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Assessing the digital development of human capital

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***Abstract* — The relevance of the study is due to the fact that digitalization stimulates a significant reorganization of companies, creates new requirements for the skills of employees. Global challenges in the digital development of human capital are associated with the transformation of the vision of priority groups of skills for success in the digital environment. The subject of this study is to identify and review the main factors affecting the digital development of human capital. The empirical base of the study was the materials of the Boston Consulting Group, McKinsey Global Institute, IBM Institute for Business Value, KPMG, as well as the author's study. Each analyzed source was evaluated for the content of information on factors that affect and may affect the digital development of human capital and its global trends. The scientific novelty of the study is to assess the digital development of human capital, determining the factors influencing its formation, their prioritization and a structured description of the identified factors and trends. The practical significance lies in the fact that the results and conclusions of this study will allow companies to form the drivers of all transformations: business, operations, technology and people.**

Keywords — digital economy, human capital, digital development, skills, education, business processes, factors, assessment.

I. INTRODUCTION

Digitalization stimulates a significant reorganization of companies, creates new requirements for workers' skills and affects the demand for jobs in the ICT industry and in other sectors of the economy. When any significant new technology emerges, employees and users need new skills to be able to use it effectively and support potential productivity growth. Global challenges in the digital development of human capital involve transforming vision priorities for success in the digital skills group environment.

In the report of the Organisation for Economic Cooperation and Development (OECD) "Prospects for the Digital Economy 2017" [1] digitalization is seen as a catalyst for the development of business innovation. It has many opportunities, but it also creates new challenges, particularly for companies to understand how to use digitalization tools to improve productivity and how to develop staff in a digital environment. Digital skills have become an important requirement for digital employment, but a large proportion of the population still lacks the basic skills needed to operate in the new digital world [2]. According to the OECD, the lack of basic digital skills and computer experience usually occurs in people aged 55-65 years, people with no secondary education and people with low qualifications. The lack of these skills in adults is particularly worrisome, as people with the weakest digital skills are automatically at risk of losing their jobs in the current technological transformation of the workforce. Thus, changes in the labour market will affect those workers who have the lowest level of digital skills and those who are least prepared to upgrade their skills.

As part of the OECD Directorate for Education's International Adult Competence Assessment Programme (PIAAC) from 2011-2012 adult skills are being examined. PIAAC's tasks include four main blocks: reading, understanding written text, numerical literacy, and problem-solving skills in technologically saturated environments. In particular, the ability to perceive and process electronic texts is tested, as well as the conscious use of information available in the virtual environment [3]. A 2015 analysis by PIAAC found that the level of development of digital problem-solving skills is directly related to the risk of unemployment.

The most protected from this point of view are employees who can confidently solve professional problems in a technologically saturated digital environment.

II. DATA COLLECTION AND RESEARCH METHODOLOGY

As part of the Action Action Plan for Digital Education (DEAP) [4], launched in January 2018, the European Commission focused on digital competency, such as problem-solving and digital collaboration. Similar challenges for transforming core skill groups are highlighted in the World Economic Forum's analysis and corporate analytical reports (Figure 1).

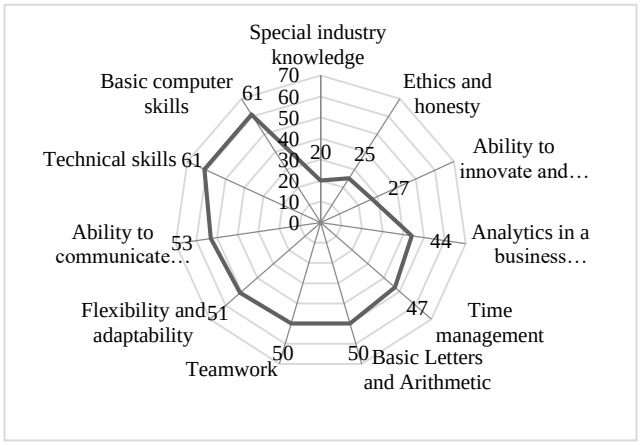

Fig. 1. Demand for the competence of workers in industry, % [5].

It is obvious that technical competence remains the most sought-after, and the importance of developed soft skills - social, behavioral and cognitive - is increasing to successfully conduct business in digital environments and adapt to changing environments. Digital literacy is not limited to the acquisition of individual technical knowledge and skills.

Today, the digital development of human capital is acutely challenged, defined by the knowledge and skills needed for the safe and efficient use of digital technologies [6]. At the heart of the digital development of human capital is the development of digital competencies as the ability to meet a variety of challenges in the use of information and communication and digital technologies. Various government agencies, consulting companies and researchers have developed models of digital competencies/skills that complement each other in many ways. They provide the main areas for development: digital/information literacy, communication and cooperation, dealing with a large flow of information and solving problems that machines will not be able to cope with. The importance of digital skills to work and social integration is increasing. In the future, they will be vitally needed. It is already clear that a high level of employees with digital competencies at different levels in the company will provide it with a competitive advantage (see Figure 2).

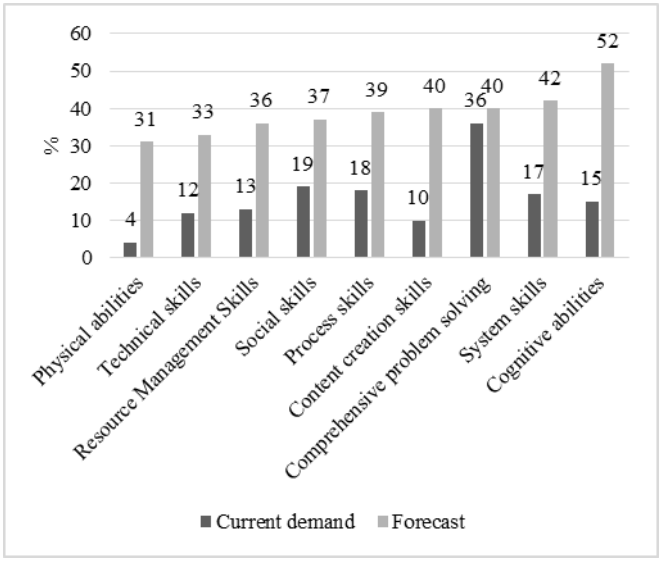

Fig. 2. Demand forecast for competencies by 2020, % [7].

Universities, companies and people themselves must make an equal contribution to the digital development of human capital, fostering a responsible and appropriate attitude to the use of technology, including knowledge of digital rights and responsibilities, and the etiquette of networking [8]. According to IBM's 5,600 Global Skills Ceo survey, half of respondents believe that companies themselves are responsible for nurturing the necessary skills from employees, and only 39% of respondents believe that employees themselves should be engaged in digital development and maintaining their professional skills (Figure 3).

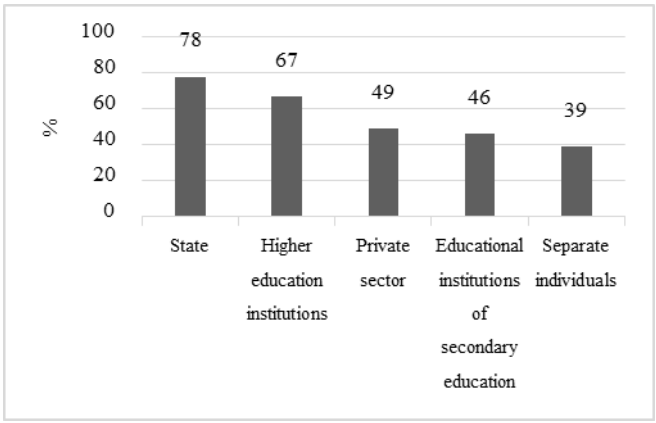

Fig. 3. Who is responsible for developing and maintaining work skills [9]

The most important challenge for managers here is the lack of investment in the digital development of human capital to ensure the necessary level of learning. It is important to note that the increasing importance of integrated problem-solving and social cooperation skills makes it possible to predict the increasing demand for professions in the social sectors (education, health) and services (financial services, coaching), which are critically dependent on the synthesis of technological and communication skills.

For the digital development of human capital, it is not enough to gain knowledge or develop skills once, it is necessary to regularly update the acquired luggage. Countries on the upper trajectory are implementing lifelong learning solutions, either through the education system, on the basis of employers or on their own [10]. Attempts to discuss this agenda in Russia have not yet led to success. Today, the country does not have a system solution for updating competencies throughout life. Most people's education ends with graduation, no later than 25 years (Figure 4).

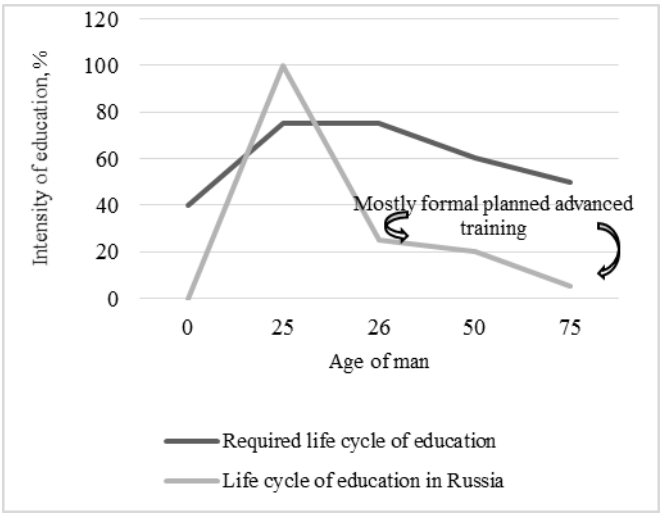

Fig. 4. The Life Cycle of Education in Russia [11].

Training in the process of work is often represented by either formal development of skills, in which there is no real development and renewal of skills, or a point closing of the gaps in the education system. Nevertheless, on average in Russia, employers' costs for training employees are 10 times less than in Europe. In educational programs in our country 15% of the working population and 1% of pensioners participate in educational programs - for comparison, in developed countries it is 40 and 5% respectively [12]. A large proportion of the world's population aged 25 years considers the bulk of their educational cycle complete and is not prepared to make significant efforts to improve the educational standard and/or update the current skills package.

An important group of challenges to the digital development of human capital is associated with the low motivation of employees to master specific digital skills in the context of a complex combination of technological and communication skills. Awareness of the speed of updating employers ' request and the associated individual risks continues to be critically low in many cases. According to KPMG, a significant proportion of employees would prefer not to undergo (re) training in the field of digital skills development in the absence of special requirements from the employer.

The resource gap is aggravated by the fact that, due to high uncertainty, it is difficult to accurately assess the prospects for digitalization for a number of professional groups, which causes staff exclusion even when corporate, the digital skills training programmes provided by the employer are already taking place. There is a situation where most workers are indifferent or demotivated to be trained in digital skills (Figure 5).

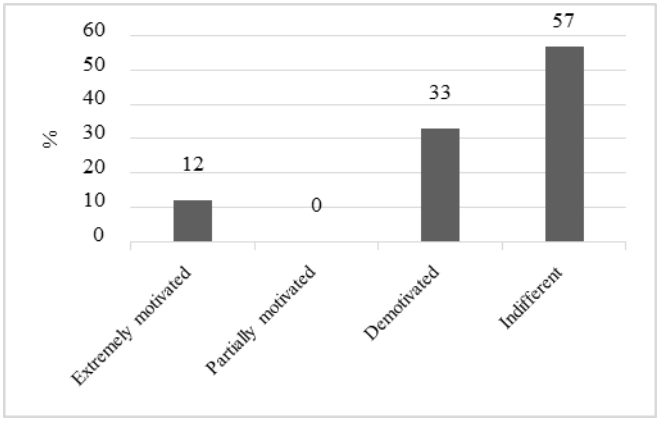

Fig. 5. Staff motivation level for digital development in the corporate sector.

As the digital development of human capital as a whole is critically hampered by the low input threshold of staff, a number of countries around the world are making efforts to develop monetary and non-monetary stimulus programmes. In particular, the Ministry of Education of Singapore has developed an extensive system of educational lending. In order to develop a responsible approach to self-education, all Singaporeans aged 25 and over have been offered an indefinite loan of 500 Singapore dollars to pay for online digital education since January 2016. The catalogue of courses from public universities and private providers is constantly being replenished. More than 70 courses are offered on artificial intelligence alone. As the development of digital literacy and digital skills is generally critically hampered by the low input threshold for learners, a number of countries around the world are making efforts to develop monetary and non-monetary programmes Stimulate. In particular, the Ministry of Education of Singapore has developed an extensive system of educational lending. In order to develop a responsible approach to self-education, all Singaporeans aged 25 and over have been offered an indefinite loan of 500 Singapore dollars to pay for online education since January 2016. The catalogue of courses from public universities and private providers is constantly being replenished. More than 70 courses are offered on artificial intelligence alone [12].

Educational systems are undergoing significant changes. The obsolescence of knowledge due to rapid technological changes and the need to regularly update knowledge raises the question of maintaining relevance and continuous updating of curricula and courses corresponding to the need for regular updates digital environment. With the development of digital technologies, teachers of all qualifications are also increasingly required to use a variety of technological tools and the ability to instill these digital skills.

Thus, the key challenge for modern education is to build an adaptive educational system that responds to changes in the digital environment, and to create the conditions for the implementation of individual (personalized) trajectories of digital human capital development.

The answer to this challenge will be the creation of ecosystems including public and private educational organizations, business representatives and other employers, industry groups, professional communities (Figure 6).

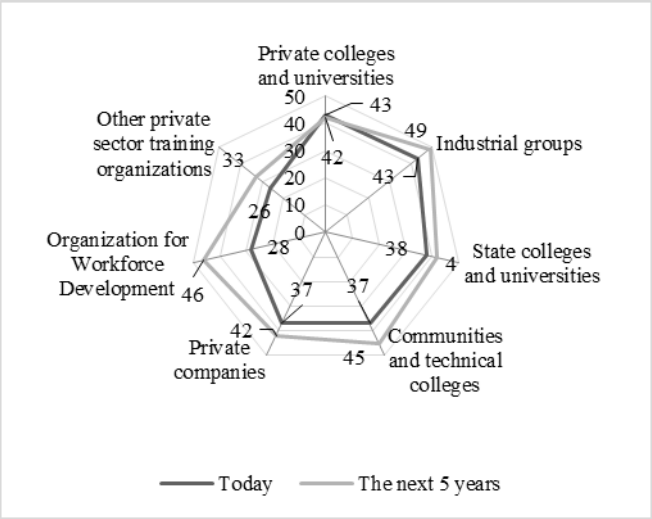

Fig. 6. Contributions from human capital formation and digital development organizations, % of respondents.

With this format of interaction, companies will be better prepared for the digital development of human capital and increase their competitiveness. As part of the ecosystem approach at the university level in Europe, the possibility of creating a pan-European platform to stimulate mixed learning, dialogue of researchers and online education is being discussed. At the same time, there is an update of the content of the educational environment. For example, in October 2017, the Ministry of Education of Singapore initiated a special program to create a single platform for the training of several groups of consumers: citizens, job seekers, employers, educational organizations.

The construction of a single platform for training reflects the trend towards a comprehensive solution of complex problems in the field of digital development of human capital. At the same time, in accordance with the tendency to increase the importance of "soft" skills as part of digital competence, training courses on storytelling and the use of design thinking are offered. In the context of rapid changes, not only students should develop their skills, but also teachers, because they do not always have time to learn new technologies and update knowledge. For example, according to the HSE Institute for statistical studies and Economics of knowledge, less than 40% of Russian education workers undergo advanced training. At the same time, according to the international research Teacher Education and Development Study in Mathematics (TEDS-M), the average score of the Russian mathematics teacher is only 340-380 out of 1000, which is low compared to the European level. Moreover, the system of Russian education is poorly updated with new staff: annually no more than 25% of graduates of pedagogical universities go to work in the specialty. One of the reasons is too low demand for new staff: school staffing is 99.2%.

Digital development of human capital is increasingly linked to the integration of approaches and learning formats with new technologies - mobile devices, flexible user interfaces, chatbots, artificial intelligence, virtual and augmented reality technologies, etc. the potential to update the environments of digital learning and improve the quality of digital development of human capital. However, the digital development of human capital is dominated by formats that were created before the widespread use of mobile communications and have not yet been adapted or poorly adapted for deployment on mobile devices. A key vector in the digital development of human capital is determined by the need to complement existing formats of educational products to teach digital skills with new approaches based on mobile learning and the use of artificial Intelligence.

At the same time, the integration of corporate training tasks with support for a high level of emotional and social satisfaction of users - the ability to maintain communication and cooperation in a heterogeneous digital environment-acquires a special role. On a global scale, the depth of artificial intelligence implementation in the education sector remains relatively insignificant. The reasons for this are not only the conservatism of the educational environment itself, but also the unexplained ethical challenges related to the use of learners ' data to build personalized and adaptive digital development systems (Figure 7).

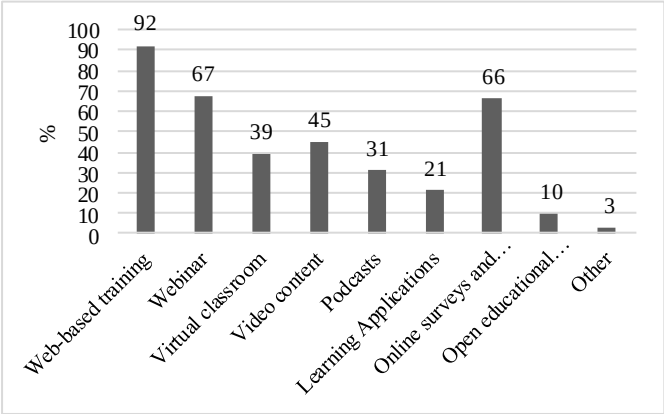

Fig. 7. Types of training for digital development of human capital in enterprises.

Updating the educational environment of digital human capital development is closely linked with increasing awareness of users and consumers in relation to current and potential threats in virtual environments. Therefore, along with the increasing level of personalization of solutions for the digital development of human capital, it is important to update the issue of certification of educational digital products for

cybersecurity, which is still at the initial stage of discussion. Thus, the expansion of the initiative "European programming week" (EU Code Week) is expected to be associated with increasing expertise in the field of teaching the basics of cybersecurity and information behavior.

The readiness of different types of audience to master the tools of digital development of human capital is closely linked to the balance of formats and learning technologies, which can create a level of intensity that is comfortable for all participants in the learning process. learning new information. In both basic and secondary education, there is increasing emphasis on the collective learning of new knowledge. Gradually, the idea of learning as a collaborative process, responding to the needs of certain communities, structured depending on their personal and professional development tasks, is emerging.

Individual educational trajectories of students are formed by a combination of different training courses and forms of learning, such as online learning, mobile and mixed learning. At the same time, work becomes one of the key elements of education, i.e. the line between vocational education and work is blurred. An important feature of the concept of digital development of human capital is a clear representation of how different forms of digital learning and their corresponding digital skills are determined by the level of social activity of users.

In fact, the digital development of human capital is embedded in the process of acquiring new social connections, everyday communication in the digital age. Given that many of the expertise and types of tasks are still being communicated in personal interaction, an understanding of the best use of different techniques for digital skills training is to be developed. In this regard, it is not appropriate to completely separate the challenges of digital development of human capital from the general culture of human development in enterprises. In general, it is necessary to properly assess the set of tasks that are associated with the transformation of the educational environment of digital development of human capital so that it can effectively support the integration of different formats. This environment should support the ability of interactive feedback from users to learning tools to correct them directly during training sessions. In its fully deployed state, a balanced system of different training formats should enable the user to actively participate in the increment of knowledge. There is also the question of at what levels of training, retraining and development skills need to be improved. You can compare the following forms of training and levels of digital training with the desired competencies and skills in a particular area.

The formation of corporate learning systems in the digital development of human capital is based on the constant interaction of training and business units. However, there is no standard methodology for assessing the success of the transfer of acquired skills and skills to the workplace. The task is greatly complicated by the lack of direct interaction between the different departments in determining the functionality of the digital development systems of human capital. A separate challenge in terms of the effectiveness of the training impact is the alienation of IT professionals from participating in meaningful discussions on the design of training systems, tools for evaluating and monitoring user progress and the overall contours of their interaction with the digital development system of human capital (Figure 8).

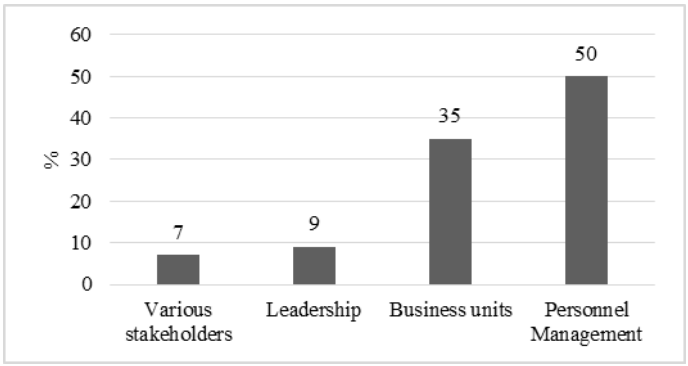

Fig. 8. Distribution of digital development of human capital.

Limiting the tasks facing IT and computer support departments with purely technical issues leads to such requests for learning structure and a set of tasks that can be unrealizable or only implemented with large Costs. At the same time, external contractors are excluded from regular work to monitor the effectiveness of digital capital training systems developed with their participation for obvious reasons. As a result, internal corporate services, primarily HR departments, most actively involved in the design of corporate digital development programs for human capital, use staff assessment tools, poorly integrated with the technological foundation of training systems. The return assessment of the learning impact is thus procedurally and technologically separated from the opportunities offered by virtual learning environments. In many cases, direct assessment of the educational impact is not formalized and does not imply the systematic application of adequate assessment tools to the digital development of human capital (Figure 9).

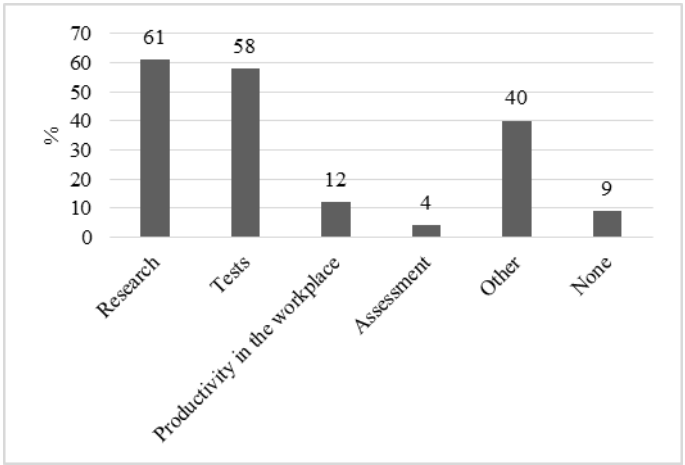

Fig 9. The prevalence of tools to assess the digital development of human capital.

KPMG data show a relatively weak depth of penetration of advanced psychometric approaches in the practice of monitoring and monitoring the educational trajectories of staff. Given the heterogeneous structure of motivating employees to complete training programs, a high-quality system of support for their educational progress is particularly important. However, a large part of the corporate sector operates on the basis of outdated, long-un-updated LMS systems. Updated electronic educational support and monitoring systems, on the other hand, collect a body of user data that is currently under-analytically competent. Surveys point to a lack of skilled data professionals as one of the biggest obstacles to the use of data analytics in business.

Features of digital human capital development require the creation of methods for assessing digital skills at the individual level. Instead of traditional testing "at the entrance" and "at the exit" there is a need for multiple sections on the behavior of staff in connection with a different time dynamics of digital learning systems. Educational institutions are increasingly turning to adaptive technologies and quantitative assessment of the educational process, especially in terms of measuring staff behavior, learning outcomes and evaluation ROI (Figure 10).

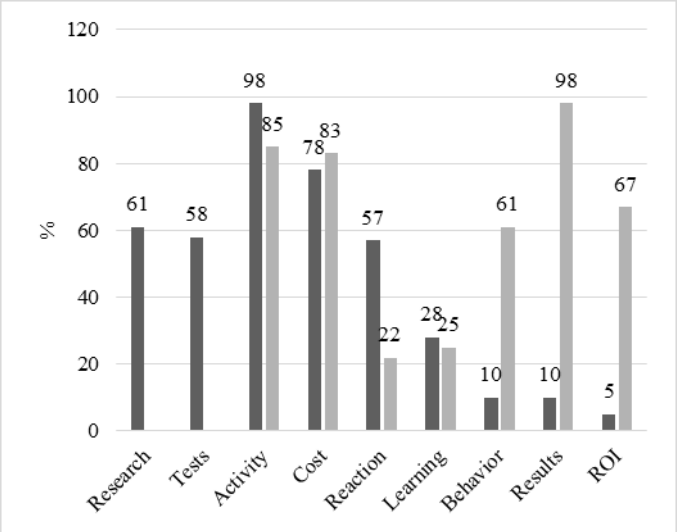

Fig 10. Expectations of customers training.

The quantitative assessments of the effectiveness of digital human capital development are used to assess academic performance, student progress, skills acquisition and other indicators. They also require special approaches to assessing intangible, primarily temporary, costs. Criteria for assessing the skills, creativity and critical thinking skills of staff need to be developed. Developed LMS systems also allow to fundamentally change the density of assessment of involvement in the digital development of human capital: opening up content generation opportunities to users, frequency of opening training sessions and other parameters.

III. THE RESULTS OF THE STUDY AND THEIR DISCUSSION

Accelerating technological change poses serious challenges to world education in the digital development of human capital. Among such challenges, we have included a number of areas, the work on which requires immediate joint action on the part of educational institutions, business environment and the state:

1. A growing shortage of specialists with complex digital skills. When any significant new technology emerges, employees and users need new skills to be able to use it effectively and support potential productivity growth. Digital skills have become an important requirement for digital employment, but a large proportion of the population still lacks the basic skills needed to operate in the new digital world. Universities, companies and people themselves must make an equal contribution to the digital development of human capital, fostering a responsible and appropriate attitude to the use of technology, including knowledge of digital rights and responsibilities, and the etiquette of networking.

2. Forming models of digital competencies for people of different age groups and professional communities. There is a paradoxical situation in which the population that already has the greatest awareness of technological innovation receives the greatest resources in terms of the level of overall digital skills development. The efforts of corporate entities and workers to develop human capital digitally continue to show a persistent lag in terms of adequate institutional and regulatory support.

3. Increasing the demand for digital skills in a professional environment. According to IBM's 5,600 Global Skills Ceo survey, half of respondents believe that companies themselves are responsible for nurturing the necessary skills from employees, and only 39% of respondents believe that employees themselves should develop and maintain their professional skills. The most important challenge here for managers is investing to ensure the right level of training.

4. Formation of motivation system for digital development of human capital throughout life. An important group of challenges to the digital development of human capital is associated with the low motivation of employees to master specific digital skills in the context of a complex combination of technological and communication skills. It is important to make efforts to develop programs of monetary and non-monetary stimulation of education.

5. Optimal combination of standard educational approaches with new technologies used in teaching on digital development of human capital. A key challenge for modern education is building an adaptive educational system that responds to changing environments and creating the conditions for the implementation of individual (personalized) trajectories of human digital development Capital. Digital development of human capital is dominated by formats that have been created prior to the widespread use of mobile communications and have not yet been adapted or are poorly adapted for deployment on mobile devices. A key vector in the

digital development of human capital is determined by the need to complement existing formats of educational products to teach digital skills with new approaches based on mobile learning and the use of artificial Intelligence.

IV. CONCLUSION, RECOMMENDATIONS FOR FURTHER INVESTIGATION AND LIMITATIONS

An assessment of the digital development of the human capital of enterprises has been carried out, allowing to formulate the main challenges, the work on which requires immediate joint action on the part of educational institutions, business environment and the state:

- A growing shortage of specialists with complex digital skills. When any significant new technology emerges, employees and users need new skills to be able to use it effectively and support potential productivity growth. Digital skills have become an important requirement for digital employment, but a large proportion of the population still lacks the basic skills needed to operate in the new digital world. Universities, companies and people themselves must make an equal contribution to the digital development of human capital, fostering a responsible and appropriate attitude to the use of technology, including knowledge of digital rights and responsibilities, and the etiquette of networking.
- Forming models of digital competencies for people of different age groups and professional communities. There is a paradoxical situation in which the population that already has the greatest awareness of technological innovation receives the greatest resources in terms of the level of overall digital skills development. The efforts of corporate entities and workers to develop human capital digitally continue to show a persistent lag in terms of adequate institutional and regulatory support.
- Increasing the demand for digital skills in a professional environment. According to IBM's 5,600 Global Skills Ceo survey, half of respondents believe that companies themselves are responsible for nurturing the necessary skills from employees, and only 39% of respondents believe that employees themselves should develop and maintain their professional skills. The most important challenge for managers here is investing to ensure the right level of training.
- Forming a system to motivate the digital development of human capital throughout life. An important group of challenges to the digital development of human capital is associated with the low motivation of employees to master specific digital skills in the context of a complex combination of technological and communication skills. It is important to make efforts to develop programs of monetary and non-monetary stimulation of education.
- The best combination of standard educational approaches with new technologies used in digital capital training. A key challenge for modern education is building an adaptive educational system that responds to changing environments and creating the conditions for the implementation of individual (personalized) trajectories of human digital development Capital. Digital development of human capital is dominated by formats that have been created prior to the widespread use of mobile communications and have not yet been adapted or are poorly adapted for deployment on mobile devices. A key vector in the digital development of human capital is determined by the need to complement existing formats of educational products to teach digital skills with new approaches based on mobile learning and the use of artificial Intelligence.

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