Digitalization of education in the leading universities of Saint Petersburg

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Abstract. The sphere of high technologies in the developed countries is gradually becoming the main source of economic growth, defines structural changes in economy and contributes to modernization of systems. That is why information-communication technologies represent the main instrument of modernization of the industrial production system, development of social infrastructure, structural transformation of economy. Implementation of information-communication technologies requires specialists who have totally new competencies which causes reorganization of the higher education system. The process of digitalization in the higher education system is carried out over the course of recent years. In this context, the aim of the study is estimation of education digitalization in leading universities of Saint Petersburg. The main directions of digitalization of education have been systematized within the framework of the study, basic risks and supposed results have been revealed. Estimation of digitalization of leading universities is being carried out in the following directions: implementation of education process, optimization of business-processes and optimization of document flow and organization of the process of the academic teaching staff retraining, organization of access to scientific works of universities. As a result, it has been revealed that only 3 leading universities of the city take active part in digitalization: they create online-courses, their own electronic educational environment; they provide access to their staff members' studies. The analysis of the structure of expenses in these universities has revealed insufficiency of financing for teaching staff information technologies. We should also note a general tendency of reducing expenses on digitalization in the educational sphere. In future, this will cause underdevelopment of education in teaching new technologies and preparing specialists with competencies non-demanded on the market.

1. Introduction
Progressive development of the society economic system provides quantitative and qualitative improvement of the volume and structure of personal consumption. Currently, such development of systems is impossible without active integration of information-communication technologies (ICT) in this process. According to the information from open sources [1], the level of introducing and operating information-telecommunication systems in Russia is much lower than that in the developed countries of Europe and the USA. Analytics explain the existing situation with a serious break in digital skills between different groups of population of the country and inequality of the digital environment in general. “Digital Economy” program, approved on June 28, 2017 [2], predetermined to a large extent the main directions of development of social institutions including higher education institutions. By
2025, the higher education system must be restructured and able to prepare a sufficient number of qualified users of informational technologies who have required competencies. As the process of the education system reforming is long and costly, today it is necessary to correct this process as adjusted for digitalization and constantly changing outer environment. Today, application of innovative technologies is understood under the term “digitalization” [3]. The technologies transform operation processes and business models by means of replacing or supplementing an individual on the basis of using advanced analytics, artificial intelligence, mobile and portable devices, robot automation and integration technological platforms. The active process of digitalization of education in the leading universities of Russia began in 2015 when the first national portal of open education was implemented. Three years have passed from the moment of this project implementation. It allows giving interim estimates to the results obtained within the framework of digitalization of the leading universities. Thus, the aim of the study is estimation of education digitalization in leading universities of Saint Petersburg.

2. Data and method

The analysis of periodical publications [4–7] and analytical studies [8–10] in the field of digitalization allowed us to systematize risks related to this process, directions of implementation and expected results in the sphere of education. Estimation of the current results of education digitalization in leading universities of Saint Petersburg was implemented according to main directions of digitalization development (table 1).

| Potential risks                               | Main directions of development                                                                 | Result                                                                 |
|-----------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Technical (loss of password, dissemination of personal information) | The process of education                                                                 | Increasing availability of education in the leading universities of the country |
| Consuming (risk of using services of low quality) | The process of optimization of business processes                                            | Promotion of mobility                                                  |
| Communicational (cyber stalking)              | The process of optimization of document flow                                                | Resources saving (including time resources; reducing paper document flow) |
| Content (using unlawful or unethical information) | The process of organizing access to scientific works of universities with the aim of studying and developing the science community | Decreasing asymmetry of information                                     |
| Internet-dependence                           |                                                                                             | Increasing productivity of processes (reducing the human factor and the quantity of random mistakes) |
|                                               |                                                                                             | Increasing competitive ability of Russian universities on the global market |

Within the framework of this study, 5 leading universities have been selected on the basis of their rating [12] – Saint Petersburg University, Peter the Great St. Petersburg Polytechnic University, ITMO University, Saint-Petersburg Electrotechnical University ETU "LETI", Saint Petersburg Mining University. 3 of the specified universities are participants of the national project of increasing competitive ability of Russian education among leading international research and educational centers. They have the goal of entering the first hundreds of the QS rating [13].

Basic provisions of the general theory of systems, theories of economic measurements and also results of fundamental and applied research of national [14–17] and foreign [18–20] specialists in the field of digitalization have compiled the theoretical base of the study.
3. Results and discussion

From the point of view of digitalization of the education process, the following aspects have been analyzed: providing the process of education with actual ICT, teaching staff retraining, creating electronic informational-educational environment.

The process of digitalization is directly associated with providing the process of education with actual ICT. The size and structure of costs of the leading universities of Saint Petersburg in 2010–2016 are presented in figures 1 and 2.

![Figure 1. ICT costs for higher education in Saint Petersburg (Source: executed by the author on the basis of [20]).](image)

![Figure 2. Structure of ICT costs for higher education in Saint Petersburg for 2016.](image)

Currently, the largest part of costs in the ICT sphere is directed to purchasing computer equipment and software. We should note that the structure of costs of universities contains such expense items as training academic teaching staff connected with the use of ICT. For the moment, the share of this category of costs doesn't exceed 0.5% which is obviously not enough in the age of digitalization. Teaching staff for training qualified users of information technologies should have required competencies; follow the fashion of advanced informational technologies and direct future university graduates toward them. Let us also note the general tendency of reducing costs of universities for ICT. On the whole, the given tendency may be characterized as a negative one. The idea of creating a digital university on a special education platform, where courses of the leading world universities will be placed, often appears to be the main goal of digitalization of higher education. This fact will contribute to increasing the quality and availability of education. National and foreign platforms of open education are presented in table 2 where participation share of the leading Saint Petersburg universities is identified.
Table 2. Digitalization of educational processes in the leading universities of Saint Petersburg.

| National platforms | Saint Petersburg University | Peter the Great St. Petersburg Polytechnic University | ITMO University | Saint Petersburg Electrotechnical University ETU “LETI” in the Name of V. I. Ulyanov (Lenin) | Saint Petersburg Mining University |
|--------------------|-----------------------------|-----------------------------------------------------|----------------|-------------------------------------------------------------------------------------|----------------------------------|
| The number of courses on the platform, “Open Education”, pcs. | 42                          | 39                                                  | 33             | 2                                                                                  | 0                                |
| The part of courses of the university in the total number of courses placed on the platform, “Open Education”, % | 13.25%                      | 12.30%                                              | 10.41%         | 0.63%                                                                               | 0.00%                            |
| The number of courses on the platform, “Stepik”, pcs. | 4                           | 1                                                   | 0              | 3                                                                                  | 0                                |
| The part of courses of the university in the total number of courses placed on the platform, “Stepik”, % | 0.73%                       | 0.18%                                               | 0.00%          | 0.55%                                                                               | 0.00%                            |
| The availability of its own electronic information-education environment | +                           | +                                                   | +             | -                                                                                  | -                                |
| International platforms |                              |                                                     |                |                                                                                     |                                  |
| The number of courses on the platform, “Coursera”, pcs. | 49 (6 of them are in English) | 8                                                   | 0              | 0                                                                                  | 0                                |
| The part of courses of the university in the total number of courses placed on the platform, “Coursera”, % | 1.81%                       | 0.30%                                               | 0.00%          | 0.00%                                                                               | 0.00%                            |
| The number of courses on the platform, “edx”, pcs. | 0                           | 0                                                   | 2 (2 of them are in English) | 0                          | 0                                |
| The part of courses of the university in the total number of courses placed on the platform, “edx”, % | 0.00%                       | 0.00%                                               | 0.05%          | 0.00%                                                                               | 0.00%                            |

Let us note that the leading universities of Saint Petersburg are almost not presented on international platforms which make their education least competitive at the international level. A small set of courses in a foreign language also significantly limits the target audience of students. The number of courses of the three leading universities of the city on national platforms constitutes one third of all registered courses. Let us also note a significant discontinuity in digitalization between the first three universities in the rating and other institutions. The given aspect is not connected with participation of universities in the national project, 5-100-2020 (LETI, financed out of the funds of the project, is significantly behind in digitalization).
From the point of view of digitalization of the leading universities business processes, the following aspects have been analyzed: the system of cooperation of the senior management with employers, digital access of employers and students to the required information.

From the point of view of organizing access to scientific works of universities, such factors have been studied as the availability of an electronic library system, the availability of electronic resources, and also the presence of publications of staff in the electronic university library.

The results of the study are presented in table 3.

Table 3. Digitalization of business processes and organizing access to scientific works of universities in the leading Saint Petersburg universities.

| Organization of access to informational resources of the university (including documentation, personal information) | Saint Petersburg University | Peter the Great St. Petersburg Polytechnic University | ITMO University | Saint Petersburg Electrotechnical University ETU “LETI” in the Name of V. I. Ulyanov (Lenin) | Saint Petersburg Mining University |
|---|---|---|---|---|---|
| The presence of an applicant's user account | + | + | + | + | - |
| The presence of a student's user account | + | + | + | + | + |
| The presence of an employee's user account | + | + | + | - | + |
| The presence of a class timetable (platform) | + | + | + | - | - |

| Organizing access to electronic library resources | | | | | |
| The presence of an electronic library system | + | + | + | + | + |
| The presence of electronic resources (access to ELS, DB) | 219 | 68 | 29 | 55 | 14 |
| The presence of an electronic university library (employees' publications) | 13451 | 45031 | 18360 | 20858 | 2347 |

The results presented above demonstrate the fact that the leading universities of Saint Petersburg are generally interested in digitalization of employer-employee relations. When analyzing sites we have revealed the platform, “Digital Rectorate” where employers and students can directly ask questions which interest them. The three leading universities have also developed a platform where a class graph of students is depicted and which informs the students in case of canceling or shifting classes.

Regarding organizing the process of accessing scientific works of universities, there are studies of the universities' employees presented on all sites of the leading universities in this or that proportion. Let us note that SPB University provides a wide access to international electronic data bases contributing to the quality and timeliness of the studies undertaken in the framework of the university and also to integration of employees into the international scientific community.

4. Conclusion
The main goal of this research has been achieved within the framework of this study – evaluation of education digitalization in the leading Saint Petersburg universities. The revealed tendencies have made it possible to conclude the following: a huge break in digitalization of the educational process between the three universities of Saint Petersburg, which have leadership positions in ratings, and other universities; underdevelopment of education integration of the universities being studied into the international system through the use of education platforms; a small choice of courses in foreign languages which significantly limits the target student audience; reducing universities expenses on ICT; underfunding of retraining of teachers having competencies requested on the market; the universities’ intention to establish digital cooperation between an employer and an employee and also the ability to undertake highly qualified studies by employees.

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