

Russian Information Systems at Research Institutions: Evaluation of Webometric Indicators

O. M. Udartseva*

State Public Scientific Technical Library, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

*e-mail: udartseva@spsl.nsc.ru

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Abstract—The results of a webometric analysis of 20 information systems of research institutions are presented to assess the content of these systems and study their relevance. The paper considers the values of four basic metrics, namely, Size, Rich files, Scholar, and Visibility, and it performs an analysis of the traffic of these systems. As a result, the lack of visibility of closed products of Current Research Information Systems in the web space was revealed. Scholar indicators speak for a low citation of publications included in the information systems of scientific research.

Keywords: information systems, Current Research Information Systems, Open science, webometrics, webometric indicators

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INTRODUCTION

Current Research Information Systems (CRIS) are used today to accumulate and store information about the research activities of any scientific institution, in particular, the areas of scientific activity, research projects, funding organizations, structural divisions, employees, publication activity, etc., and they are also used as a tool for stimulating scientists and teachers to effective scientific activity and training of scientific personnel, assessing the implementation of plans for the state task for research work and examining the results obtained during the research activities of the institution [1, p. 212]. The effectiveness of this information product created by universities and research institutes and its impact in the web environment can be assessed by quantitative data for webometric indicators.

Since the mid-1990s, webometric approaches have been used to assess the content and structure of the Internet. Based on the analysis of the basic metrics (*Size, Rich files, Scholar, Visibility*) of search engines, the *Webometrics Ranking of World Universities* compiled by the *Cybermetrics Lab* Spanish research group under the leadership of I. Aguiyo was first implemented and become widely known [2]. The ranking methodology has become widespread and formed the basis for ranking the websites of academic organizations, including those in Russia [3–5]. Ranking is an informative method of assessing the development of a web resource, that helps encourage organizations to take measures to optimize their own web resources, post full-text information for free access on the Inter-

net, and increase the number of web pages to provide general information on the organization on the network, and make it possible to assess big data [6, 7]. Rankings based on webometric indicators have been developed, with data of various web objects being ranked: sites [5, 8], repositories [9, 10], and information systems [11, 12]. *The Ranking Web of Repositories* website (<https://repositories.webometrics.info/en>) presents the CRIS ranking, which is updated every six months. Here, the latest data, as of June 2022 are presented. The ranking results show that the first place is occupied by *the Information System of Masaryk University* (Table 1).

Among the world's best information systems for research institutions, the 28th place in the ranking is occupied by the information portal of Ural Federal University named after the first President of Russia B.N. Yeltsin. To make such systems more convenient and accessible to the scientific community, experts study their functionality [1, 13–15], consider statistical services, and offer metrics to assess their effective functioning, namely, scientometric indicators (indicators of demand, influence, and activity) [14, p. 13].

Authors of scientific publications have shared their experience in designing and implementing information systems in the activities of research institutions [16, 17] and note that the existing Russian national information products cannot yet claim the status of a national CRIS because the information they provide is not exhaustive in terms of the depth of the collected data. In this connection, they propose to integrate data on the efficiency of work in scientific areas and indi-

Table 1. Top 20 global CRIS systems as of June 2022 (*Transparent Ranking: CRIS by Google Scholar*)

Place in the ranking	Information systems	E-mail	Country	Number of entries
1	Information System of Masaryk University	https://is.muni.cz/	Czech Republic	95400
2	Research Portal of the University of Groningen	https://research.rug.nl/	Netherlands	35500
3	Research Portal of Aalborg University	https://vbn.aau.dk/en/	Denmark	29000
4	ACCEDA CRIS of the University of Las Palmas de Gran Canaria;	https://accedacris.ulpgc.es	Spain	18000
5	Brussels Free University Research Portal	https://researchportal.vub.be/	Belgium	16700
6	Information on research of the University of Twente	https://research.utwente.nl/	Netherlands	15900
7	Amsterdam Free University Research Portal	https://research.vu.nl/	Netherlands	13500
8	Research System of the Wageningen University and Research Center;	https://research.wur.nl/	Netherlands	13000
9	University of Southern Denmark Research Portal	https://portal.findresearcher.sdu.dk/en	Denmark	11400
10	University of Edinburgh Research Portal	https://www.research.ed.ac.uk/	United Kingdom	10700
11	Copenhagen Business School Research Portal	https://research.cbs.dk/	Denmark	9110
12	Macquarie University Research Portal	https://researchers.mq.edu.au/	Australia	8750
13	Monash University Research Portal	https://research.monash.edu/	Australia	7570
14	University of Ulster Research Portal	https://pure.ulster.ac.uk/en/	Ireland	6130
15	Ghazi University Research Information System	https://avesis.gazi.edu.tr/	Turkey	5770
16	University of New England Research Portal	https://rune.une.edu.au/	Australia	5370
17	Roskilde University Research Portal	https://forskning.ruc.dk/en/	Denmark	5280
18	University of Gdansk CRIS	https://repozytorium.bg.ug.edu.pl/	Poland	5120
19	University of Birmingham Research Portal	https://research.birmingham.ac.uk/	United Kingdom	5070
20	Aalto University Research Portal	https://research.aalto.fi/	Finland	4760

vidual research teams to be collected in the information system of a research institution, into the national CRIS for conducting full-scale scientometric studies [18, p. 223].

However, despite the obvious relevance of modern CRIS products, there has been little integration of this information product in decision-making. To change this, some [19] have proposed to combine the efforts of CRIS developers to make information systems useful for satisfying their users in solving daily tasks.

RESEARCH METHODOLOGY

In this study, we used the CRIS webometric survey method developed by universities participating in the Priority 2030 program and research institutes that are subordinate to the Federal Agency for Scientific Organizations, as well as information systems of national importance—the “Truth” Intelligent System for Thematic Research of Scientometric Data (Moscow State University, <http://istina.msu.ru/>) and the “Socionet” Scientific Information System (<https://socionet.ru/>).

To estimate quantitative indicators, 20 information systems of research institutions were selected.

The webometric study was carried out in two stages:

- At the first stage, the values of four basic metrics were collected, which were measured using the *Google* and *Google Scholar* search engines; the *MegaIndex* web service was used to track the mass of references to the studied information systems. The following metrics were selected as the basic ones: *Size* measures the number of indexed pages of the site; *Rich files* is the number of full-text documents; *Scholar* reports the scientific nature of the site, determined by the number of documents on *Google Scholar*; and *Visibility* provides the number of unique external links to the site;

- At the second stage, to assess the demand for information systems of research institutions, additional indicators of their traffic were collected using *SimilarWeb*, which aggregates analytical data (visits, bounces, average visit time, average number of pages viewed per visit, and traffic sources).

To avoid errors, the data were collected and rechecked for 1 week and then entered into a table. This approach to the collection of quantitative data did not allow obtaining indicators which are accurate to the single digit figures; however, they are objective relative to each other, which makes it possible to compare the obtained quantitative values [20].

RESULTS OF THE STUDY AND INTERPRETATION OF WEBOMETRIC INDICATORS

S Indicator (*Size*). This indicator reflects the number of web pages in the information systems of research institutions. This score is an indicator of the relevance of *CRIS* pages to search engines, showing the total number of pages indexed. Closed information systems of research institutions are characterized by zero traffic values, which is an expected result: *Google* search algorithms do not allow indexing of closed objects. The first place in terms of the number of pages was occupied by the “Truth” system, with 553 000 pages (Table 2). This result is predictable, as the information system of the Moscow State University is a platform for many research institutions [21]. It is followed by information products developed by the Ural Federal University named after the first President of Russia B.N. Yeltsin (<https://science.urfu.ru>, 56900 pages) and National Research Tomsk State University (<https://science.urfu.ru>, 38100 pages). The remaining *CRIS* are characterized by their relatively small size, which can be an objective indicator of the total number of employees of the institution, in proportion to which the number of indexed pages is significantly lower.

R Indicator (*Rich Files*). Currently, electronic repositories of publications are often combined with

information systems of research institutions [22]. In this regard, to provide access to an electronic archive in such systems, the principles and standards of open access initiatives are applied, in particular, the *Open Archives Initiative Protocol (OAI)* [14] proposed in 2000 by Cornell University (United States). To implement open access to publications, the initiatives that support the *European Commission Open Access* policy are used [23]. The *Rich files* indicator reflects the total number of full-text documents hosted on the information systems platform of research institutions. To analyze the number of such documents, only pdf files were taken into account, which made it possible to avoid double counting of documents in different formats (doc, ppt, rtf, etc.) [9, p. 480]. Access to the full text of the digital archive of the research activities of the institution may or may not be provided, depending on the desire of the given organization or the author of the given publication [14]. According to the results of the evaluation of data from the *Google* search engine, the largest number of full-text documents is presented on the platform of the “Truth” Information System, at 53 300 files. The digital archives of publications in the *CRIS* of the National Research Nuclear University “MEPhI” and the Institute for Socio-Political Research of the Russian Academy of Sciences average about 2000 documents. The remaining open *CRISs* of research institutions demonstrate the absence of significant electronic archives (see Table 2). Most of the analyzed information systems only compile data from one organization, so the quantitative values of the *Rich files* indicator for these systems are significantly lower than for the platforms that post information about the scientific activities of several institutions at once.

Sc Indicator (*Scholar*). This indicator is determined by the number of search results in the *Google Scholar* system and is an index of the scientific nature of the studied web resource, in our case, the information system. Indexing on *Google Scholar* is influenced by the presence of open access digital archives hosted on the information systems platform [24]. The results of the analysis of the *Scholar* indicator revealed weak indexing of records in the *Google Scholar* system; this trend is observed for all information systems of research institutions, except for the *CRIS* of the Ural Federal University named after the first President of Russia B.N. Yeltsin, namely, 4830 entries. These results may indicate the problems that arise during indexing in *Google Scholar*, which has also been noted by researchers in the study of US institutional repositories. In their opinion, the reason for low indexing is that repositories are created using *Dublin Core*, which does not properly reflect bibliographic citations for academic articles [25]. At the same time, *Google Scholar* offers recommendations for improving indexing, including for repositories. To clarify existing problems, information system administrators can use the free *Atmire Analyzer* service ([SCIENTIFIC AND TECHNICAL INFORMATION PROCESSING Vol. 49 No. 4 2022](https://ana-</p>
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Table 2. Webometric indicators of information systems of scientific organizations in Russia as of September 2022

No.	Information systems	Size	Rich files	Scholar	Visibility
1	“Truth” Intelligent System for Thematic Research of Scientometric Data	553000	53300	145	50760
2	Research Portal of Ural Federal University named after the first President of Russia B. N. Yeltsin	56900	4	4830	12070
3	“Archives of the Russian Academy of Sciences” Information System	14700	0	0	3230
4	Information System of National Research Tomsk State University	38100	1	0	1850
5	“Socionet” Information System	1350	476	329	1690
6	Information System of the FSBIS G.K. Boreskov Institute of Catalysis of the SB RAS	168	19	0	1230
7	Information System of St. Petersburg State University of Aerospace Engineering	1700	134	0	882
8	Information System of St. Petersburg Mining University	4400	67	12	807
9	Corporative Portal of the Yaroslavl-the-Wise Novgorod State University	17800	5	4	384
10	Information System of National Research Nuclear University “MEPhI”	5080	1770	0	352
11	Information System of National Research Tomsk Polytechnic University	4180	0	0	276
12	Information System of Samara State Medical University of the Ministry of Health of the Russian Federation	19	10	0	25
13	Information System of Astrakhan State University	4660	475	52	20
14	Information System of Russian State Agrarian University – MAA named after K.A. Timiryazev	1	0	0	18
15	Information System of I.T. Trubilin Kuban State Agrarian University	0	0	0	15
16	Information System of Volga Research Medical University of the Ministry of Health of the Russian Federation	0	0	0	8
17	Information System of Mari State University	0	0	0	8
18	Information System of the Ural Branch of the Russian Academy of Sciences	0	0	0	4
19	Information System of Adyghe State University	0	0	0	0
20	“Stankin” Information System of Moscow State Technological University	0	0	0	0

lyzer.atmire.com/), which helps to identify the problem and understand what it is.

V Indicator (Visibility). The number of unique external links indicates the authority of the web resource. Moreover, the quality of inbound links affects ranking in search results, as users only view the first three pages of search results [26]. Based on the analysis of the quantitative data of the *Visibility* indicator, it is possible to evaluate the traffic of information systems. The most popular of the ones we are considering are the systems of the Moscow State University (“Truth”) (50760 visits), Ural Federal University named after the first President of Russia B.N. Yeltsin (12070 visits) and the Archives of the Russian Academy of Sciences Information System (ISARAN) (3230 visits). Here, there is a correlation between the *Visibility* indicator and the policy of open access to data of a particular information system. Closed information systems have rather low visibility indicators; the main

task of these systems is to accumulate and store information on the research activities of a particular scientific institution, and data are provided only to employees who carry out this activity and manage it.

The high quantitative values of the considered metrics are an indicator of good visibility in the web space for information systems in comparison with other similar systems. Among the Russian information systems analyzed, the indicators of the “Truth” System are the highest, which characterizes this information system as widely used, including for the examination of the results obtained in the course of the research activities of an institution or a particular scientist. Thus, the effective development of information systems in the web space is due to several reasons: on the one hand, good visibility and increased interest in the information system is due to open access to the hosted data; on the other hand, this is an understandable result of the

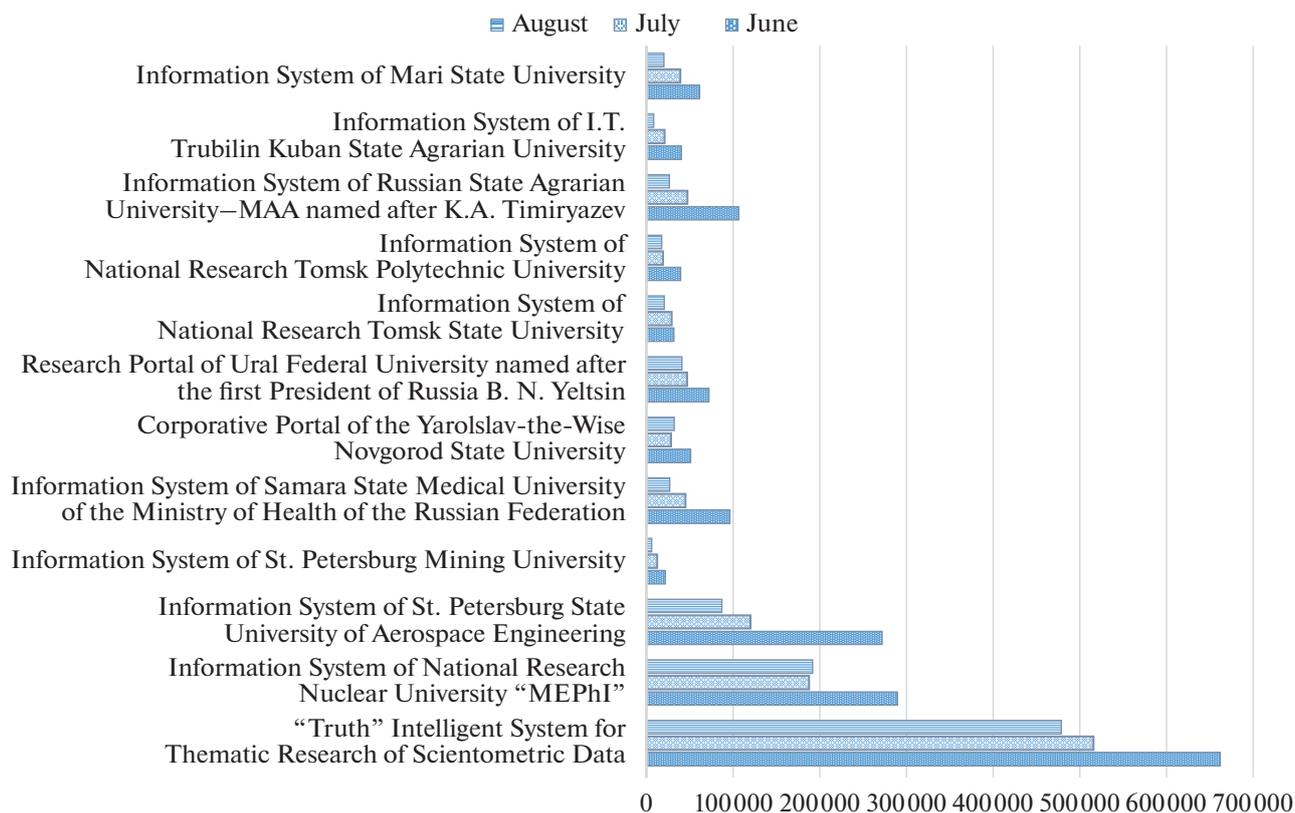


Fig. 1. Traffic of information systems for three months according to the *SimilarWeb* data as of September 2022.

policy of a particular system, namely, to accumulate data of dozens of scientific institutions.

INDICATORS OF DEMAND FOR RUSSIAN INFORMATION SYSTEMS

The eight information systems we are considering do not have analytical data in the *SimilarWeb* service due to their low traffic, with less than 5000 visits per month. As noted earlier, this is the result of closed access to the research data of the information system as well as the collection of information limited to only one organization. With such indicators, monthly visit data is not displayed in the *SimilarWeb* service, so these systems were excluded when assessing their traffic (Fig. 1).

An analysis of the dynamics of quantitative indicators of visits in the *SimilarWeb* service over the past three months indicates a decline in the traffic of information systems, as is natural due to vacations of employees of scientific institutions and a decrease in activity in the implementation of research projects (Fig. 1). High levels of traffic are demonstrated by the “Truth” Information System of the Moscow State University, the information systems of the National Research Nuclear University “MEPhI” and the St. Petersburg State University of Aerospace Engineering.

To perform an objective assessment of the demand for information systems, it is necessary to compare several indicators (bounces, viewing depth, and average visit time). For users of Russian information systems, the average visit time is 2 min. 29 sec. During this time, visitors view about 3.6 pages, which shows the depth of study of the scientometric data presented in information systems. With an average bounce rate of 47.8%, average visit time and browsing depth can be interpreted as user interest in these digital information products. As a rule, users access information systems by going directly from their saved bookmarks or entering their email address into the address bar of a search, as evidenced by the average direct traffic figures of 50.1%. In second place is traffic from search engines, for which the average indicators are 31.7%. It can be noted that the main source of traffic for closed information systems is direct transitions, while this source for open access systems is logging into the system from search engines. Open information systems are characterized by high bounce rates (Table 3); however, at high values of search traffic, this is a regularity. This trend reflects the policy of using open information systems by external users. For closed information systems, the opposite trend is the norm, when both bounce rates and search traffic rates are low, which corresponds to the target group of users who access the system, namely, employees of a particular research

Table 3. Traffic indicators for information systems according to the *SimilarWeb* data as of September 2022

Information systems	Bounce rate, %	Viewing depth	Average visit time	Traffic sources, %		
				direct	referral	search
Information System of St. Petersburg Mining University	71.24	1.75	0:01:39	12.91	5.25	81.84
Research Portal of Ural Federal University named after the first President of Russia B.N. Yeltsin	68.91	2.01	0:02:04	11.35	9.29	79.36
“Truth” Intelligent System for Thematic Research of Scientometric Data	64.97	2.49	0:02:02	25.24	4.43	67.95
Information System of National Research Tomsk Polytechnic University	57.60	2.74	0:01:41	28.01	4.94	67.05
Information System of I.T. Trubilin Kuban State Agrarian University	52.17	1.77	0:01:10	19.18	65.40	9.73
Corporative Portal of Yaroslavl-the-Wise Novgorod State University	49.92	1.85	0:01:38	80.74	11.06	5.51
Information System of the National Research Nuclear University “MEPhI	48.31	4.91	0:04:33	55.84	13.83	19.95
Information System of Samara State Medical University of the Ministry of Health of the Russian Federation	39.56	9.19	0:02:42	89.57	1.74	5.34
Information System of National Research Tomsk Polytechnic University	34.15	3.45	0:04:14	15.10	62.38	22.52
Information System of St. Petersburg State University of Aerospace Engineering	32.08	4.95	0:02:26	64.92	3.33	20.50
Information System of Mari State University	29.62	2.62	0:05:08	98.95	0.01	0.01
Information System of Russian State Agrarian University—MAA named after K.A. Timiryazev	25.15	5.14	0:00:32	99.90	0.01	0.01

institution. The main source of traffic for such information systems is direct traffic (65–99%).

High quantitative values for visits are not always an indicator of resource demand. Based on a comparative analysis of the listed indicators (bounces, viewing depth, average visit time), high demand among users is demonstrated by the information system of the Samara State Medical University of the Ministry of Health of the Russian Federation, as evidenced by a small share of bounces (39.6%), while the average number of viewed pages per visit was 9.2, and the average visit time was 2 min. 42 sec., which is quite enough for both getting acquainted with information and editing it.

The analytical study proves that information systems are a sought-after product of scientific and scientometric information not only for employees of research institutions whose scientific results are reflected in them, but also for external visitors who study and examine the results of this work.

CONCLUSIONS

Research activities are evaluated based on the results recorded in the institutional or national information systems of research institutions in an automated or semi-automated mode, which makes it

urgent to perform the work related to filling these information products, finalizing their functionality, and evaluating the effectiveness of their development using webometric indicators. This assessment would make it possible to draw conclusions concerning how the information system created is developing, to determine the best practices of existing automated products, and to use the results of the system assessment for its further optimization. However, webometric indicators are constantly changing and therefore require constant monitoring.

The results of the study of Russian information systems of research institutions allowed us to draw some conclusions:

- More than half of research institutions consider the information system as a tool for their own reporting on the results of research work, which is expressed by the closeness of data for external use;
- Open access to scientific and scientometric data of information systems increases their visibility in the web space, strengthening their role in the management of research activities;
- Full-text digital collections hosted on the platform of Russian information systems are insignificant. Their volume usually corresponds to the type of system (institutional, national);

- Traffic of closed information systems is lower than that of open ones;
- Search traffic is an effective source of traffic for open information systems, while for closed systems, it is direct traffic.

REFERENCES

- Vasenin, V.A., Afonin, S.A., Zenzinov, A.A., Lunev, K.V., and Shachnev, D.A., Mechanisms of "Istina" system for intelligent state analysis and progress stimulation for projects in the sphere of science and higher education, *Nauchn. Servis Seti Internet*, 2019, no. 21, pp. 210–221. <https://doi.org/10.20948/abrau-2019-48>
- Methodology for calculating indicators, Ranking Web of Universities. <http://www.webometrics.info/en/Methodology>. Cited May 22, 2021.
- Shokin, Yu.I., Vesnin, A.Yu., Dobrynin, A.A., Klimenko, O.A., Rychkova, H.V., and Petrov, I.S., Investigation of the academic web space of the Siberian Branch of the Russian Academy of Sciences, *Vychisl. Tekhnol.*, 2012, vol. 17, no. 6, pp. 85–98.
- Aguillo, I.F., Ortega, J.L., and Fernández, M., Webometric ranking of world universities: Introduction, methodology, and future developments, *Higher Educ. Europe*, 2008, vol. 33, nos. 2–3, pp. 233–244. <https://doi.org/10.1080/03797720802254031>
- Verma, M. and Brahma, K., A Webometric analysis of National Libraries' websites in South Asia, *Ann. Libr. Inf. Stud.*, 2017, vol. 64, no. 2, pp. 116–124. <http://nopr.niscair.res.in/bitstream/123456789/42441/1/ALIS-%2064%282%29%20116-124.pdf>. Cited May 22, 2021.
- Polyak, Yu.E., Antopol'skii, A.B., and Usanov, V.E., Webometric analysis of Russian research and educational institutions: New algorithm of ranking, *Materialy 8-i Mezhdunarodnoi konferentsii, posvyashchennoi 60-letiyu VINITI RAN "Aktual'nye problemy informatsionnogo obespecheniya nauki, analiticheskoi i innovatsionnoi deyatel'nosti"* (Proc. 8th Int. Conf. Devoted to 60th Anniversary of All-Russ. Inst. of Scientific and Technical Information, Russian Academy of Sciences, Actual Problems of Information Provision of Sciences, Analytic, and Innovation Activity), Moscow, 2012, pp. 42–43.
- Polyak, Yu.E., Evaluation and ranking of websites: Webometric ratings, *Nauchn. Redaktor Izdatel'*, 2017, vol. 2, no. 1, pp. 19–29. <https://doi.org/10.24069/2542-0267-2017-1-19-29>
- Udartseva, O.M., Blinov, P.Yu., and Kosyakov, D.V., Webometric ranking of library sites in the world, *Autom. Doc. Math. Linguist.*, 2021, vol. 55, no. 5, pp. 229–241. <https://doi.org/10.3103/S0005105521050083>
- Aguillo, I.F., Ortega, J.L., Fernández, M., and Utrilla, A.M., Indicators for a webometric ranking of open access repositories, *Scientometrics*, 2010, vol. 82, no. 3, pp. 477–486. <https://doi.org/10.1007/s11192-010-0183-y>
- Fan, W., Contribution of the institutional repositories of the Chinese Academy of Sciences to the webometric indicators of their home institutions, *Scientometrics*, 2015, vol. 105, no. 3, pp. 1889–1909. <https://doi.org/10.1007/s11192-015-1758-4>
- Orduña-Malea, E., Aggregation of the web performance of internal university units as a method of quantitative analysis of a university system: The case of Spain, *J. Am. Soc. Inf. Sci. Technol.*, 2013, vol. 64, no. 10, pp. 2100–2114. <https://doi.org/10.1002/asi.22912>
- Transparent Ranking: CRIS by Google Scholar, Ranking Web of Repositories. June 2022. <https://repositories.webometrics.info/en/cris>. Cited September 23, 2022.
- Kabakova, E.A., Automated system for accounting intellectual activity results as a tool of complex accounting the organization's research activity results (the case of ASA IAR VOLRC RAS), *Vopr. Territorial'nogo Razvit.*, 2019, no. 4, p. 7. <https://doi.org/10.15838/tdi.2019.4.49.7>
- Kogalovskii, M.R. and Parinov, S.I., Metrics of online information spaces, *Ekonom. Mat. Metody*, 2008, vol. 44, no. 2, pp. 108–120.
- Al'perin, B.L., Vedyagin, A.A., and Zibareva, I.V., Sci-Act—An information analytical system of the Institute of Catalysis of SB RAS to monitor and promote scientific activities, *Tr. Gos. Publ. Nauchn.-Tech. Bibl. Sib. Otd. Ross. Akad. Nauk*, 2015, vol. 9, pp. 95–102.
- Zhizhimov, O.L., Fedotov, A.M., and Shokin, Yu.I., Basic principles, architecture and realization of information systems ICT SB RAS, *Izv. Kyrgyzskogo Gos. Tekh. Univ. im. I. Razzakova*, 2016, no. 3-1, pp. 348–352.
- Zaycev, D.A., Garmayeva, T.Ts., Konovalova, A.A., Kulikov, S.M., and Mendeleeva, L.P., Experience of designing and implementing current research information system in National Research Center for Hematology, *Vrach Inf. Tekhnol.*, 2020, no. S1, pp. 43–50. <https://doi.org/10.37690/1811-0193-2020-S1-43-50>
- Tarasevich, Yu.Yu. and Shinyaeva, T.S., Criteria for assessment of current state and development of research based on scientometric data analysis, *Vopr. Obraz.*, 2015, no. 2, pp. 221–240. <https://doi.org/10.17323/1814-9545-2015-2-221-234>
- Yair, G., Managing minds: The challenges of current research information systems for improving university performance, *Handbook of Operations Research and Management Science in Higher Education*, Sinuany-Stern, Z., Ed., International Series in Operations Research & Management Science, vol. 309, Cham: Springer, 2021, pp. 117–130. https://doi.org/10.1007/978-3-030-74051-1_4
- Aguillo, I.F., Altmetrics of the open access institutional repositories: A webometrics approach, *Scientometrics*, 2020, vol. 123, no. 3, pp. 1181–1192. <https://doi.org/10.1007/s11192-020-03424-6>
- Vasenin, V.A., Zanchurin, M.A., Kozitsyn, A.S., Krivhikov, M.A., and Shachnev, D.A., Architectural and technological aspects of the development and maintenance of large information analysis systems in

- the area of science and education, *Programmnaya Inzh.*, 2017, vol. 8, no. 10, pp. 448–455.
<https://doi.org/10.17587/prin.8.448-455>
22. Galimberti, P. and Mornati, S., The Italian model of distributed research information management systems: A case study, *Procedia Comput. Sci.*, 2017, vol. 106, pp. 183–195.
<https://doi.org/10.1016/j.procs.2017.03.015>
23. Príncipe, P., Rettberg, N., Rodrigues, E., Elbæk, M.K., Schirrwagen, J., Houssos, N., Nielsen, L.H., and Jörg, B., OpenAIRE Guidelines: Supporting interoperability for literature repositories, data archives and CRIS, *Procedia Comput. Sci.*, 2014, vol. 33, pp. 92–94.
<https://doi.org/10.1016/j.procs.2014.06.015>
24. Arlitsch, K. and O'Brien, P.S., Invisible institutional repositories: Addressing the low indexing ratios of IRs in Google Scholar, *Library Hi Tech*, 2012, vol. 30, no. 1, pp. 60–81.
<https://doi.org/10.1108/07378831211213210>
25. Neal, D.M., Campbell, A.J., Williams, L.Y., Liu, Ye, and Nussbaumer, D., “I did not realize so many options are available”: Cognitive authority, emerging adults, and e-mental health, *Libr. Inf. Sci. Res.*, 2011, vol. 33, no. 1, pp. 25–33.
<https://doi.org/10.1016/j.lisr.2010.07.015>

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