

Impact of the Pandemic on the Condition of Agricultural Scientific and Educational Information Resources Presented in the Internet Space

Victor Medennikov¹^a, Ludmila Muratova²^b and Sergey Salnikov²^c

¹Federal Research Center "Computer Science and Control" of RAS, Vavilova 44-2, 119333, Moscow, Russia

²VIAP I n.a. A.A. Nikonov - branch of the FSBSIFRC AESDRA VNIIESH, Bolshoi Kharitonyevsky 21-1, 107078, Moscow, Russia

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Abstract: The paper discusses the changes in the structure and condition of scientific and educational information resources that have been made available by Russian agricultural universities in the Internet space during the pandemic in terms of emerging new digital tools in the educational process. We have also monitored the impact of the "social order" requiring to create a structured information Internet space for these resources that plays a triune role: supporting the scientific research; raising the education level (sometimes, through re-training) for all population segments; an efficient system of transferring scientific and educational knowledge to the economy by providing an unrestricted access to this knowledge not only for traditional users represented by researchers, students and teachers, but also for future applicants, employers, public authorities, manufacturers, businesses, managers and other categories of population. To monitor this process, we have developed the relevant method for surveying universities' websites. Our analysis of the results of this survey in 2021 and in 2013, 2016 confirmed our assumption that the pandemic will cause the emergence of new digital tools but only in the field of online learning and publication activity, which are aimed solely at the internal audience of universities through closing such resources by adding passwords for accessing them by other interested users. At the same time, the digital tools being introduced are ontologically unrelated to each other; they duplicate the content, which leads to significant financial costs for universities and the state, thus postponing the future creation of some structured information Internet space for scientific and educational resources.


1 INTRODUCTION


The social order for creating some structured information Internet space of scientific and educational resources, being driven by the coronavirus pandemic, has mainly manifested in the emergence of new digital tools in the educational process in the form of online learning and publication activity. Such an activation of the social order was due to the need for switching universities to online learning and remote working. The entire world and Russian educational process is in need of such digital transformation. For these critical industries to meet new challenges, their systemic transformation is

required towards creating a modern competitive scientific and educational environment.

The pandemic has especially exacerbated the competitiveness problem of this process with a sharp increase in the importance of universities' images. In (The educational, 2021), this problem is most clearly defined: on the one hand, significant investments are required in the new digital online educational technology, and on the other hand, the pandemic has reduced the income of educational institutions due to a decrease in the effective demand by families as well as the influx of applicants from abroad, etc. Today, the image of a university depends not only on the quality of its educational process; of great importance is also its competent and effective representation on the Internet.

^a <https://orcid.org/0000-0002-4485-7132>

^b <https://orcid.org/0000-0002-4030-0599>

^c <https://orcid.org/0000-0001-7952-4496>

In this study, we have considered one of the ways to increase the competitiveness of educational institutions using the example of agricultural universities by assessing the effectiveness of their use of scientific and educational information resources (SEIRs) in the Internet space, which makes it possible to adequately assess the position of an agricultural university in the world ranking of educational services (Medennikov, 2017), followed by making decisions on the areas to invest in. For this purpose, we need to develop an appropriate method and questionnaire. In the digital economy (DE), their websites are one of the most effective ways of such an assessment.

Based on the main, general principle of digital transformation of all sectors of economy, including education and science, in the form of creating an information management system; that is, collection, processing, storage, and dissemination of the necessary data in a form adapted to the daily activities of institutions, based on the widespread integration of disparate data into a single system, the social order driven by the pandemic should also generate a demand for integration methods to present SEIRs not only to students and teachers of a particular university, but also to future applicants, employers, researchers, public authorities, manufacturers, businesses, managers and other population segments. There are appropriate opportunities to do this (Kulba, 2020; Zatsarinnyy, 2019; Ereshko, 2018).

2 RESEARCH METHOD

In (Ereshko, 2020; Medennikov, 2017), the authors have considered the concept and a mathematical model for creating a single cloud-based digital platform of scientific and educational information resources (DPSEIR), based on its triune role.

First, it should be informatization of the science itself. There, the DPSEIR should be created because of the exponential growth in the amount of information in science, the emerging opportunity to create new information technology that ensures an efficient mining of the necessary knowledge. Information technology, primarily based on the Internet, has provided the scientific community with qualitatively new opportunities for a wide exchange of ideas between researchers and information scientific resources and for their digital interaction (Raikov, 2019).

Second, information technology can perform the functions of stimulating scientific and technological progress only with a certain level of intellectual

potential of society, and the key role in its creation is played by the education system. Once again, in the process of transforming scientific knowledge into educational one, information computer technology (ICT) plays a great role. For instance, it is shown in (Milgrom, 1990) that investment in ICT are more effective with a high level of two other complementary assets, organizational and human capital. That is, investments in ICT are associated with significant costs of changing organizational and human capital, depending to a large extent on education.

Third, the DPSEIR in the Internet space provides an effective system for the transfer of scientific knowledge to the economy; it promotes the development of scientific concepts of the digital economy (DE), its digital platforms, scientific support and monitoring of the digitalization process of the country, industries, businesses, territorial entities and society. Thus, the business community implicitly expresses its requirements for the need to create such a space. When surveying agricultural companies to assess the effectiveness of their information and consulting services (ICS), farmers expressed a desire to get such a system where they could quickly find, e.g., a development in the form of a means for combating any plant or animal disease; then get immediately all publications, all consultants, regulatory information, and online learning on this topic. Next, they could find the required supplier of the formulation in the relevant database with minimum procurement and logistics costs.

A large-scale survey of the needs of farmers in 22 regions by visiting them with a survey of public authorities and businesses has showed that the following types of knowledge representations are most in demand in the Russian economy: developments, publications, consulting activities, regulatory information (RI), online learning (OL), application software packages (ASP) and databases (DB). It turned out that these types of knowledge are available in one form or another on the websites of scientific and educational institutions and the ICS (Medennikov, 2017).

It has been shown that improvement of the Internet technology allows for integrating, based on them, the ontological modeling into a single DPSEIR from a unified scientific and methodological standpoint with a simple and user-friendly navigation system, followed by hosting these resources at one provider based on common classifiers, such as the state heading list of scientific and technical information and industry-wide product classifier. However, to present heterogeneous website structures

as homogeneous structures (given that, in line with modern trends in the Internet technology, when providers begin to offer services for storing website content in powerful database management systems), it was generally accepted that SEIRs should be stored, on the one hand, in the form of catalogs or a full-format electronic presentation, and on the other hand, as an unordered list or as an ordered electronic presentation.

Therefore, the need to create a DPSEIR is due, on the one hand, to the demands of the digital economy, which requires a significant number of highly qualified specialists, a comprehensive renovation of production facilities, retraining of employees of all levels and migrating to modern management methods; and on the other hand, the ICT capabilities to integrate all scientific and educational resources into a single information space of knowledge from a unified scientific and technological standpoint with placing information resources (IR) in the cloud using unified registers and classifiers.

In addition, this project allows to implement a scientometric approach, a quantitative assessment of the role of educational and scientific institutions, publications and their authors worldwide in a particular field of research; to calculate various rankings of scientific research in economics and related fields; to evaluate the effectiveness of scientific activities of a particular institution or an author; to determine the dynamics of authors' h-indices, the number of citations and their ranking, similarly to the Russian Science Citation Index (RSCI), but with a tool that is understandable and open to most users of this data in the global network, which makes it possible to adequately assess the place of such institution or author in the global scientific and educational environment. This possibility is implemented using various subprojects-services stored in various DBs, similar to the RePec system.

In this regard, we would like to hope that a sharp surge of interest in online learning, electronic catalogs, and full-format electronic presentation of publications will be a trigger for creating a DPSEIR, which includes all these elements.

Therefore, based on the briefly outlined conceptual provisions of the method for examining the condition and amount of SEIRs on the websites of agricultural universities, Table 1 shows the survey questionnaire in a generalized form at the levels of departments, faculties, and universities, in quantitative terms by types of knowledge presentations.

3 RESEARCH RESULTS

In this section, we discuss the summary SEIR representation on agricultural universities' websites with our comments on individual institutions, in comparison with similar data from SEIR surveys carried out in 2013 and 2016 (Medennikov, 2017), (Medennikov, 2014). The values of indices for 2013, 2016 and 2021 are divided by slashes.

3.1 Developments

In 2013, 85% of universities posted information about their developments on their websites; in 2016, similarly, 46 out of 54 (85%) did so. The increase in the number of developments was 93.6%, but this increase was provided only by 10 universities; other institutions either reduced or stopped publishing information about their developments. It should be noted that several websites have published electronic catalogs and a full-format presentation of developments. However, this means publishing development catalogs on three websites, rather than posting information about them in a database management system (DBMS). In 2021, these universities have stopped publishing this information, but six new leaders have appeared, who dramatically increased the availability of unordered full-format presentations up to 567 items on their websites. At the same time, both electronic catalogs and full-format presentations of developments have completely disappeared with a significant reduction in the number of items in an unordered catalog list.

3.2 Publications

In 2013, 93% of universities provided information about publications on their websites; in 2016, their share was already 89%, that is, 48 out of 54. However, an increase in publications took place only in departments (3.3%) with a significant decrease in faculties (2.6 times); at the university level, the decrease is even greater (6.5 times). This decrease was due to the following universities: Bryansk State Agrarian University (SAU), Velikiye Luki State Agricultural Academy (SAA), Gorsky SAU, Kuban SAU, and Omsk SAU. It should be noted that Kuban SAU has already an electronic catalog and a full-format presentation of publications. In 2021, the pandemic has forced a dramatic change in the structure of evolutionary forms of storing publications. Thus, a large number of electronic library systems (ELS) appeared in the market, which agricultural universities began to take as an example:

Table 1: Questionnaire for surveying the condition and amount of SEIRs on the websites of agricultural universities.

University and presentation level	Unordered catalog list	Electronic catalogue	Unordered full-format presentation	Ordered full-format presentation
Name				
Department				
Faculty				
University level				
.....				
Total				

IRBIS64, IRBIS64+, Ruslan, Mark Web, MegaPro, Booki, Znaniy, Youwrite, IPRbooks, AgriLib, the Network Electronic Library of Agricultural Universities under the auspices of the Lan' publishing house (over 8,000 books), and a number of less used resources. Accordingly, there was a sharp increase in the number of publications in an electronic catalog form up to 55,082 and 21,114 items made available as a full-format presentation of publications of university's staff and students. Most of the above-listed ELSs support electronic catalogs only.

We are drawing your attention to this fact since these ELSs include a significant number of publications from other institutions, other than the university in question. At the same time, there is a trend to decreasing the number of publications in the previously dominant forms. In general, the picture is variegated both in developments and in publications; we cannot find the presence of anyone's coordinating hand. In addition, you can get access to an ELS only with a password; only some of them allow access as a guest to catalog forms.

3.3 Databases

In 2013, only seven universities (12%) presented DB information on their websites, mostly in the form of an unordered catalog list, and six universities (11%) in 2016. In 2016, there was a sharp surge in the number: 24.7 times. Two universities: Russian State Agrarian University – Moscow Agricultural Academy (RSAU–MAA) posted 145 DBs on its website (only at the top level) in the form of an electronic catalog, whereas Kuban SAU presented them in the form of an unordered list (538, 4 of which at departments, 7 at faculties, and 527 at the university level). There is no way to check these DBs for operability. In 2021, there was an almost complete degradation (zeroing) of this type of knowledge presentation; only on the websites of three universities, information about seven DBs is still available, by inertia, in the form of an unordered catalog list.

3.4 ASP

In 2013, only 10 universities (17%) presented ASP information on their websites, mostly in the form of an unordered catalog list (80 at the department level and 42 at the top level) and 13 universities (24%) in 2016. In 2016, there was also a sharp increase in the number: 7.5 times, up to 151 at the department level and 828 at the university level. The overlap between the two university lists is minimal: only two of them continued publishing information about ASP on websites both in 2013 and in 2016: Kuban SAU and Orenburg SAU. In 2021, there was an almost complete change of leaders: Kuban SAU and Orenburg SAU stopped publishing ASP, but Stavropol SAU took up the lion's share of this type of knowledge presentation at the department level (50 out of 57), whereas Ryazan State Agrotechnological University (SATU) and Bashkiria SAU, at the top level (13 and 7, respectively). It is also impossible to check their operability. It is worth noting that these websites have no online development: neither ASP, nor DB. This is due to the fact that, currently, the vast majority of providers do not offer services for using optimized and statistical ASPs, not even Excel. Some providers render services only for using a DBMS.

3.5 Online Learning

In 2013, only five universities provided more than one OL item of information on their websites, mainly in the form of an unordered catalog list, and six universities provided it in 2016, the same form. In 2016, there was a sharp increase in the number: almost 2 times from 620 to 1,194. There is no overlap between the two university lists. This also suggests that the SEIRs presentation on websites is at the discretion (fantasy) of their developers. In 2021, there was a sharp change in the number in the opposite direction: from 1,194 to 11. The main reason for this was the pandemic, which forced the universities' administrations to implement a special OL service that could be accessed only with a password received in certain institution departments.

3.6 Consulting Activities

In 2013, this type of activity was mainly presented on the website of Ryazan SATU (51 consultants), due to the fact that the ICS actively worked in Ryazan in the past. In 2016, there was a sharp increase both in the number of consultants: 3.5 times, and in the number of universities: over 14. However, there is only one consultant left in Ryazan SATU. Meanwhile, in 2016, information about 189 consultants was made available in departments (9 of which in the form of an electronic catalog; the rest, as an unordered catalog list), but it almost disappeared as soon as in 2021 (one consultant in the form of an unordered catalog list). On the contrary, the departments demonstrated a decrease from seven in 2013 to four in 2016 with a sharp increase up to 37 consultants in 2021, all in the form of an unordered catalog list. At the university level, similar dynamics was recorded: 62 in 2013, 216 in 2016 (43 of which in the form of an electronic catalog, the rest, as an unordered catalog list), and 76 in 2021 in the form of an unordered catalog list. There, the pandemic played a negative role, having left only information in the form of an unordered catalog list with a significant decrease in the number of consultants.

3.7 Regulatory Information

In 2013, this information was published on websites of 39 universities: 299 items in the form of an unordered catalog list, 936 items, as an unordered full-format electronic presentation, and 1,385 in the form of an ordered full-format electronic presentation. In 2016, there was a sharp decrease from 299 to 65, from 936 to 328, and from 1,385 to 19, respectively. This is apparently due to the great complexity of maintaining this type of information resource, especially in the absence of a DBMS. In 2021, on the contrary, there was a sharp increase in RI items in the form of an unordered catalog list (up to 15,800); a reduction of their number in the form of an ordered full-format electronic presentation from 328 to 134, and their liquidation in the form of an ordered full-format electronic presentation. Such multidirectional trends can be explained, on the one hand, by the relevance of RI during the pandemic and, on the other hand, the complexity of maintaining them on a website due to the lack of methodological guidance from the Ministry of Education and Science and the Ministry of Agriculture.

Table 2: Summarized indicators of the condition and amount of SEIRs by types of knowledge presentation on the websites of agricultural universities in quantitative terms (2013/2016/2021).

Type of knowledge presentation by levels	Unordered catalog list	Electronic catalog	Unordered full-format presentation	Ordered full-format presentation
Developments				
Department	2212/2106/1624	32/52/0	1/3/18	0/0/0
Faculty	1646/257/252	29/17/0	1/0/0	1/132/0
University level	885/3684/2792	461/391/0	246/337/567	0/248/0
Publications				
Department	56270/53472/66859	17/335/254	386/4634/2246	2/96/0
Faculty	10093/3743/1388	13/5/0	11/86/3	2/0/0
University level	23172/18649/14034	100405/408/55082	2852/344/345	6/0/21114
DB				
Department	15/07/07	0/2/0	0/0/0	0/0/0
Faculty	1/7/0	1/0/0	1/0/0	1/0/0
University level	6/530/0	0/145/0	0/0/0	0/0/0
ASP				
Department	80/151/57	1/0/0	0/0/0	0/0/0
Faculty	1/0/0	1/0/0	1/0/0	1/0/0
University level	42/828/20	8/2/0	0/25/0	0/0/0
OL				
Department	0/8/1	0/7/0	0/5/0	0/2/0
Faculty	97/5/1	0/0/0	0/0/0	0/0/0
University level	620/1194/11	0/0/0	0/0/0	0/3/0
Consultations				
Department	0/189/1	0/9/0	0/0/0	0/1/0
Faculty	7/4/37	0/0/0	0/0/0	0/3/0
University level	62/216/76	0/43/0	0/9/0	0/0/0
RI				
Department	185/52/13409	0/0/0	36/2/0	0/0/0
Faculty	1/1/419	1/0/0	27/16/36	1/1/0
University level	299/65/1972	0/0/0	936/328/92	1385/19/0

4 CONCLUSIONS

Our research has confirmed the assumption that pandemic will promote creating new digital tools in the field of online learning and publication activity; but their implementation raises many questions about the technology for designing and deploying these systems, the weak methodological role of the Ministry of Education and Science and the Ministry of Agriculture, which contradicts the basic principles of digitalization of society.

First of all, a non-systematic approach to implementing a large number of ELSs that are ontologically unrelated to each other and duplicate the content (when you have to digitize the same material dozens of times, which leads to significant financial costs for universities and the state) postpones the future creation of a DPSEIR which plays the above triune role: supporting the scientific research, raising the education level for all population segments, and an effective system for transferring knowledge to the economy. The current course of digital transformation in education gives rise to disintegration methods for presenting SEIRs to the above user groups. At the same time, the presentation of online learning and publication activity is improved at the expense of other types of knowledge presentations, which also does not promote creating a modern competitive scientific and educational environment.

This approach is also observed in the digitalization of agriculture, which is outsourced to large agricultural holdings, raising doubts that creating technological platforms for DE the by state corporations and agricultural holdings, without a single concept, architecture, standards, and a general designer with his own scientific and pilot production base, would lead to their integration in the future. After enough time has passed since this program was adopted in the country, we can see the negative effects of such a decision on the example of university websites. In addition, digital feudalism gave rise to the illusion of the uselessness of scientific institutions engaged in digitalization of society, economy, and science in a comprehensive manner from a systemic standpoint.

The lack of demand for science by the economy and society has allowed illiterate and quirky managers to lead the process of informatization in the industry. It is enough to mention the statements that the main result of the DE program should be an

increase in the number of farmers' Internet connections (Petrikov, 2021).

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REFERENCES

- Medennikov, V. I., Muratova, L. G., Salnikov, S. G., 2017. Methodology for assessing the effectiveness of the use of information scientific and educational resources. *Analitik*: 250.
- Kulba, V., Medennikov, V., 2020. A model of the Russia's agriculture readiness for digital transformation. In *IEEE Xplore Digital Library*.
- Zatsarinnyy, A. A., Gorshenin, A. K., Kondrashev, V. A., Volovich, K. I., Denisov, S. A., 2019. Toward high performance solutions of research digital platform. In *Procedia Computer Science 13-th International Symposium on Intelligent Systems, INTELS2018*, 150.
- Ereshko, F., Medennikov, V., Muratova, L., 2018. Modeling of a digital platform in agriculture. In *IEEE Xplore Digital Library*.
- Ereshko, F., Medennikov, V., Flerov, Y., 2020. Effectiveness of the use of scientific and academic information resources. In *IEEE Xplore Digital Library*.
- Raikov, A., 2019. Strategic analysis of the long-term future needs of educational services. In *IEEE Xplore Digital Library*.
- Milgrom, P., Roberts, J., 1990. The Economics of Modern Manufacturing: Technology, Strategy and Organization. In *American Economic Review*, 80(3). pages 511-528.
- LNCS, Homepage, 2021. Retrieved from <http://repec.inecon.org/>.
- Medennikov, V. I., Muratova, L. G., Salnikov, S. G., 2017. Models and methods of forming a single information Internet space of agricultural knowledge. *GUZ*. pages 426.
- Petrikov, A.V., 2021. Digitalization of the agro-industrial complex and improvement of agricultural and rural policies. Retrieved from <http://www.viapi.ru/news/detail.php?ID=228044>.