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THE PRINCIPLES OF ORGANIZING THE EDUCATIONAL SYSTEM FOR PERSONNEL TRAINING IN A DIGITAL ECONOMY

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The article considers the changes taking place in almost all countries of the world, associated with the transition to a digital economy. The focus is on the peculiarities of higher education as the most important factor determining the opportunities for the development of any economic system. Currently, Russia has to modernize higher education in accordance with the needs of the labor market and further integration of Russian education into the global economic and educational space. The article confirms that universities have to change the educational paradigm in the developing digital economy. We have proposed a change from the outdated traditional models of educational activities to new ones that can stand up to the challenges of our time. We have formulated the main principles of organization of the educational process, such as the introduction of the competence approach into the educational process, use of methods of project-based learning, digitalization and informatization of education, the implementation of individual educational trajectories. We have considered the principle of forming professional competences through the integration of education, science, business structures and enterprises of high-tech industry on the basis of communities of teachers, students, and scientists. The proposed method of electronic portfolio (web portfolio) as one of the innovative teaching methods based on the formation of an individual educational trajectory. Analysis of the structure and interaction of the portfolio of the university allows to improve the system of criteria and indicators for estimating the efficiency of educational and scientific activities of faculties and institutes of the university, to streamline the organization and management of the university. Measures based on the principles offered will allow to implement new forms of training, increase the motivation of participants in carrying out scientific research and the efficiency of university's management. This will provide the possibility of forming an innovative environment of the university on a qualitatively new level, and building a system of university management in accordance with the university's tasks and taking into account modern trends. There is a plan to develop a mechanism of managing the innovative potential of the university in the nearest future in order to conduct personnel training on a fundamentally new quality level, taking into account contemporary tendencies.

Keywords: digital economy; higher education; human resources; competence; project learning; individual educational trajectory

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ПРИНЦИПЫ ОРГАНИЗАЦИИ СИСТЕМЫ ОБРАЗОВАНИЯ ПРИ ПОДГОТОВКЕ КАДРОВ В УСЛОВИЯХ ЦИФРОВОЙ ЭКОНОМИКИ

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Рассмотрены изменения, происходящие практически во всех странах мира, связанные с процессом перехода к цифровой экономике. Большое внимание уделено особенностям функционирования системы высшего образования как важнейшего фактора, предопределяющего возможности развития любой экономической системы. В настоящее время для России необходимыми являются процессы модернизации высшего образования в соответствии с потребностями рынка труда, а также в целях интеграции отечественного образования в мировое экономическое и образовательное пространство. Показана необходимость смены образовательной парадигмы университетами в результате развития концепции цифровой экономики. Предложен переход от устаревших традиционных моделей образовательной деятельности к новым, наиболее соответствующим вызовам современности. Сформулированы основные принципы организации образовательного процесса, такие как внедрение компетентного подхода в образовательный процесс, использование методов проектного обучения, цифровизация и информатизация образования, реализация индивидуальных образовательных траекторий. Рассмотрен принцип формирования профессиональных компетенций в результате интеграции образования, науки, бизнес-структур и предприятий высокотехнологичной промышленности на базе сообществ преподавателей, студентов, ученых. Предложен метод электронного портфолио (web-portfolio) как один из инновационных методов обучения на основе формирования индивидуальной образовательной траектории. Результаты анализа структуры и взаимодействия портфолио вуза позволят совершенствовать систему критериев и показателей оценки эффективности образовательной и научной деятельности кафедр и институтов вуза, организацию и управление деятельностью вуза. Выполнение мероприятий на основе предложенных принципов позволит реализовать новые формы обучения, повысить мотивацию участников при проведении научно-исследовательской деятельности и увеличить эффективность управления вузом. При этом будет обеспечиваться возможность формирования инновационной среды университета на качественно новом уровне, а также выстраивания системы управления вузом в соответствии с решаемыми им задачами и с учетом современных тенденций. Планируется разработка механизма управления инновационным потенциалом вуза в целях подготовки кадров на качественно новом уровне с учетом современных тенденций.

Ключевые слова: цифровая экономика; высшее образование; кадры; компетенции; проектное обучение; индивидуальные образовательные траектории

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Introduction. For the last ten years, the development of information and communication technologies (ICT) has gained vast significance in the world. Countries are rapidly moving towards a new economy which has digital technologies as its main instrument and information as a main production resource on a

level with energy, materials and finances. Scientists call this new economy digital, communicative, network, or Internet economy in their works, that is, they emphasize the point that ICT, digital communication, computer networks, modern communications have to be used in business.

The term ‘digital economy’ was the subject of much debate at the beginning of the 21st century, since different specialists had different opinions on what the new economy was, and, accordingly, described it by different names. The term appeared due to two factors: the rapid development of this phenomenon in Great Britain, the USA and Australia, as well as formalization of the term in the European Union [1].

The notion of digitalization indicates a new step in the improvement of production management and production itself on the basis of implementing ICT, from the Internet of things to digital government technologies. In the foreseeable future, the rank of each country in the world community will be governed by the level of computerization. The countries that are able to implement the principles of digital economy will achieve economic efficiency, competitiveness, a permanent increase of standard of living, a cutback in the cost of living, optimization of educational trajectories for disabled people, usage of their potential as a positive element of digital economy.

The modern development of digital economy has led to digital transformation of all aspects of human activity [2–5], such as commerce, construction, power engineering, development of cities and railroads. In these conditions people and their ways of communication with the environment must change in order to meet the demands on performing industrial and other functions in the digital world. Digital transformation influences both industrial and social spheres, including education.

The sphere of education is one of the key and most promising fields of the competition for economic influence between the countries in the 21st century. Global competition sets completely new goals for the government in the sphere of education. These goals are connected with emerging new professions, as well as needs for personnel in amounts that is cannot be found at the labor market. To ensure successful development of digital economy, the educational system must provide competent specialists for the economy. The countries able to adapt their educational infrastructure to the new needs will significantly strengthen their economic positions while shifting to digital economy. Russia has every chance to maintain its own competitiveness by modernizing the educational system and personnel training.

Representatives of 40 most developed countries signed the «Digital Economy: Innovation, Growth and Social Prosperity» Ministerial Declaration at a Ministerial Meeting under the auspices of the Organization of Economic Co-operation and Development (OECD), held in June 2016 in Cancun (Mexico). Russia joined this path in December 2016.

In December 2016, the path to digital economy became the leading direction for Russian economy in general. It happened after President Vladimir Putin stated the following in his annual address to the Federal Assembly: «I suggest that we should launch a widescale systematic program of the economy of new technological generation – the so-called digital economy. In its realization we will rely on Russian companies, scientific, research and engineering centers of the country».¹ At the moment, when it comes to the development of Russian economy, the most important issue is the necessary competences and educational technologies for developing such skills.

Under the auspices of the Agency of Strategic Initiatives (ASI), the Russian Federation Government approved the Program «Digital Economy of Russian Federation» (referred to as the Program from now on) on July 28, 2017. The Program is aimed at «creating the conditions of the development of people’s knowledge in the Russian Federation, increasing the general quality of citizens’ lives through increasing the availability and quality of goods and services that are made in the digital economy using contemporary digital technologies...».² This Program is implemented within the framework of the Strategy of the Development of Information Society in Russian Federation for 2017–2030, approved by the Decree of the President of the Russian Federation issued on May 9, 2017, and it takes into consideration the objectives fulfilled within the framework of the National Technological Initiative.³

¹ Poslaniye Prezidenta Rossiyskoy Federatsii Federalnomu Sobraniyu Rossiyskoy Federatsii ot 01.12.2016. URL: <https://ria.ru/politics/20161201/1482599952.html> (accessed October 24, 2017).

² Ob utverzhdenii programmy «Tsifrovaya ekonomika Rossiyskoy Federatsii». Rasporyazheniye. Rasporyazheniye No. 1632-r ot 28 iyulya 2017 g. URL: http://www.consultant.ru/document/cons_doc_

³ LAW_82134/ (accessed October 24, 2017).

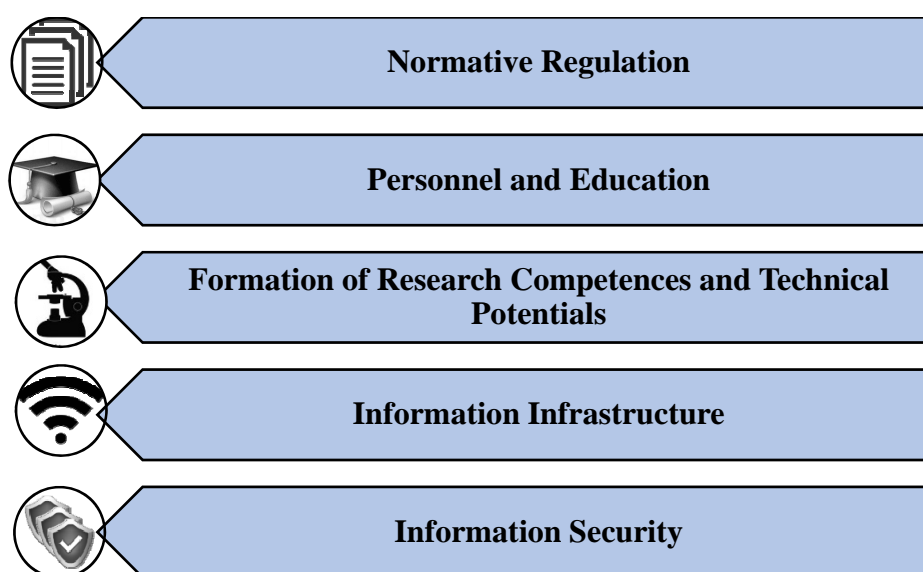


Fig. 1. Basic directions of the Program «Digital Economy of Russian Federation»

The report «Global Information Technologies» for 2016, assessing the extent to which digital technologies were used by countries to increase competitiveness and prosperity, was presented at the World Economic Forum. The data shows that Russian Federation holds so far the 41st rank in readiness for digital technology [6]. At the same time, Russia significantly falls behind such countries as Singapore, Finland, Sweden, Norway, the USA and the Netherlands. The Program projects that in eight years Russia will take the leading positions in the rating of attractiveness for highly skilled specialists, which is especially important in the global economic environment, where integration processes are intensifying. Skilled personnel are needed to fulfil such plans.

Personnel training is one of the five basic directions of the Program within the framework of the «Personnel and Education» direction (Fig. 1). Apart from the basic directions, the Program proposes three more directions, such as «Government Management», «Smart City» and «Digital Health Care».

The main goals of the «Personnel and Education» direction are:

- creating the key conditions of personnel training for the digital economy;
- perfecting the educational system which should provide competent personnel for the economy;
- the labor market that should rely on the demands of the digital economy;

- creating a motivation system for acquiring the necessary competences and participation of personnel in the development of Russian economy.⁴

The analysis of these goals shows that Russia has every chance to maintain its competitiveness through modernization of education systems and personnel training.

Goals and objectives. The main goal of the study is to formulate a number of principles which must be the foundations of the smart university concept. Accordingly, the objectives of the study are to analyze and determine the main principles of the organization of smart universities and to show the connection between these principles. From the theoretical point of view, the study is significant for the formation of the basics of conceptualization of smart education.

Renewing outdated programs of vocational education and career training to eliminate the gaps in digital skills necessary for modern economy may be one of the government's first steps in adapting the educational system to the needs of the digital economy. These changes must be introduced at the federal level, since a significant part of industries requiring qualified specialists for digitalization are situated outside big cities. The curriculums of modern

⁴ Ob utverzhdenii programmy «Tsifrovaya ekonomika Rossiyskoy Federatsii». Rasporyazheniye. Rasporyazheniye No. 1632-r ot 28 iyulya 2017 g. URL: http://www.consultant.ru/document/cons_doc_

universities virtually lack subjects preparing students to search for problems and objectives, analyze the society's needs and ways of satisfying them. For this purpose, it is expedient to develop intellectual information and analysis systems for vocational education management [6, 7].⁵ A system of information management and analysis in the sphere of education should perform a number of complex tasks, aimed developing the educational system in accordance with the objectives set and the current activities of educational establishments. Artificial intelligence systems (information, expert, analytical ones) are expected to be widely introduced into the educational process in the foreseeable future.

The current share of employees whose functions are connected with the implementation and development of digital technologies is 2 % of the general working population of Russia [8]. This is half as much as in the countries that are digital leaders, such as the USA and Europe. Russia also falls behind the leading countries in the level of employment in the high tech and knowledge-intensive branches. This indicator is estimated to be about 5.5 % in Russia, while in Germany it is about 10 % [8].

In the long term, all levels of the Russian educational system need to undergo extensive transformations on the basis of the following principles:

- usage of methods of project teaching;
- implementation of the competence approach;
- digitalization and computerization of education;
- individualization of teaching (flexibility of educational trajectories).

Let us consider the implementation of each of these principles that can be used to develop a full-scale concept of a new type of university.

A transition to *project education* is happening in the world. Projecting is defined as the creation of new objects with pre-determined characteristics. On-the-job training during various projects becomes the main method of personnel training. To achieve that, integrative scientific and educational creative spaces have to be created at universities. Such spaces must be aimed at forming the environment for interdisciplinary project work on Russian and international industry orders executed jointly by

representatives of academic institutions, industrial enterprises, students, postgraduate students and teachers. In order to successfully develop this activity, the key technologies should be rapidly introduced, the material and technical base should be improved, and a positive experience of working with the world's leading high tech enterprises should be acquired.

Using the methods of project teaching in personnel training implies integrating the educational processes with scientific search. As a result, on the one hand, the learners' creativity is improved, they generate new knowledge and become highly qualified specialists in the future, and, on the other hand, knowledge-intensive technologies are created and subsequently introduced data into the real sector of economy. The educational process in such a university is implemented by education within the process of creating new knowledge, that is, through the integration of science, the educational process and production. This type of education is connected with practice much more closely. Thus, the university becomes both a direct producer of new knowledge and an active participant of transforming the gained knowledge into technologies and services.

Integration of the educational, scientific and business environments and the real sector of economy allows industrial enterprises to influence the teaching process and to obtain the personnel trained in accordance with the current tendencies. In their turn, universities monitoring the changing demands of different industrial branches for specialists are interested in swiftly reassessing the contents of educational programs and teaching methods, which in turn increases the competitiveness of a university.

In the developing digital economy, the main tasks of higher educational institutions include not only transferring a certain set of relevant skill and training specialists in a narrow professional field, but also teaching students to independently and quickly extract the necessary information from a rapidly increasing volume of data, create knowledge, develop competencies, that is, the introduction of a *competence approach*. It is advisable to focus on the competences of graduates as an end result of project-oriented learning. Competencies can be defined as personal qualities that are continuously developed in the process of education in a university,

⁵ LAW_82134/ (accessed October 24, 2017).

expressed in the ability and readiness for independently solving research tasks on the orders of domestic and global industrial enterprises, mastering the methodology of research work, being capable of using the existing methodological developments in professional activities.⁶

The best results in forming the competences of specialists can be achieved with the help of practical solution of complex industry tasks by teachers and different kinds of students working in interdisciplinary teams based on the leading scientific schools through mutual accomplishment of interdisciplinary research using high techn equipment and innovative industrial technologies (Fig. 2).

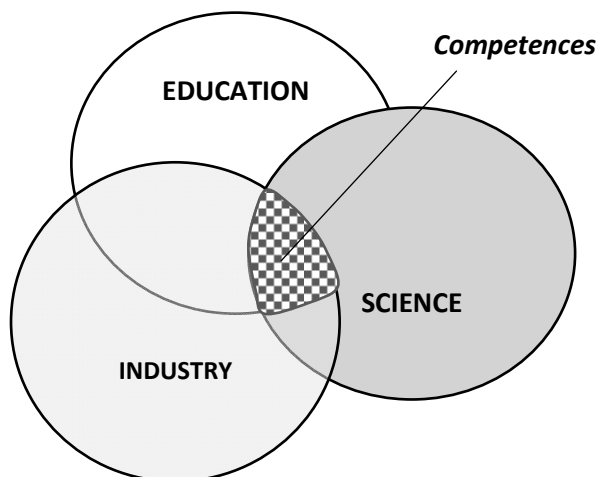


Fig. 2. The principle of the formation of professional competences

The most important factor in the transformation of modern society and higher education in particular is its global **computerization** and **digitalization**, caused by rapid development of information technologies, Internet resources, communication channels and different means of transfer and exchange of information. Information technologies bring new opportunities for the educational system, allowing educational establishments to cover additional categories of students, including foreign ones, opening up new horizons of

teaching and learning, giving new means and innovative educational technologies, enhancing research opportunities.

Since the digital society is based on intellectual labor, a system of continuous education (called 'lifelong' in the USA, 'continued' in England and 'renewable' in Sweden [9–14]) is very important. Continuous education takes into account the demands of the real economy and involves constant training of specialists throughout their life. The modern smart society and its approach to lifelong education entail providing access to training where it is convenient to the learner, that is, the mobility of content consumption becomes an essential principle of smart education.

Implementation of cloud technologies allows to provide a universal net access to a general repository ('storage' of information), which assumes that an intelligent search system is available. Access to the Internet resources for every user, as well as the availability of various educational Internet content satisfy the students' need to obtain information and improve their knowledge. Cloud evaluations and a quick inflow of mobile devices have determined one of the important directions in education that is mobile training as a modern technology of studying, personnel training and re-training [15].

The importance of students' personal development is becoming evident, which requires personalizing the training trajectories in the format of lifelong education, as well as increasing the self-sufficiency in studying. Individual training involves diagnostics of individual achievements and difficulties, prediction and planning of individual educational trajectories, assessment of relative (individual increments) and absolute (compliance with external criteria) results, giving recommendations to learners. At the same time, a crucial factor here is supporting every student's motivation, as well as providing educational elements, which give opportunities for maximum development of individual abilities and talents.

The traditional system of personnel training in higher vocational education assumes that the interconnection of participants of the educational process is built on subject-object relations, where the teaching subject is limited by the conditions set by curriculums, and the learning object has to gain a certain amount of knowledge (passive acquiring of information) [16, 17].

⁶ О Стратегии развития информационного общества в Российской Федерации на 2017–2030 годы Указ Президента Российской Федерации No. 203 от 09.05.2017 г. URL: <http://www.kremlin.ru/acts/bank/41919> (accessed October 24, 2017).

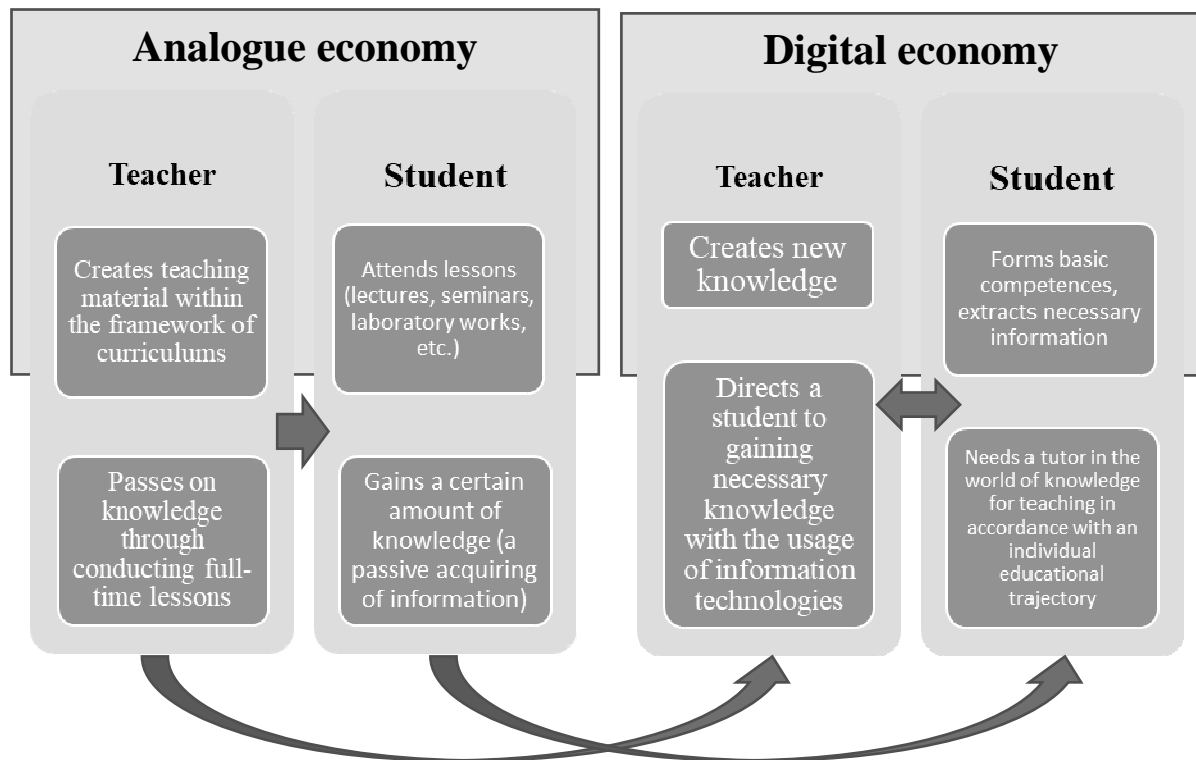


Fig. 3. Change in the positions of the participants of the educational process

Innovative methods in education should lead to a change of the teachers' role: they act not just as knowledge holders, but also as tutors (consultants, experts) who initiate the students' creative search for applying innovative technologies in the studying process, as well as of forming competences and developing individual educational trajectories (Fig. 3). The traditional lecture-seminar system of teaching should be complemented with an interactive form of teaching, carried out as a cooperation of students and teachers where the participants interconnect, make decisions together, share information, model situations.

The method of web-portfolio is an innovative method of training on the basis of forming an individual educational trajectory. The portfolio is a modern innovative educational technology which is based on authentic estimation of results of educational, scientific and professional activities. As a rule, the portfolio represents students' self-presentation of their achievements, recorded by the students themselves. Within the framework of the competence approach, the portfolio manifests itself as a way of demonstration, development and evaluation of students' competences, a mechanism

of monitoring their achievements, presenting the students' successes to interested parties. The portfolio contributes to the development of social and professional communication of students and graduates, helps establishing contacts with potential employers. Unlike the traditional resume, the web portfolio allows to present and evaluate social, personal and professional competences of students, define their inclinations, trace the direction of their development significantly better.

The totality of portfolios of students, graduates and teachers makes up the portfolios of departments and institutes, which in turn form the portfolio of the university, within which they all actively integrate with one another and with the external environment, i.e., applicants and employers (Fig. 4).

Thus, web portfolios of students and teachers are the core of their achievement rating. Analysis of the portfolios contents allows to improve the system of criteria and performance indicators related to educational and scientific activity of departments and institutes, as well as to improve the organization and management of the university's activity.

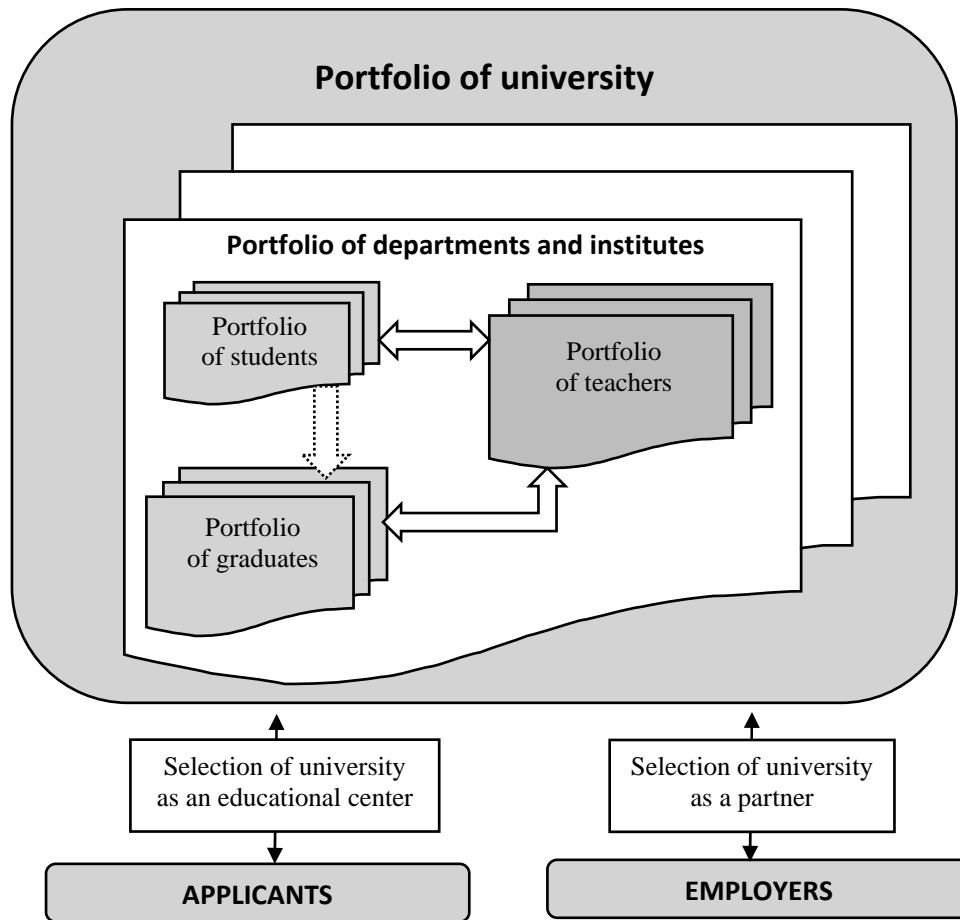


Fig. 4. The structure and interaction of the university's portfolios

The results obtained.

1. We have established that universities need to change the educational paradigm as a result of the development of the concept of digital economy.

2. We have defined the general principles of the organization of educational process, such as the implementation of the competence approach, the use of project teaching methods, digitalization and computerization of education, implementation of individual educational trajectories.

3. We have examined the principle of forming professional competences as a result of integration in education, science, business and high tech industries on the basis of the communities of teachers, students and scientists.

4. We have offered a method of web portfolio as one of the innovative methods of teaching on the basis of forming an individual educational trajectory.

Conclusions. We believe that effective use of modern educational technologies in the teaching practice of Russian educational establishments offered in this study will make it possible to improve the quality of educational services and increase the amount of highly qualified personnel in the digital economy in the long term.

The main principles of organization of education are the implementation of the competence approach to the educational process, use of methods of project teaching, digitalization and computerization of education, implementation of individual educational trajectories.

One of the methods of education within the framework of a smart university is the method of web portfolio, which is based on forming an individual educational trajectory. The analysis of the structure and interaction of the university's portfolio allows to improve the system of criteria and indicators for assessing the educational and scientific performance of departments and

institutes, as well as to improve the organization and management of the university's activities.

Introducing the measures based on the principles offered will allow to implement new forms of training, increase the motivation of participants in carrying out scientific research and the efficiency of the university's management.

The directions of possible research. There is a plan to develop a mechanism of managing the

innovative potential of a university in the nearest future in order to conduct personnel training on a fundamentally new qualitative level, taking into account the modern trends.

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