

A Regional University in the Conditions of the Transition to Digital Technologies: Trends, Opportunities and Prospects for Managing Research Activities

Una universidad regional en las condiciones de la transición a las tecnologías digitales: tendencias, oportunidades y perspectivas para la gestión de las actividades de investigación

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Abstract

Speeding up in the digitalization of the country's economy has a positive effect on the economic development of the regions, but this requires not only legislative initiatives, but also their scientific justification. The conceptual apparatus for managing the research activities of a regional university in the context of the transition to digital technologies was developed in the paper. It has been proven that in the new economy, universities make a significant contribution to the development of innovation and economic growth. The goal of transforming the research activities of the regional university is outlined, and its main directions are determined. The priorities, tasks, activities and results of the transformation of the research activities performed by the regional university are highlighted. A conceptual approach to digital management of research activities performed by the regional university is proposed. A conceptual model of a digital management module for the performance of research activities of a regional university based on advanced business analytics has been developed.

Keywords: Digital Technologies, Digital Management, Regional University, Research Activities, Transformation, Performance.

Resumen

Acelerar la digitalización de la economía del país tiene un efecto positivo en el desarrollo económico de las regiones, pero esto requiere no solo iniciativas legislativas, sino también su justificación científica. En el artículo se desarrolló el aparato conceptual para gestionar las actividades de investigación de una universidad regional en el contexto de la transición a las tecnologías digitales. Está comprobado que en la nueva economía, las universidades hacen una contribución significativa al desarrollo de la innovación y el crecimiento económico. Se delinea el objetivo de transformar las actividades de investigación de la universidad regional y se determinan sus principales orientaciones. Se destacan las prioridades, tareas, actividades y resultados de la transformación de las actividades de investigación realizadas por la universidad regional. Se propone una aproximación conceptual a la gestión digital de las actividades de investigación que realiza la universidad regional. Se ha desarrollado un modelo conceptual de un módulo de gestión digital para el desempeño de actividades de investigación de una universidad regional basado en analítica empresarial avanzada.



Palabras clave: Tecnologías digitales, Gestión digital, Universidad regional, Actividades de investigación, Transformación, Desempeño.

Introduction

The strategic goal of each region is to build an innovative economy, one of the main resources of which is the human potential of science, education and high-tech sectors of the economy. The development of science and the formation of an information society have highlighted the core of human capital encompassing leading scientists, and also scientific and pedagogical workers, and researchers as components of intensive development. It is they who generate knowledge and innovation creating favorable conditions for the innovation process, and who are an important factor in the creation and development of an effective innovation economy, knowledge economy, education, healthcare, and the quality of life of the population.

New socio-economic changes are characterized by the formation of a "new society", the driving force of science of which is knowledge. In the current conditions, the modernization of research activities of any university is aimed at developing a favourable research environment that ensures the realization by teachers and researchers of their potential, the participation of all categories of students in scientific activities, the formation of professional project teams in research areas that are promising in the context of the Strategy of scientific and technological development of the Russian Federation, strategies for the socio-economic development of the region, in particular, the Primorsky Territory. One of the most important factors in the sustainable development of a regional university within the context of the transition to the sixth technological mode is the integration of science and education with the real sector of the economy, which contributes to the accumulation and increase of the intellectual and professional component of regional human capital.

Materials and methods

The aim of the study is to scientifically substantiate the theoretical and methodological provisions and practical recommendations for improving the management system of research activities of a regional university within the context of the transition to digital technologies, as well as developing a conceptual approach to digital management of the effectiveness of those research activities.

The theoretical and methodological basis of the research is the fundamental management provisions

and principles used for the development and transformation of the university. To achieve this goal, a complex of general scientific and special methods was used: theoretical generalization, abstract logical method, graphic analysis, synthesis, deduction, induction, integral assessment, and cognitive modeling.

The object of the research is the process of managing the research activities of a regional university in the context of its transition to digital technologies. The subject of the research is theoretical and methodological provisions and scientific and practical aspects of the process which comprises the management of research activities of a regional university.

Results

In the era of transition to a digital economy, the growing scale of the use of scientific and technological innovations requires a modern university to be a flagship that contributes to the sustainable socio-economic development of the country by training in-demand personnel, generating and commercializing new knowledge, creating a scientific and educational environment that supports innovation, entrepreneurial initiatives, and harmonious personal enhancement.

Radical changes are taking place under the influence of digital technologies in the methods of scientific research, in the forms of employment in the scientific sector, in the mechanisms of accounting, legal protection and commercialization of the results of intellectual activity.

Strategic priorities and guidelines for the development of Russian science are aimed at its entry into the top five countries being world leaders. The main development trends are outlined in the National Science Project and are aimed at the development of scientific and scientific-production cooperation, the formation of scientific and educational centres and world-class scientific centres, the creation of advanced infrastructure and the development of human resources for research and development. It is quite obvious that the solution of global breakthrough tasks lies in the area where academic institutions and leading national research and federal universities function. An increase in the role of regional universities in the implementation of the National project is possible within the transformation of research activities in the trend of the



priority areas of the Strategy for Scientific and Technological Development, the implementation of innovative solutions that respond to major challenges, and also in the development of advanced research, the results of which will be in demand by business and industry (The strategy of scientific and technological development of the Russian Federation approved by the Decree of the President of the Russian Federation No. 642 dated 01.12.2016; The National Project "Science" Design Abstract approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects, Minutes of December 24, 2018).

One of the flagships of science and education in the Russian Far East is the Vladivostok State University of Economics and Service (hereinafter referred to as VSUES) being a multidisciplinary Russian regional university with a multilevel structure of training. The university promotes for the development of the region through the production and dissemination of advanced knowledge and experience, and also through training in-demand personnel for significant industries in the region. Of course, regional universities are the drivers of the regional development and their functioning is impossible without transformations (Mamychev et al., 2020). The logic of transformations is based on such challenges as the globalization of science and education, ensuring the country's strategic security, increasing demands from employers and society, developing technologies, and also increased competition in the labour market, services and goods. The transformation of the research activities in the regional university is aimed at the development of a favourable research environment that ensures the realization of the potential of teachers and researchers, the participation of all categories of students in scientific activities, the formation of professional project teams in research areas that are promising within the context of the implementation of the national project "Science", the Strategy of the technological development of the Russian Federation, and also the Strategy of social and economic develop-

ment of the Primorsky Krai (Petruk & Shashlo, 2019; Shabunina, 2020; Gorchakov, 2020).

The purpose of the transformation of research activities is to ensure the relevance of university science through promising applied and fundamental research, sustainable transfer of frontier technologies focused on the requirements of the external environment (Ablazhei et al., 2018; Petruk & Shashlo, 2019; Science, society, culture: problems and prospects of interaction in the modern world). The result of achieving the above goal should be an increase in the efficiency of research and innovation activities of the university.

The key issues to be addressed by managerial actions, special attention and special efforts are the following:

1. Development of fundamental and applied science, which should be based on the principles of the Strategy of Scientific and Technological Development of the Russian Federation, the national project "Science", experience and achievements in the scientific research activity (SRA) of the university;
2. Increasing in the demand for the results of scientific and innovative activities by the real sector of the economy based on the project- and practice-oriented education at the university and the regional specifics;
3. Development of the personnel potential in the university: transformation in this direction is based on the personnel policy of the VSUES, and on the support of scientific schools (Baranichenko et al., 2019; Slobodyan, 2019; Kuzubov, 2017).

Thus, the global goal of transforming the research activities of the university is set based on the strategic priorities of state policy in the field of science, and on the specified specific problems to which managerial actions should be directed; the successful implementation of this goal is possible only through the implementation of a number of activities presented in Table 1.

Table 1. The main tools and results of the research activity transformation

Activity	Result
Priority 1. Inclusion of the university's research activities in the global research agenda.	
Objective 1.1. Creation of a centre of competence in the frontier research area	
1. Creation of joint research centres with universities in other countries. 2. Attracting world scientists to scientific schools. 3. Opening of joint scientific laboratories. 4. Strengthening the material and technical base of the scientific sector	1. Development of scientific knowledge in the research areas of science, expansion of research topics, and also expansion of the composition of research teams. 2. Determination of the scientific frontiers of the university. 3. Creation of new research collaborations in breakthrough areas of science. 5. Increase in income from research activities.
Objective 1.2. Creation of a system of transfer and adaptation of advanced technologies.	
1. Improving the system of stimulating the scientific and practical work of the university for re-	1. Creation of a system for the introduction of innovative technologies in the region with their adaptation to regional



<p>search.</p> <p>2. Implementation of a system of analytics for global scientific research and innovation.</p>	<p>realities and needs.</p> <p>2. Creation of a system for monitoring the needs of the region and assessing the possibility of introducing advanced world technologies on the basis of the scientific capacities of the university.</p> <p>3. Increasing income from research activities</p>
<p>Priority 2. Development of scientific and scientific-production cooperation</p>	
<p>Objective 2.1. Creation of a system of interaction with the real sector of the economy</p>	
<p>1. Formation of the "portfolio" of projects actual and demanded by the business environment.</p> <p>2. Creation of a single information space for research groups and individual experts.</p>	<p>1. Creation of a platform for an effective dialogue between the university and representatives of the real sector.</p> <p>2. Providing conditions conducive to the involvement of teachers in the implementation of projects ordered by the real sector of economy.</p>
<p>Objective 2.2. Creation of a system of interaction with potential industrial partners</p>	
<p>1. Transformation of the structure of training areas, taking into account the development of engineering specialties.</p> <p>2. Attracting leading researchers in priority areas of scientific and technological development.</p> <p>3. Building a system of interaction with potential industrial partners in the region.</p>	<p>1. Creation of conditions for the implementation of projects demanded by the industry of the region</p> <p>2. Increase in the number of trained engineering specialists.</p> <p>3. Increased income from research activities</p>
<p>Objective 2.3. Creation of a system for involving students in research activities and research and production cooperation</p>	
<p>1. Design technologies in the organization of research work.</p> <p>2. Creation of a system for stimulating project learning</p>	<p>1. Implementation of the adaptive learning concept, taking into account the individual abilities, experience and needs of students</p> <p>2. Increase in income from scientific activities.</p>
<p>Objective 2.4. Expansion of scientific cooperation of the university</p>	
<p>1. Development of partner networks for scientific research and training of highly qualified personnel</p> <p>2. Expansion of scientific collaborations</p> <p>3. Conclusion of agreements on scientific cooperation</p> <p>4. Creating an affiliate network of science and business</p>	<p>1. Creating conditions for increasing the efficiency of scientific research by combining intellectual and material and technical resources</p> <p>2. Creation of conditions for the development of new topics of scientific research</p> <p>3. Creation of conditions for the implementation of projects demanded by the industry of the region</p> <p>4. Deep integration of the university with academic science</p>
<p>Objective 2.5. Support for priority and interdisciplinary research areas</p>	
<p>1. Creation of a Communication Laboratory as a system for organizing, developing and supporting the work of interdisciplinary research groups.</p> <p>2. Development of a system of grant support for scientific projects.</p>	<p>1. Maintaining conditions and a comfortable environment for the implementation of interdisciplinary research projects</p> <p>2. Determination of the scientific frontiers of the university.</p> <p>3. Increased income from research activities</p>
<p>Priority 3 - Development of infrastructure for research and development</p>	
<p>Objective 3.1. Creation of scientific centres of competence in priority areas of science</p>	
<p>1. Creation of scientific centres in frontier directions</p> <p>2. Opening a joint scientific laboratory with research institutes</p> <p>3. Strengthening the material and technical base of the university research sector</p>	<p>1. Development of scientific knowledge, expansion of research topics, composition of research teams.</p> <p>2. Creation of new research collaborations in breakthrough areas of science</p> <p>3. Increasing income from research activities</p>
<p>Objective 3.2. Development of basic departments</p>	
<p>1. Continuing the practice of creating "basic departments".</p> <p>2. Strengthening the material and technical base of the university research sector</p>	<p>1. Opening of basic departments.</p> <p>2. Involvement of students and staff in research and development.</p> <p>3. Ensuring effective interaction between the university and research organizations using modern scientific equipment.</p> <p>4. Expansion of topics of scientific research and innovative development</p>
<p>Objective 3.3. Creation of scientific laboratories with foreign partners</p>	
<p>1. Development of network integration with for-</p>	<p>1. Creation of conditions for effective interaction between</p>



eign partners through the intensification of the work of the international scientific laboratories within the framework of strategic partnerships with foreign universities	scientists of the university and scientists of foreign universities. 2. Growth of academic mobility.
Priority 4. Development of human resources in research and development areas	
Objective 4.1. Reproduction of scientific and scientific-pedagogical personnel	
1. Improving the system of financial support for scientific schools. 2. Development of a support system for promising young scientists.	1. Stimulation of infrastructural and institutional support of professional and career growth of gifted youth. 2. Increase in the share of researchers under the age of 39 in the total number of university researchers. 3. An increase in the proportion of doctors of sciences, including those under the age of 45.
Objective 4.2. Development of a system for attracting and retaining leading scientists	
1. Creation of flexible formats for recruiting highly qualified specialists from other institutions.	1. An increase in the number of highly qualified specialists capable of implementing breakthrough scientific projects. 2. Creation of conditions for the formation of new research teams, and also improving the quality of scientific research. 3. Increase in income from research activities.
Objective 4.3 System for the development of youth science	
1. Continuing the practice of implementing the project "System for the development of youth science". 2. Creation of a grant fund for support and promotion of student research projects, development of a system of academic exchange and internships in foreign and Russian universities. 3. Formation of a system of career trajectories for talented students (Bachelor's programme - Master's degree programme - postgraduate studies) in the research circuit of the University	1. Strengthening the brand of the university as a centre for youth scientific activity. 2. Increase of student loyalty, formation of an attractive image of the university for applicants. 3. Creation of conditions for the implementation of a system of continuous participation of students in research activities within the educational process and outside of educational activities. 4. Increase in the share of researchers under the age of 39 in the total number of university researchers

It is advisable to consider one of the components of digital transformation, i.e. the management of the effectiveness of research activities from the standpoint of various approaches to transforming operational processes (Gorodetsky & Yusupov, 2020; Garanin & Sandler, 2020; Shashlo, 2017). Until recently, the information model of company management was described by Howard Dresner's Corporate Performance Management (CPM) concept. However, the digital revolution has created an information divide between the strategic and operational levels of management. The need arose to build a management system that could function in real time (RTE, real time enterprise). Actualization of this task requires further development of H. Dresner's concept, the author's vision of which is presented in Figure 1.

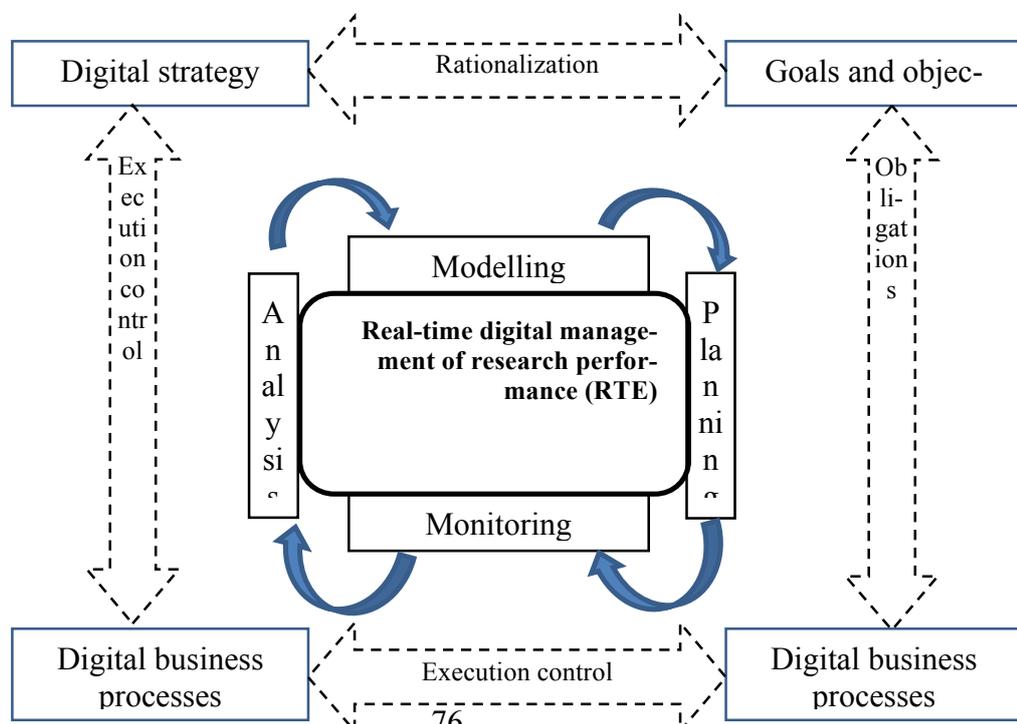




Figure 1. Conceptual approach to digital management of the research activity performance of a regional university

Let us consider the process of transformation of research activities and information support in a continuous cycle of digital control based on such classical units of the CPM system as analysis, modelling, planning and monitoring:

- 1) Analysis. To implement digital control, the classic CPM solution providing Plan-Actual analysis must evolve from a descriptive analysis towards an intellectual and advisory analysis.
- 2) Modelling. Modelling is closely related to analysis. Modelling of Key Performance Indicators of research activities (KPI) based on scenario analysis "What-If" will develop and is already developing towards predictive modelling based on predictive analytics.
- 3) Planning. In the generally accepted Plan-Actual-Forecast paradigm, planning is an actual-based forecasting function. In the new digital paradigm, it should not only be based on forecasting results and actual results of core activities, but it should be adaptive. Obviously, machine algorithms and recommendation analytics will play a big role in decision making, helping top management make decisions in real time.
- 4) Monitoring will develop through the further development of visualization tools and deep integration with analytical programs and services for working with smart devices, big data, and other components of the digital ecosystem (Colin, 2020; Akutina, 2018; Kuzubov et al., 2018; Lavrentyeva et al., 2020; Botashev et al., 2020; Gerashchenko et al., 2019).

It should be noted that modern information concepts and technologies make it possible to comprehensively approach the improvement and rationalization of the concept of managing the effectiveness of research activities. Thus, the use of balanced scorecards can simultaneously improve the efficiency of planning and monitoring processes. Digital business processes can be rationalized to a large extent using technologies such as digital platforms and cloud computing.

So, the further development of the classical CPM concept is associated with the digitalization of strategy, business models and business processes, as well as with the transition to the management of research activities in a real-time system (RTE), as shown in Figure 1. The semantic centre of the performance management is its analytical part. The efforts of leading researchers from all over the world are directed at its improvement. The result of these efforts is called "Advanced business analytics". The generalization of research allows building a conceptual digital model for managing the performance of research activities based on advanced business analytics (Figure 2).

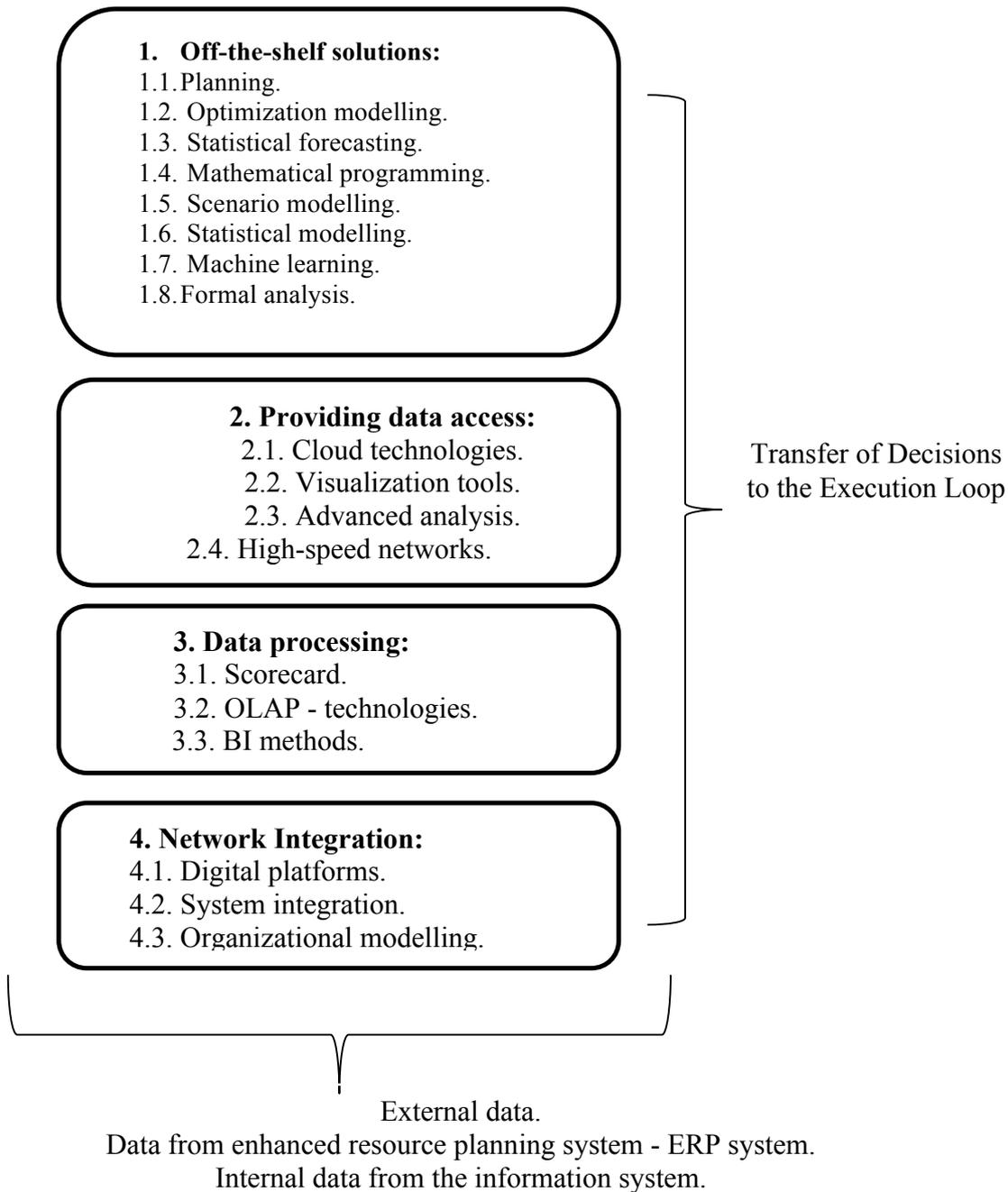


Figure 2. Conceptual model of the digital performance management module for research activities of a regional university based on advanced business analytics

At the first level, there are formal methods used in the management of research activities at the initial stages (1-2). Methods that were not used in traditional CPM solutions are gradually emerging (Unit 1.7). Advanced business analytics includes units, applications and services presented at the levels 3-4, and in some cases at the level 2. Business analytics of a new generation can support both strategic and operational corporate governance loop based on statistical data processing, mining analysis and optimization modelling.

Tools for physical data access (units 2.1 and 2.4) and tools that provide opportunities for their analy-

sis and visualization (units 2.3 and 2.4) should be distinguished at the level of providing data access (level 2).

Data processing tools (level 3) provide the ability to quickly and efficiently transform data to change their structure and composition according to certain algorithms. It should be noted that the modern foundation for such a transformation can be considered the concept of a balanced scorecard (unit 3.1), which comprehensively reflects activities not only from financial, but also from other points of view (client, innovation, etc.).



The fourth level links the digital R&D performance management module to the existing information structure of the organization. The methodological basis for this is the methods of organizational modelling (unit 4.3), among which the concepts of UML, IDEF and others can be noted. From the point of view of technology, it is advisable to use digital platforms (unit 4.1) for the digitalization of the control system; the use of digital platforms makes it possible to effectively realize the most significant advantages of the digital economy: transboundariness, the ability to take into account the participation of all users in the overall result, web access technologies.

The list of basic requirements for the construction of models and systems for digital management of research activities can be formulated in the most general form as follows:

- 1) Requirements for digital development strategy.
- 2) Requirements for digital management of operational efficiency.
- 3) Requirements for digital transformation of the organizational structure.
- 4) Requirements for digital transformation of business processes.
- 5) Requirements for information and analytical support of digital management.
- 6) Requirements for the speed of decision making (real-time models in the composition of real-time information systems (RTS)).
- 7) Requirements for working with digital data (integration of Advanced analytics with corporate digital processes).
- 8) Requirements for digital competencies of personnel.

Efficiency will increase due to the creation of a system of interaction with the real sector of economy, the development of partner networks for scientific research and training of highly qualified personnel, support of priority and interdisciplinary scientific areas, and the development of university infrastructure focused on research and development (Volodarskaya, 2020; Zezyulko, 2020; Aseev et al., 2020; Kuzubov, 2018). The quality of training students increases due to the introduction of a system of continuous and consistent participation in research activities within and outside the educational process, and the formation of an integral system for training and professional growth of scientific and scientific-pedagogical personnel, which provides conditions for young scientists to carry out scientific research and development (Rodionov, 2020; Smolin, 2020).

Conclusions and discussion

Thus, the transformation of research activities in a regional university will contribute to an increase in its effectiveness, as well as the motivation of scientists in terms of:

- Carrying out scientific research work of a fundamental and applied nature in a certain scientific field providing an increase in scientific knowledge;
- Development and implementation of research projects on topical problems of science, including for the nomination of grants and other forms of support for scientific and other foundations;
- Obtaining targeted funding from the funds owned by the University; financing from funds raised from external sources (grants from scientific foundations, orders for research works from third-party organizations, sponsorship of enterprises and organizations, foundations, individuals, etc.); funding from the funds of Institutes and departments, obtained through the commercialization of the results of their research activities;
- Fuller disclosure of their creative abilities by assisting in the organization of scientific work;
- Interaction with the scientific community of leading Russian and international scientific centres, and with research laboratories.

It has been proven that universities make a significant contribution to the development of innovation and economic growth in the new economy. Technological leadership in the context of global competition is determined by the ability of the university system to provide an advanced level of research and training of highly qualified personnel. At the same time, the need to carry out research and innovation activities for Russian universities is a new challenge. This factor has a decisive influence on the competitiveness of the Russian national innovation system.

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