Labor Market Transformation in the Context of the Digitalization of the Economy

V. V. Borisova\textsuperscript{1(✉)}, E. E. Panfilova\textsuperscript{1}, and Hendra Raza\textsuperscript{2}

\textsuperscript{1} State University of Management, Moscow, Russia
\{vv_borisova, ee_panfilova\}@guu.ru
\textsuperscript{2} Universitas Malikussaleh, Aceh Utara, Indonesia
hendra.raza@yahoo.com

Abstract. The purpose of the study was to identify key trends that determine the structural and qualitative changes in the labor market in a crisis state of the economy after exposure to coronavirus and intensifying business digitalization processes at the same time. In the course of the study, the tasks of analyzed factors that influence the transformation of the labor market in the context of digitalization are considered. The authors identify the problems of training specialists in universities based on the active use of online education tools. Particular attention is paid to the search for optimal tools for the interaction of business and public authorities in the preparation of university graduates in demand for various sectors of the economy. During the study methods of comparison, generalization, grouping, as well as comparative and statistical data analysis are used to reveal the features of labor market transformation in the context of business digitalization. The main result of the authors' paper is the development of guidelines for the effective interaction of universities, business and public authorities in the preparation of specialists demanded by the labor market who have digital competencies for working in a transforming business.

Keywords: Business digitalization · Competence · Labor market · Transformation · Trend

1 Introduction

Digitalization of the economy in the Russian Federation and abroad is inextricably linked with the implementation of the “Industry 4.0” concept, which involves the use of the Internet of things, predictive analytics, virtual reality technologies, additive manufacturing, and reverse engineering [19]. For industrial enterprises of high-tech sectors of the economy, competitiveness in the transformation of business processes will be determined not only by technological, organizational and informational readiness for radical changes, but also by the innovative activity of personnel in the labor market. For the leadership of organizations the issue of increasing the innovative activity of the staff of both already working and potentially attracted young specialists after graduation becomes relevant [8].

Obviously, the solution to this problem is associated with the formation of an effective mechanism for the interaction of the triad “business - university - public
authorities.” Under the influence of cloud computing, neuromarketing technologies and mixed reality technologies, the content of the work of performers is changing, the role of formed digital competencies among staff and the ability to work with a corporate data warehouse are increasing. The structure of the labor market is undergoing changes, freeing itself from the established professions such as an engineer, a manager, a marketer and moving to the demand for such positions as a coordinator of production in distributed communities, a foresight and a portfolio manager of corporate venture funds.

2 Methodology

Nowadays, the transformation of the labor market in the context of business digitalization is taking place not only under the influence of the technological revolution, but also the institutional one. The latter involves a change in the managerial model and its synchronization with state authorities in terms of targeted programs in the training of specialists. The study accepted the hypothesis that the modification of the managerial model is based on the theory of convergence. Its adherents say that in the context of globalization, there is a rapprochement of the socialist and capitalist management systems, systems of managing the national economies of different countries due to the fact that the same type of changes are occurring in engineering and production technology. This fact leads to the same changes in the economic life of society, both Russia and Indonesia [16].

The outbreak of the coronavirus pandemic will lead to a surge in enterprise bankruptcies and increased raiding. By virtue of this fact, HR (Human Resources)-managers will focus on finding applicants for vacancies opened by large businesses. The methods used for the selection of personnel in digitalization are undergoing changes. And mobile recruiting applications, ATS (Applicant Tracking Systems), various online tools for evaluating a candidate for a vacant position will become increasingly popular [9].

The dominant factor affecting the labor market is the expansion and implementation of the Industrial Internet of Things (IIoT). This will inevitably lead to increased demand for specialists and graduates of universities who possess digital competencies that allow you [15]:

- to manage the business processes of the organization using digital doubles and shadows,
- to plan interaction with contractors within the framework of several digital platforms,
- to conduct an IT audit on implemented functions and procedures,
- to implement projects in a digital environment using cloud data storages,
- to coordinate the work of remote access employees in outstaffing, as well as to work on electronic trading platforms and with self-executing contracts.

In order to identify the effect of synergistic interaction between universities and enterprises of the real sector of the economy, the study used methods of comparing the quality of education at universities; methods of generalization, concretization, grouping
and systematization in assessing the distribution of university students by popular specialties of instruction. Statistical, structural-dynamic and comparative analysis methods were used to study the trends in the development of the modern market for higher education, taking into account distance learning forms, online platforms, as well as to determine the degree of compliance of graduates’ specialties with the requirements of the modern labor market in the context of the digitalization of the economy. As the basis, analysis and synthesis methods were taken to identify the specifics of the organization of interaction between universities, business and public authorities [17].

The transformation of the labor market is influenced by external and internal factors. External factors include the success of various programs to digitalize business, transport, research and development, as well as the introduction of professional standards for the activities of specialists in the corresponding functional area. The internal factors include the personality-oriented approach of applicants and their parents when choosing a future profession, forming an individual learning path, as well as the effectiveness of the career-oriented interaction model in the “school-college-university” combination.

The result of the transformation of the labor market in the context of digitalization is the preparation of a strictly defined number of graduates, both colleges and universities, that are fully demanded by the labor market. The criteria for assessing the quality of educational programs of universities prepared together with employers (representatives of the real sector of the economy) are the level of starting salary, the number of employed graduates in the specialty (including students with disabilities) [18]. To identify key trends in the choice of applicants for the popular areas of training/specialties when studying undergraduate and graduate programs, linear coefficients of absolute structural changes were calculated.

In the framework of the organization of career guidance work for universities, it is necessary to orient students on the learning continuity, the interoperability of acquired specialties and monitoring of priority areas of economic development, including energy efficiency, strategic information technology, medical technology. The model for training a specialist in demand on the digital labor market should be based on the principles of multidisciplinarity, the use of project/collaboration tools, as well as the multidimensionality of “big data” used to construct the model of the control object. Roadmaps developed separately for various sectors of the economy, high-tech, knowledge-based and others can become tools for assessing the effectiveness of labor market transformation in the context of digitalization.

3 Results

Traditionally, the labor market in the Russian Federation is largely influenced by the institutional environment, which implies active state regulation of the educational activities of educational institutions through control numbers for students, regulation of accreditation and licensing procedures [1]. One of the quality indicators of education assessment is the ratio of the number of private educational institutions to the number of state and municipal educational institutions, as well as the ratio of the number of students studying in private educational institutions, to the number of students of state
and municipal educational institutions (Fig. 1). Students of non-state educational institutions are in strong competition with graduates of state universities on the labor market.

As can be seen, from the academic year 2010/2011 to the academic year 2018/2019, there was a steady decrease in the ratio of the number of private organizations to the number of state organizations, accordingly 70.75% to 49.4%. Thus, the ratio of the number of students in private educational institutions to the number of students in state and municipal educational institutions decreases in the period under review from 20.54% to 10.02%, respectively. The lowest chain growth rate of student admission of 14.69% is typical for the 2010/2011 academic year. This was mainly due to the fact that some students couldn’t organize their time, were unable to meet strict requirements and find a strong motivation to study. Since 2012, the trend has changed

Fig. 1. The dynamics of the ratio of the number in private educational institutions to state/municipal educational institutions in comparison with the ratio of the number of students in private organizations to state and municipal organizations (Source: authors based on [12]).
and this is due to the fact that students choose international programs, as well as they study simultaneously on several educational programs.

The main forms of impact on the labor market by private companies, businesses and the state abroad (including Indonesia) include the following [2]:

- public-private partnership in the training of specialists,
- reduction of specialties in the framework of multidisciplinary training (training of highly specialized specialists),
- internships at the enterprise,
- development of partnerships in the implementation of educational programs through an invitation to conduct master classes by leading experts in relevant field of activity.

The influence of internal motivational factors of applicants when choosing a future field of study and, accordingly, further professional implementation in the labor market is presented in Table 1.

**Table 1.** Structure of the distribution of students in the most popular specialties/areas of training in the specialty program in the period from 2014 to 2018

| Specialties/training areas                              | Years   |
|---------------------------------------------------------|---------|
|                                                         | 2014    | 2015    | 2016    | 2017    | 2018    |
| Law                                                     | 5,86    | 3,16    | 0,20    | 0,02    | 0,0     |
| Finance and credit                                      | 3,75    | 1,90    | 0,08    | 0,0     | 0,0     |
| Organization management                                 | 3,69    | 2,05    | 0,14    | 0,01    | 0,0     |
| Economics and enterprise management (by industries)    | 3,81    | 1,98    | 0,07    | 0,0     | 0,0     |
| Accounting, analysis and audit                         | 2,28    | 1,19    | 0,08    | 0,0     | 0,0     |
| Medical business                                        | 7,94    | 11,44   | 20,58   | 21,40   | 21,75   |
| State and municipal government                          | 2,02    | 1,10    | 0,09    | 0,0     | 0,0     |
| Industrial and civil engineering                        | 1,15    | 0,66    | 0,03    | 0,0     | 0,0     |
| Economic security                                       | 1,62    | 3,63    | 6,38    | 6,95    | 7,02    |
| Dentistry                                               | 0,51    | 3,58    | 5,64    | 0,0     | 5,77    |
| Others                                                  | 67,37   | 69,31   | 66,71   | 71,62   | 65,46   |
| **Total**                                               | **100** | **100** | **100** | **100** | **100** |

Source: authors.

According to Table 1, since 2015, the structure of the distribution of students in the areas of study has been changing and there is a rejection of humanitarian areas in favor of the specialty “Economic Security” (directly related, including taking into account cyber threats in the organization’s activities and the use of digital competencies), as well as “General Medicine” (i.e. knowledge-based industry related to medicine). The role of the latter in the context of various epidemics and threats is increasing significantly. During the course of the study, absolute chain and basic structural shifts were calculated for the distribution of students in undergraduate programs in the most popular specialties. Data are presented for the period from 2016 to 2018 (Table 2).
As follows from the Table 2 in 2017, there is a decrease in the share of undergraduate students in the areas of “Economics” (by 1.35% compared to 2016), “Management” (by 0.97%) and “State and Municipal Administration” (by 0.13%). Thus, there is a tendency to abandon humanitarian areas of study (partially lagging behind the restructuring of systems thinking based on the components of “Industry 4.0”) in favor of more technical areas (“Electrical Power and Electrical Engineering”, “Construction”). It is no coincidence, since many interviewed company managers note the fact that the transformation of the labor market in the context of digitalization of the economy is primarily associated with technological readiness to automate business processes. Thereby, the organizational and managerial component is secondary [6].

During the study in 2015–2017, the degree of compliance of the position held by employed graduates with the specialty received in a higher educational institution was assessed. As the analysis shows, the highest degree of compliance (over 70%) of the profession of employed graduates is typical for technical areas, such as computer and information sciences, computer science and computer technology and information security. The competencies acquired during training in the specialties of these areas are widely in demand in various industries and more than correspond to the set trends of “Industry 4.0”. However, computer and technical literacy are only one side of the demonstration of the modern labor market in the context of digitalization. The basic tendency in the selection of personnel is the demand for “soft skills”, formed not only by universities, but by the external environment itself. Soft skills provide the development of digital skills based on professional skills [10].

However, the interpretation of soft skills is subject to changes due to the needs of implementing various digitalization programs, including Industry 4.0, and taking into account the specifics of the employers themselves (hard skills) are less variable. In this regard, the search for the required personnel is complicated by the fact that universities as the main suppliers of new specialists with basic knowledge, developing hard skills, they cannot quickly rebuild the learning system to take into account new trends, and,

| Specialty                                      | Chain shifts, % | Basic shifts, % |
|-----------------------------------------------|-----------------|-----------------|
|                                               | 2016 2017 2018  | 2016 2017 2018  |
| Economy                                       | 3.45 −1.35 −1.2 | 1.68 0.33 −0.87 |
| Law                                           | 3.71 −0.47 −0.92| 3.61 3.14 2.22  |
| Management                                    | 1.82 −0.97 −0.58| 1.22 0.25 −0.33 |
| Teacher education                             | 1.75 0.02 4.47  | 0.85 0.87 5.34  |
| Building                                      | 1.36 0.03 −0.05 | 1.52 1.55 1.5   |
| State and municipal government                 | 1.04 −0.13 −0.15| 1.21 1.08 0.93  |
| Power industry and electrical engineering      | 0.82 0.1 0.09   | 0.96 1.06 1.15  |
| Psychological and pedagogical education        | 0.57 −0.06 0.02 | 0.72 0.66 0.68  |
| Others                                        | −14.52 2.83 −1.68| −11.77 −8.94 −10.62|
| Total                                         | 0 0 0 0 0 0     |

Source: authors.

Table 2. Absolute chain and basic structural shifts of distribution undergraduate programs in the most popular specialties of training in 2016–2018, %
therefore, the professional community will be forced constantly to adjust the requirements to qualify job seekers or use its own opportunities for training.

Enterprises that are residents of special economic zones (technopolises, technology parks, industrial parks) in Moscow and the Moscow Region traditionally use the configurator of the “1C staff turnover program” to close staffing requirements taking into account the emerging structural changes in the labor market. For example, 169 technology parks closed 83% of the need for personnel in the range from 14 to 30 days in 2019. More than 50% of specialists annually undergo advanced training or professional retraining programs in the field of investment management in the digital environment, contractual relations using digital signatures, and innovative project management in the framework of international cooperation. The typical age structure of the technopolis of the city of Moscow is as follows: 30.5% are workers aged 51–60; 21.0% - workers aged 31–40; 20.0% - workers under the age of 30; 19.0% - workers aged 41–50; 9.5% are over 60 years old.

The qualitative staff composition of a typical technopolis by level of education is as follows: 55% of employees have higher education, which makes it possible to move up the career ladder. The remaining 45% are workers with secondary vocational education. Statistically average rotation for employees of the highest category is carried out once every 5 years, for qualified personnel once every 3 years and for work positions once a year. The transformation of the labor market is accompanied by a change in the set of tools that accompany the process of staff training. Thus, according to the results of the study, about 35% of technopolises use corporate centers and universities to improve the skills of their employees. 15% of industrial parks are focused on the use of distance learning courses posted on various online platforms [3]. About 17% of technology parks are interested in interacting with universities, government bodies and business partners within the framework of a single ecosystem implemented on a digital platform in the “single window” mode.

4 Discussion

A number of researchers of transformation processes in the digitalization of the economy indicate the fact that information tools/technologies make a great contribution to the implementation of the concept of open innovation. Organizations will be able to participate in the implementation of high-tech projects in a remote format, including minimizing the cost of research and development. At the same time, there is a growing risk of leakage of confidential and insider information from cloud data warehouses and digital platforms [5]. The results of the study confirm that the presence of digital competencies in the field of data protection for employees working in distributed networks significantly increases the information security of the company. At the same time, the issue of not only maintaining, but also developing the already formed digital competencies due to the rapid obsolescence of information management tools is still relevant. Scientists emphasize that the Chief Data Officer – CDO is becoming a key figure in the organization [13].

Analysts consider that highly paid specialists will not have difficulty solving routine tasks. Some of them will be taken over by robots, chat bots from process control to
virtual recruiting. In this regard, they will have more opportunities for a creative decision making to find and apply non-standard methods of solving problems in poorly structured and unstructured situations. Consequently, software skills requirements will increase as a factor of competitiveness in the labor market [14].

Forecasts of specialists testify to the value of managerial personnel who are able to work in multitasking conditions and willingness to develop a new business area. That is why the initial vocational guidance of schoolchildren, project training and hybrid training (a semester of studies, a semester of work at the enterprise) will allow the younger generation, which is shaping the future labor market, to master professions that are not currently available. Eichar in an organization in the context of the digitalization of the economy is turning from a specialist in personnel search into an expert in selling the best vacancies of an employer to a highly competent jobseeker. By 2025, according to experts, generation Z (born in 1997 and younger) will make up about 25% of the labor force in the labor market [12]. It is typical for this generation to be between personal life and financial reward. Since representatives of this generation have developed digital competencies, employers will have to adapt to their values.

In this case, we will see a change in the forms of labor relations, the restructuring of the education system to train new personnel and the adaptation of the labor market itself to the new realities. The shift in emphasis from the need to look attractive to the employer and be able to integrate into the organization’s processes to provide a contribution to the company’s valuation to find jobs that will provide the applicant with the opportunity to realize his potential in a professional environment based on his own needs and preferences throughout his career, thereby increasing its own value, including for the employer, it will require major changes in the training of such personnel. Is the current education system able to change as fast as the modern labor market is changing in the context of digitalization? The discussion between researchers shows that at present, the balance between hard skills and soft skills is gradually shifting towards “soft skills” [11].

However, no answer has been formed yet who is the initiator of such a shift: the candidates themselves, who own digital competencies and set the labor market a certain standard for the level of professionalism and soft skills, or companies, realizing the needs of the digital society, setting standards for the level of key digital skills for staff selection. One way or another, the labor market, having a high degree of adaptability to emerging needs, in response to the growing digitalization trend, will determine the demand for digital competencies that can give impetus to the development of soft skills. The educational space, following modern trends, will have to take this circumstance into account in the system of training specialists.

5 Conclusion

Transformation of the labor market in the context of the digitalization of the economy affects the mechanisms of interaction in the triad of “business - universities - government”. The rapid growth in the use of digital services and platforms is a serious challenge not only for employers, but also for hired personnel. Organization leaders are restructuring their business processes by automating routine operations and patterns of
interaction with business partners. The state is forced to revise university financing programs, priority areas for training specialists and investing in public-private partnership projects. Universities are more oriented towards individualization of student learning with the parallel formation of the student’s electronic portfolio.

Accordingly, specialists with competencies confirmed not only by university diplomas, but also certificates of various online schools, platforms and corporate training centers will be in demand on the digital labor market [4]. Given the emerging trends in the labor market, one of the priority areas of research will be the assessment of the psychological readiness of staff (employees/government officials) to interact in a virtual environment. Legal aspects of regulating labor relations in the digital environment, paying taxes for various modes of work (remote access, outstaffing, project work) will also come to the fore.

References

1. Afonasova, M.A., Panfilova, E.E., Galichkina, M.A., Slusarczyk, B.: Digitalization in economy and innovation: the effect on social and economic processes. Pol. J. f Manag. Stud. 19(2), 22–32 (2019). https://pjms.zim.pcz.pl/resources/html/article/details?id=190160
2. Aghayeva, K., Slusarczyk, B.: Analytic hierarchy of motivating and demotivating factors affecting labor productivity in the construction industry: the case of Azerbaijan. Sustainability 11(21), 5975 (2019). https://doi.org/10.3390/su11215975
3. Akhmetshin, E.M., Mueller, J.E., Chikunov, S.O., Fedchenko, E.A., Pronskaya, O.N.: Innovative technologies in entrepreneurship education: the case of European and Asian countries. J. Entrep. Educ. 22(1) (2019). https://www.abacademies.org/articles/innovative-technologies-in-entrepreneurship-education-the-case-of-european-and-asian-countries-7827. html. Accessed 15 May 2020
4. Al-Tkhayneh, K., Kot, S., Shestak, V.: Motivation and demotivation factors affecting productivity in public sector. Adm. Manag. Public 33, 77–102 (2019)
5. Ardolino, M., Rapaccini, M., Saccani, N., Gaiardelli, P., Grespi, G., Ruggeri, C.: The role of digital technologies for the service transformation of industrial companies. Int. J. Prod. Res. 56(6), 2116–2132 (2017)
6. Betelin, V.B.: Challenges and opportunities in forming a digital economy in Russia. Herald Russ. Acad. Sci. 88(1), 3–9 (2018)
7. Bondarenko, N., Borodina, D., Gokhberg, L.: Indicators of Education in the Russian Federation: 2020: Data book. HSE, Moscow (2020)
8. Borisova, V.V., Panfilova, E.E., Zhukov, P.V., Matulis, S.N., Matveev, V.V., Teymurova, V.E.: Information support in the enterprise risk management. Int. J. Manag. Bus. Res. 9(1), 158–169 (2019)
9. Carrincazeaux, C., Gaschet, F.: Regional innovation systems and economic performance: between regions and nations. Eur. Plan. Stud. 23(2), 262–291 (2015)
10. Doyle, S., Senske, N.: Soft skills for digital designers. In: Architecture Conference Proceedings and Presentations, vol. 81, 475–480, Iowa State University, Iowa (2016)
11. Foerster-Pastor, U.S., Golowko, N.: The need for digital and soft skills in the Romanian business service industry. Manag. Mark. Challenges Knowl. Soc. 13(1), 831–847 (2018)
12. Graham, M., Hjorth, I., Lehdonvirta, V.: Digital labour and development: impacts of global digital labour platforms and the gig economy on worker livelihoods. Eur. Rev. Labour Res. 23(2), 135–162 (2017)
13. Hussain, S., Rizwan, M., Nawaz, M.S., Hameed, W.: Impact of effective training program, job satisfaction and reward management system on the employee motivation with mediating role of employee commitment. J. Public Adm. Govern. 3(3), 278–293 (2013)

14. Lacity, M., Willocks, L.: A new approach to automating services. MIT Sloan Manag. Rev. 58(1), 40–49 (2016)

15. Pugh, K.J., Bergstrom, C.M., Spencer, B.: Profiles of transformative engagement: identification, description, and relation to learning and instruction. Sci. Educ. 101(3), 369–398 (2017)

16. Steinmayr, R., Spinath, B.: The importance of motivation as a predictor of school achievement. Learn. Ind. Differ. 19(1), 80–90 (2009)

17. Toktamysov, S.Z., gizi Vekilova, A.I., Gasimzade, E.E., Kurilova, A.A., Mukhin, K.Y.: Implementing the education of future entrepreneurs in developing countries: agile integration of traditions and innovations. J. Entrep. Educ. 22(5) (2019). https://www.abacademies.org/articles/implementing-the-education-of-future-entrepreneurs-in-developing-countries-agile-integration-of-traditions-and-innovations-8569.html. Accessed 15 May 2020 (2019)

18. Vasiliev, A.: Entrepreneurial education quality management to improve university competitiveness. J. Entrep. Educ. 23(1) (2019). https://www.abacademies.org/articles/entrepreneurial-education-quality-management-to-improve-university-competitiveness-9020.html. Accessed 15 May 2020

19. Weber, R.A.: The economics of effective leadership (2015). https://leadersforpurpose.com/the-economics-of-effective-leadership/. Accessed 10 Aug 2020