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CREATION AND DEVELOPMENT OF COMFORTABLE INFORMATION ENVIRONMENT OF SCIENCE AT THE UNIVERSITY: LIBRARY CONTRIBUTION

The **objective** of the study was identification of essential characteristics of a comfortable information environment of science and determining the role of the University library in its creation and development. **Methods.** The information base of the research consists of the publications of researchers and specialists on the problems under study, as well as of the results obtained during the research works of the authors of the article; both were interpreted by the authors and set out in the context of the research objective. **Results.** The findings are the presented analysis of definitions of the notions of "information environment", "information environment of science", "comfort of information environment". Essential characteristics of comfortable information environment of science are featured. The practical value of the research is the applicability of the results to the work of other University libraries. **Conclusions.** It is stated that the Belarusian National Technical University Scientific library makes a significant contribution to the creation and development of a comfortable information environment of science of the University by means of the introduction into practice of such activities as: information support of applied research and experimental development carried out in a number of priority areas of scientific and technical activities in the Republic of Belarus, the creation and maintenance of open access resources, the formation of the needs of scientists and researchers in primary scientific data, advisory work on researchers registration in various systems of identification of author profiles, bibliometric research.

Keywords: information environment; information environment of science; comfort of information environment; open access resources; primary research data; institutional repository; bibliometric research; scientific serials; scientific journals; systems of identification of author profiles; information support; information services; digital transformation of science

Introduction

The development of information and communication technologies and their integration into research processes and scientific communication poses new challenges for university libraries in the context of the implementation of the traditional function related to the information support of scientific and educational processes. In this regard, the question arises: how to create a comfortable information environment for science at the university, with all the variety of tools and services existing today within the framework of the information infrastructure of science, which allow realizing various goals and tasks of research nature? To solve this problem, it is necessary to determine the essential characteristics of the comfortable information environment of science and the role of the university library in its formation and development.

Methodology

The information base of the study was made up of publications by scientists and specialists in the field of research, as well as the results obtained during the research works of the authors of the article. Both the first and the second sets were interpreted by the authors and considered in this article in the context of the purpose of the study.

Results and discussion

At first sight, the term “information environment” is among the intuitive ones. At the same time, an analysis of the literature on this topic indicates the ambiguity of its interpretation. As an example, let us consider some of them.

The very first definition, proposed by the Internet when entering a corresponding request in Google, interprets the information environment as “a combination of technical and software means for storing, processing and transmitting information, as well as the socio-economic and cultural conditions for the implementation of information processes” (“Informatsionnaya sreda”, 2019). The first part of the definition assumes that the storage, transmission and processing of information without hardware and software is impossible, which cannot be disagreed, given the exponential growth of information volumes in the modern world. The second one places an additional emphasis on telecommunications, since “informatization” is “policies and processes aimed at building and developing a telecommunication infrastructure that unites geographically distributed information resources” (“Informatizatsiya”, 2019).

The following definition interprets the information environment as “a set of information conditions of the subject existence (this is the availability of information resources and their quality, development of information infrastructure). The information environment represents the conditions for the development of the subject “<...>, however, the degree of its preference is determined by the internal characteristics of the subject,” namely, a priori awareness, cognition, his/her information needs (Smirnov, 2001). Here, the reference to the role of information environment in the development of a subject and the dependence of development not only on the environment, but also on the subject's thesaurus are important. A remark about the role of the subject's thesaurus is also expressed by Yu. A. Shreider (1976). Namely, in his statement that in one case “the comfort of the information environment can be achieved by improving the search accuracy (in this case, the information service reduces the consumer’s choice, cutting off noise for him/her), and in another case, by providing scientific information with the necessary meta-information. In this latter case, comfort consists in increasing the possibilities of choice for the consumer him/herself. With this approach, the determining criterion is not the criterion of sufficiency and quality of information resources, but the criterion of quality (comfort) of the information environment” (Shreider, 1976, p. 4).

T. A. Ozhereleva notes that “the information environment <...> is created by a person to solve his/her tasks” and therefore “can be used as a support system or as a management subsystem” (Ozhereleva, 2014, p. 23). In the definition of this author, the information environment is considered as part of the “information field” (Ozhereleva, 2014, p. 23), which is interpreted as “a reflection of the properties and characteristics of the surrounding world” (Tsvetkov, 2014, p. 551).

Consideration of various definitions of the concept of “information environment” convinced us that in relation to the *information environment of science*, we should focus on the concept presented in the work of K. A. Kalyuzhnyi (2015). This author rightly notes that if “space exists around a person, regardless of a person, his/her values and ideas,” then the environment “on the contrary, is always humanized and concrete, obviously assumes the presence of a person or society. The environment is gradually formed by a person and at the same time affects him/her. The environment, unlike space, is always inhabited by people, fixing the results of their activities and expressing their relationships. Thus, a certain part of the space is projected into the environment, on which a variety of prints of social processes is superimposed” (Kalyuzhnyi, 2015, p. 11). Moreover, "the content of the information environment is various forms of discourse – oral and written speech, computer records <...>, a constantly ongoing scientific dialogue <...>, as well as knowledge as a special form of information alienated from the personality of the researcher and becoming the public domain

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<...>. In general, <...> the information environment is quite complex and heterogeneous. It includes “personal contacts, correspondence, exchange of manuscripts, preprints and prints, seminars and conferences, scientific journals and other publications, as well as a scientific information system that provides scientists with an ever-expanding range of information services” [1] (Kalyuzhnyi, 2015, p. 15).

Accordingly, the information environment is defined as “the anthropogenic part of the space in which the subjects and objects of information processes supported by the information infrastructure and related to the search, processing and storage of information and knowledge interact and self-organize” (Kalyuzhnyi, 2015, p. 17). Its first function is “to consolidate and reproduce information and knowledge”, and the second one is to ensure the comfort of “information exchange. Herewith, comfort is understood subjectively, in the sense that some subjects find it useful to use an expanded set of capabilities for searching, processing and storing information, while others require narrowing this set to the minimum necessary for making a choice” (Kalyuzhnyi, 2015, p. 18). Here, a quote from an old publication by Yu. A. Shreider is appropriate, which clarifies that “the comfort of the information environment can be achieved by <...> providing scientific information with the necessary meta-information. In this <...> case <...> comfort consists in increasing the choice of the consumer him/herself” (Shreider, 1976, p. 4).

Among the signs of the information environment of science, to which A. K. Kalyuzhnyi puts our attention, we note “openness” (Kalyuzhnyi, 2015, p. 18) and “redundancy” (Kalyuzhnyi, 2015, p. 19). At the same time, we take “redundancy” as a condition of reliability and, therefore, the comfort of the information environment.

One of the distinguishing characteristics of the information environment of science is a limited circle of participants in information processes, which include scientists, researchers and administrators of science. The comfort of the information environment is both its ability to provide each of the participants with the selected documentary information and ready-made solutions for transmitting the documentary information they generated into its channels (publications, etc.) and repositories etc., as well as the ability to provide them with the opportunity of comfortable independent information exchange and search. The comfort of the latter is natural to understand not only as the convenience of their implementation, but also as providing the acceptable completeness of the reflected documentary information and the relative compactness of its “channels and repositories” at the same time.

What is the role of the Scientific Library of the Belarusian National Technical University (hereinafter – BNTU) in the formation of a comfortable information environment for science, capable of ensuring the consolidation and reproduction of information and knowledge and the effective satisfaction of research needs?

In the framework of this paper, we will not consider the traditional direction of the library's activities related to information support of the scientific and educational processes of the university through the organization of licensed access to world scientific databases of full-text journals of world scientific publishing houses and citation indices. In terms of providing scientists and researchers with documentary information selected for them let us dwell on the preparation of a system for informing responsible executors of research work carried out in a number of Priority areas of scientific and technical activity in the Republic of Belarus for 2016 – 2020, approved by the Decree of the President of the Republic of Belarus of April 22 2015, No. 166[2]. The system being created is based on the following considerations:

[1] The quote inside the quote refers to (Ozhereleva, 2014, p. 3).

[2] Research work "Development of a bibliometric methodology for the selection and evaluation of the world scientific periodicals, the publications in which are necessary for the high-quality implementation of scientific research in the Republic of Belarus."

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1. The comfortable information environment necessary for researchers in natural sciences and technology should combine the requirements of content redundancy and relatively limited volume.
2. Neither non-critical involvement of the services of the most famous publishers and information providers, nor, moreover, the use of the cheapest options for "subscription packages" and sources of open access, guarantees effective scientific and information services for research in a particular branch of science. In the context of the rapid growth of the world information resources and against the background of limited financial abilities for their use to organize the scientific and information services of the researchers, it is necessary to attract precisely those databases, "subscription packages", and other sources about which there is reasonable evidence that they will provide access to the information necessary for research in sufficient volume and diversity in the best way.
3. The most important, demanded and universal channel of documentary scientific information on science and technology[3] are scientific journals – a channel through which a researcher is provided with about seventy or more percent of the corresponding world documentary flow.
4. Other (in addition to scientific journals) serial publications (periodicals and continuing collections, series of monographs) provide coverage of the proceedings of the most important international industry conferences and summarizing monographs, manuals and guides on the most important problems of the industry (since they often appear in the form of continuing serial publications).
5. Databases, publishers, provider services, "subscription packages", etc. selected for the organization of information services should be evaluated by the presence in them of at least 60-80% of the cited serial publications.

For the purpose of this selection, a bibliometric methodology was developed. It is based on the use of citation analysis at the level of serial publications with a "citation window" of one year, and includes accounting the cumulative figures of citations to publications that are made in the *selected specialized source journals* and calculating the "*discipline impact factor*," i.e. an indicator similar to the "impact factor" (the ratio of the number of references to the number of publications). However, in the numerator of this latter indicator there is a citations figure to the publications being evaluated that are made not in all journals indexed by JCR, but only in the **selected specialized** journals (Hirst, 1978). The difference from the Hirst's methodology is that the "publication window" is chosen equal to "5+1" year, that is, the five previous years and the year during which the references were taken into account. Moreover, as additional steps, the methodology also includes selection based on the data on citations given by the serial editions being evaluated to *specialized journals*, with a "citation window" of one year and a publication window of "5+1", with a choice of *citing* publications, respectively, as well as the calculation of the "discipline susceptibility factor," that is, the ratio of the number of references made during the year in the serial publications being evaluated to the publications of highly specialized journals to the number of publications in *citing* publications during one year. An example of such a study is (Lazarev & Yurik, 2018). As a result, ranked lists of the relevant thematic periodicals were compiled (placed in the figshare open data repository); the totality of databases necessary to create a comfortable, reasonably compact and complete research environment has been determined; methodological recommendations on the selection of the world scientific serial

[3] Information service of social sciences is not considered in connection with other laws of functioning of scientific communications in them, although BNTU has quite powerful research schools in social sciences as well.

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publications have been developed to improve information services for specialists in the natural sciences and technology.

Since 2012, the library has supported a repository based on DSpace software to place and store documentary information generated by scientists and researchers of BNTU. The repository is one of the largest in the Republic of Belarus and contains, by the end of 2018, 45,025 documents. In 2018, the number of virtual visits to the repository amounted to 43,2129, the number of “electronic issues” of documents – 1,780,000.

It should be noted that the Scientific Library supports the principles of open science and actively implements open access to publications in practice, by not only creation and support of a university repository, but also by five sites of BNTU scientific journals. Since 2014, the scientific journal management system has been operating on the platform http://ejournal.by/, which ensures compliance with international standards for the presentation of content. Currently, access is provided to more than 4,500 publications. Since 2017, all manuscripts of articles received in the BNTU journals through the system are tested by the ANTIPLAGIARISM system. The library actively interacts with the editions of scientific journals of BNTU, rendering all possible assistance in bringing the journals in line with international requirements, for example, in the preparation of reference lists in accordance with internationally accepted citation styles.

The transition to an open science model involves providing free access not only to scientific articles, but also to the primary scientific data of experimental studies. By open scientific research data, we mean the type of open data representing the results of scientific research available on the Internet for free download, modification and distribution without any legal or financial restrictions (York University, (n.d.)).

The general availability of scientific primary data makes it possible to compare the results of experiments conducted by various researchers, increases the reliability of conclusions, and maintains transparency and reproducibility of data, strengthening confidence in science. Among the expected results from the use of open research data are: 1) the growth of the scientific segment and increase in its influence and usefulness; 2) more transparent mechanisms for assessing and monitoring scientific activity; 3) effective models of management, forecasting, strategic planning (Kachan et al., 2018).

We believe that the formation of a modern comfortable information environment for science at the university is impossible without expanding the range of information services that form the need of scientists for the primary scientific data of experimental studies. The first step in the development of this direction of the library was the study of world experience. In 2017, a group of experts, including one of the authors of this material, in the framework of the research project "Analysis of world experience and development of proposals for a development strategy for 2018-2020 and for the future until 2025 of the system of scientific, technical and innovative information of the Republic of Belarus as an element of the national innovation system” analyzed global trends in the digital transformation of science and education and compiled a list of digital tools designed to assist researchers at each stage of the research life cycle. Identified digital tools act as platforms for the publication of scientific data, exchange of experience, open discussion of the research process and results. Among them there are: a variety of search engines, repositories of scientific works (ArXiv, biorXiv, F1000, etc.), repositories for preparing and posting data (re3data.org, Dryad, Figshare, Zenodo, etc.), open source repositories (BioLINCC, GitHub, DataHub, etc.), universal (Twitter, Facebook, Google+, LinkedIn, etc.) and specialized scientific social networks (Academia, ResearchGate, Mendeley, etc.), online platforms for working with bibliographic data (bibliographic managers) (CiteULike, Zotero and Mendeley etc.), peer review services (Publons, Academic Karma, Journal Review, etc.), etc. (Kachan et al., 2018).

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The next step is to place on the website of the Scientific Library a section on primary scientific data – from an introduction to the topic (definition of a concept, the possibility of data management) to recommendations on the use of digital tools for the preparation and placement of scientific primary data. And finally, the introduction of services related to providing assistance in finding the data necessary for research; recommendations of sources for placing primary scientific data and preprints of BNTU researchers and assistance in placing data etc.

The service associated with assisting in the selection of journals for the assumed publication of research results that are fully consistent with the needs, capabilities or desires of the researcher is gaining popularity. This refers to both the selection of the leading world journals in a specific scientific field (in accordance with a bibliometric assessment), and, for example, the fourth quartile journals, however, indexed in Web of Science or Scopus. Both the selection of journals at the request of researchers, as well as the corresponding training courses take place.

A popular area of the library's activity is assistance in registering researchers in various author profile systems: Goodge Scholar, ORCID, ResearcherID and RSCI. The number of trainings on this issue conducted by the library is measured in dozens, consultations – in hundreds, as the number of profiles created only in Goodge Scholar from December 2016 to the present, it has increased from 200 more than ten times. These measures are designed to increase the visibility of the work of BNTU researchers by the international community. At the request of the researchers, they are also consulted on the use of the ResearchGate research social network and Mendeley cloud service for data distribution, where one can directly store both one's publications and related factual information in a format convenient for the international scientific community.

Productive information services for scientists, researchers and administrators of science are no longer presented without a bibliometric examination. It includes the following areas: collection, structuring, coordination and interpretation of bibliometric data; organization of consultations for the administration, departments and staff of the university; conducting research on scientific productivity, national and international cooperation. Every year, an assessment is made of the effectiveness of the publication activity of BNTU researchers as a whole. It is based on the study of their citation and publications in leading world journals; such an assessment is carried out for individual researchers at their request; researchers training on bibliometric techniques of such self-esteem is organized according to their requests.

A number of the described directions are reflected to one degree or another on the website of the BNTU Scientific Library – http://library.bntu.by.

Conclusion

Introducing into practice of the Scientific Library of BNTU such areas of activity as information support of applied research and experimental development carried out in a number of priority areas of scientific and technical activity in the Republic of Belarus, the creation and support of open access resources, the formation of the needs of scientists and researchers in primary scientific data, advisory work on registration in various systems for identifying author profiles, bibliometric studies, - contributes to the formation and development of a comfortable information environment of science at the university. It is capable of ensuring the consolidation and reproduction of information and knowledge and the effective satisfaction of a whole range of information needs of scientists, researchers and administrators of science. In addition, new directions allow the librarians to form competencies necessary for successfully solving the problems of searching and processing scientific information in the context of the digital transformation of science; strengthen the integration of the library into management processes;

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increase the prestige of the library within the university; improve the “visibility” of the library in a broad academic context.

REFERENCES

Hirst, G. (1978). Discipline impact factor – a method for determining core journal list, *Journal of American Society for Information Science, 29*(4), 171-172. doi: https://doi.org/10.1002/asi.4630290403

Informatsionnaya sreda. (2019). In: *Finansovyy slovar*. Retrieved from https://dic.academic.ru/dic.nsf/fin_enc/23436 (in Russian)

Informatizatsiya. (2019). In: *Vikipediya: svobodnaya entsiklopediya*. Retrieved from: https://ru.wikipedia.org/wiki/%D0%98%D0%BD%D1%84%D0%BE%D1%80%D0%BC%D0%B0%D1%82%D0%B8%D0%B7%D0%B0%D1%86%D0%B8%D1%8F(in Russian)

Kachan, D. A., Bogatko, A. V., Bogatko, I. N., Yenin, S. V., Kulazhenko, V. G., Lazarev V. S. … Yurik, I. V. (2018). Integratsiya informatsionnykh resursov otkrytogo dostupa dlya obespecheniya nauchno-obrazovatelnogo protsessa v uchrezhdeniyakh vysshego obrazovaniya. *Otkrytoe obrazovanie, 22*(4), 53-63. doi: 10.21686/1818-4243-2018-4-53-63 (in Russian)

Kalyuzhnyi, K. A. (2015). Informatsionnaya sreda i informatsionnaya sreda nauki: sushchnost i naznachenie. *Nauka. Innovatsii. Obrazovanie, 18*, 7-23. Retrieved from http://sie-journal.ru/informaczionnaya-sreda-i-informaczionnaya-sreda-nauki-sushhnost-i-naznachenie (in Russian)

Lazarev, V. S., Yurik, I. V. (2018). Selection of periodicals to support nanotechnology research. *Scientific and Technical Information Processin, 45*(2), 87-99. doi: 10.3103/s0147688218020065

Ozhereleva, T. A. (2014). Ob otnoshenii ponyatiy informatsionnoe prostranstvo, informatsionnoe pole, informatsionnaya sreda i semanticheskoe okruzhenie. *Mezhdunarodnyy zhurnal prikladnykh i fundamentalnykh issledovaniy, 10*(2), *21-21*. Retrieved from https://applied-research.ru/ru/article/view?id=5989 (in Russian)

Tsvetkov, V. Y. (2014). Information field. *Life Science Journal, 11*(5), 551-554. Retrieved from http://www.lifesciencesite.com/lsj/life1105/083_24537life110514_551_554.pdf

Shreider, Yu. A. (1976). Informatsionnye protsessy i informatsionnaya sreda. *Nauchno-tekhnicheskaya informatsiya. Seriya 2. Informatsionnye protsessy i sistemy, 1*, 3-6. (in Russian)

Smirnov, M. A. (2001). Informatsionnaya sreda i razvitie obshchestva. *Informatsionnoe obshchestvo, 5*, 50-54. (in Russian)

York University. *What is open data? (n.d.).* Retrieved from *https://www.library.yorku.ca/web/open/overview/open-data/*

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ФОРМУВАННЯ ТА РОЗВИТОК КОМФОРТНОГО ІНФОРМАЦІЙНОГО СЕРЕДОВИЩА НАУКИ В УНІВЕРСИТЕТІ: ВНЕСОК БІБЛІОТЕКИ

Мета. Виявлення істотних характеристик комфортного інформаційного середовища науки і визначення ролі університетської бібліотеки в її створенні та розвитку. **Методи.** Інформаційна база дослідження складається з публікацій дослідників і фахівців із досліджуваних проблем, а також результатів, отриманих в ході досліджень авторів статті; обидва були інтерпретовані авторами і викладені у контексті мети дослідження. **Результати.** Представлені результати аналізу визначення понять «інформаційне середовище», «інформаційне середовище науки», «комфортність інформаційного середовища». Наведені суттєві характеристики комфортного інформаційного середовища науки. Практична цінність дослідження – застосування результатів до роботи інших університетських бібліотек. **Висновки.** Встановлено, що Наукова бібліотека Білоруського національного технічного університету вносить значний вклад у створення й розвиток комфортного інформаційного середовища науки університету шляхом впровадження в практику таких видів діяльності, як: інформаційна підтримка прикладних досліджень та дослідно-конструкторські розробки, що здійснюються по ряду пріоритетних напрямків науково-технічної діяльності в Республіці Білорусь, створення та підтримання ресурсів відкритого доступу, формування потреб вчених та дослідників в первинних наукових даних, консультативна робота з реєстрації дослідників в різних системах ідентифікації авторських профілів, бібліометричні дослідження.

Ключові слова: інформаційне середовище; інформаційне середовище науки; комфортність інформаційного середовища; ресурси відкритого доступу; первинні дані досліджень; інституційний репозиторій; бібліометричні дослідження; наукові серії; наукові журнали; системи ідентифікації профілів авторів; інформаційна підтримка; інформаційні послуги; цифрове перетворення науки

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