Implementing Web-Oriented Services at the University Library

Andriy Andrukhiv[a], Solomiia Fedushko[a], Maria Sokil[a], Artem Zakharchenko[b], Iryna Shvorob[a], Oleksandr Markovets[a]

[a] *Lviv Polytechnic National University, 79007 Lviv, Ukraine*
[b] *Taras Shevchenko National University of Kyiv, 02000 Kyiv, Ukraine*

Abstract

University library acting an important role in preparing future qualified specialists in various fields by providing them with the necessary informational resources. This paper is focused on its processes. Modern development of automation of library processes in University quite rapidly passes. Implementation of computer and telecommunication technologies in the work of libraries is no longer fashion, but an urgent requirement to improve productivity and quality of library and information services through the creation, usage and integration of electronic resources and the automation of library processes. Created electronic catalogs and arrays of digital documents together with the means of telecommunication are necessary for the fulfillment of the main task is providing users' access to different types of informational resources of libraries at minimum total cost. Acquisition and organizational processes of university library differ from other types of libraries through the connection with the educational process. Informatization performances a huge role in library functioning. Introduction of new systems, including web-oriented library system, such as Koha, helps to provide quality services to the library users, and in a co-pandemic period provide these services remotely. And the statistics presented in the publication confirm this. To solve the current problems completing the library fund is a constant exchange of data between different structural units of high school: teaching management, scientific research department, department, institutes, departments, etc. Relevance of data in such an exchange is quite low, as in the best-case data is updated twice a year, and human resources that are responsible for status of this information is quite large. The library and the appropriate University departments are interested in obtaining relevant data in an automated mode.

Keywords 1

University, library, web-oriented service, web access statistic, library fund, user access.

1. Introduction

Among the factors that provide higher education system functioning information providing (IP) occupies an important place, i.e. the process of satisfaction of informational needs (IN) of students, teachers and scientists for getting education, providing scientific research and various forms of professional and teaching activities. Although the IP of higher education is the main function of higher education institutions' libraries, they are not always able to fully fulfill its purpose through certain technical, legal, financial and other factors [1,2].

In recent years, the structure of higher education and, therefore, higher education institutions have undergone significant changes, such as increasing the number of training programs; multilevel training of students; improvement of educational opportunities such as the introduction of forms of distance

IT&AS'2021: Symposium on Information Technologies & Applied Sciences, March 5, 2021, Bratislava, Slovakia
EMAIL: andriy.i.andrukhiv@lpnu.ua (Andrukhiv A.); solomiia.s.fedushko@lpnu.ua (Fedushko S.); mariia.b.sokil@lpnu.ua (M. Sokil); artem.zakh@gmail.com (A. Zakharchenko); iryna.b.shvorob@lpnu.ua (Shvorob I.); oleksandr.v.markovets@lpnu.ua (O. Markovets)
ORCID: 0000-0001-5915-8855 (Andrukhiv A.); 0000-0001-7548-5856 (Fedushko S.); 0000-0002-3877-8403 (A. Zakharchenko); 0000-0001-5569-2647 (Shvorob I.); 0000-0001-8737-5929 (O. Markovets)

learning; organization of affiliates and others. Thanks to the reform of higher education that provides the Bologna process, implementation of new educational technologies significantly increases the place and role of libraries in university informational security. Through the introduction of the learning process of new standards and curriculum new courses are creating, self-studying of students is activated, causing the gain requirements for IP of educational process.

According to the Program of the Cabinet of Ministers of Ukraine is a necessary part of the development of education should be the introduction of modern informational technology and computerization of schools [1-3]. These technologies and telecommunications networks will help to ensure wide public access to educational resources. According to this, in recent years, informational security, including higher education, is affected not only by traditional but also by electronic means, i.e. based on the effective usage of computer technology, specialized library web sites and electronic databases. Visitors to the library have the opportunity to use electronic periodicals, have online access to a certain number of full-text documents or fragments of selected texts with the possibility of copying on paper or electronic media.

1. Place and role of libraries in informational providing of University

University defines library content of work on recruitment and organization of its funds to provide full educational, scientific processes in universities. Providing literature is considered wholly in the presence of one textbook, training manual on the list of literature for three students. For distance learning is one set of teaching materials for each discipline per student.

Therefore, to improve the quality of the educational process required to establish and manage work to maintain educational process of educational and methodological literature, which is one of the urgent and important tasks in the university libraries.

Traditionally library solves this problem in two ways are quantitative and qualitative content of fund. In the quantitative approach, providing of literature is carried out according to accreditation requirements, which involve the purchase of literature in accordance with applicable regulations. Qualitative formation of the fund provides acquisition of literature needed for performing specific individual plans of the learning process of students. In practice, these processes occur side by side. Under conditions of lack of funding the task of full completing subjects with educational literature is solved step by step.

Modern development of automation of library processes in higher education institutions passes quite rapidly. Implementation of computer and telecommunication technologies in the work of libraries is no longer fashion, but an urgent requirement to improve productivity and quality of library and information services through the creation, usage and integration of electronic resources and the automation of library processes. Created electronic catalogs and arrays of digital documents together with the means of telecommunication are necessary for the fulfillment of the main task - providing users' access to different types of informational resources of libraries at minimum total cost. Acquisition and organizational processes of university library differ from other types of libraries through the connection with the educational process. These features include:

- Target completing of funds (mainly for educational purposes);
- Cyclicity of learning process leads to cycling of books delivery (peak loads of books delivery are held at the beginning of the semester and at the end - the return of the literature);
- The relative stability of the number of library users (the number of graduates is approximately equal to the number of entrants);
- Permanent monitoring of indicators of books providing for timely procurement or cancellation of literature that is used in the learning process.

Respectively, qualitative solving of problems with IP educational and scientific processes is possible through the integration of library informational system with university informational system. Working in such system will allow users to:

- Ease of access to necessary information;
- The reliability and quality of received information;

- A variety of forms of obtaining information;
- Comfort working.

Library a higher education institution plays an important role in preparing future qualified specialists in various fields, providing them with the necessary informational resources. This is what is focused on all of its processes. Providing informational support with usage of modern information technology and the integration with information-analytical system of university management will:

- strengthen the information and management role of the library;
- activate the relationship of the educational process;
- provide the principle of a single entry and data processing;
- provide personal responsibility for the quality of this information;
- reduce errors during transformation or transmission of information.

2. The use of automated library information systems in the work of libraries of higher education institutions

In Ukraine is acute problem of operational access to scientific information. Several years ago, the center of access to scientific information was the library. With the development of informational technology, the Internet has become such a center. This change is related to lag of libraries of Ukraine from scientific communication, which have sooner mastered informational technologies. However, despite the global commercialization of scientific resources, the Internet cannot always provide all the necessary information. Considering tendency of transition, the scientific community to work with electronic documents and the ability to expand the range of provided services, libraries need to need to organize themselves so that to maximize and in the shortest time satisfy informational needs of the user. To solve this problem the automation of library processes is made.

Complex automation of libraries is a difficult task in informational technology that needs to attract skilled workers, such as - librarians, system analysts, linguists and programmers. Library automation is a separate, independent branch of science which originated in the late 70s due to limited financial and human resources.

Properly planned and organized in time process of automation will allow management to ensure the transition of the library to a new platform of services of its users. Of course, this process will bring significant changes to the management of the library itself - there will be new forms of service, completing, the statistical reports will change, etc.

Despite all the problems, informatization of libraries in Ukraine is developing: Automated Library Information System (ALIS) are procured and implemented effectively; new services are developed; existing services are reoriented on the web.

Effectively organized process of automation of the library will:

- faster and better serve the users;
- simplify the work of librarians;
- expand the potential of the library;
- increase the prestige of the library;
- organize effectively its management.

The transformation of the library in Library and Information Centre (LIC) in the near future is inextricably linked to the change of forms and types of services provided to users. This in turn poses new librarians serious tasks associated with the choice and implementation of Automated Library Information System (ALIS) as a means automation of activity of LIC.

Automated Library Information System (ALIS) is a set of software modules that form a comprehensive information system and are designed to control resource of the library [4-8].

Model of functioning of the entire library depends on proper and reasonable choice of ALIS. To date, cost and maintenance cost is a key factor in the choice of ALIS. The price range of such systems is quite large - from free up to $ 200 000. Moreover, the most expensive does not mean best, since such systems may contain features that will never be used, and the money have to be paid for them. Criteria

for selecting ALIS should be contained in project of library automation. In general, the overall ALIS structure can be represented as (Table.1):

Table 1
Simplified ALIS structure

Entry	ALIS	Exit
Orders	Acquisition module	Acts
New Arrivals		Inventory books
Write-off		Reference lists
		Other (e.g. statistic information)
Bibliographic description Accompanying documentation (UDC, list of directories topics, other)	Cataloging and processing fund module	Thematic structured lists
Group Security Policy Lists of users	Security module	Restriction of access rights
Users' enquiries and bookings organizations	Service module	Answers to queries Statistical data
ALIS database	Other modules	Sample of the necessary information from the ALIS database

ALIS consists of the following modules:

- Acquisition module;
- Cataloging and processing fund module;
- Security module;
- Service module;
- Other modules.

Acquisition module covers that part of that has to do with the formation of orders for literature, documenting orders process, preparation of advertising and cancellation of orders, processing of new receipts, necessary operations analysis fund, preparation of statistical information. This module should be able to:

- draw new orders;
- prepare and analyze the needs of the library (for example, which structural unit is provided with literature the least, to properly plan the next purchase of literature);
- print books of summary and inventory accounting;
- plan the fund renovation;
- write off the literature;
- analyze the index of books providing;
- other (depends on the method of fund acquisition and work of acquisition department).

Cataloging and processing fund module is allowing to structure existing in the library literature. A significant advantage of automation of this process is the ability to display the information you need, ask the right format and sort the results. This module must support the following functions:

1. receive structured reference lists filtered by specific criteria (e.g. by UDC, LBC);
2. import structuring criteria (e.g. UDC, directory listings topics);
3. conduct or allow to organize search of electronic catalog common mistakes and correct them;

4. conduct an inventory of the fund;
5. support the possibility of expanding the list of fields to describe the literature (e.g., the ability to add annotations to the bibliographic description, keywords);
6. other (depending on the specific operation of the library. For example, ALIS can be a separate module, giving the parameters of stacks and as a result, the module produces recommendations for optimizing literature placement).

Security module is compulsory module, which regulates access opportunities to a librarian or user to defined database of ALIS. This module plays a critical function in system tracking. Distributed organization of access prevents unauthorized access to the ALIS database (or part thereof). The module should provide:

1. access control (module function that allows you to create a new user in ALIS and give it limited access rights to opportunities or resources ALIS);
2. confidentiality (module function that allows users to see whether librarians limited set of information. For example, to give access of user profiles to a limited number of librarians);
3. integrity (function module that allows access to ALIS functionality regardless of technical or programmatic forms of security, protection of data destruction).

The module has the following criteria:

- control of access;
- identification and authentication;
- event logging and notifications;
- integrity monitoring;
- working capacity restoration.

Basically, this module is used by services that support ALIS. ALIS should include:

- the ability to create user;
- granting him access rights;
- recording user's actions;
- possibility of ALIS software working capacity restoration.

User Service Module is a module designed for the distribution and issuance / return of literature to users. The module should be able to handle:

- information about the issued document;
- user’s profile;
- place of publication;
- information about debtors.
- The module should have the following features:
- automated issue and return of books;
- import / export list of users;
- formation of statistical information;
- interlibrary loan support;
- convenient mechanism of literature search (e.g. for users - electronic catalog of Internet, for librarians - separate one with advanced features seeker);
- functions work with debtors;
- automated order processing from readers (for example, order literature with web forms over the Internet);
- reservation literature for the reader;
- change user status (locked / active);
- recording of services provided (e.g., use of an electronic catalog, providing information, etc.);
- other (depending on the specifics of our users. For example, servicing organizations, servicing users with special needs, print readership demands, print library card, etc.).

ALIS with a minimal set of features is shown in Figure 1.1.

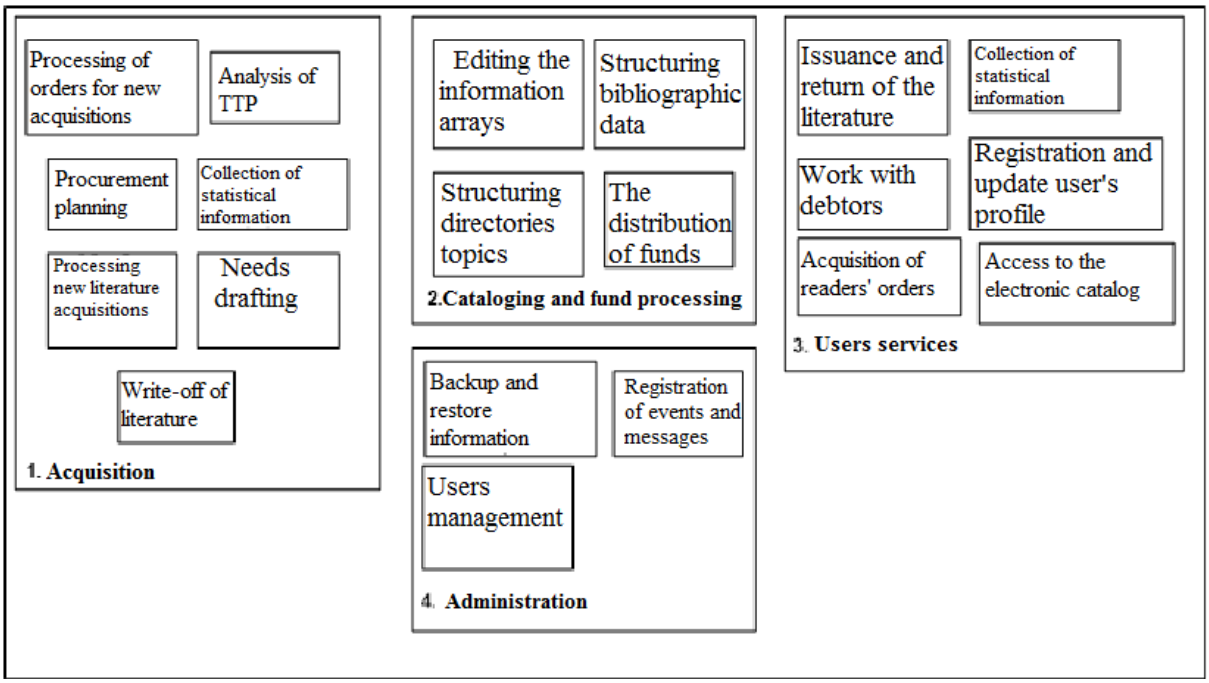


Figure 1: Typical ALIS structure with a minimal set of functions

The service module is a key in ALIS, since all processes of library activities are designed to meet information needs of the user and the module aggregates the results of other modules.

Other modules - designed to solve related problems of ALIS. These modules include:

- exchange module of bibliographic information;
- ALIS integration module to another information system;
- synchronize information module with other systems;
- modules specialized sampling or data processing;
- module providing background information;
- others.

Additional modules are designed to extend the functionality of ALIS, add new functions and features, and thus attract new users and existing - to expand the range of services, making their work more productive and comfortable.

Described general structure of ALIS will form requirements to select or change the library system. It is important to understand that implementing ALIS in work all its functions will not be available immediately. It is a gradual process. For example, first module is implemented and tested acquisition, then readers' service, etc. Currently on the market is represented a series of library systems from developers from the whole world. In Ukraine there are installed such systems as UFD / Library; Ruslan; IRBIS; Koha; Liber; Aleph; Alma, Marc-SQL and others. Each of these systems has its own characteristics, but they all accomplish the basic automation of main library processes. Because the library is a unit of the University, it is quite natural that its system should also be part of University IS. Autonomy of information products that are introduced in the school complicates their interactions or makes it quite impossible. Therefore, implementing ALIS, you need to provide for the possibility of full or partial integration of IS University.

This can be achieved in two ways:

- by developing a module for ALIS. This module can already enter the ALIS, or should be possible to create such a module;
- using an information system of the University in composition of which ALIS is now part of.

This integration can be realized exclusively under the conditions:

- the availability of appropriate software and hardware solutions;
- arrangement of automated workplaces;

- appropriate staff training;
- understanding the necessity of working together in a single system, which can lead to structural reorganization and prepare appropriate regulatory guidance materials.

Construction of an integrated library system is quite long and complex process that requires coordination and control at all stages of implementation and support of the management of the university, creating project.

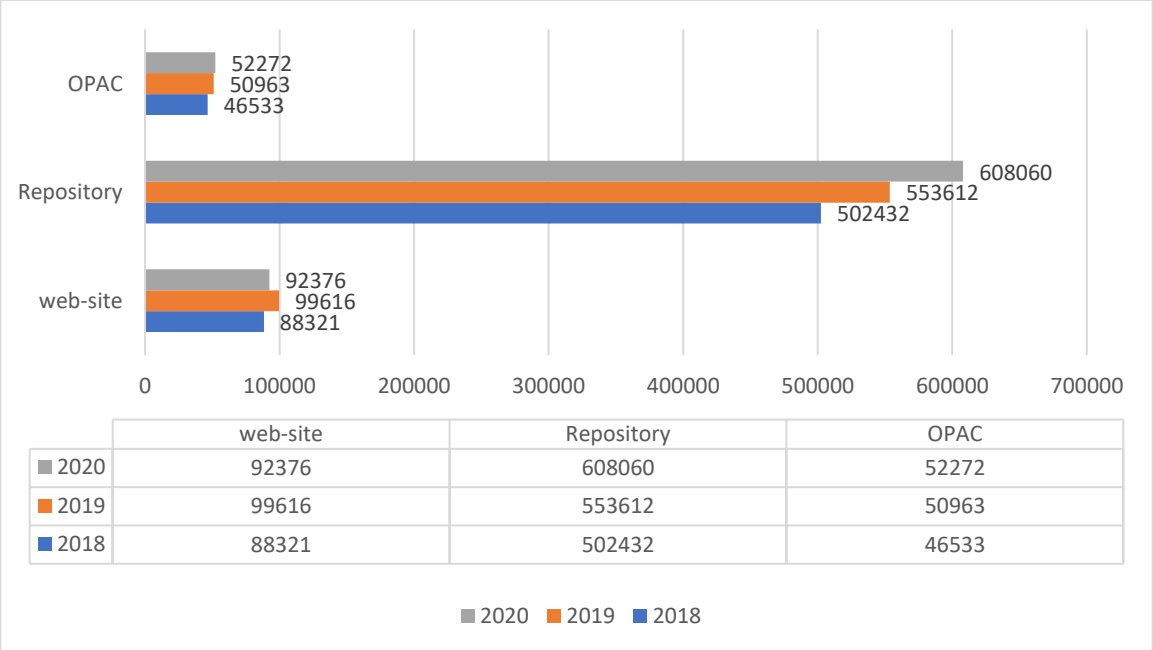
University libraries have certain characteristics that must be considered when selecting and operating ALIS:

- availability of literature with many instances;
- distance learning;
- specificity of acquisition: educational literature according to the curriculum; research - in accordance with the work program, current and future training curriculum specialists;
- Permanent transformation of reference lists, which is used in the learning process by updating courses, opening new departments and specialties.

Introduction to the work of the integrated library system will require reorganization of relationships between different units of high school. As a result of these relationships become more transparent, will be clearly marked persons who are responsible for the quality of information and quality of work of the unit. For efficient operation such a system an information model with clearly highlighted information flows, the scheme of processing and data exchange standards needs to be built.

3. Results

In 2020 the Scientific Library of Lviv Polytechnic National University introduced a new library system – KOHA. The main purpose of implementation is integration into the information environment of our university. As the result, it helps us to survive in COVID epidemy are users used our services not less than in 2019. On the Figure 1.2 you can see web access statistics to our resources.



	web-site	Repository	OPAC
2020	92376	608060	52272
2019	99616	553612	50963
2018	88321	502432	46533

Figure 2: Web access statistics to web-site(library.lpnu.ua), repository (ena.lp.edu.ua), OPAC (opac.lpnu.ua)

A new Library OPAC contains 565626 bibliographic records. It was created by the data analyses and transport from the other LIS which was worked until 2020. On the Figure 1.3 you can see the development dynamic of OPAC.

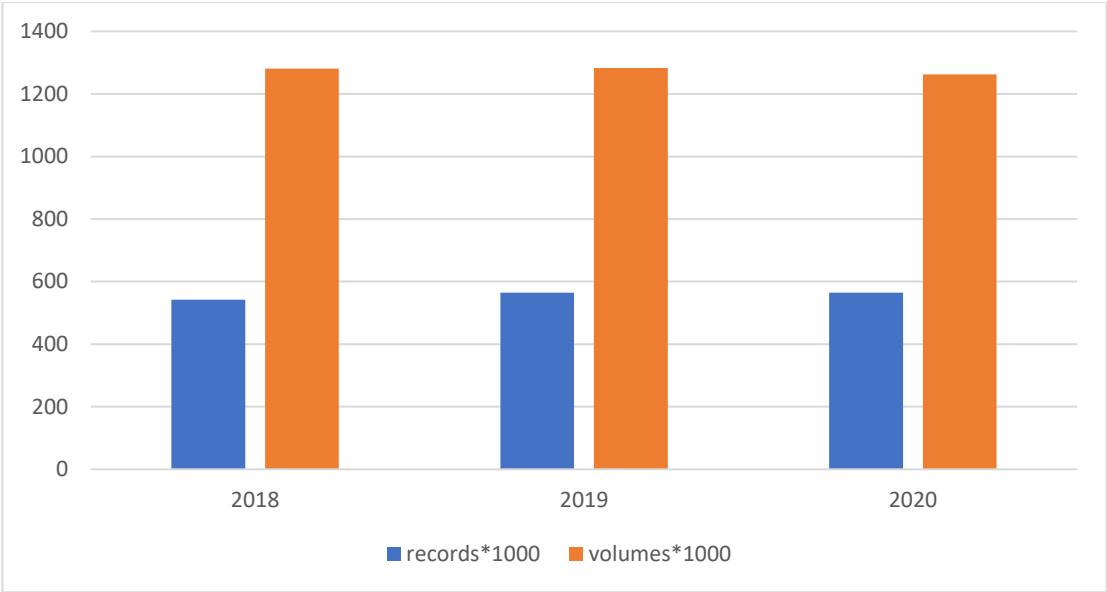


Figure 3: The development of OPAC

Among with the introduction of the new library system, work continued on filling with institutional repository (as can you see on Figure 1.4)

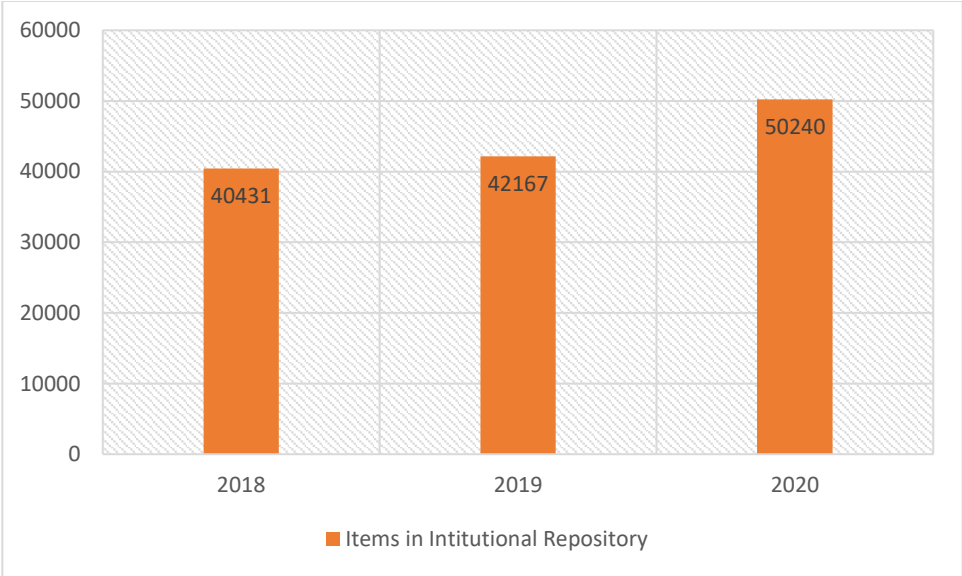


Figure 1.4 The development and filling of Institutional Repository (ena.lp.edu.ua)

From 2017 in Scientific Library proxy server is working. It organizes remote access to all electronic databases via LDAP authorization. All students and employments have access. In 2020 this service has been very requested (as you can see on Figure 1.4)

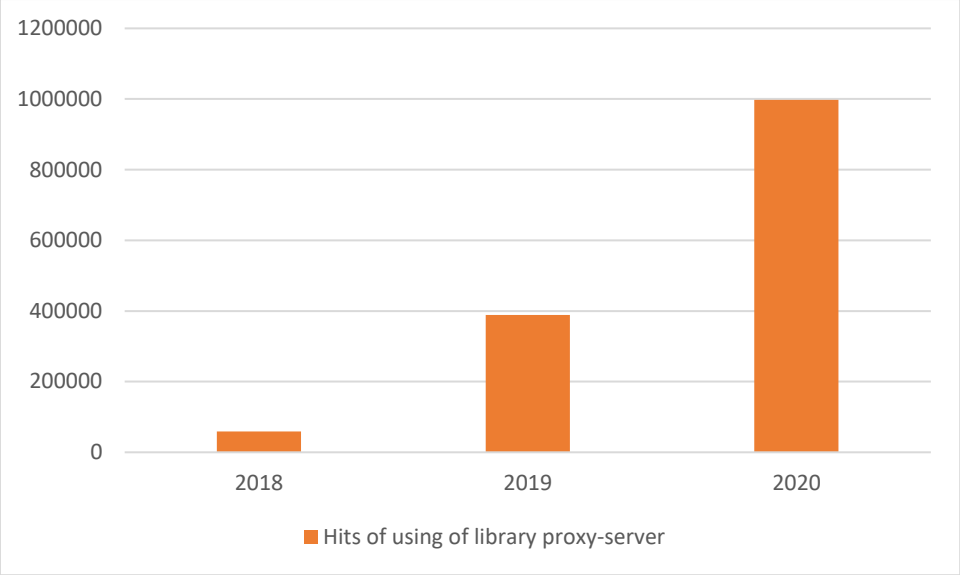


Figure 4: Using statistic of proxy-server

Therefore, informatization plays a huge role in library functioning. Introduction of new systems, including web-oriented library system, such as Koha, helps to provide quality services to the library users, and in a co-pandemic period provide these services remotely. And the statistics presented in the publication confirm this. However, it should be understood that informatization is not limited to the library system. You need to pay attention to the website, other specialized web services and support them.

3.1. Traffic & Engagement of Lviv Polytechnic Scientific Library Repository

Traffic & Engagement of repository of Lviv Polytechnic Scientific Library also analyzed by means of special software Similar Web. The main parameters are shown in Table 2.

Table 2
Engagement overview (Jan 2020 - Mar 2020)

Parameters	Value
Monthly visits	48,398
Monthly Unique Visitors	36,243
Visit Duration	00:00:56
Pages / Visit	1.27
Bounce Rate	85.65%

The statistics of visits over time and the trend of visits over the period from January to March, 2020 of Lviv Polytechnic Scientific Library Repository is shown in Figure 5.

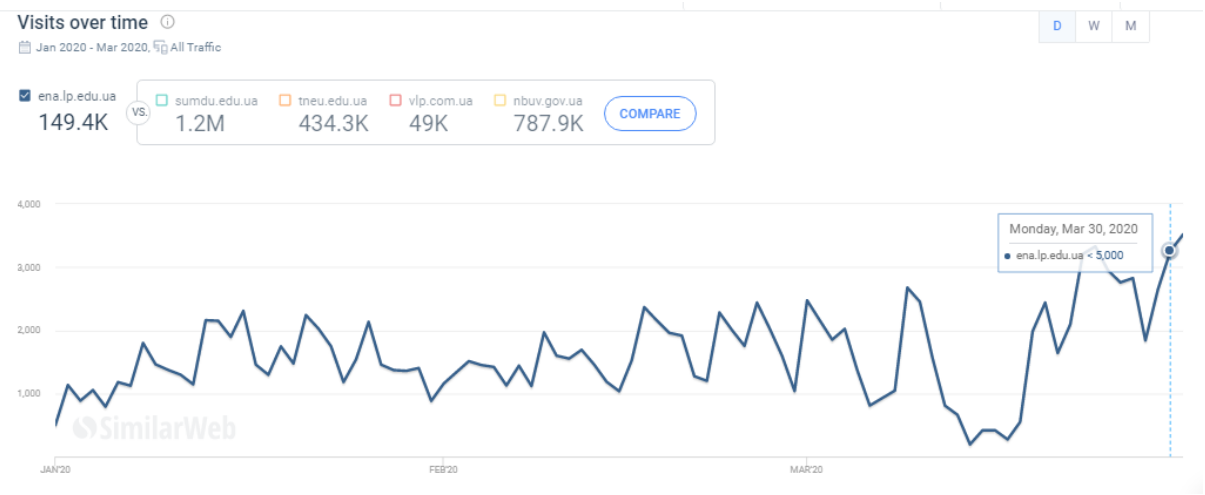


Figure 5: Visits over time

The Traffic and Engagement the period from January to March, 2020 of Lviv Polytechnic Scientific Library Repository is shown in Figures 6 - 10.

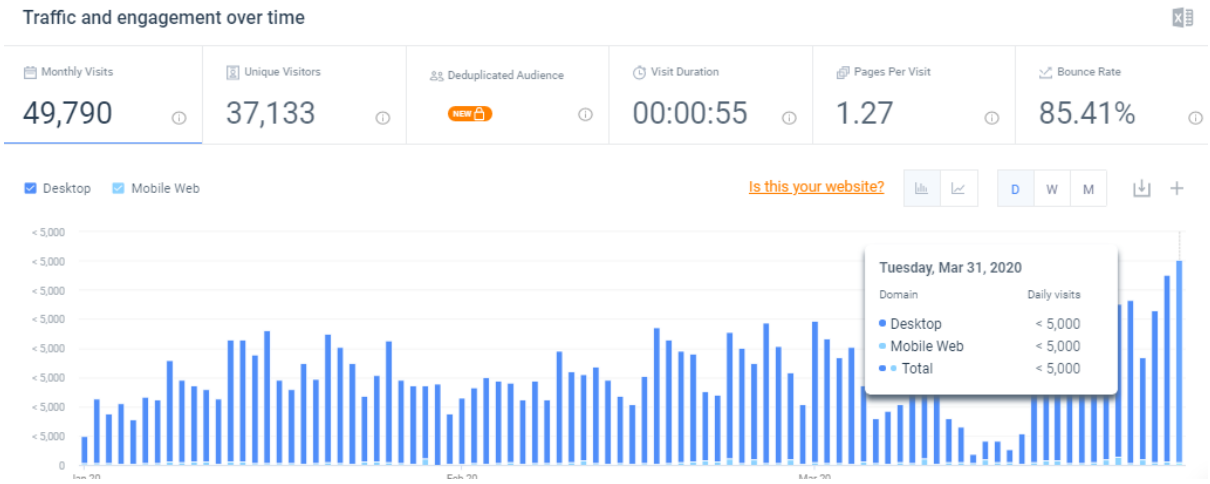


Figure 6: Traffic and Engagement over time

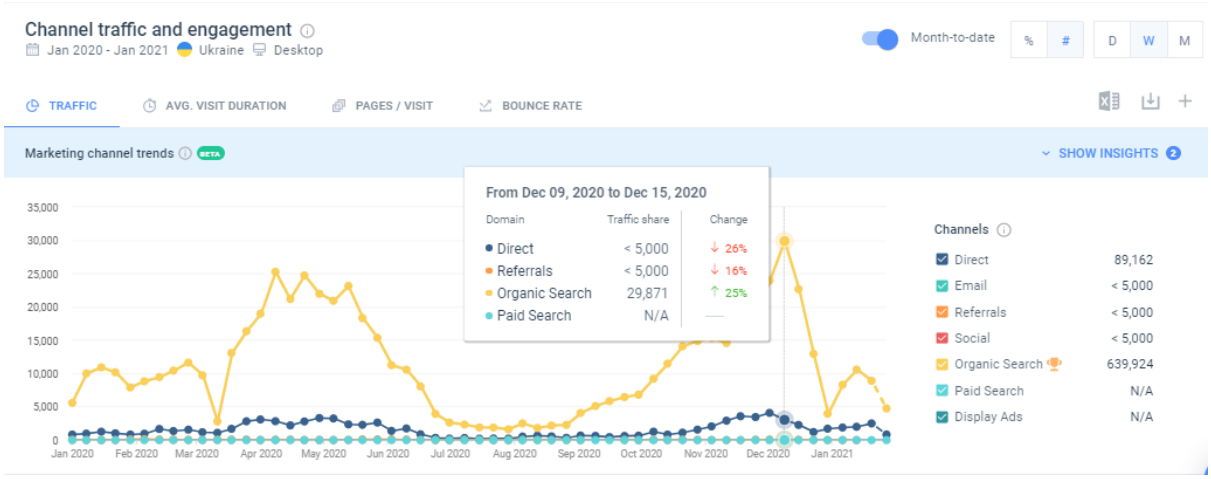


Figure 7: Channel Traffic and Engagement (weekly)

Figure 8: Average visit duration: Channel Traffic and Engagement (daily)

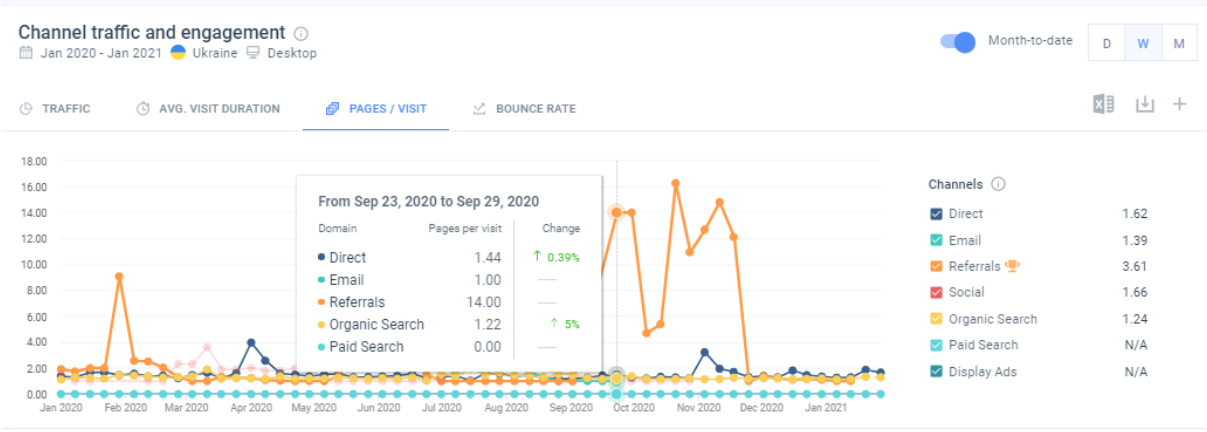


Figure 9: Pages/visit: Channel Traffic and Engagement (weekly)

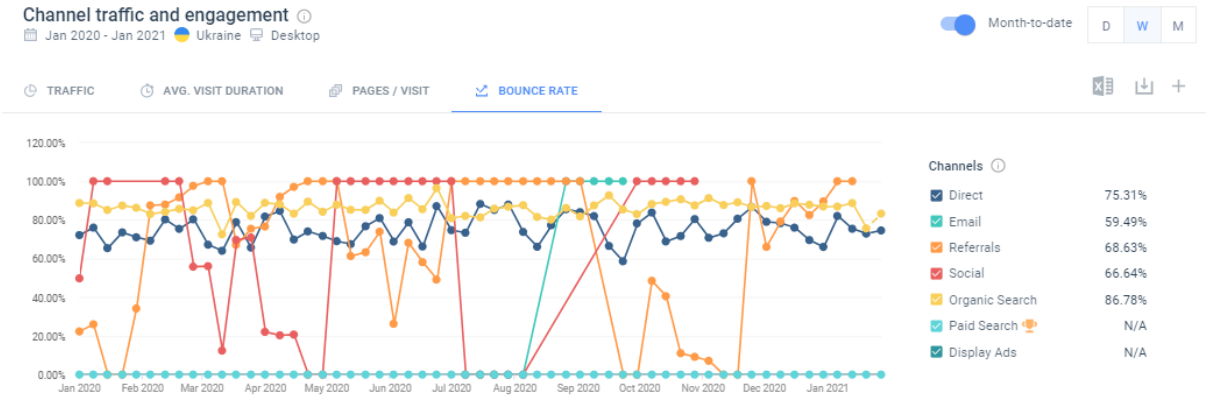


Figure 10: Bounce rate: Channel Traffic and Engagement (weekly)

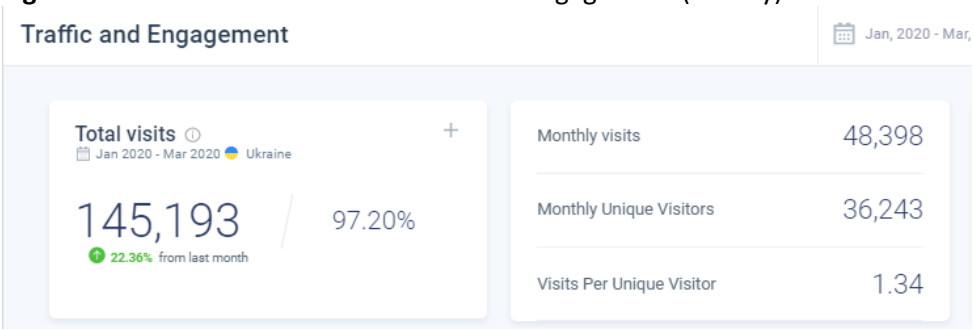


Figure 11: Total visitors: Traffic and Engagement

Traffic share by country is represented in Figure 13.

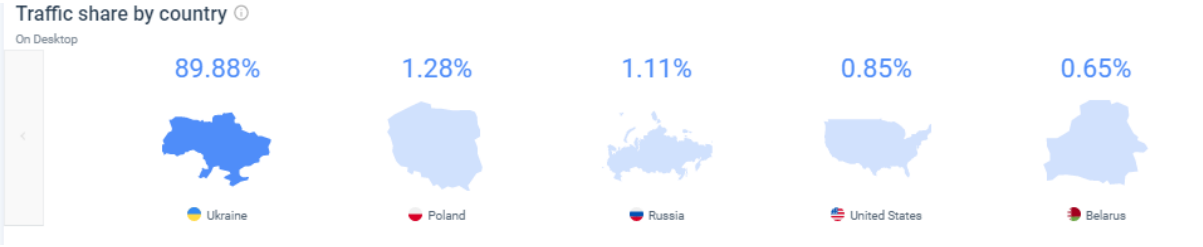


Figure 12: Traffic share by country

Percentage of traffic share of Lviv Polytechnic Scientific Library Repository is sent to website by the following countries: Ukraine (89.88%), Poland (1.28%), Russia (1.11%), United States (0.85%), and Belarus (0.65%).

4. Conclusion

To solve the current problems completing the library fund is a constant exchange of data between different structural units of high school: teaching management, scientific research department, personnel department, institutes, departments, etc. Relevance of data in such an exchange is quite low, as in the best-case data is updated twice a year (at the beginning or the end of each semester), and human resources that are responsible for status of this information is quite large. Therefore, the library and the appropriate University departments are interested in obtaining relevant data in an automated mode. For example, information on student's debt in library or employee may be assigned to the dean's office, accounting and others. This can eliminate the circulation of certain documents, for example bypass lists. Information about the timing of enrollment and expulsion of students from IS institutions can be used to determine the dates of the start / end of service for students in the ALIS.

5. References

[1] K. D. Abbas, Automation in Nigerian University Libraries: Mirage or Reality? Information and Knowledge Management 4(4), 2014. www.iiste.org

[2] O. Adara, Koha Uptake in Nigeria: Prospects and Challenges. Paper presented at the KOHACon conference, International Institute of Tropical Agriculture, Ibadan Nigeria, 2010.

[3] O. Adara, Managing Koha installs in a developing country. Presentation at Kohacon12, Edinburgh, Scotland, 2012.

[4] R.A. Egunjobi, R.A. and Awoyemi, "Library automation with koha", Library Hi Tech News, Vol. 29, No. 3, 2012, pp. 12-15.

[5] K. Molodetska, Yu. Brodskiy, S. Fedushko, Model of Assessment of Information-Psychological Influence in Social Networking Services Based on Information Insurance. CEUR Workshop Proceedings. Vol 2616: Proceedings of the 2nd International Workshop on Control, Optimisation and Analytical Processing of Social Networks (COAPSN-2020), Lviv, Ukraine, May 21, 2020. p.187-198. http://ceur-ws.org/Vol-2616/paper16.pdf

[6] S.J. Haider, "Library automation in Pakistan", The International Information and Library Review, Vol. 30 No. 1, 1998, pp. 51-69.

[7] M. D. House, "Implementing the open-source Koha-ILS at the Deutsche Schule Charlotte", Digital Library Perspectives, Vol. 32 No. 4, 2016, pp. 253-269.

[8] B. Joy, "KOHA and LIBSYS: a comparative study", Journal of Advances in Library and Information Science, Vol. 3 No. 4, 2014, pp. 350-35

[9] S.R. Ponelis, and P. Adoma, "Diffusion of open source integrated library systems in academic libraries in Africa: the case of Uganda", Library Management, Vol. 39 Nos 6/7, 2018, pp. 430-448.

[10] T. Yavorska, O. Prihunov, Y. Syerov, Libraries in Social Networks: Opportunities and Presentations. CEUR Workshop Proceedings. 2019. Vol 2392: Proceedings of the 1st International Workshop on Control, Optimisation and Analytical Processing of Social Networks, COAPSN-2019. P. 242–251.
[11] J. Pruett, and N. Choi, "A comparison between select open source and proprietary integrated library systems", Library Hi Tech, Vol. 31 No. 3, 2013, pp. 435-454.
[12] M. Rafiq, and K. Ameen, "Adoption of open source software in Pakistani libraries: a survey", Information Age, Vol. 4 No. 3, 2010, pp. 35-38.
[13] C. R. Todd, "Librarian as data migrator: a functional pathway from millennium to koha", Digital Library Perspectives, Vol. 34 No. 1, 2018, pp. 60-69.
[14] A. Rehman, K. Mahmood, R. Bhatti, "Free and open source software movement in LIS profession in Pakistan", Library Philosophy and Practice, Vol. 1, 2012.
[15] I. Walls, "Migrating from innovative interfaces' millennium to Koha: the NYU health sciences libraries' experiences", OCLC Systems and Services: International Digital Library Perspectives, Vol. 27 No. 1, 2011, pp. 51-56.
[16] S.Q. Yang, and M.A. Hofmann, "The next generation library catalog: a comparative study of the OPAC of koha, evergreen, Voyager", Information Technology and Libraries, Vol. 29 No. 3, 2010, pp. 141-150.
[17] N. Boyko, V. Korkishko, B. Dohnyak, O. Vovk "Use of Neural Networks in Q-Learning Algorithm". 32nd International Symposium on Computer and Information Sciences, ISCIS 2018: Computer and Information Sciences, Poznan, Poland, September 20-21, 2018, pp. 188-195.
[18] N. Boyko, N. Tkachuk. Processing of Medical Different Types of Data Using Hadoop and Java MapReduce : The 3rd International Conference on Informatics & Data-Driven Medicine (IDDM 2020), Växjö, Sweden, November 19-21, 2020, CEUR. pp. 405-414.
[19] E. G. Morton-Owens, K. L. Hanson, I. Walls, Implementing Open-Source Software for three Core Library Functions: A Stage-by-Stage Comparison. Journal of Electronic Resources in Medical Libraries, 8 (1), 2011, pp.1-14.
[20] S. Omeluzor, et. al. Implementation of Koha Integrated Library Management Software (ILMS): the Babcock University Experience. Canadian Social Science, vol. 8 (4), 2012, p. 211-221.
[21] T. Yavorska, O. Prihunov, Yu. Syerov, Efficiency of Using Social Networks in the Period of Library Activity in Remote Mode. CEUR Workshop Proceedings. Vol 2616: Proceedings of the 2nd International Workshop on Control, Optimisation and Analytical Processing of Social Networks (COAPSN-2020), Lviv, Ukraine, May 21, 2020. p. 214-226. http://ceur-ws.org/Vol-2616/paper18.pdf
[22] A. A. Süzen, "A Risk-Assessment of Cyber Attacks and Defense Strategies in Industry 4.0 Ecosystem," IJCNIS, vol. 12, no. 1, pp. 1–12, Feb. 2020, doi: 10.5815/ijcnis.2020.01.01.
[23] I. Davydova, O. Marina, A. Slianyk, Y. Syerov, Social Networks in Developing the Internet Strategy for Libraries in Ukraine. CEUR Workshop Proceedings. 2019. Vol 2392: Proceedings of the 1st International Workshop on Control, Optimisation and Analytical Processing of Social Networks, COAPSN-2019. P. 122–133.
[24] Dong, Baoli, et al. "Web service-oriented manufacturing resource applications for networked product development." Advanced Engineering Informatics, 22.3, 2008, pp. 282-295.
[25] A. Cowgill, J. Beam, & L. Wess, Implementing an information commons in a university library. The Journal of Academic Librarianship, 27(6), 2001, 432-439.
[26] Ahamed. M. Mithun and Z. A. Bakar, "Empowering Information Retrieval in Semantic Web," IJCNIS, vol. 12, no. 2, pp. 41–48, Apr. 2020, doi: 10.5815/ijcnis.2020.02.05.
[27] C. R. Bowron, & J. E. Weber, Implementing the READ scale at the Austin Peay State university library. The Journal of Academic Librarianship, 43(6), 2017, 518-525.
[28] Darch, Peter T., et al. "Library cultures of data curation: Adventures in astronomy." Journal of the Association for Information Science and Technology 71.12, 2020, pp. 1470-1483.