users receive an email with a verification link enabling them to complete the registration process. In Cherry, the administrator normally grants the privilege of only reviewing and depositing new items;

¹⁵ A user manual was presented during the three-day training for the academics and research staff of the University of Belgrade – Faculty of Chemistry and Innovation Center: *Cherry User Manual*, (retrieved on November 17, 2020).

3. **Curation** – the existing records in the repository cannot be modified by users but the administrator can make changes such as adding files (usually PDF), adding new metadata, deleting or modifying metadata, moving records from one collection to another and, if necessary, deleting a complete record;
4. **Mapping** – if the authors of a paper are from both the University of Belgrade – Faculty of Chemistry, and the Innovation Center, it is necessary to make the relevant record visible in both collections. After depositing in one collection, the record is mapped in the other. Item mapping enables both entities to keep a full record of their publications in their respective collections without creating duplicate records.
5. **Statistics** – the administrator has access to the visit statistics for individual records, an overview of the most frequently searched terms in a certain period of time and the statistics of procedures for accepting, rejecting or modifying metadata undertaken by the administrator.

Only registered users can deposit new items. After selecting the collection, the user fills in the following fields to describe the publication:

- Authors - in the format “Surname, Name” in the order as listed in the original paper;
- Title - title of the publication;
- Source – the title of the journal or proceedings (in case a paper is deposited), or the title of the book if a chapter is deposited;
- Date of publication;
- Collation – volume, number, home page or article number and end page;
- Identifiers – DOI, ISSN or ISBN, PubMed, COBISS-ID, arXiv, Scopus and WoS. Based on DOI, it is possible to display citation counts from Dimensions¹⁶ and Altmetric Attention Scores¹⁷. Altmetric is a platform offering alternative metrics for scholarly papers by tracking online sources, especially social networks, blogs, Wikipedia and other websites. The number of mentioned publications is measured through a weighted arithmetic mean in which the DOI number of the paper is stated and is shown by a graphic illustration in different colors (each color represents a separate platform in which the paper is mentioned). Depending on the source, each mention is multiplied by a certain coefficient.¹⁸ Dimensions is at certain extent free access¹⁹ citation database which tracks

¹⁶ [Dimensions](#), (retrieved on November 17, 2020).

¹⁷ [Altmetric](#), (retrieved on November 17, 2020).

¹⁸ [Altmetric Attention Scores](#), (retrieved on November 17, 2020).

¹⁹ [Dimensions](#), (retrieved on November 17, 2020).

data from research and academic institutions with a total of over 100 million searchable publication. In addition to scholarly articles, information on research data, patents, projects, clinical trials and public policy documents can be found. Scopus and WoS identifiers are important for displaying citation data within a record.

- Funding information – is entered in the form of machine-readable code for data transfer to the OpenAIRE - European Open Science Infrastructure. Funding information is provided in the format recommended by the OpenAIRE Guidelines for Publication Repositories.²⁰
- Type of publication – journal article, book, book chapter, conference object, lecture, doctoral thesis, master’s theses, bachelor’s thesis, review, working document, preprint, report, annotation, informative article, patent and other as a choice when the document is not classified in any of the above categories;
- Publication version – published, draft, submitted, accepted and corrected;
- Language – multiple publication languages can be selected;
- Summary;
- Keywords – free-style keywords, without controlled dictionary terms;
- Other authorships – in the format “Surname, Name” in the order as listed in the original publication;
- Publishers – in the format “place : publisher”;
- Any notes – related to the publication;
- Access – open access, closed access, restricted access and embargoed access;
- License type – Creative Commons licenses.

At metadata input, special attention should be paid that along with metadata, it is necessary to deposit a full-text file. Depending on the type of publication, not all fields are required.

Cherry currently has eighty-eight registered users who can submit their new research outputs, and the process of depositing one publication takes five to twenty minutes, depending on the user’s skills. The software is accessible and clear, and the input form has three segments. The process of depositing is explained in great detail during individual and group training for researchers in order to encourage them to deposit their publications regularly.

²⁰ [OpenAIRE Guidelines for Publication Repositories](#), (retrieved on November 17, 2020);

4 Versions of documents and licenses

In order to comply with the mandate defined in the Open Science Platform, librarians remind researchers of the original function of the repository and the obligation to deposit full-text files within twelve months since the publication. The solution to cases where authors cannot deposit the published versions of papers due to publishers' rights is provided by the so-called green open access. Authors are allowed to deposit the peer-reviewed versions of their articles in the institutional repository immediately or after the embargo period required by the publisher of the journal in which the article is published.²¹ Given that authors from the University of Belgrade – Faculty of Chemistry publish mostly with foreign publishers such as Elsevier, Wiley, Springer, and others whose journals are highly ranked, the Cherry administrator takes special care of the level of availability of such papers before verifying deposits and making full-text available. In such cases, two versions of the document are deposited: the published version, which will permanently remain restricted to the public and available only to registered users, and the accepted version, which has undergone peer-review but has not been copyedited and typeset. Access to supplementary materials, which are not subject to copyright transfer, is often restricted on publishers' websites. For that reason, a third record is formed for supplementary materials or research data and these materials are usually made open access in the repository. The two versions of the paper and the supplementary materials, if available.²² In case of a paper originally published in open access, there is no need to deposit the peer-reviewed manuscript. In this case, only the published version is deposited and is made publicly available. In addition to journal articles, books, book chapters, various contributions to periodicals, conference papers are also deposited, and for each publication it is necessary to define the access level and a license, so that the copyright is not infringed. Each record contains machine-readable Creative Commons licenses in line with the OpenAIRE repository guidelines.²³ When depositing, the authors provide this information, and administrators perform additional checks in the original

²¹ Information on journal policies as regards self-archiving can be found on the website [SHERPA/RoMEO](#), (accessed on November 17, 2020).

²² [Example of a publication containing links to related records – the peer-reviewed version and supplementary data](#), (accessed on November 17, 2020).

²³ [OpenAIRE Repository Guidelines License Condition](#), (accessed on November 17, 2020)

publication, on publishers’ websites and/or in SHERPA/RoMEO during the verification step.

5 External application for administrator

This part of the paper presents the external applications developed by RCUB and their operation in combination with the DSpace software. Because items’ metadata cannot be changed by users, the external applications perform operations that cannot be implemented or are difficult to perform in DSpace. The goals and benefits of this approach include metadata quality control, time savings, greater accuracy in handling metadata and easy metadata export.

5.1 Authors, projects, publications (APP)

Years ago, monitoring the scholarly work of all employees required a lot of time, keeping in mind that there was no unified system where complete data would be grouped. The primary function of the application *Authors, projects, publications*²⁴ is the creation of pages listing all records from the repository related to one author or project. Metadata download is also enabled for single records or groups of records. DSpace software versions 5 and 6 do not offer a number of options offered by APP, and DSpace 7 is still in beta. To meet a large number of users’ requests, RCUB has developed this external application to enable metadata download according to various parameters.

By running search by author name or ORCID ID it is possible to obtain a complete bibliography of an author affiliated with the Faculty of Chemistry or the Innovation Center.²⁵ ORCID is a register that assigns a unique and persistent identifier to researchers. Researchers can supplement their profiles with new papers manually or by downloading metadata from other databases. The selection of papers in APP can be limited using filters, i.e. according to the publication year, type, version (peer-reviewed or published), and based on the publication rank in the national research evaluation system used by MESTD – shown in Figure 1. Metadata are exported for individual records or groups of records in the RIS or BibTeX formats. The exported data may be imported into a reference manager where a bibliography is

²⁴ *Authors, projects, publications*, (accessed on November 17, 2020).

²⁵ The completeness of bibliographies depends on the diligence of researchers in depositing their own papers in the repository.

formed according to a desired citation style. Additionally, within the bibliography of author's works, the projects in which the author participated are presented, as well as those that are only mentioned in the publication. In order to retrieve a list of publications associated with a project, it suffices to enter a project code in the search field. Search results are accompanied with the list of all co-authors of the retrieved publications. The selection of papers is limited using filters, i.e. according to the publication year, type, version and the publication rank in the national research evaluation system used by MESTD.

The third segment of the application lists publications and citation counts. If a record is equipped with WoS and Scopus identifiers, the corresponding citation counts will be displayed next to the title in the list, and in addition to these two most well-known citation databases, Altmetric Attention Score and Dimensions citations are also displayed. The scores based on the weighted number of mentions on social networks, blogs, pages, are automatically calculated for each publication if the DOI is provided in the appropriate metadata field in the repository. It is possible to export metadata for all records in Cherry in RIS or BibTeX formats. It is possible to completely export all records from Cherry also in RIS or BibTeX format, and further narrowing the choice of works for export is equal to export by author name or by project name (by applying filters). Narrowing the selection of items for export is equal to the export by the name of the author or by the name of the project (by applying filters). The application is developed to meet users' requests. After the latest upgrade, it is possible to display and export publication metadata belonging to individual communities and collections in the repository. The application is the most appreciated at the time of preparing research progress reports because it is publicly available.

5.2 Ellena

Access to the application Ellena²⁶ is limited to repository managers, i.e. those responsible for verifying deposits. This has been proven as a good practice because limited access prevents potential abuse. The application consists of three segments: Metadata Editor, Multiload and Administration. The first part of the Metadata Editor is used for mass changes of metadata, most commonly author names. Different versions of the name (written in different alphabets, with and without the middle initial, double surnames with and without hyphens, different surnames, etc.) are connected with the help of a

²⁶ Ellena, (accessed on November 17, 2020).

APP

Authors
Projects
Publications

Communities & Collections

Sort By

Publication Year
Deposit Date
Title
Type
Access

Publication Year

2020 (1)
2019 (3)
2018 (7)
2017 (11)
2016 (7)
2015 (7)
2014 (7)
2013 (3)
2012 (8)
2011 (12)
2010 (7)
2009 (2)
2008 (1)
2008 (3)
2005 (1)
2004 (1)

Type

article (70)
other (9)
bookPart (1)
doctoralThesis (1)

Version

publishedVersion (78)
acceptedVersion (3)

M-Rank

aM21 (2)
aM21~ (1)
M21 (13)
M22 (14)
M23 (38)
M23~ (1)
M24 (2)

Vujišić, Ljubodrag V.

Link to this page

https://cherrychem.bg.ac.rs/APP/faces/author.xhtml?author_id=orcid:0000-0001-7625-7484&item_offset=0&project_offset=0&sort_by=dc.date.issued

Authority Key

orcid:0000-0001-7625-7484

Name Variants

Vujišić, Ljubodrag V. (81)

Projects

search...

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Natural products of wild, cultivated and edible plants: structure and bioactivity determination

Ontogenetic characterization of phylogenetic biodiversity

Sekundarni metaboliti samoniknih, lekovitih biljaka: izolovanje, karakterizacija i biološka aktivnost

Characterization and application of fungal metabolites and assessment of new biofungicides potential

Micromorphological, phytochemical and molecular investigations of plants - systematic, ecological and applicative aspects

Diversity of the flora and vegetation of the Central Balkans: Ecology, chorology, and conservation

The effects of magnetic fields and other environmental stressors on the physiological responses and behavior of different species

University of Graz

Molecular characterization of bacteria from genera *Bacillus* and *Pseudomonas* as potential agents for biological control

Novel encapsulation and enzyme technologies for designing of new biocatalysts and biologically active compounds targeting enhancement of food quality, safety and competitiveness

Austrian Academy of Sciences at the Institute of Zoology, University of Graz [23811]

Department of Agricultural and Food Sciences, University of Bologna, Italy

DOC fellowship of the Austrian Academy of Sciences, at the Institute of Zoology, University of Graz [23811]

Federal Ministry of Education and Science project (the Federation of Bosnia and Herzegovina) [05-39-4362-1/13, 0101-39-145/13]

Funkcionalna analiza ontogenetske diverzifikacije faune i modifikacije evolutivnih odgovora tokom filogenije

Volkswagen Stiftung

European Commission

Advancing research in agricultural and food sciences at Faculty of Agriculture, University of Belgrade

Molecular mechanisms of redox signalling in homeostasis: adaptation and pathology

Study of structure-function relationships in the plant cell wall and modifications of the wall structure by enzyme engineering

Investigation on the medicinal plants: morphological, chemical and pharmacological characterisation

The membranes as sites of interaction between the intracellular and apoplasmic environments: studies of the bioenergetics and signaling using biophysical and biochemical techniques.

Traditional and new products of cultivated and wild growing fruits and grape vines, and by-products during processing, with special emphasis on indigenous varieties: chemical characterization and biological profile

Geography of Serbia

Biofizika istraživanja membranskih procesa: interakcija membranskih receptora i kanala sa spoljašnjim faktorima i intracelularna regulacija

Farmakodinamska i farmakogenetska istraživanja novih lekova i prediktivna/prognostička vrednost farmakoterapije u onkologiji

Ministry of Science and Environmental Protection of the Republic of Serbia

Author's Bibliography

RIS

BibTeX

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Pygidial gland secretions of *Carabus* Linnaeus, 1758 (Coleoptera: Carabidae): chemicals released by three enarles

Figure 1. Example of author bibliography

local unique identifier in the form of an alphanumeric string. If the author has an ORCID ID, it is assigned instead of the local identifier generated by the software. In this way, in next to the name in Cherry, the ORCID logo is displayed, which links to the corresponding ORCID profile. Administrators continuously curate this database by finding ORCID IDs on the ORCID website, through communication with the authors and with the support of RCUB, through occasional notifications of newly registered ORCID IDs for individuals affiliated with the University of Belgrade – Faculty of Chemistry and the Innovation Center. For frequent names, it is technically possible to add the middle initial. Each name in Cherry is entered in the Latin script, regardless of how it is cited in the original publication. Linking names is additionally important for authors who have changed their last name. By linking the various versions of a name using a unique identifier, it is made possible to display all the publications of an author in a single list, which can further be exported to create a complete bibliography. Communication between researchers and administrators is necessary because the consolidation of author names is an ongoing process.

Each record in the repository has its own internal identifier in the form of an integer. Identifiers are assigned automatically and the most recent records have the highest numbers, sorted in descending order of entry as a useful tool for the administrator to have better visibility and data modification. Metadata Editor is searchable. Search can be limited to a specific collection and specific Dublin Core fields.

The second segment is Multiload, which enables metadata import from various sources. The most important options are DSpace Replicator, where metadata can be ingested into Cherry by copying the URL of a record from another DSpace repository, and RIS, where metadata is ingested from other databases using reference managers. Before ingesting metadata via DSpace Replicator, a whole set of metadata is displayed so that a repository administrator can make changes and corrections, if necessary. When using metadata retrieved from citation databases or publisher sites, greater care is taken because it is not always possible to optimally map the metadata fields in citation databases, reference managers and the repository. The Dublin Core metadata fields should be properly filled out in order to obtain detailed and complete metadata records enabling unambiguous identification of the publication. This ensures that users and aggregators are offered detailed, high-quality and accurate metadata. Incorrect input can create confusion and lead to incorrect citation. Some of Dublin Core fields used in Cherry and other

repositories developed by RCUB that comply with the OpenAIRE repository guidelines²⁷ are shown in Table 1.

In the Administration segment of Ellena, the administrator is allowed to grant privileges to new members. At the University of Belgrade – Faculty of Chemistry, there are currently no interested parties, apart from librarians, who would take administration duties and ingest metadata through Ellena. This shortcoming can be overcome by hiring more librarians. A workflow involving one or more trained administrators within each department responsible for massive metadata ingestion could be adopted by the Faculty. In this case, the administrators would control what is published annually by researchers affiliated with the Faculty and the Innovation Center. Currently, researchers only deposit individual publications directly into the repository, in which they have support from the Library.

5.3 NomadLite

Application NomadLite²⁸ aims to facilitate the curation of metadata relating to projects, Scopus and WoS identifiers and publication ranks used in the evaluation of scientific research at the national level. When depositing publications, researchers sometimes omit funding information.²⁹ To ensure metadata accuracy and completeness, RCUB has developed a tool for repository administrators. NomadLite, shown in Figure 2, uses text mining to retrieve funding information. The identified information must be checked and verified by the administrator for each record separately.

Scopus and WoS identifiers do not need to be filled out manually during deposit (which would involve the manual searching of these databases). NomadLite uses APIs to retrieve these identifiers. With one click, the administrator verifies the identifier based on a comparative analysis of data from the citation database and Cherry (title, the name of the first author and publication year).

When manually depositing data, researchers are not offered the option to add publication ranks because this field is not provided in the repository software. The ranking of research results displayed in Cherry is defined by analysts for a specific research area at MESTD and is easily verifiable on

²⁷ [OpenAIRE Repository Guidelines - Publication Type](#), (accessed on November 17, 2020).

²⁸ [NomadLite](#), (accessed on November 17, 2020).

²⁹ Data are downloaded from the address [Nardus ProjectData.xml](#), (accessed on November 17, 2020).

dc.rights	Entered into field
Open, free access	openAccess
Closed access	closedAccess
Restricted access	restrictedAccess
Delayed open access	embargoedAccess
dc.rights.license	Entered into field
CC BY	BY
CC BY-SA	BY-SA
CC BY-ND	BY-ND
CC BY-NC	BY-NC
CC BY-NC-SA	BY-NC-SA
CC BY-NC-ND	BY-NC-ND
CC0	0
All rights reserved	ARR
dc.type	Entered into field
Journal article	article
Bachelor's thesis	bachelorThesis
Master's thesis	masterThesis
Doctoral thesis	doctoralThesis
Monograph	book
Chapter in the monograph	bookPart
Reviews	review
Conference paper	conferenceObject
Lecture	lecture
Working document	workingPaper
Preprint	preprint
Report	report
Annotation	annotation
Informative contribution	contributionToPeriodical
Patent	patent
Other	other
dc.type.version	Entered into field
Draft version	draft
Unreviewed version	submittedVersion
Reviewed version	acceptedVersion
Published version	publishedVersion
Corrected version	updatedVersion

Table 1. Full-text availability level

Pretraga

Grape seed flour of different grape pomaces: Fatty acid profile, soluble sugar profile and nutritional value
Milinčić, Danijel D.

IZABRANI PROJEKTI:

REZULTAT PRETRAGE:

“Korišćenje biljnih izvora proteina, dijetalnih vlakana i antioksidanasa u proizvodnji hrane”

Izaberi

“... other grape varieties. Unique fatty acids and soluble sugar profiles of seed flour of autochthonous grape variety Prokupac together with good nutritional quality parameters indicate to its possible use as a new functional food ingredient. Acknowledgement. This investigation was supported by the Ministry of Education, Science and Technological Development of Republic of Serbia through Grants No. TR31069 and O172017. ИЗВОД КОШТИЦЕ ГРОЖЂА РАЗЛИЧИТИХ КОМИНА: МАСНО-КИСЕЛИНСКИ ПРОФИЛ, ПРОФИЛ РАСТВОРЉИВИХ ШЕЋЕРА И НУТРИТИВНА ВРЕДНОСТ ДАНИЈЕЛ Д. МИЛИНЧИЋИ1, АЛЕКСАНДАР Ж. КОСТИЋИ1, БОЈАНА Д. ШПИРОВИЋ ТРИФУНОВИЋИ1, ЖИВОСЛАВ Љ. ТЕШИЋИ2, ТОМИСЛАВ Б. ТОСТИИ2, АЛЕКСАНДРА ДРАМИЋАНИИ2, МИРОЉУБ. Б. БАРАЋИ1 и МИРЈ...”

“Korelacija strukture i osobina prirodnih i sintetičkih molekula i njihovih kompleksa sa metalima”

Izaberi

“... varieties. Unique fatty acids and soluble sugar profiles of seed flour of autochthonous grape variety Prokupac together with good nutritional quality parameters indicate to its possible use as a new functional food ingredient. Acknowledgement. This investigation was supported by the Ministry of Education, Science and Technological Development of Republic of Serbia through Grants No. TR31069 and O172017. ИЗВОД КОШТИЦЕ ГРОЖЂА РАЗЛИЧИТИХ КОМИНА: МАСНО-КИСЕЛИНСКИ ПРОФИЛ, ПРОФИЛ РАСТВОРЉИВИХ ШЕЋЕРА И НУТРИТИВНА ВРЕДНОСТ ДАНИЈЕЛ Д. МИЛИНЧИЋИ1, АЛЕКСАНДАР Ж. КОСТИЋИ1, БОЈАНА Д. ШПИРОВИЋ ТРИФУНОВИЋИ1, ЖИВОСЛАВ Љ. ТЕШИЋИ2, ТОМИСЛАВ Б. ТОСТИИ2, АЛЕКСАНДРА ДРАМИЋАНИИ2, МИРОЉУБ. Б. БАРАЋИ1 и МИРЈАНА Б. ПЕШИЋИ...”

Izaberi

Ni jedan od ponuđenih projekata ne odgovara.

Figure 2. Machine-readable data for a number of project

ProRef information service.³⁰ The repository administrator in the Cherry applies the existing publication ranking by transferring data from relevant sources, and the selection is made by reviewing the offered ranks in the application - shown in Figure 3. In case of papers published during the year for which Impact Factor is not yet announced, the administrator will assign a temporary rank, and the application assigns a tilde sign (~). This makes it possible to filter publications with a temporary rank. After the new Impact Factors are published on the Journal Citation Report website, the administrator uses NomadLite to assign the final ranks.

³⁰ ProRef provides insight into the ranks of journals. The information service consists of three data sources: Journal Citation Report annual reviews, publication rank in the national evaluation system and lists of journals proposed by the faculties of the University of Belgrade in the field of social sciences and humanities: [List of Journals](#), (retrieved on November 17, 2020)

Saturation mutagenesis to improve the degradation of azo dyes by versatile peroxidase and application in form of VP-coated yeast cell walls

Ilić Đurđić, Karla (2020)

Enzyme and Microbial Technology (0141-0229)

dc.citation.rank M21-

Godina	Disciplina	Izvor	Ocena	
2019	Biotechnology & Applied Microbiology	WoS	M22	☐
2018	Biotechnology & Applied Microbiology	WoS	M21	☐

Ukloni

Saturation mutagenesis to improve the degradation of azo dyes by versatile peroxidase and application in form of VP-coated yeast cell walls

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Enzyme and Microbial Technology (0141-0229)

dc.citation.rank M21-

Godina	Disciplina	Izvor	Ocena	
2019	Biotechnology & Applied Microbiology	WoS	M22	☐
2018	Biotechnology & Applied Microbiology	WoS	M21	☐

Ukloni

Figure 3. Publication ranking

5.4 REPORTmaker (RM)

The lists displayed in the application REPORTmaker³¹ help the administrator to control the quality of metadata:

- Records where full-text content is missing;
- Records where the document version name is missing;
- Journal articles where the ISSN information is missing;
- Records where the access information is missing;
- Records where the license information is missing;
- Books, book parts and conference papers without an ISBN;
- Book parts and journal articles where the title of the source publication is missing;
- Records where the publication year is missing.

ISSN and the availability of full text are particularly important. Without ISSN, in most cases, NomadLite would not be able to retrieve the information about the publication rank, which would result in incomplete lists

³¹ REPORTmaker, (accessed on November 17, 2020).

according to these ranks in APP. The availability of full text is the most important because it contributes to greater visibility and citation counts. REPORTmaker is the latest application which will be further improved and upgraded to enable even better metadata quality control. The current options have been developed based on repository administrators’ observations related to the most common errors and omissions during deposit.

6 Google Analytics

Tracking the visits of Cherry is done using the free version of Google Analytics. The information available to administrators is:

- Real-time report - currently active users, page views and most active pages;
- Number of users, number of sessions, number of visits to one page only, duration of the session;
- Traffic channel, source from which users access the repository;
- Trend of activity during time of use;
- View user retention;
- Users by time of day;
- Sessions by country;
- Sessions per accessed device;
- Pages visited by users.

Record	WoS	Scopus	Altmetric	Dimen.	Visits	Time	Year	Access
1.	12	14	-	18	243	00:02:50	2018	Gold OA
2.	9	16	1	20	209	00:03:25	2016	Gold OA
3.	51	54	121	51	192	00:01:34	2017	Restricted
4.	32	34	3	21	134	00:01:24	2016	Gold OA

Table 2. Citation analysis of the most visited records from April 2019 to October 2020

Each set of data can be limited to a specific period, which is set manually. Table 2 shows the overall performance from April 2019 to October 2020. The first four most visited papers are marked with the numbers³². The records

³² 1. Microbial fertilizers: A comprehensive review of current findings and future perspectives

are accompanied with the total number of citations in WoS and Scopus databases in Table 3, for the period from April 2019 to October 2020. An interesting presentation of the change in the number of citations and visits is reflected in the Table 4 because the data refer to the period before June 2020. In the time interval of only four months, all records show an increase in the number of citations, as well as in the number of visits in the repository.

Record	WoS	Scopus	Altmetric	Dimen.	Visits	Time	Year	Access
1.	9	13	-	14	185	00:02:25	2018	Gold OA
2.	6	12	1	17	185	00:04:07	2016	Gold OA
3.	36	43	124	42	183	00:01:35	2017	Restricted
4.	27	31	3	20	132	00:01:24	2016	Gold OA

Table 3. Citation analysis of the most visited records from April 2019 to June 2020

Google Analytics does not track visits to deposited files, but only to the landing pages with metadata. Keeping this in mind, it may be concluded that the total number of visits is significantly greater than the data displayed in Google Analytics. In the coming period, more attention will be paid to the development of a system for monitoring content traffic in the repository.

7 Conclusion

The presented achievements indicate the comprehensiveness of repositories for scholarly publications, which conform to clearly defined guidelines and rules. Each rule was tested before it was introduced in order to provide the highest possible effect based on the developed European and other international repositories using the same software. Given that new records are added on a daily basis, in the future, the picture of the scientific work at the University of Belgrade – Faculty of Chemistry, and the Innovation Center will be even more complete. The improvements of the system, monitoring

-
2. Antifungal and antibacterial activities of *Petroselinum crispum* essential oil
 3. Design of coiled-coil protein-origami cages that self-assemble in vitro and in vivo
 4. Equilibrium solubility measurement of ionizable drugs - consensus recommendations for improving data quality

Number of users	Total about 6,722
	5,577 via computer
	1,118 via mobile phones
	46 via tablet
Number of sessions	Total about 14,551
	12,499 via computer
	2,003 via mobile phones
	49 via tablet
Number of visits to only one page	48,37%
Session duration	35 min. 47 sec.
New Visitors	87%
Returning Visitors	13%
Visits from the top ten countries	Serbia: 3,097 users (45.73%)
	Germany: 437 users (6.45%)
	United Kingdom: 347 users (5.12%)
	India: 185 users (2.73%)
	China: 177 users (2.61%)
	Turkey: 157 users (2.32%)
	Brazil: 131 users (1.93%)
	Bosnia & Herzegovina: 115 users (1.70%)
	Iran: 96 users (1.42%)
	Japan: 91 users (1.34%)
Browsers	Chrome: 4,799 users (71.19%)
	Firefox: 820 users (12.16%)
	Safari: 362 users (5.37%)
	Edge: 196 users (2.91%)
	Opera: 111 users (1.65%)
	Others: 6.02%
Operating Systems	Windows: 5,018 users (74.43%)
	Android: 931 users (13.81%)
	Macintosh: 320 users (4.75%)
	iOS: 224 users (3.32%)
	Linux: 116 users (1.72%)
	Others: 0.07 %
Sessions per device	Computers: 82.73%
	Mobile Phones: 16.59%
	Tablet devices: 0.68%
Most Active Users	Wednesdays from 10 AM to 3 PM

Table 4. Records attendance analysis

and innovations in the communication between librarians and developers increase the overall added value that Cherry brings to the institution.

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The use of the Omeka Semantic platform for the development of the University of Belgrade, Faculty of Mining and Geology digital Repository

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ABSTRACT: Under the regulations of the Ministry of Education, Science and Technological Development, a digital repository based on the Omeka S data storage platform has been developed for the Faculty of Mining and Geology. The platform has been upgraded with the required modular extensions, Solr index and automatic OCR. Furthermore, document indexing and search have been fine-tuned with the aid of e-dictionaries of the Serbian language, which has brought about outstanding results in terms of usage facilitation and overall speed of document storage and search within the repository that is a part of the application.

KEYWORDS: Digital Repository, Omeka, Digital Library searching.

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1 Introduction

In 2018, the Ministry of Education, Science and Technological Development of the Republic of Serbia prescribed the mandatory deposit of metadata of scientific research publications in the appropriate national, thematic or institutional repository for all institutions engaged in scientific research.¹ In accordance with that, in June of 2019, the Faculty of Mining and Geology of the University of Belgrade started developing a software solution for the

¹ Platforma za otvorenu nauku

repository. The platform was selected according to the Compliance with the *Open Archives Initiative* standards and the principles of FAIR metadata dissemination.

FAIR (*Findable, Accessible, Interoperable, Reusable*) principles ensure that metadata is visible, accessible, interoperable and durable. The basic FAIR principle is that data must have at least one unique identifier based on which it can be found in the repository in which it is stored or in some other repository to which it is linked. Such a unique identifier should thus enable the retrieval of data according to a standardized protocol. Data interoperability is achieved by referring to other data (metadata) and is measured by the performance of the repository in various data exchange methods, both with users and with other software.

In addition to many open source software solutions such as DSpace with Cris add-on, e-Prints, Omeka and others, we opted for the Omeka² platform due to previous positive experiences, ease of installation, flexibility and a large number of software add-ons to extend basic functions, which are also open access. A large number of institutions use the Omeka platform for various applications of digital archiving of diverse content, which also contributes to the credibility of the platform³ and a large user base is a prerequisite for an active user community gathered at the forum,⁴ where users can consult with colleagues from other institutions, add-on authors or the development team of the Omeka project itself. Creating a multi-purpose platform is exactly one of the goals we wanted to fulfill. It implies the creation of a repository of not only scientific papers published in foreign journals, but also professional and scientific papers in the Serbian language. An important functionality is the possibility of mutual thematic and spatial connection of research results related to a locality, which is very important in the field of mining and geology. The development of the repository and its software add-ons, as a rule, follows the principles of Agile Project Management and design that takes into account the needs of users (User-Centered Design) (Perry and Waggoner, 2018). Focusing on users, inclusive and iterative development are key components of the repository development process, which means close cooperation of the development team with fellow librarians and other faculty employees from the Mining and Geology Department whose feedback on software needs and testing contributed to the development process.

² Omeka

³ Omeka Directory

⁴ Omeka Forum

Examples of previous positive experiences of using the Omeka platform are ROmeka@RGF⁵ (Томашевић et al., 2017) and the digital library of the Criminal Police Academy⁶ (Vorkapić et al., 2017). Romeka@RGF served as an open source development platform on which query extension software and morphological dictionaries were successfully applied when searching the digital library, which showed how important these language resources are for the relevance of the obtained results, ie for increasing system response (Tomašević et al., 2018). A special OWL⁷ RuDokOnto ontology has also been developed for this digital library in order to better show users the relationship between the elements of the project documentation for which the library is intended to be stored (Лазић и др., 2019). Another advantage of the Omeka platform is the number of users and their activity in further software development. Omeka Semantic,⁸ an improved version of the Omeka Classic platform, was used to create the repository. A detailed list of all add-ons for the basic version of Omeka Semantic can be found on the GitHub page of the project author.⁹ Omeka Semantic is intended for institutions that manage multiple sites that share resources with each other. Also, Omeka Classic uses only Dublin Core for metadata, while Omeka S (Semantic) supports multiple namespaces, linking to ontologies and creating dictionaries, and is also compliant with Linked Open Data principles. An example of using the Semantic version of the platform is Henri Poincaré’s Corpus of Digitized Correspondence with Famous Scientists, published using the Omeka S development environment, combining RDF (Rich Document Format) repositories and SPARQL¹⁰ queries (Bruneau et al., 2020). Numerous long-term solutions of digital archives based on the Omeka platform have indicated that the platform can be successfully used at the Faculty of Mining and Geology not only as a specialized digital library but also as a repository for scientific papers and various forms of digital resources. Omeka is also used as a teaching tool for independent research projects of students (Cuenca and Kowaleski, 2018). As a platform for different types of digital archives, it is widely used in the digital humanities, not only for written digital objects, but also for multimedia content (Gill et al., 2020).

⁵ ROmeka@RGF

⁶ Digital Library of the Criminal Police Academy

⁷ OWL RuDokOnto Ontology

⁸ Omeka Semantic

⁹ Omeke Semantic - GitHub

¹⁰ SPARQL

The repository of the Faculty of Mining and Geology¹¹ was built as a standalone application on a server within the institution. It can be accessed by all users via the Internet, and can be used via a standard user interface through a web browser and through an API (*Application Profile Interface*). The OAI-PMH¹² (*Open Archives Initiative - Protocol for Metadata Harvesting*) has also been established, so that metadata from the entire repository is available this way as well. The API is particularly important because it allows for further upgrades over the system, and the OAI-PMH protocol is one of the more well-known ways of automated data exchange between a metadata aggregation system and a repository. The metadata of all papers are publicly available, and the availability of the full text of the papers is defined by the application of various licenses in accordance with the authors of the papers.

2 Technical aspects of the repository

The operating system on which the repository was built is *Ubuntu*¹³ distribution of the Linux operating system, version 19.04. For the needs of the Omeka platform, a 5.7 version of the MySQL¹⁴ server has been installed, and *Apache Solr*¹⁵ is also used to search full text.

The current repository¹⁶ contains a total of 3874 records of 10 different types of papers: in-proceedings (1333), journal articles (1052), doctoral dissertations (688), master's thesis (621), chapter in the monograph (113), conference prints (20), specialist paper (18), monograph (1), practicum (1) and habilitation paper (1). All papers for which the original document is available, in addition to containing metadata, the text is available and searchable over the full text, and this functionality is enabled by using the SOLR index whose integration is available as a plug-in (*plug-in*) for Omeka platform.

Additional Omeka functionalities are provided by software add-ons, and the modules used are:

1. *Advanced Search Plus module* - Module for additional fields that are searchable via advanced search (search for records by creation date, availability and resource type, etc.);

¹¹ The repository of the Faculty of Mining and Geology

¹² OAI-PMH protocol

¹³ Ubuntu

¹⁴ MySQL

¹⁵ Apache Solr

¹⁶ Given data on the 15.10.2020

2. *Bulk export* – A module that allows mass export of metadata in various formats;
3. *Citation* – Module for displaying a string for quoting papers in bibliographic sources;
4. *Clean Url* – A module that displays URLs as simple links suitable for SEO (Search Engine Optimization);
5. *CSS editor* – A module that adds options for entering external CSS styles on the administration page;
6. *Custom Ontology* – A module that allows the creation of custom ontologies to describe resources that cannot be described by standard ontologies;
7. *Custom Vocab* – A module that allows you to create your own dictionaries for describing objects, which allows us to create drop-down lists when entering metadata and provide uniform values of certain fields with metadata;
8. *Derivative Images* – Module for automatic creation of images for display of papers – e.g. automatic generation of a small image of the home page of the paper for which a source in pdf format is available;
9. *Group* – Module for grouping users and resources in order to determine access rights and visibility;
10. *Collecting* – Module for adding forms through which users who are not repository administrators can add records;
11. *Guest User* – Module for creating user profiles for users who are not administrators;
12. *OAI-PMH Repository* – A module that makes the repository accessible via the OAI-PMH protocol for data exchange;
13. *Search* - Module for advanced search parameters;
14. *Search adapter for Solr* - Integration module with Solr index that allows searching papers in full text;
15. *Auto Suggest* – A module that allows automatic display of metadata suggestions for object description.

The whole system consists of an application written in the PHP programming language, a MySQL database for metadata and a Solr index for storing full-text documents. In addition to all the functionalities offered by additional modules, the repository has the ability to automatically read resources (scanned documents) that have not been previously machine-readable and save their text, which allows searching the entire text of documents, and which is especially suitable for stored pdf files created by scanning. Google’s

open source program *Tesseract*¹⁷ is used for automatic optical character recognition (in the background) or OCR (*Optical Character Recognition*). The search has been improved and enhanced with the possibilities of smart search for all inflected forms of words, so that the requested term will be found even though it does not appear in the form specified in the query, which will be discussed in more detail later in this paper.

3 Entering data into the repository

There are two types of entries in the user interface - bulk and standalone. The repository supports the principle of self-storage, which means that authors of papers can store their own papers after logging into the system. The structure of user accounts firmly follows the data structure of other parts of the information system of the Faculty of Mining and Geology, so that for each user has a certain department and chair where it belongs, which enables more detailed filtering and analysis of data in the system. Each user receives a username and password from the administrator, who assigns them access rights and authorizations to paper in the repository. There are three categories of users:

1. The author – researcher – can add his papers, and in accordance with the authorizations can see other papers in the repository;
2. Librarian – manages all records in the repository and controls the entry and import of data by authors, exports data from the repository;
3. Administrator – performs complete site administration, manages user accounts, metadata and pages.

The user interface is adapted to the employees at the faculty, so they can easily archive their papers on their own. The simplest example of entering a paper in the repository looks like this: after the author logs in to the system, he chooses the type of his paper from the drop-down menu and fills in the form with the required information (metadata about the paper) and uploads a file if necessary (Figure 1), and then the librarian, after the control, accepts it, and if necessary supplements it with metadata and verifies it so that it becomes visible in the repository. Selecting a paper type from the drop-down menu generates a form specifically designed for the required paper type, which makes it easier for users to enter data. Another way to make it easier for users to enter data and to control the quality of the data entered

¹⁷ *Tesseract*

are drop-down lists with predefined values designed for each form separately, where feasible. Mandatory fields when entering data are marked with a “*” and the system certainly does not allow the storage of incorrectly entered record. Also, next to each input field there is an example of correctly entered data. A total of 270 user accounts were created and several workshops were organized where members of the development team trained users for self-archiving of papers.

Figure 1. Form for posting a paper published in a journal

Significant acceleration of data entry was achieved by integrating meta-data retrieval tools from the DOI (*Digital Object Identifier*)¹⁸ database. If the paper has been previously assigned a DOI identifier, the user can press the button to “download data from the DOI database” and automatically fill in the form with the downloaded data. Data entry can also be performed through a mass data entry add-in, where the data must be saved in a single CSV (*Comma Separated Value*) file in which the input field data is separated by commas. Users of the *librarian* and *administrator* categories have the privilege of such data entry, in order to avoid misuse or incorrect data entry.

¹⁸ Digital Object Identifier

4 Data display

The home page, also the repository search page (Figure 2) consists of three parts:

1. Main menu bar – which contains links to an advanced search page, a page for posting a new paper (for authorized users only), and a page for viewing a list of authors and their works. Next to the field for entering search terms, there is a drop-down menu from which the category to be searched is selected (one specific metadata category or full text);
2. Left menu for filtering search results and sorting found results;
3. Search results display – consists of the highlighted title of the paper, the author, the button for generating a string to cite the paper, the abstract and the generated image of the title page of the paper. During the detailed presentation of the work (which is obtained by clicking on its title), you can see the display of all metadata and resources, if they are set. As a result of the search of the text of the document, instead of the abstract, excerpts of the text (*snippets*) are displayed in which the found terms are emphasized.

For each resource in PDF format added to the repository (after being verified by the librarian), a new title page is automatically generated with the repository logo, basic metadata (author(s), title, year of publication, etc.) and a citation string, which becomes first page of the document.

In addition to the user interface for those searching the repository, Omeka's admin panel is also used, a special interface through which the repository is administered. These pages are available in the user categories *librarian* and *administrator*, and the ease of use of the admin panel is one of the main advantages of the Omeka platform.

Changes in the source code of the application and the use of language resources have significantly improved the system in two directions:

1. Search assisted by electronic dictionaries – improvement of Solr system;
2. Snippets presentation – source code enhancement and several add-ons for Omeka S.

Based on the Serbian electronic dictionaries (Krstev, 2008), lists of related terms were first generated, which were then imported into the Solr environment on the repository server. This type of connection enables a smarter search of the repository and obtaining better quality results. Searching a

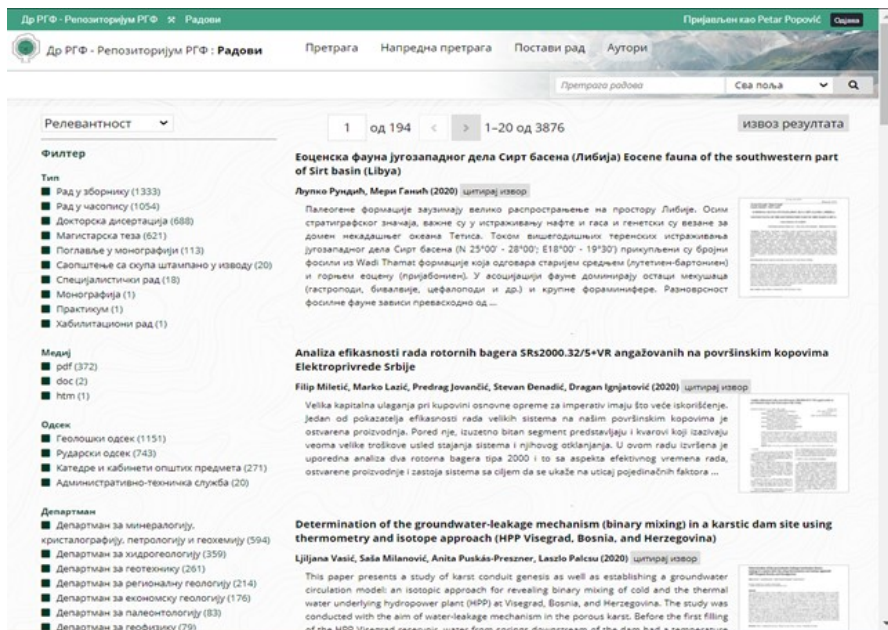


Figure 2. Home page

word automatically takes into account all its inflectional forms (tenses, number, cases, etc.), synonyms (if given in the database), as well as transliterated pairs of those words (it does not matter whether the search is performed in Cyrillic or Latin). Once imported, the lists also enable smart indexing in the Solr system, which reduces the namespace, index size and thus greatly speeds up the repository search process, although it takes a few extra seconds during the initial indexing of papers. All this together ensures that the user gets to the requested information quickly, avoiding multiple repository searches on any particular query.

Changes to the source code of appendices, among other things, include displaying marked parts of the text in which the requested terms were found (Image 3), functionality of reading scanned documents, automatic filling of input forms from the DOI database, etc. As a complementary software, when implementing background processes, the Redis¹⁹ server – Server for managing multiple background processes is also used. This ensures the smooth operation of the Omeka application while in the “background” the system solves more hardware-intensive tasks such as OCR of attached documents.

Figure 3 shows an example of search results for the keywords “underground water source.” As we can see in the passages of the text, the inflectional forms of the words “source,” “underground” and “water” are also emphasized. The search parameters define that all metadata fields are searched, including the entire text of the document, so the most relevant search result is considered to be the document in which the variant forms of the requested terms appear together several times. Among the search parameters, we can choose the search only by metadata, by title, keywords, abstract, author, year of publication, mentor. These fields were considered as the ones that users could most often search for, so they were set aside for quick search on the home page. Other fields can be searched via the advanced search page, where advanced users are enabled to create more complex queries via a graphical interface. The MySQL database is used for search by metadata and the Solr index is used for full-text search. The results of the obtained search can also be reported as a text file in the form of a list of references to papers. It is an efficient way to easily print a bibliography, and in combination with filtering the results with the help of facets, it becomes a particularly useful tool for different needs.

Also, a very important functionality when searching the repository is the ability to filter the obtained results, using facets on the left side as shown in Figure 3. It is possible to narrow the search by several parameters such

¹⁹ [Server for managing multiple background processes – Redis](#)

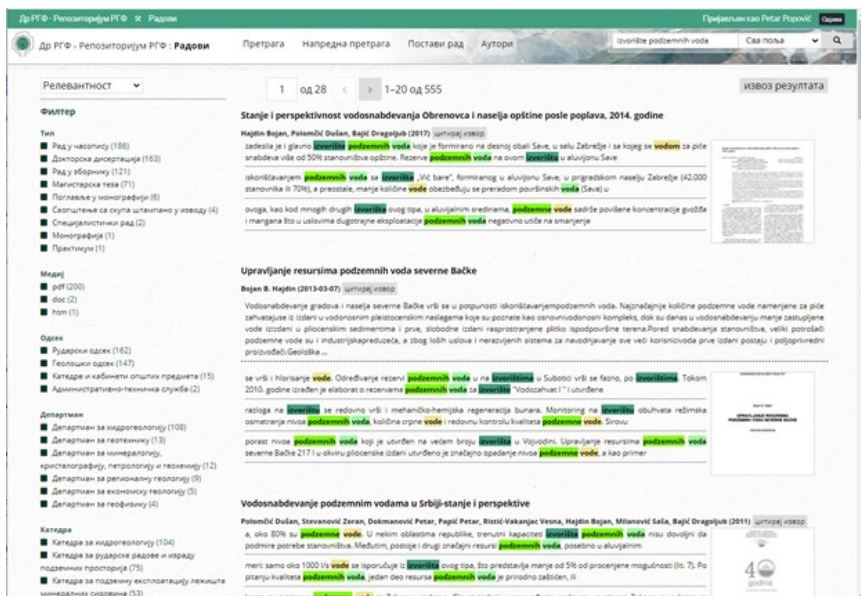


Figure 3. Search results view

as type of paper, format of the resource stored, department and chair of the Faculty to which the author belongs, narrower (eg. M14, M21, M22,...) and wider scientific paper category (M10, M20, M30,...), author and period of publication. Also, next to each facet, there is a number of documents that belong to a certain category, which can also help the user when finding the desired document or creating a list for export. On a specific example, it is possible to report papers for an individual researcher in a certain period, which is especially important when collecting data for election to the title.

5 Conclusion

As Omeka is an open source platform, many adaptations and additions to the functionality are possible, which in the case of the Digital Repository of the Faculty of Mining and Geology has been improved in the best possible way with the help of existing language resources for the Serbian language. These extensions to language resources significantly contribute to the quality of search results and a more user-friendly interface that is intended for non-IT users, and allows quick and easy storage, retrieval and use of metadata of entered works. Likewise, the simple user interface for administrators and librarians offered by Omeka brings many possibilities for editing access rights and site control, which enables easy work for librarians without the need for constant support from IT experts. In line with the needs of Omeka users, new open source modules are constantly appearing to improve existing ones and add new functionalities. They can, with administrator privileges, be added to the system without further modification of the source code, which is an additional benefit. As a further direction of the repository development, it is planned to switch to newer versions of Omeka and implement new add-ons for various functions if needed, as well as implement tools for extracting full-text information, such as named entities (locations, events, minerals, ore) to enrich the search capabilities.

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Linguistic Bibliographic Database iSybislaw¹

ABSTRACT: Bibliographic database iSybislaw, created at the Institute of Slavic Studies PAN, is the most extensive database of metadata and full text of scientific monographs, serial publications and their parts in the field of Slavic linguistics. It originates from the annual bibliographic reviews of the journal *Rocznik Slawistyczny* and the monographies *Bibliografia Językoznawstwa Slawistycznego*. Today it stores data for over 21,000 units and cooperates actively with over 20 international, foreign and national Polish institutions. The work of the database is especially monitored by the Commission for the Linguistic Bibliography of the International Committee of Slavists.

KEYWORDS: databases, linguistic bibliography, iSybislaw.

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Language Information System iSybislaw² is a specialized bibliographic database of the Institute of Slavic Studies of the Polish Academy of Sciences in Warsaw (Instytut Slawistyki Polskiej Akademii Nauk) of national and international literature in the field of linguistic Slavic studies, including contrastive and confrontational Slavic and non-Slavic linguistics. In addition to metadata, the iSybislaw database provides access to the full texts of documents in a large number of cases (Rudnik-Karwatowa, 2014). The iSybislaw system is widely available and promotes open access to knowledge.

The information needs of users with a specific scholar and professional profile, their recognition and fulfillment are the basic motive for the emergence and work within the system. The users are primarily experts, linguists:

¹ The paper was created within the project "Lexical, creative and phraseological innovations in modern Serbian and Polish" of the Committee for Serbian Language and Literature in comparison with other languages and literatures of the Department of Language and Literature of SANU and the Institute of Slavic Studies of PAN.

² iSybislaw

members of the academy, doctors of philosophy, students of Slavic studies, researchers of non-Slavic languages, historians and literary historians. The development, maintenance and improvement of such a system, as well as the provision of relevant, accurate and complete information are challenges for the international team of associates involved in its work. The iSybislaw bibliographic database is the most extensive modern system for searching bibliographic information in the field of linguistic Slavic studies.³ The database currently contains data on over 21,000 documents. In addition to bibliographic descriptions, the system contains, via hyperlinks, complete texts in dedicated archives and is open access. The project is being implemented with the financial support of the Ministry of Science and Higher Education of the Republic of Poland.

Bibliographic data is submitted by Polish and foreign associates. Afterwards, it is verified and processed at the Center for Slavic Scientific Information PAN (Centrum Slawistycznej Informacji Naukowej PAN). The Institute of Slavic Studies PAN cooperates with international scientific organizations,⁴ as well as with foreign and national scientific institutions. This cooperation takes place with and without a signed agreement within the iSybislaw system.

The institutions with a signed agreement are:

- Belarus, Minsk: Research Center of Belarusian Culture, Language and Literature of the National Belarusian Academy of Sciences (Цэнтр даследаванняў беларускай культуры, мовы і літаратуры Нацыянальнай акадэміі навук Беларусі);
- North Macedonia, Skopje: Research Center for Areal Linguistics Božidar Vidoevski, Macedonian Academy of Sciences and Arts (Истражувачки центар за ареална лингвистика Божидар Видоевски, Македонска академија на науките и уметностите);
- Germany, Bautzen: Sorabistic Institute (Serbski institut);

³ The leading international linguistic bibliography is the *Bibliographie Linguistique / Linguistic Bibliography*, which provides bibliographic data on the largest number of languages. It was created under the auspices of the Standing International Linguistic Committee. The *BLonline* bibliographic database has been available to users since 2002. The material related to the Serbian language represented in that database is submitted by Jasna Vlajić Popović (Влајић Поповић, 2016).

⁴ The Commission on Linguistic Bibliography of the International Committee of Slavists and The Terminological Commission of the International Committee of Slavists.

- Slovakia, Bratislava: Ljudovit Štur Institute of Linguistics of the Slovak Academy of Sciences (Jazykovedný ústav Ľudovíta Štúra Slovenskej akadémie vied);
- Ukraine, Kiev: Institute of Ukrainian Language of the National Academy of Sciences of Ukraine (Інститут української мови Національної академії наук України);
- Czech Republic, Prague: Czech Language Institute of the Czech Academy of Sciences (Ústav pro jazyk český Akademie věd České republiky).

Institutions with which no agreement has been signed but there is mutual cooperation are:

- Estonia, Tartu: Department of Slavic Philology, University of Tartu (Slaavi filoloogia osakond Tartu Ülikool);
- Poland, Warsaw: Sjem Library (Biblioteka Sejmowa), Slavic Foundation (Fundacja Slawistyczna), Institute for Scientific Information and Bibliographic Studies, University of Warsaw (Instytut Informacji Naukowej i Studiów Bibliologicznych Uniwersytetu Warszawskiego), Department of Belarusian, University of Warsaw (Katedra Białorusistyki Uniwersytetu Warszawskiego), Scientific Society of Warsaw (Towarzystwo Naukowe Warszawskie);
- Poland, Poznan: Adam Mickiewicz University Institute of Polish Philology (Instytut Filologii Polskiej Uniwersytetu im. Adama Mickiewicza);
- Poland, Lublin: Institute of Polish Philology, Maria Curie-Skłodowska University (Instytut Filologii Polskiej Uniwersytetu Marii Curie-Skłodowskiej);
- Poland, Wrocław: Institute of Slavic Philology, University of Wrocław (Instytut Filologii Słowiańskiej Uniwersytetu Wrocławskiego);
- Russia, Moscow: Institute of Slavic Studies, Russian Academy of Sciences (Институт славяноведения Российской академии наук), Faculty of History, Moscow State University M.V. Lomonosov (Исторический факультет Московского государственного университета им. М.В. Ломоносова), Faculty of Foreign Languages and Areal Studies, Moscow State University M.V. Lomonosov (Факультет иностранных языков и регионоведения Московского государственного университета им. М.В. Ломоносова), Faculty of Philology, Moscow State University M.V. Lomonosov (Филологический факультет Московского государственного университета им. М.В. Ломоносова);
- Croatia, Zagreb: Office of the Representative for the Polish Minority of the City of Zagreb (Ured Predstavnik poljske manjine grada Zagreba).

Bibliographic material from the territory of Serbia was submitted by Ljudmila Popović (Faculty of Philology, University of Belgrade), for the period 1993–1996 and Marta Bjeletić (Institute for Serbian Language SASA), for 1998–2004 (Голубовић, 2019). The Committee for Serbian Language and Literature in comparison with other languages and literatures of the Department of Languages and Literature of SASA approved in 2019 cooperation with the Institute of Slavic Studies PAN. Joint research project is entitled “Lexical, morphological and phraseological innovations in modern Serbian and Polish language”. The main tasks within the project are the collection, interpretation and classification of bibliographic material according to formal, semantic and functional parameters. Collected bibliographic data on texts in the field of linguistic Slavic studies from the Serbian scholar community will be processed and indexed in the iSybislaw bibliographic database. Full texts will be included in the repository of the Institute of Slavic Studies PAN iReteslaw, in open access, through cooperation with DAIS platform developed within SASA.⁵ One of the most important goals set within the project is the development of a dictionary of key words in the Serbian language, which will be used to index stored papers, in order to determine their subject and theme. Collaborators on the project are Jelena Janković, head researcher (Institute for Serbian Language SASA) and Ana Golubović, bibliographer (Faculty of Philology, University of Belgrade).

The most extensive international bibliography of Slavic linguistics in printed form was *Bibliografia Językoznawstwa Slawistycznego*, published by the Slavic Publishing Center (*Slawistyczny Ośrodek Wydawniczy*) which is part of the Center for Slavic Scientific Information PAN. It was the result of decades of work on the international Slavic bibliography published in the journal *Rocznik Slawistyczny*, launched in 1908 in Krakow. The annual bibliography of scholar monographs and papers in collective monographs and periodicals in the field of general linguistics and Slavic studies entitled “*Przegląd bibliograficzny*” was its permanent column. The material was distributed according to the topic in the following sections: general linguistics and Slavic studies, Old Slavonic language, Bulgarian, Macedonian, Serbo-Croatian, Slovenian, Czech, Slovak, Lusatian, Polish and Russian language, Slavic languages in comparison with other languages.

In the second half of the 20th century, the journal was published in two volumes a year, the second of which was bibliographic. After the Second

⁵ DAIS

World War, the first bibliographic review, for the period from 1939 – 1945, appeared in the second volume of issue XVI (1950). In the next issue, an extensive post-war bibliography for the period 1946 – 1948 was added. The annual bibliographies came after that, but the dynamics of their publication over time was in increasing discrepancy with the current calendar year. The increase in the volume of bibliographic material and the quality of communication among contributors were the main reasons why that bibliography was delayed for up to five years, at one point. After the issue XLVII in 1991 the bibliography was separated from the journal to become a series of six extensive monographs entitled *Bibliografia Językoznawstwa Slawistycznego*. The series contain bibliographic material for the period from 1992 to 1997 (Голубовић, 2009).

Significant progress in the development of the modern system was achieved in 1998. Then, at the XII International Congress of Slavists in Krakow, the preliminary concept of the bibliographic database of Slavic linguistics Sybislaw was presented. It was developed within the Institute of Slavic Studies PAN in cooperation with Polish and foreign academic institutions, with the support of the Slavic Foundation (Bojar and Rudnik-Karwatowa, 1998). At the end of 2007, the iSybislaw system was established. First, a collection of data not included in the previous system was converted (for the year of 1998). This ensured the continuity of data in the collections. The iSybislaw database today contains information from 1992 onwards (Mikos, 2014).

The iSybislaw database includes not only Slavic linguistics, confrontational and contrastive linguistics, but also theoretical and general linguistics. Users are referred to different types of documents: non-serial publications (monographs, collections of papers, dictionaries, reference literature, etc.), serial publications (journals), as well as articles, reviews, chronicles. A bibliographic record of a monographic publication whose reviews are also in the database refers the user to these types of documents as well. Units that contain a description of a serial publication provide a list of those issues of a given journal that have been processed within the database. The system allows information to be found through multiple languages because the language range is unlimited. The principle of processing bibliographic data in the iSybislaw system is based on the registration of formal and subject attributes of the publication. That includes keywords, subject classification,

abstracts and comments, sometimes in two languages, in the source language of the publication and in Polish (Kowalski, 2014).

The use of iSybislaw information resources has been simplified thanks to a dictionary of key words in the field of Slavic linguistics. The dictionary of key words was created by the contributions of institutions or individuals who submitted bibliographic material. They were required to provide the key words for each bibliographic unit by which the unit could be found in the database. The dictionary includes only terms that characterize modern publications. Terms that are too detailed were not included in the dictionary. Much attention has been paid to less known terms with increasing use. The existence of keyword checklists facilitates the work of indexers, as well as the adequate presentation of the described units. The subject determination of bibliographic records is enabled by the dictionary of key words in Polish, other Slavic languages and English. The construction of keyword dictionaries in these languages is not at the same stages of development. Establishing equivalence classes between terms belonging to different languages allows successful searching in multiple languages. That is why a significant responsibility lies in the work of the linguists involved in the project and their mutual cooperation. The development of terminology of linguistics as a science and the implementation of terms in the keyword register of the iSybislaw system, according to the model of equivalence classes, is a current topic of several scholar studies (Іващенко, 2018; Карпіловська, 2018; Кислюк, 2018; Ковальський and Банасяк, 2017; Остапчук and Алексеева, 2014; Остапчук, 2018; Таран, 2018; Babik, 2018; Banasiak, 2014; Kowalski and Rudnik-Karwatowa, 2017).

Searching the iSybislaw database is possible via all fields of the formal part of the bibliographic description, via any element (title, author, issue, document language) and by keywords. Thanks to the development of the program and through the system of hierarchical and associative search, it is possible to reach the optimal amount of information on a single request (Sadowska, 2018). Modern science is characterized by an exponential growth of published works in the digital space as well. Along with the many positive aspects of such development, the sheer amount of topics available makes it difficult to access the relevant information. Optimization of activities related to scientific creativity and digital visibility in various information and search systems is a key factor of availability (Banasiak et al., 2018; Rudnik-Karwatowa et al., 2013). Thesauri and multilingual term registers are designed to make it easier for users to ask queries. The subject of each bibliographic unit in the iSybislaw database is also determined within the

classification system, whose roots go back to the way of classifying bibliographic material in earlier, printed, forms of this bibliography. The names of all authors and the names of publishing collections are given separately. The database of names allows grouping of several forms of names and surnames of one person (Latin, Cyrillic, etc.) to be recognized within each given query.

Title:	Языковой образ мира : очерки по этнолингвистике	
Author/editor:	Ежи Бартмиński	
Publication place:	Москва	
Publisher:	"Индрик"	
Year:	2005	
Series:	Традиционная духовная культура славян. Зарубежная славистика	[Show]
Pages:	528 s.	
Note:	Bibliogr.	
Languages:	rus	
Author headings:	au. Bartmiński, Jerzy	[Show]
Keywords:	język polski , językowy obraz świata , lingwistyka kulturowa , słownictwo , stereotyp językowy , styl	
Classification:	8.2.1.6. Polish. Stylistics	[Show]
	8.2.6. Polish Lexicology	[Show]
	8.2.8. Polish. Psycholinguistics	[Show]
	8.2.9. Polish. Ethnolinguistics	[Show]
Inbound references:	Recenzja: WYSOCHAŃSKI Włodzimierz - "Slavia Orientalis" 2007	[Show]
	Recenzja: RUDENKA Alena - "Беларукая лінгвістыка" 2006	[Show]

Figure 1. Example of a monographic publication record

Processing of each unit flows through a series of steps and in relation to that, each record in the database can have a different status and level of visibility. The initial stage is a working version of the record, which is then sent for verification, to be accepted or returned for review. During processing, associates in the system have the ability to use hidden comments for easier communication. Such comments are not visible to external users of the database. While the record is being processed, it is not fully available to them. When a record becomes available, it can have the status of an accepted record or the status of a record converted from a previous version of the database (Mikos, 2014).

Creating linguistic bibliography in the field of Slavic studies is one of the activities within the Institute of Slavic Studies PAN that confirms dedicated continuous action of bibliography creation for more than a century. Having gone through numerous transformations, following the scientific achievements and the needs of its users, the Polish Slavic bibliography has expe-

rienced a series of metamorphoses, from a column in a journal to a multi-content database, with significant success. Additional emphasis on the necessity of the presence of bibliographic data, scholar texts and associates from the Serbian scholar community is unnecessary, but raising of such cooperation to the institutional level gives the process a new perspective.

Title:	Pojęcie "językowy obraz świata" i sposoby jego operacjonalizacji	
Author/editor:	Jerzy Bartmiński	
Published in:	Jaka antropologia literatury jest dzisiaj możliwa? .- Poznań, 2010	[Show]
Pages:	155-178	
Languages:	pol	
Abstract:	Przedstawiona zostaje historia pojęcia, rozważania nad tym, czym jest językowy obraz świata oraz nad źródłami do jego badania (słownictwo, frazeologia, utarte kolokacje i metafory). Ilustracje stanowią znaczenie 'koń'. (BO)	
Author headings:	au. Bartmiński, Jerzy	[Show]
Keywords:	językowy obraz świata , konotacja 2 (relacja asocjacyjna) , 'koń' , znaczenie	
Classification:	8.2.5. Polish. Semantics. Pragmatics	[Show]
	8.2.9. Polish. Ethnolinguistics	

Figure 2. Example of a record of a paper within a collective monography

Title:	Спроба синтаксичної типології польської і сербської мов	
Author/editor:	Предраг Пипер ; пер. з сербської М. Супрунчука	
Published in:	Паланістыка = Полонистыка = Polonistyka [Show]	
Journal issue:	2002 / 2003 [druk 2004]	
Pages:	59-75	
Languages:	bel	
Abstract:	Переклад artykuła: Предраг Пипер, "Прилог синтаксичке типологije польског и српског језика", [In:] "Études linguistiques Romano-Slaves offertes à Stanisław Karolak" (Kraków, 2003). (EV)	
Author headings:	au. Piper, Predrag	[Show]
	tl. Suprunčuk, Mikita	[Show]
Keywords:	analiza typologiczna , język polski , język serbski , składnia 1 (tworzenie wyrażeń złożonych) , typologia językowa	
Classification:	1.1.1.1. General part. Problems of modern languages. Contrastive studies	[Show]
	8.2.1.4. Polish. Syntax	[Show]
	4.1.4. Serbo-Croatian group. Syntax	[Show]

Figure 3. Example of a journal article record

Examples of bibliographic descriptions in the iSybislaw database are given in the following tables. Figure 1 contains an example of a monographic publication record, Figure 2 gives an example of a record of a paper within a collective monography, Figure 4 provides an example of a journal record, and Figure 3 is an example of a journal article record.

Title: Rocznik Slawistyczny = Revue Slavistique	
Author/editor: red. Franciszek Slawski	
Publication place: Wrocław ; Warszawa ; Kraków	
Publisher: Zakład Narodowy im. Ossolińskich : Wydaw. Polskiej Akademii Nauk	
Year: 1997 - 2017	
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Links: Zawartość czasopisma od tomu 60 (2011)	

Figure 4. Example of a journal record

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