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EDUCATION AND DIGITAL TECHNOLOGIES: ISSUES AND PROSPECTS OF THE DIGITAL TRANSFORMATION OF MANAGEMENT AND EDUCATIONAL PROCESSES IN UNIVERSITIES

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Abstract: Global trends in the development of society, education, science and economy are aimed at the transition to digital transformation. In essence, this means that all processes of social, educational, scientific, entrepreneurial and other activities are completely moving into the digital environment. The development of Russian institutions of higher education requires a transition to digital transformation in all areas of education.

The study provides a theoretical analysis of the issues and prospects of the digital transformation of management and educational processes in universities. Based on an expert survey, options for the digital transformation of the university management system, options for the administrative division of ICT departments and ICT structure of management and educational processes of universities are identified.

Keywords: digital transformation; university; information and communication technologies (ICT); information technology (IT); management; educational process.

I. INTRODUCTION

Digital transformation is an important step towards adapting higher education institutions in modern conditions. There is no doubt that the transformation of higher education is already underway. Therefore, the issue of the digital transformation of management processes is considered in many studies [1-5].

S.J. Berman [6] believes that the goal of digital transformation is to transfer all information interaction processes into the digital space, which will increase the efficiency and quality of activities by reducing time and efforts to obtain complete, timely, accurate and reliable information necessary for management, learning, scientific research, international activities, economic work, etc. Key in this definition is the concept of digital space, which, according to K. Schwertner [7], is computer-implemented databases and software, as well as the organizational infrastructure within which such a space is created.

For the implementation of digital transformation in universities in research [8-10], the following recommendations are proposed:

1. Digital transformation affects every part of the university, not just ICT.

2. It is necessary to link all digital activities of the university with the overall vision and strategy of the university.

3. Invest in communities built around willing and capable digital innovators.

4. Adopt a project-based approach focused on the needs of the customer and not on the internal structure of the university.

The study [11] examines the issues that arise in the process of the digital transformation of universities. The study found that many universities lack a clear vision of the disruptive impact of digital technology on higher education. Common causes of this phenomenon can be: understanding that universities have a new breed of clients with whom they have to interact and competitors with whom they need to

compete in new and different ways; inability to simultaneously develop existing ways of working, adding new methods, tools and capabilities; culture that hinders the rapid development and release of new technologies; lack of trust in digital services and cloud technologies or concerns about their reliability, security and sustainability [12, 13].

Another major inhibitor of digital transformation at universities, according to researchers [14, 15], is digital literacy, meaning knowledge, skill and confidence in using available technologies and devices to achieve the desired results. University faculty and staff may be afraid to use tools that they lack confidence in using, where they may feel disadvantaged in front of students [16-18].

M. Brown [19] believes that the tasks of the digital transformation of university activities require the use of a unified project management methodology. After all, university digital transformation projects, like any other projects, must be implemented using management methodology. In this methodology, a basis should be laid that allows one to clearly define the goals and objectives, as well as results, of digital transformation projects and develop management tools, while minimizing risks through in-depth analysis of digital transformation issues and rational planning [20].

P. Ghemawat [21] believes that the peculiarity of the formation of the methodology of projects for digital transformation of universities is a combination, on the one hand, of tools for creating software tools and, on the other hand, tools for managing individual digital transformation projects. The effectiveness of this process also depends on the provision of various software and information tools for managing digital transformation projects. That is, a unified information field is needed, which includes: a description of the university's digital transformation projects; digital transformation tools; information environment for projects of organizational changes in the university (digital transformation department, electronic document processing department, project management center) [22].

The areas of knowledge from the standpoint of the formation and implementation of the methodology of digital transformation projects of the university should provide: management of the psychology of changes; implementation management; methodological maturity management; management of the information environment of university digital transformation projects; impact management. The given areas of knowledge make it possible to build targeted systems of impacts on those involved in projects to implement digital transformation projects of the university [23].

The purpose of the study is to explore the issues and prospects of the digital transformation of management and educational processes in universities.

The hypothesis of the study: an integral part of the digital transformation of management and educational processes in universities is the development of an information and communication pedagogical environment.

According to the results of the study, it can be concluded that the purpose has been achieved.

II. METHODS

To achieve the purpose of the study, a set of theoretical and empirical research methods was used:

theoretical methods (analysis, synthesis, comparison, generalization) – in the study of scientific literature on the issues and prospects of the digital transformation of management and educational processes in universities;

empirical methods (expert survey method).

The main research method was a survey of experts in the field of higher education (expert survey) to determine options for the digital transformation of the university management system, options for the administrative division of ICT units and ICT structure of management and educational processes of universities.

The expert survey was attended by 40 experts, university staff (administrative staff, technical staff and teachers) with at least 10 years of experience in higher education.

All survey participants were warned about the purpose of the survey and the intentions of the research organizers to publish the research results in a generalized form.

III. RESULTS

AllAccording to the experts, in the existing digital management systems of universities not only in Russia, but also in the world, the construction and implementation of ICT infrastructure are carried out in three ways (Table 1).

Table 1. Options for the Digital Transformation of the University Management System

№	Options of digital transformation	% of the total number of universities
1	Partial outsourcing	50-40%
2	Independent construction and implementation of ICT management infrastructure	30-40%
3	Full outsourcing	10-20%

Note: compiled based on the expert survey

In the first case, as the experts noted, the construction and implementation of ICT management infrastructure are provided not only by the educational institution's own efforts, but also by the help of outsourcing companies. This makes it possible to attract someone else's experience, reduce the cost of servicing certain business processes and partially release internal resources of the university for solving other issues.

In the third case, according to the experts, universities have the following advantages:

a) the main efforts of the educational institution are not directed at servicing business processes, thereby reducing their costs;

b) outsourcing ensures the reliability and stability of ICT development, since the outsourcing company bears legal responsibility for the work performed in accordance with the concluded contract;

c) the internal resources of the university are freed up for solving other issues.

The experts noted that the disadvantages of both partial and full outsourcing are the threat of non-compliance with confidentiality, insufficient opportunity to influence the

outsourcer's company, the inconsistency of the development of the educational institution's business processes with the services provided, the threat of bankruptcy of the outsourcing company or an increase in the cost of outsourcing. At the same time, independent planning of ICT development and their implementation allows avoiding the described risks and, ideally, allows the university to be a kind of outsourcer for other educational institutions. In addition, the independent development and implementation of ICT resources provide opportunities for clear control of a group of developers and an assessment of their respective professional qualities, the gradual construction of an appropriate base, which will correspond to innovations, and the involvement of students of relevant specialties in professional work.

On the other hand, there is a clear distribution of universities according to the administrative division of ICT units during the digital transformation of the university management system. Therefore, the following types of systems are possible (Table 2).

Table 2. Variants of the Administrative Division of ICT Units

№	Variant of the administrative division of ICT units	%*
1	university administration – 1 department of ICT management and provision	75%
2	university management – n departments of management and ICT provision	85%
3	university management – 1 department of ICT management and provision – outsourcing company	60%
4	university management – outsourcing company	55%

Note: compiled based on the expert survey; * – percentage of expert mentions

Taking into account the results of the expert survey, let us consider the systems of the first two types in more detail.

The experts believed that in the case of the existence of a system of the type "university management – n departments of management and ICT provision", each department has a clear purpose and performs only a certain range of tasks, which ensures greater quality and speed of their implementation. The advantages of the existence of a system of the first type are a lower number of working personnel, and, consequently, saving budgetary funds of the institution by reducing the total amount of wages and tax payments, as well as reducing the amount of necessary technical and material support. However, needing, in most cases, a larger number of employees, the second type of system provides an opportunity for a clear distribution of rights and responsibilities. This, in turn, allows controlling the quantitative and qualitative indicators of the activities of departments, provides a better quality of performance of assigned tasks in a shorter time frame and, therefore, saves funds allocated for the implementation of projects.

The experts noted that the system of the first type most often corresponds to the infrastructure of the university, which does not have significant technical, educational and human resources or is at the initial stage of the digital transformation of the management system and does not have the appropriate funds to implement and support other

systems or does not pay attention to the development of its own ICT infrastructure.

As an example, a system of the second type can be constructed as follows (Table 3). Moreover, each of the structural units must have clearly defined directions and forms of activity.

Table 3. Example of the division of structural subdivisions of ICT management at a university (a system of the type "management – n departments of ICT management and provision")

№	Structural unit of ICT management in universities	Directions and forms of activity
1	ICT governance	Management coordination; Search for funding sources; Cooperation with partners.
2	Department of support of administrative processes of the university	Design, construction, management and support of the information network of the university (software part); Installation and configuration of servers; Antivirus protection of the information system; development and maintenance of information and analytical systems; Consulting on the design and development of information systems; Web hosting and services for the implementation and support of ICT by other structural units of the university.
3	Department of Support for the academic component of the university	Design and development of Web sites in various educational areas using educational information and open-source systems; Design, development and support of educational software; Design, development and support of distance learning systems and the like.
4	Technical and operational department	Provision of the educational process with technical teaching aids (installation of equipment in accordance with the subject of classes and technical requirements of the teacher, ensuring timely access of students and teachers to the premises for conducting classes and other scheduled events, restricting access to classrooms for unauthorized persons); Performing highly qualified work on the maintenance of computer, printing and copying, video projection equipment in the university departments and classrooms; Carrying out repair and maintenance work on computer, printing and copying, video projection equipment; Setting up and maintaining the local network, telephone communication and university alarm systems; Development of various guidance materials for the use of alarm systems, telephone communication, etc.; Control over the fulfillment of fire safety and sanitary and hygienic requirements in computer classrooms.
5	Other structural units of the university (faculties, departments)	Development of educational and methodological support; Implementation of IT in the educational environment; Development of own electronic educational tools (EET); Development of own EET as part of the research work of students; Creation of distance courses.

Note: compiled based on the expert survey

The example of the organization of a system of this type is the operating information and communication systems of Harvard, Stanford and many other well-known universities in the world. For example, the ICT infrastructure of Harvard University has about 18 structural units with clearly defined tasks and areas of activity (Academic Technology Management Group, Harvard Academic Computing Committee, ICT Security Group, Advisory Group on Administrative Systems, Committee of Working Standards, Project Review Board, etc.).

On the other hand, according to the "sectoral" purpose, the ICT structure of the management and educational processes of the university may have the following components (Table 4).

Table 4. ICT Structure of Management and Educational Processes of the University

№	Component of the structure	Components
1	ICT administrative direction	IT infrastructure: structural units and technical resources
		software resources: information and analytical systems
		information and legal resources
2	Information and communication pedagogical environment	IT infrastructure: structural units and technical resources
		software resources and methodological support: standard (special and system) and methodological (Learning Management System (LMS), Web multimedia resources, software and methodological environment and complexes) software
		information and legal resources

Note: compiled based on the expert survey

Each of these constituent parts of the ICT structure of management and educational processes of the university has its own set of components, and the cross-section of these sets makes it possible to determine the common components of each of the elements of the university ICT structure. Thus, the development of administrative ICT and the information and communication pedagogical environment simultaneously depends on the information resources of the university and the built ICT infrastructure. Next, we will consider in more detail each element of the university's ICT structure.

IV. DISCUSSION

According to the opinion of the expert community, the main components of the administrative ICT are software, information resources and IT infrastructure, information and analytical systems, business applications that allow keeping records of employees (address, qualifications, position, vacations, salaries, sick leaves, registration, benefits, time spent on work), students (admissions, specialty, graduation, distribution, academic leaves, orders) and applicants (passport and educational information, a list of faculties, specialties and documents that are required for admission) of the university, accounting, control over material values.

A university's information resources are its web portal, which should contain complete and detailed information regarding the structure of the university and its work. The portal provides data on institutes, faculties and departments of the university, its employees, leading teachers and their scientific schools; information about projects, forms of study, specialties, admission and payment methods; the latest news concerning the life of the university: conferences and seminars, educational and entertainment events, publication of scientific and methodological collections, work of laboratories and centers, as well as events in the field of science and culture.

Legal resources are the regulatory framework of the university, which is aimed at the development of ICT and the introduction of IT in the educational process.

As for technical resources, their components and main characteristics must correspond to the modern requirements of universities. Therefore, the number of pieces of equipment, workplaces, square meters of the area serviced by one employee (student) or a group of employees (students) should be determined in accordance with the service rate (determined by the equipment operation regulations and calculated based on the service time rate) [24].

In addition, the experts pointed out the need to provide each student with their own client space. Today, each student has their own laptop, tablet or another device that allows them to work without attachment to a stationary workplace. The main task of the educational institution remains to provide students with access to the necessary resources at any time and from anywhere in the university.

One of the most important components of the digital transformation of management and educational processes in universities, according to the experts, is the existence of its own local network in universities, which will provide access to all resources of the educational institution, as well as the global network. Moreover, the choice of providers and their number should be influenced not only by the pricing policy and the quality of the services provided, but also by the real assessment of the needs and technological support of the educational institution.

All of the interviewed university employees (100%) testified to the creation of local networks, as well as regional (5%) and corporate (25%) networks on their basis, and ensuring their access directly to the Internet – a network of the first level of telecommunication interaction (100%).

In addition to the use of a wired network, according to the experts, the introduction of wireless technologies is important. Thus, the use of Wi-Fi technologies by universities makes it possible to create additional "client" places, which is of great importance in our time, since most users prefer using their own computer equipment. In addition, the use of this resource should provide:
– access to distance learning servers;
– access to the global Internet;

– work with a personal folder on the file server of computer cabinets;

– work with corporate e-mail of computer cabinets;

– work in a local network with access to all resources;

– work in scientific networks of the world, etc.

Speaking about the availability of connection to local and global networks, a large number of information and educational resources, the experts also talked about the need to create special service and account-oriented systems that would provide the possibility of constant access for subjects of educational and administrative processes to the necessary services and materials and means with an appropriate distribution of access rights and taking into account the construction of an open educational environment.

Thus, by the account-oriented system, researchers [25, 26] understand the presence of their own online-accounts of users with the appropriate access rights to the electronic data storage with the ability to view, edit and distribute information open to them. A service-oriented system is an open system that includes the necessary services, tools and information resources, created for the interaction of all subjects of the educational and administrative processes of the university, dissemination and obtaining the necessary information from the external environment [27, 28].

The experts also noted the positive and significant impact on the digital transformation of management and educational processes in universities of cooperation between universities, their joint participation in projects, competitions and grants (not only at the regional but also at the international level). According to one of the respondents, the relevant relationship "provides an opportunity for the effective and efficient use of ICT for scientific purposes, the implementation of administrative and educational tasks". In addition, the experts noted that the implementation of such projects predetermines the infusion of additional funds into the budget of the educational institution aimed at ensuring organizational, technical and other project needs, which is significant support in building the ICT infrastructure of Russian universities.

V. CONCLUSION

Today, the issue of the effectiveness of management of educational institutions is relevant, when the old methods of management are transformed into qualitatively new achievements of management science. One of the most important areas of management reform is the use of the latest technologies, the digital transformation of management and educational processes.

To implement innovations, educational institutions need to be involved in the process of introducing ICT into educational and administrative processes and to create innovation and technology centers and technology transfer centers based on universities. It is important to pay attention not only to the current state of the university's ICT, but also to the strategy of their development.

The results of the study confirmed the hypothesis that the development of an information and communication pedagogical environment is an integral part of the digital transformation of management and educational processes in universities.

It should be remembered that as a result of certain management models, the question arises of changing the algorithm of the necessary behavior of all subjects carrying out their activities in universities. In this context, for the effective use of information ICT, an educational institution must take into account the following requirements: a) form a clear idea of its own strategies for educational services and the role of ICT in their implementation; b) be transparent to students, teachers, applicants and other interested parties; c) keep track of funds, costs of ICT, management of these facilities and understand their significance; d) extend responsibility for organizing appointments necessary to successfully exploit new ICT capabilities; e) participate in international projects.

An important stage in the process of the digital transformation of universities is the constant monitoring of the development and implementation of ICT in educational and business processes, the study of changes in the rating indicators of the university and their dependence on the use of certain strategies of information and technological development of a higher educational institution.

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