

# Dynamic model of social risks in the digital economy

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**Abstract** — In this paper, issues related to the development of new risk assessment methods and their impact on social processes in conditions of the digital economy formation and development are studied. A generalized definition of the digital economy using a term *innodiversification* is proposed. The authors' classification of digital economy risks is demonstrated. A dynamic model of social risks in the digital economy is proposed. It has been found that social risks in the digital economy increasingly grow with each year. Research has shown that there is an urgent need to find a solution for the issue of skills mismatch in the labor market. It is necessary to increase the number of competitively strong workers with a great and permanently renewable stock of knowledge, skills and competences required for a given time. The above is impossible without involving the state agencies, education system, social actors and population in the implementation of said goal.

**Keywords** — digital economy, digitalization, risks, social risks, dynamic model.

## I. INTRODUCTION

At the first stage of its introduction and adoption, the digital economy generates more problems than it is able to solve [1]. Yet, there is no other option, and we merely cannot evade it because we have to follow the intellectual and technical progress to get closer to excellence. Therefore, we should foresee the risks, be prepared to them, minimize them and, if possible, avoid them.

Though the impact of digital technologies on the behavior of socioeconomic systems is quite notable, the respective issues remain for the most part insufficiently studied [2, Vol. 7, p.116]. Not much attention is paid to the influence of risks on the development of digital potential that may contribute to the growth of social tension. Besides, the business development problems in the context of the digital economy formation are insufficiently described and the emergence of new risks specific for digital economy is not considered in the general system of current economic relations. Thus, the purpose of this research is to study the basic aspects of the business entity transformation and adaptation to the conditions of digital economy and, primarily, the impact of new possible risks on such transition.

Based on the study of numerous definitions and concepts, we have formulated in [3, p. 385] a generalized definition of the term "digital economy". We propose the following definition: "Digital economy is an environment that includes a set of digital infrastructure and *innodiverse* information and communication technologies of doing business." We suggested the term "*innodiversification*" in 2016 [4, p.284] to describe the penetration of innovations into new sectors. The above was also confirmed by a sociological research carried out by the World Economic Forum jointly with the Eurasia Competitiveness Institute and a consulting company Strategy Partners [5]. The poll included 313 employers from 20 countries with an aggregate economy volume equal to 70% of the world GDP representing 12 sectors with a total number of employees about 15 million. The report highlighted *innodiversification* technologies in the digital economy expected to have the most impact on the labor market before 2020 (Fig.1).

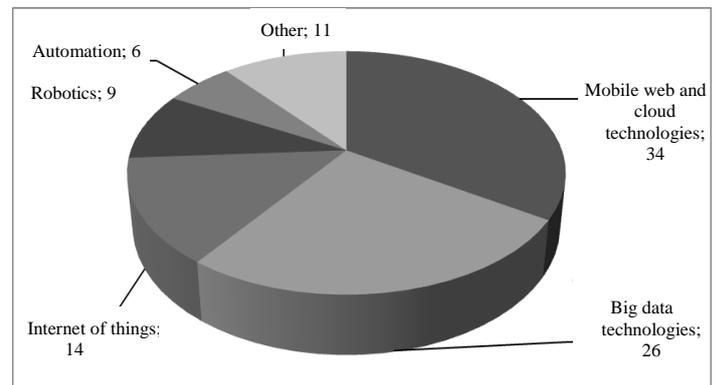


Fig. 1. Technologies to have the most impact on the labor market before 2020, % [5]

Thus, the digital economy poses a challenge to our state: on the one part, the development of digital economy promotes the economic growth and, therefore, formation of resources which could be used for social development, on the other part, however, the digitalization, from the strategical point of view, leads to the spiritual impoverishment of the people making them prefer gadgets and "the worldwide web" to the delights of nature, the further individualization of life and social degradation and, hence, depletion of human resources able to

withstand the expansion of ideologies hostile to our country [6, p.11].

In the present-day environment, our country is "bound" to develop digital economy in order not to lose the geopolitical competition. To prevent the digital economy management from transition to transnational corporations and those behind them, the information and communication technologies center should be provided with a facility of cryptographic protection from risks [7, p.179] determined in the approved program "Digital Economy of the Russian Federation" [8] as one of structural components on which the program is focused. In addition, it is necessary to "develop an immunity" to the destructive influence of digitalization on people and social stability [9, p.175].

Study of the current practice for implementation of the pension reform shows that its efficiency is determined not only by optimization of the pension scheme itself but to a greater extent by "external" factors and risks existing throughout the whole pension insurance period (average length in Russia up to 70 years) [9, p.176]. The international practice of pension system development shows that the most significant impact is exerted by macroeconomic and demographic risks. In the current century, the priority should be given to a new complex of risks induced by the digital economy. Digital risks related to the pension schemes development can be perceived in the sharp reduction of the public demand for participation in working activities and active "displacement" from manufacturing processes and substitution of the human labor. This leads to the reduction of employment and the necessity to amend the system of labor relations as an economic mechanism for labor product distribution between the employer (receipt of profit) and the employee (receipt of wages).

Social protection systems were "built in many countries of the world to ensure the adequate material support for their citizens in the event of unfavorable socioeconomic circumstances. The risks associated with social care measures for each individual and the whole human society are the main reason for the appearance of a variety of such measures and their gradual integration into the unified system of government control" [10].

Social risk is a socially recognized probable event that may, in the case of its occurrence, result in the total or partial disability or bring about a restriction on the demand for the person's labor, which, in turn, causes the total or partial loss of earnings being the source for worthy existence [10].

## II. METHODS

Classification methods most widely used in the research practice can be subdivided into three groups: hierarchical, faceted and descriptive. In this study, mainly the hierarchical methods have been applied (Fig.1) where a serial algorithm is used for division of a given set of items into subordinate subsets. According to these methods, subsets form "a unified classification system for a distributed set with interrelated subdivisions, a whole where all parts are interrelated and subordinated in a particular manner" [3].

## III. RESULTS

Based on the study of different information sources [3, p.386], the authors have developed their own classification of risks inherent in the digital economy (Fig. 2).

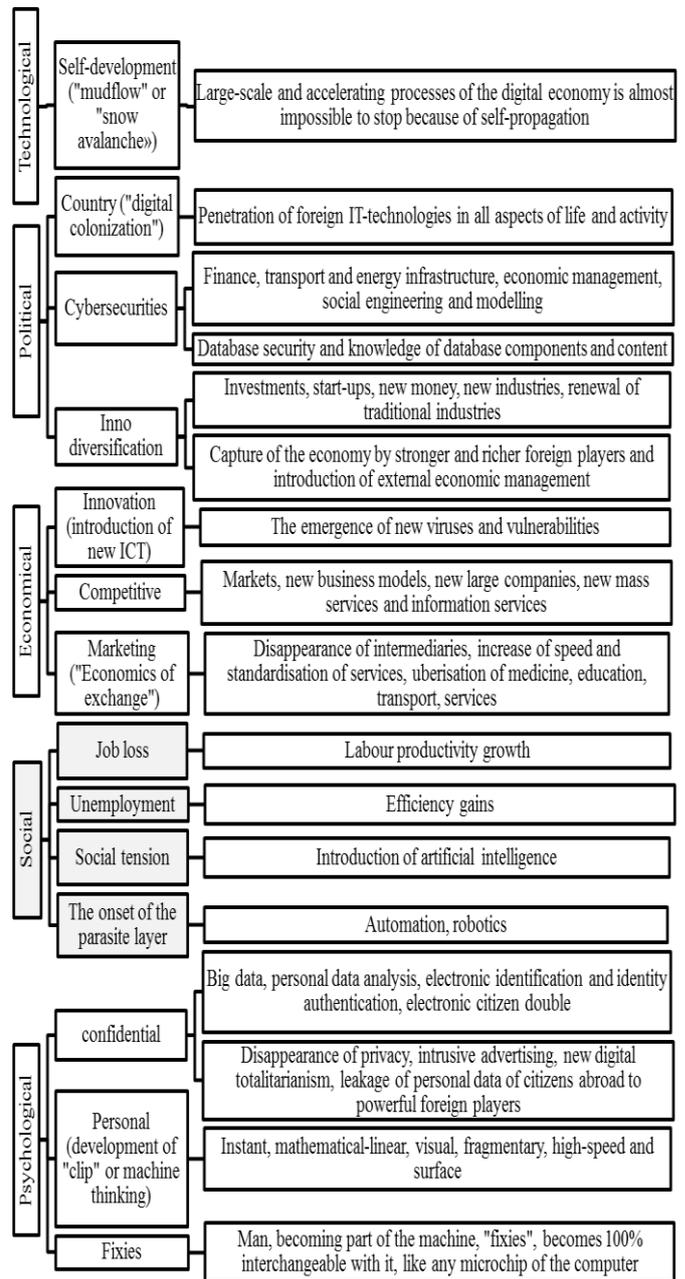


Fig. 2. Risks inherent in the digital economy

The comparative study of risk classification (Fig.2) and digital economy (Fig.3) showed that though the social risks had much in common there were, nevertheless, significant differences in them. In particular, this was true for the risks related to earned income and, most of all, for the risk of unemployment. Note that the risks related to earned income in the digital economy were prone to drastic changes. Therefore, we proposed a dynamic model of social risks for the digital economy shown in Figure 3.

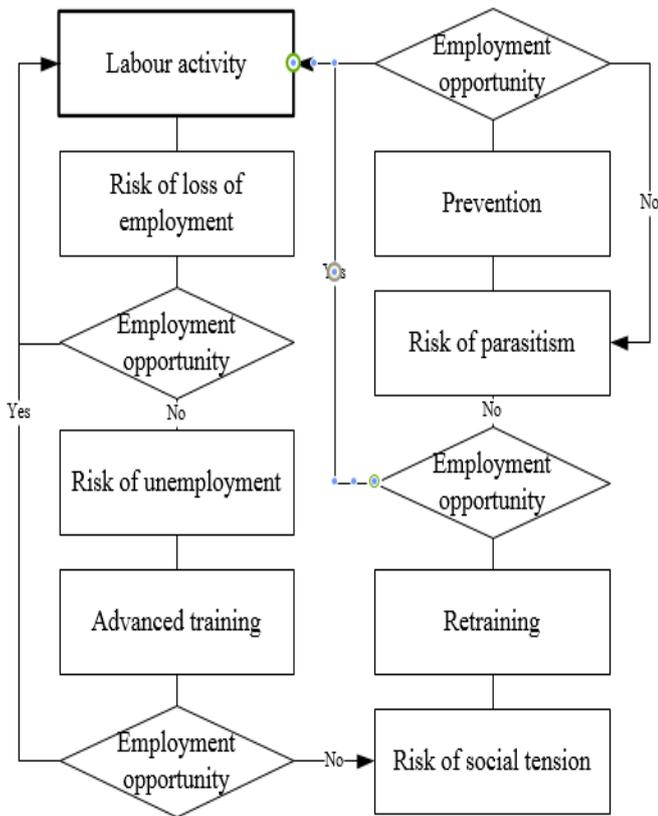


Fig. 3. Dynamic model of social risks for the digital economy

As follows from Figure 2, any working activity can be associated with the risk of losing the job. In [11, p.781], the job loss risks for a period of six years are considered and the first attempt is made to study the influence of employment factors on numerous indicators of welfare level and job satisfaction with reference to job loss. According to numerous experts, the mass-scale elimination of jobs caused by the automation and introduction of robotics would start in the next three-five years. As a result, the risk of job loss would grow. Table 1 shows the trends of changes in the number of jobs according to the poll conducted among experts from the developed countries throughout the globe [5].

"Recent studies show the following trends characteristic for the employment conditions:

- Growth of dynamics (increase in the number of both dismissed and hired workers);
- Increasing shortage of the personnel with required skills and knowledge;
- Changes in the labor conditions for workers (mitigation of the requirements applicable to the place and time of work, increase of workload, modification of the labor content);
- Continuing demand for experience in a certain professional field; growing importance of social, intracultural and managerial knowledge and skills" [12].

TABLE I. TRENDS OF CHANGES IN THE NUMBER OF JOBS FOR A PERIOD UNTIL 2020, % PER ANNUM

Area, sphere, sector	% per annum	
	Increase	Decrease
Big data technologies:		

Mathematics and computer science	4.59	
Management	1.39	
Finance	1.34	
Sales	1.25	
Office		6.06
Internet of things:		
Administration and programming	4.54	
Design and engineering	3.54	
Office		6.20
Equipment maintenance, repair and installation		8.00
Manufacturing technologies and 3D printing		3.60
Robotics and automation		0.83
	16.65	24.69

#### IV. DISCUSSION

It is expected that social consequences caused by the introduction of the digital economy would be large by size and extremely difficult.

First, it should be noted that new technologies are emerging in many sectors. Today, we can see the coming of smart cash registers, self-driving cars, drone aircraft and many other digital technologies, therefore, many drivers, pilots and cashiers are bound to lose their jobs.

Second, the disappearance of old jobs would not result in the emergence of new ones. Indeed, the new technologies adopted would not merely need the qualified personnel. Therefore, a plenty of jobs would be lost in the process of digitalization.

Looking at the countries affected by the digitalization more than our country, US and Canada, for example, we could note that they are much concerned with the employment reduction problem when many people have lost their jobs and whole cities become bankrupt [13].

This fate may soon overtake Russia as well. A question how to deal with "useless" people is being asked increasingly often. This problem should be resolved on a comprehensive basis without letting it run its course.

Since the digital economy requires a higher performance, not all workers who have lost their jobs would be able to take positions similar to those they had before, if their skills have remained the same. Therefore, if such workers want to find employment, they need to upgrade their qualification to stand the unemployment risk. It would take a certain time and resources to upgrade one's skills. Prospect for retraining the staff for a period until 2020 are shown in Figure 4.

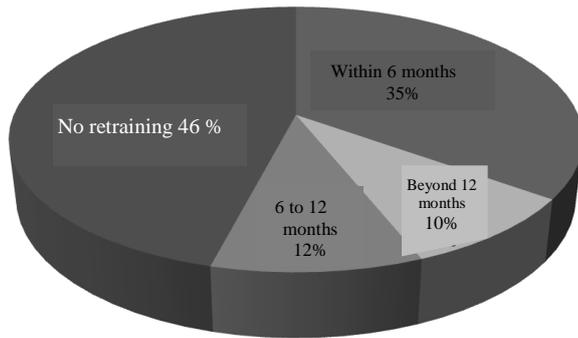


Fig. 4. Prospects for retraining the staff for a period until 2020, % [5]

The retraining of middle-age people would result (for age-related reasons) in their taking downgrade and, therefore, less paid positions. Highly skilled specialists would find themselves in a lower position than the unqualified personnel because they had been involved to the last moment in the process of transition from the traditional production routine to the production based on digital technology, so they would be "thrown" into the labor market when the positions adequate for their status are already filled. Hence, it promotes the formation of the social tension atmosphere that may lead to the rejection of the digital economy introduction idea [14].

Considering that not all the unemployed would be able to find a job even after upgrading their qualification, the emergence of the social tension risk could be expected, if the number of such unemployed grows significantly. To find a job, the unemployed would have to learn new professions required by the digital economy at different stages of its formation and development. The list of top five professions most requested by the digital economy in the next decade includes: managers experienced in the work on digital projects; software developers; digital marketing experts, emotion designers; e-business legal advisers; and drone aircraft operators [15]. Besides, new professions not previously known to us will appear.

A the stage of digital economy adoption, it would be "not advantageous" for an individual to be a professional in a particular area because professions would fade away and a person would have to change the profession several times within the active working life. In this situation, a person does not care about making efforts to receive training, if it would be necessary to spend time and money for retraining after the next five or seven years [14]. This may result in the appearance of a freeloaders class, especially if the government significantly raises the size of unemployment benefits in the conditions of growing social tension.

The main goal, prevention of freeloaders, can be achieved by following the steps listed below: historical study of the term "freeloading", review of the factors promoting the emergence of freeloaders in the society, study of the influence that the parasitic way of life has on the social and economic spheres of the community [16, p.198]. It is this set of steps determined by different factors ensuing from the social conflict currently existing in the society that can be used to describe the essence of the problem indicated above. It would be necessary to develop a set of measures to reduce the freeloaders risk.

In order to determine the step currently taken by Russia, we need to compare the labor market structures in different countries using the approach proposed by J. Rasmussen [17].

A labor market structure for the employed population can be subdivided into three sectors: "Skill", "Rule" and "Knowledge".

The "Skill" sector includes mostly physical labor that does not require special training. Generally, this is a sequence of actions regularly repeated from day to day. Examples may include such professions as loaders, shop assistants or long-haul truck drivers.

The "Rule" sector includes professions that does not suppose any analytical or creative work and require only some special training. It is usually represented by metalworkers, construction workers, managers or medical nurses.

The "Knowledge" sector includes professions requiring higher education. Workers referred to this category should have a long-term training, spacious mind, logical way of thinking, creative abilities and capability to find a solution in difficult situations. Examples may include such professions as researchers, chief executives or firemen [18, p.383].

Russia is currently at a transitional stage. Though the digital economy is only beginning to gain momentum, big problems in the employment structure are already obvious. About 80% of the employed population lack the necessary competence for working even in a present-day market, let alone the prospects of the economy development in the future.

About 35% of Russian population are involved in the low-paid Skill-based work. The high-qualification labor regarded as "Knowledge" is performed by some 17% of the total population. This value is significantly lower than for US, Japan and Germany [18, p.387].

Thus, the most important problem is the lack of demand for Knowledge-based professions. Possible reasons for this lack of demand may include the labor remuneration policy. In most cases, the amount of wages is not related with the qualification level. For example, the driver's salary in the Russian Federation is practically the same as that of the physician. Given that people prefer stability, they better chose an easy and less demanding job than a more difficult job requiring a broader scope of knowledge, skills and responsibility. In the countries where the high-qualification labor prevails, the difference in wages is two-fold.

Yet another reason is the poor quality of education. The education system is mostly preparing Rule-based workers, that is, managers, metalworkers or construction workers, instead of supplying high-qualification engineers and researchers. It is not the education system only that should be blamed for that. Many people are going to get higher education for some unrelated reasons such as exemption from military service, raising of social status or satisfaction of the parents' wish. Moreover, after they received a diploma, people completely stop their further education thinking that they already have the necessary base of knowledge.

If the current market structure remains for the next 7-10 years, the lag between Russia and other countries may become irreparable.

Russia would not stand the global economic competition without having globally competitive talents – workers of the "Knowledge" sector. The competitive performance of Russia will be determined by the ability to produce, attract and retain specialists having a range of necessary competencies. The above would only be possible, if the human capital development methods are being developed and implemented. "A serious stratification by labor and income cannot be excluded because the retardation in the basics of digital literacy is quite notable among the low and medium-qualification workers. The lag in the employment and labor productivity growth will be caused by the insufficient awareness of the workers that they need to upgrade their skills on a regular basis during the whole period of their working life. An objective reason for that is in the absence of interrelation between the qualification growth and the level of wages payable to Russian workers. Disregarding of that may hinder the process of generating and introducing innovations in the economy, slow down the pace of economic and social development" [18, p.393]. The risk of social tension related to the risk of job loss because of inefficient operation of corporations unable to reorganize their work with due regard to the available opportunities provided by the digital economy may increase. "The employees themselves are largely prone to follow the traditional behavior, resist the mobility and innovations in their working functions and are not adapted to flexibility and self-regulation in their labor" [19, p.48].

## V. CONCLUSIONS

To avoid the growth of the number of unemployed and freeloaders with the introduction of the digital economy, it would be necessary to increase the demand for Knowledge-based professions. For this purpose, the following steps should be made:

Reconstruction of the education system to make it prepare Knowledge-based specialists. Besides the base of knowledge in their particular specialty, graduates from the higher school should have a number of other competencies necessary for their work. After adoption of the digital economy, the educational program should be updated on a regular basis.

It is necessary to continuously encourage people to enter the sphere of education. The system of teachers retraining and professional upgrading needs to be modified subject to changes in the required competences.

To refocus the priorities of students and workers, they should be taught that their education and development is to be continued for the whole period of their life not having been ended after graduation from the university. Employers should steadily encourage their personnel to continue their professional growth and update their competence.

Favorable conditions for the Knowledge-based specialists should be established. It means that an emphasis should be put on the increase of wages, on-the-job and off-hour training, steady career advancement, workplace environment conforming to the labor safety requirements, etc.

The number Skill- and Rule-based employees should be gradually reduced with the introduction of a retraining system for people from those sectors.

Favorable environment for the conduct of business should be established. The government should encourage the development of small- and medium-size business.

Hence, it is obvious that social risks in the digital economy are growing each year with an increasing pace. As seen from the studies, the labor market urgently needs to resolve the issue of skills mismatch. It is necessary to increase the number of competitively strong workers having a great and permanently renewable stock of knowledge, skills and competences required for a given time. The above is impossible without involving the state agencies, education system, social actors and our own efforts in the implementation of said goal [20].

If the old professions have to "fade away" and the new ones are expected to emerge every 7–10 years, then it would be necessary to have the respective specialists trained (approximately within a period of four years) before the advent of a new job, and teachers capable of doing that should be prepared even earlier. Anyway, the system of professional upgrading and permanent retraining should be used for implementation and intensification of these intentions but it is quite probable that just when the teacher's qualification becomes adequate to teach the profession, the profession itself would start to go obsolete.

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