

Working Conditions as a Factor of Increasing Its Productivity in Russia's Regions*



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Abstract. Labor productivity growth depends on various factors: labor potential quality and its use efficiency, improving management and working conditions at enterprises, updating material and technical base of enterprises and introduction of modern technologies in real economic sector, etc. In the study, we considered the impact on labor productivity of such factors as the loss of working time from industrial injuries. It is closely linked to the health-saving problem of working population, as in Russia, according to the statistics there is a super-mortality of working-age population, caused to a certain extent by unfavorable working conditions. The purpose of the study is to analyze the impact of working conditions on its productivity and to assess the potential GRP losses from workers' disability injured at work.

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The research used economic and statistical methods, grouping methods, and comparison methods. The information base for the analysis was the data of the Federal State Statistics Service and sociological monitoring on the assessment of population's qualitative characteristics carried out by the FSBIS VolRC RAS in the Vologda Oblast (no. = 1500). The article analyzes the dynamics of labor productivity in the regions of the Northwestern Federal District in 2005–2018, determines the share of the NWFD regions in the district's total labor productivity, evaluates health impact of employed population on labor productivity both on the basis of sociological data, and by grouping the regions by labor productivity and assessing the level of constant nervous tension, stress, the impact of production factors and other inconveniences of workplaces. The paper calculates the losses of gross regional product from disability time of injured at work. The authors prove that GRP loses from 17 to 26% in the presence of even a small number of disability days of injured at work. The practical significance of the research is to confirm the hypothesis about the influence of working conditions (the basic component of the integral indicator of the quality of working life) on its productivity which gives grounds for developing management decisions to pay special attention to the quality of workplaces.

Key words: labor productivity, working conditions, quality of working life, employed population, industrial injuries, disability days.

Introduction

One of the national goals in modern development period of the Russian Federation is called “decent and effective work”, and one of the targets that characterize its achievement by 2030 is “to ensure the growth rate of the country's gross domestic product above the global average while maintaining macroeconomic stability”¹. The achievement of decent and effective work should be ensured by solving the tasks related to sustainable growth of household incomes and level of pension provision not lower than inflation, real investment growth in fixed assets (at least 70% compared to 2020), real export growth of non-primary non-energy goods (also at least 70%) and an increase in the number of people employed in the field of small and medium-sized enterprises (including individual entrepreneurs and self-employed) to 25 million people.

The researchers note a number of factors the impact of which can negatively affect the implementation of this goal:

- decline in working-age population;
- significant structural and interregional distortions in wages and, consequently, labor productivity;
- labor supply and demand imbalance by type of economic activity;
- presence of a large share of informal employment including shadow employment [1].

The listed risks should include indicators of the quality of labor resources, primarily health of working-age population on which labor return of employees directly depends on.

Deputy Prime Minister of the Russian Federation T. Golikova voiced the importance of workers' health issues at the 3rd Forum of Social Innovations of the Regions. According to her, Russian economy lost more than 200 billion rubles in 2018 due to sick leave; she emphasized that “to develop the economy, first of all, it is necessary to create the most comfortable working conditions,

¹ On the National Development Goals of Russia through to: Presidential Decree of the Russian Federation, dated July 21, 2020. Available at: <http://www.kremlin.ru/events/president/news/63728> (accessed: March 01, 2021).

take care of employees, and their health. ... labor productivity is higher in those teams where employees are less ill”².

Rospotrebnadzor monitoring on the sanitary and epidemiological state testify the importance of this indicator in the perspective of diseases from unfavorable working conditions. Based on the analysis of environmental factors, it shows that the population of 54 Russian regions (97 million people) lived in 2019 “under the conditions of the greatest influence on the health of factors related to the nature of the territory’s industrial and economic development” [2; 3].

A World Health Organization (WHO) study assessing the most common occupational risk factors suggests that at least 1.6% of the disease burden in Europe is determined by working conditions³. According to the WHO estimates, workers’ health problems, caused by unfavorable working conditions in most countries, make a significant contribution to GNP loss (from 4 to 6%)⁴ [4].

The purpose of the research is to analyze labor productivity in the entities of the North-Western Federal District of the Russian Federation including calculation of potential labor productivity losses due to employees’ disability associated with unfavorable working conditions.

Theoretical aspects of labor productivity and factors determining it

In general, labor productivity is the ratio of output volume to the amount of the spent labor resources and is calculated to determine the

² Shabrukova N. The losses of the Russian economy due to sick leave are named. Available at: <https://gorodrobot.ru/news/104598> (accessed: March 05, 2021).

³ Global health risk factors: mortality and disease burden associated with some major risk factors: WHO report. 2015. Available at: www.who.int/evidence/bod (accessed: March 01, 2021).

⁴ Poteryaeva E.L. Expert approaches to the diagnosis of occupational diseases: domestic and foreign experience: presentation of the report. Available at: https://iriioh.ru/doc!/events/2018/RNZ-2018/01_Poteryaeva.pdf (accessed: March 01, 2021).

efficiency of functioning individual enterprises, regions, industries, and national economy [5; 6; 7].

Theoretical ideas about labor productivity have been known since the ancient world. However, the theory was formed in the works of the classics of political economy (A. Smith, D. Ricardo). They formulated the concept of “labor productivity”, revealed its role in the economy, and identified the main factors affecting its growth. The essence of the concept included not only the rational division and distribution of labor, but also the time factor, the use of technology and employees’ skills. “The development of worker’s dexterity necessarily increases the amount of work that he is able to perform, and the division of labor, reducing the work of each worker to some simple operation and making this operation the only occupation of his entire life, significantly increases worker’s dexterity” [8]. A. Smith put forward the idea of distinguishing unproductive and productive labor. By productive labor he meant labor engaged in material production. A. Smith considered the ability to increase the value of an object, that is, to make a profit, to be the criterion determining productive labor.

D. Ricardo developed A. Smith’s ideas in labor theory of value. He believed that the utility of a commodity is necessary for the exchange value availability, and the exchange value source of goods is rarity of the commodity and the amount of labor required for its production [9].

Classics of Marxism-Leninism carried out further elaboration of labor productivity theory. K. Marx significantly developed labor productivity theory with the provision on surplus value: productive is labor that produces surplus value [10].

The development of economic thought in the field of labor was subsequently reflected in two main directions: labor theory of value and theory of production factors which was initiated by J.-B. Say. He identified labor as a separate factor of human activity to give value (utility) to things [11]. Also,

representatives of neoclassical economic theory J.B. Clark and A. Marshall made a significant contribution to the science of labor.

Russian literature also gives significant attention to the topic of labor productivity. In the works of scientists of the Soviet period, the Marxist approach prevailed to understanding of productive labor. Modern Russian researchers adhere to the ideas characteristic of Western, primarily neoclassical, economic thought.

A large number of published works are devoted to the study of *factors that determine labor productivity*. For instance, the work of the American engineer-innovator of production management G. Emerson “The twelve principles of efficiency” is widely known [12]. The implementation of the principles he developed makes it possible to eliminate losses in production activities, to lead to an increase in the efficiency of human activity in general. These are correct work goals, common sense in managing work processes, competence and effective advice on emerging issues in the production and management process, discipline and order, fair and impartial treatment of employees, operational and continuous accounting, dispatching, application of certain principles and schedules, working conditions under which the result of activity will be maximum, rationing of work operations, standard written instructions regarding the order of performance of various works and mandatory performance awards. These principles are still applied in enterprises nowadays. Many of them formed the basis of modern concepts in social and labor sphere, for example, the Scientific Organization of Labor (SOL). So, F. Taylor proposed and justified the labor rationing system as a basis for determining the amount of remuneration for an employee [13], later called the “scientific” system of squeezing sweat” [14]. F. Taylor has proved that the rational organization of labor process, workplaces and labor functions leads to an increase in labor productivity.

Emerson’s principles were further developed by H. Fayol, who worked out the basics of rational production management at the beginning of the 20th century [15]. In modern science, they are consonant with the Japanese concept of “lean production” [16]. Lean production concept contains a description of losses, i.e. actions that consume resources, but do not create value for the end user: overproduction, time (waiting), unnecessary transportation, unnecessary processing steps, unnecessary inventory, unnecessary movement, release of defective products. Followers of the theory add to this list the loss of unrealized creative potential of employees. According to P. Drucker, the introduction of new concepts including “lean production” should ensure labor productivity growth in industrial enterprises [17; 18]. We should note that the national project “Labor Productivity and Employment Support”, implemented in Russia since 2019, aims to improve the efficiency of domestic companies using lean production tools⁵.

The analysis of the scientific literature allows identifying the factors that contribute to increasing labor productivity. A number of studies using mathematical models have determined that labor productivity growth can be due to the level of population’s well-being and quality of life and even the number of technical universities in the region [19]. The authors also highlight the capital ratio of labor, investments in fixed assets, foreign investments, the number of state employees of territorial authorities of federal executive bodies, and wages [20].

According to the researchers, the use of more advanced equipment and technologies, improvement of the system of production organization and management, and employees’ professional development lead to an increase in labor

⁵ Project “Labor Productivity”. Available at: https://www.economy.gov.ru/material/directions/nacionalnyy_proekt_proizvoditelnost_truda/ (accessed: March 11, 2021).

productivity [21]. Along with material and financial resources, human resources play a significant role in growing labor productivity. The economy is forced to “consider a man as an active factor in production process” [22].

Labor intensity increase, which is the amount of physical and mental effort applied by the employed population in the course of labor activity, also leads to labor productivity growth. At the same time, labor intensity, having a physiological limit to the consumption of human energy, requires to create a favorable working environment, safe working conditions, an acceptable level of severity and tension of labor process, a positive moral and psychological climate in team, etc. [23].

E. Mayo noted that labor productivity increase is promoted by moral and psychological climate in team which at the same time acts as one of the criteria for job satisfaction [24]. Satisfaction with work, which appears as a result of improving employee's working conditions, in turn, affects labor productivity growth, as the studies of J. Siegal and D. Bowen show it [25]. The content theory of F. Herzberg notes the importance of hygienic factors as poor working conditions and low wages lead to a person's dissatisfaction with their work⁶. Russian researchers also come to the same conclusions saying that the effect of this factor (job satisfaction) has been decreasing over time. F.N. Ilyasov explains it by close connection between the activities carried out and the significance of changes in working environment for employee [26]. The research of E.S. Uzyakova shows the influence of working conditions and equipment of workplaces on labor productivity growth [27]. As the key factors for labor efficiency growth, the author calls the level of technological development, respectively, both production and jobs; the level of remuneration

(motivational aspect); structural changes in the economy and employment structure.

The above determines that one of the factors of labor productivity growth is such an integral indicator as the quality of working life. It reflects the entire complex of employee's working conditions which in one way or another affect the effectiveness of realizing labor potential of the employed population. Within the framework of the research, the content of the definition of “quality of working life” (QWL) includes: remuneration, working conditions, opportunities for career growth, employment stability, psychological climate in labor collective, and social significance of work [28]. Among the above-mentioned aspects, many researchers (both domestic [29] and foreign [30–34] call working conditions the key factor and at the same time the most problematic area in the QWL assessment. The paper notes that “although wages are important, social conditions often come first in importance”, the research establishes that “there is a direct correlation between certain complexes of social conditions of organizations and productivity and quality of staff work” [35].

From the point of view of sanitary and hygienic parameters and their socio-psychological manifestation, almost all concepts and theories of increasing labor productivity include employees' working conditions. In the study, we are interested in employees' health parameters in connection with unfavorable working conditions which have a negative impact on the effectiveness of implementing labor potential. The economic assessment of health at the society level (macro level) can be considered by estimating the underproduction of GDP due to a reduction in working life. At the enterprise level (micro level) – “by assessing the loss of working time due to diseases and injuries, the additional costs associated with payment of sick leave, the costs associated with finding a replacement for an sick employee”, etc. [36]. According to I.B. Nazarova, for example,

⁶ Galyautdinov R.R. Content theories of motivation: an overview. Available at: <http://galyautdinov.ru/post/soderzhatelnye-teorii-motivacii> (accessed: March 11, 2021).

the “ideal model of self-preserving behavior of the employed” is based not only on healthy lifestyle and prevention of diseases with timely access to a doctor, but also on the possibility of choosing safe jobs or, in the absence of a choice, jobs with a minimized impact of negative factors (risks) [37]. T.V. Chubarova, analyzing the main forms of employers’ participation in the protection of workers’ health, puts special emphasis on the need for interaction between employers and the state in the issue based on mutual interest in modern economy development [38]. The work of N.A. Lebedeva-Nessevri is devoted to the problem of deterministic health losses of Russia’s economically active population [39].

Materials and methods

Information base of the research is based on documentary sources of federal and regional authorities, data from the Federal State Statistics Service, databases of the Unified Interdepartmental Statistical Information System (UISIS), as well as Russian RBC media holding.

Methodological basis is the approaches and scientific results of Russian and foreign authors on the problem of finding reserves for labor productivity growth.

The research uses general scientific and special methods. To study the regional characteristics of the dynamics of labor productivity and some aspects

of the quality of working life, the paper uses methods of analysis and diagnostics, and a comparative method to assess the current situation.

The authors carried out calculation of labor productivity by the ratio of gross regional product (mil. rubles) and the average annual number of employees (thou. people) in the region’s economy.

$$Q = \frac{V}{L}, \tag{1}$$

where Q – level of average annual labor productivity, thou. rubles/person; V – gross regional product value, mil. rubles; L – average annual number of employees, thou. people.

To assess the impact of health on workers’ productivity, the work uses a sociological method. The article presents data on monitoring the quality of labor potential of the Vologda Oblast population in 2020. Surveys have been conducted in Vologda and Cherepovets and 8 districts of the Vologda Oblast since 1996. The sample size is 1500 respondents. The method of assessing health impact on labor productivity was to allocate on the basis of the question “How often and seriously do you get sick?” (Tab. 1) the following groups:

- *conditionally healthy employees* (answer position: once a year and less often; never);
- *often ill workers with disability requiring sick leave* (response position: very often due to the weather, etc.; quite often (several times a year));

Table 1. How often and seriously do you get sick?

Possible answer	Very often, due to the weather, etc.	Quite often (several times a year)	Once a year or less often	Never
Ailments (headaches, general weakness, exacerbation of chronic diseases, injuries, wounds, etc.) that quickly pass under the influence of massage, medications, or by themselves, do not reduce the ability to work in general	<i>Often sick employees with disability with no sick leave</i>		<i>Conditionally healthy</i>	
Ailments that reduce the ability to work normally, but with no sick leave				
Diseases that lead to the loss of the ability to work in the workplace, study, etc., but do not deprive you of the opportunity to engage in self-service, do household chores, cook food, etc.	<i>Often sick employees with disability with sick leave</i>			
Diseases that are bedridden, leading to a complete loss of capacity, require service from relatives or other people: nurses, etc., treatment in a sanatorium				

– often ill workers with disability that does not require a sick leave (response position: very often due to the weather, etc.; quite often (several times a year)).

Further, we have compared the value judgments of the selected groups of employees and their self-assessment of labor productivity on the basis of an average score on a 10-point scale.

The work also used data on the assessment of working conditions of the Rosstat statistical observation “Comprehensive assessment of living conditions” (a 2018 study; possible answer to the question about working conditions: I constantly experience nervous tension, stress, exposure to harmful production factors, and other inconveniences at my main job).

Results and discussion

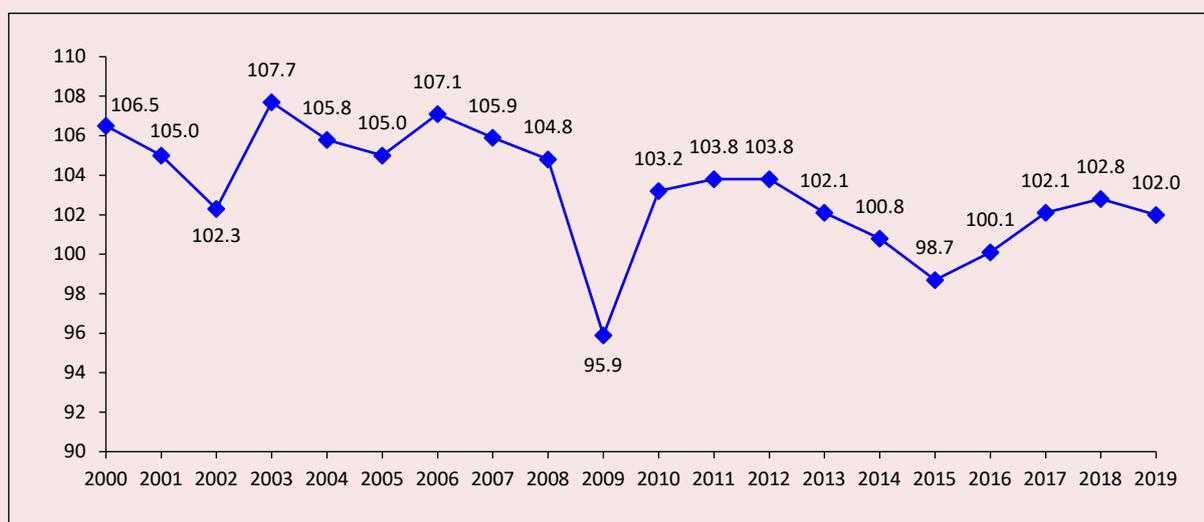
Data from the Organization for Economic Cooperation and Development (OECD) show that labor productivity in Russia is still several times behind the level of developed countries despite some growth by 2017 (\$26.5 per hour, while the leader in

labor productivity (Ireland) has this indicator 3.8 times more and is about \$99 per hour⁷).

According to Rosstat, the labor productivity index in Russia as a whole in 2000–2019 decreased from 106.5 to 102%. Its significant decline in 2009 and 2015 is particularly clearly demonstrated by the impact of the crisis phenomena in the economy in previous years (*Fig. 1*).

However, the dynamics of labor productivity index does not give an idea of absolute labor productivity indicators, so in the study, the average annual labor productivity indicator is calculated as the ratio of gross regional product (mil. rubles) and the average annual number of employees (thou. people). The analysis of changes in absolute labor productivity indicators, conducted in the entities of the Northwestern Federal District (*Tab. 2*), showed that over the thirteen years (2005–2018), labor productivity have tended to grow, both in the federal district as a whole and at the level of its individual regions. During the analyzed period, labor productivity increased by an average of

Figure 1. Dynamics of labor productivity index in RF, % of the previous year



Source: Rosstat data.

⁷ Russia is 3.8 times behind Ireland in terms of labor productivity: RBC data. 2019. Available at: www.rbc.ru/economics/05/02/2019/5c5872889a794725eb8d815e (accessed: April 08, 2020).

Table 2. Dynamics of average annual labor productivity of the NWFD entities in 2005–2018, thou. rub. / people per year (in comparable prices)

RF entity	2005	2010	2013	2014	2015	2016	2017	2018	2018 to 2005, times
Northwestern Federal District	267.1	299.4	346.4	334.4	360.6	369.2	386.8	428,2	1.60
Republic of Karelia	221.0	214.6	277.1	271.7	272.6	282.8	318.6	349,0	1.58
Komi Republic	360.7	414.2	479.4	446.8	440.8	449.9	485,5	547.5	1.52
Archangelsk Oblast	212.1	231.1	281.0	277.3	278.5	286.7	316,1	346.6	1.63
Nenets Autonomous Okrug	1614.4	2484.2	2381.4	2308.5	2491.4	2659.7	2929,6	3227.5	2.00
Vologda Oblast	320.2	238.6	284.4	287.8	315.6	297.1	325,8	369.5	1.15
Kaliningrad Oblast	183.2	223.5	265.9	271.0	267.1	280.1	303,0	322.9	1.76
Leningrad Oblast	278.9	324.0	367.8	343.9	368.4	387.1	423,1	477.1	1.71
Murmansk Oblast	298.0	309.0	347.3	341.8	382.7	394.4	420,4	445.9	1.50
Novgorod Oblast	203.4	223.8	266.1	283.7	286.2	286.8	323,2	309.8	1.52
Pskov Oblast	120.6	155.1	167.5	165.0	167.1	173.2	187,4	195.3	1.62
Saint-Petersburg	274.6	318.3	366.2	348.7	390.8	399.5	420,4	447.4	1.63

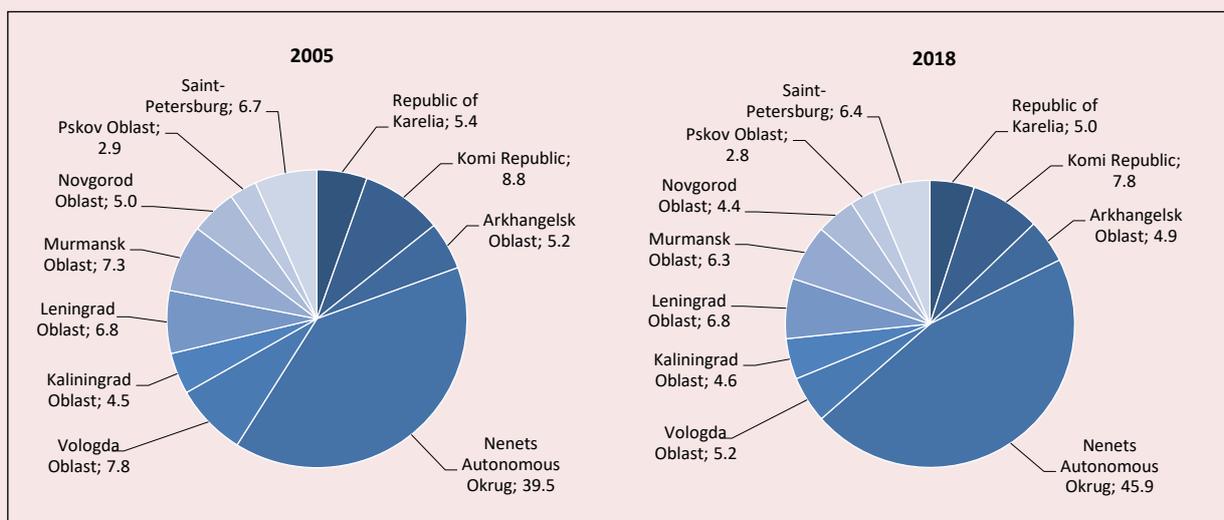
Source: authors' calculations based on Rosstat data.

1.6 times. In most regions (Arkhangelsk Oblast, Nenets Autonomous Okrug, Kaliningrad Oblast, Leningrad Oblast, Pskov Oblast, St. Petersburg), the growth rate was slightly higher than the average for the Northwestern Federal District. The largest increase in labor productivity was in the Nenets Autonomous Okrug (2 times) and the Kaliningrad Oblast (1.76 times). The Vologda Oblast showed

the lowest growth; its labor productivity indicator remained almost unchanged (the increase was 15%).

Figure 2 shows the share of the regions of the Northwestern Federal District in the total labor productivity for the district. The share of the Nenets Autonomous Okrug is significant (39.5% in 2005 and 45.9% in 2018). This is due to the fact that it is

Figure 2. Share of regions in total volume of labor productivity in the Northwestern Federal District in 2005 and 2018, %



Source: authors' calculations based on Rosstat data.

characterized by a single-industry economy with a high share of oil and gas resources production and a relatively small number of employed people (31.8 thou. people in 2018).

Also in 2018, the research noted a significant share of the Komi Republic (7.8%), the Leningrad Oblast (6.8%), St. Petersburg (6.4%) and the Murmansk Oblast (6.3%) in total labor productivity of the district. At the same time, the high level of labor productivity in the Komi Republic and the Murmansk Oblast is provided by the effects of extractive industries (in the Komi Republic, the structure of the economy is dominated by the extraction of hydrocarbons, in the Murmansk Oblast – the extraction of metal ores and non-metallic minerals, as well as a large volume of the fishing industry). St. Petersburg and the Leningrad Oblast are distinguished by a diversified economic structure where one of the leading industries is manufacturing and mechanical engineering. The Pskov Oblast has the lowest share in the total volume (2.8%). The share of the Vologda Oblast was 5.2% in 2018 which is due to the predominance of manufacturing industries in the structure of its economy (metallurgical production, production of chemicals and chemical products, wood processing and production of wood and cork products, production of finished metal products, food production).

We can assume that the industrial structure of the regional economy has a significant impact on labor productivity [42]. However, being largely

decisive, it is not the only factor explaining the differences in the levels of labor productivity in the entities of the Russian Federation.

As mentioned above, the quality of working life, in particular its main component – working conditions, which affect the health of workers and their ability to work, can affect the level of labor productivity in the region. To confirm this hypothesis, we have used data from sociological monitoring of the quality of labor potential of population that have been carried out by the Vologda Research Center of the Russian Academy of Sciences in the Vologda Oblast since 1996.

In order to assess the impact of health on labor productivity, we have identified, as mentioned above, groups of workers according to frequency and severity of diseases (conditionally healthy, ill with disability and without disability). The calculations showed that the highest level of self-assessment of labor productivity is typical for a group of conditionally healthy workers (*Tab. 3*), and in comparison with the data of 2011, value judgments have significantly increased.

Although, at first glance, the differences in the estimates of labor productivity between the selected groups are small, we still assume that often sick workers with disability are forced to hard and difficult to catch up, fight for workplace preservation, etc. This determines their hard work and, accordingly, a fairly high self-esteem. At the same time, data clearly show that healthy workers use their labor potential more effectively.

Table 3. Self-assessment of labor productivity
(the case of the Vologda Oblast), average score on a 10-point scale

Indicator	2011			2020		
	Conditionally healthy	Often sick		Conditionally healthy	Often sick	
		With disability	With no disability		With disability	With no disability
<i>Number of categories in the sample, people (%)</i>	<i>593 (39.5)</i>	<i>897 (59.8)</i>	<i>344 (22.9)</i>	<i>510 (34.0)</i>	<i>984 (65.6)</i>	<i>374 (24.9)</i>
Average score	7.2	7.1	7.2	8.5	8.3	8.4

Source: monitoring data "Quality of labor potential of the Vologda Oblast population", 2011–2020.

Table 4. Dynamics of judgments of the Vologda Oblast working-age population on barriers in realization of labor potential, %

Possible answer	2016			2020		
	Conditionally healthy	Often sick		Conditionally healthy*	Often sick	
		With disability	With no disability		With disability	With no disability
Poor working conditions	8.4	7.8	7.4	7.5	10.2	6.8
Inconvenient work schedule	7.8	10.2	9.1	6.4	8.8	6.8
Intense team atmosphere	4.3	6.0	6.5	5.9	5.7	4.8
Health problems	4.3	16.2	21.2	5.1	15.4	12.7
Inability to influence enterprise's management	7.6	8.4	9.1	4.8	7.2	7.5
Low labor intensity	5.3	4.7	3.5	4.6	1.9	1.4
Poor relations with management	1.4	3.1	3.0	2.1	3.3	3.4
Other	3.5	2.1	2.2	0.5	0.9	1.0
Not sure	37.1	30.7	26.8	43.2	35.9	40.8

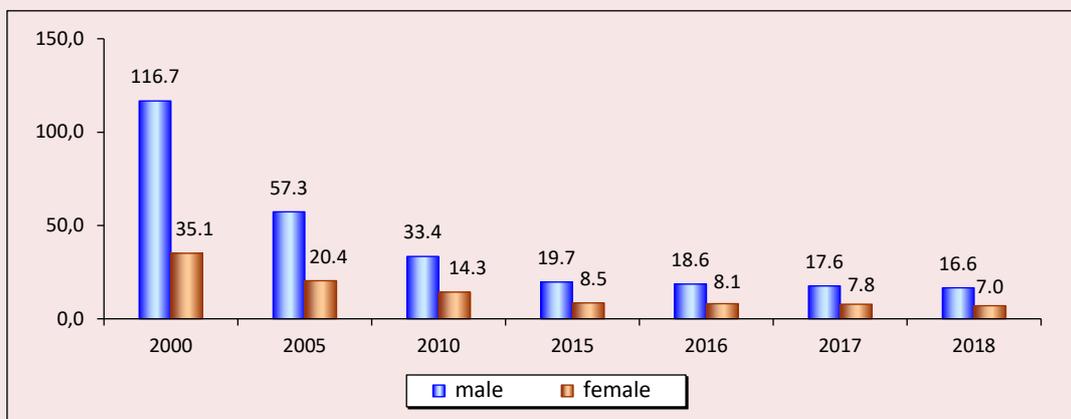
* Ranked by "conditionally healthy" column in 2020.
 Source: monitoring data "Quality of labor potential of the Vologda Oblast population", 2016–2020 rr.

Most of all, problems, related to labor productivity, arise due to the poor health of employees (Tab. 4). At the same time, the greatest problems were noted five years ago by a group of often sick workers with no disability, i.e. without registration of a sick leave (21%), in 2020, a group of employees who often take a sick leave (15%) pointed to health-related interference. We should note that healthy workers are more often referred to as a barrier to effective realization of labor potential as a factor of "unfavorable working conditions" (8.4% in 2016, 7.5% in 2020).

One of the indicators reflecting unfavorable working conditions as the main component of the quality of working life is the proportion of injuries of industrial accidents, as well as the number of man days of their disability.

Figure 3 shows that the greatest injury risk is characterized by male economic activities. In the early 2000s, the number of men injured in the workplace exceeded the corresponding figure among women by more than three times. The authors should mention that the dynamics of the number of workers affected in the workplace has

Figure 3. Number of injuries of industrial accidents in RF, thou. people



Source: data of the Federal State Statistics Service. Available at: www.gks.ru

a positive trend. By 2018, the number of male injuries decreased by 10 times (to 16.6 thou. people), the number of female injuries – by 5 times (to 7 thou. people).

The total number of man days of disability for those affected at work has decreased by more than 3.5 times since 2000. However, this indicator per 1 injured increased by more than 1.5 times (Fig. 4).

According to the results of a Comprehensive monitoring of population's living conditions (Rosstat), the regions are characterized by different level of employees' perception of the presence in the workplace of situations of nervous tension, stress, adverse effects of production factors and other inconveniences. For instance, in 2018, 19.5% of employees in the Russian Federation constantly experienced nervous tension and stress at work, 18.6% – exposure of harmful industrial factors, and 11.4% of respondents indicated the constant presence of such inconveniences as cold, damp, etc. Given that the regions are also differentiated by labor productivity level (for example, the difference between the Republic of Komi and the Pskov Oblast is 2.8 times), the question arises about

the relationship between labor productivity and estimates of the level of constant nervous tension, stress, the impact of production factors and other inconveniences.

To answer this question, we will group the regions of the Northwestern Federal District according to these criteria. To do this, we determine the optimal number of groups using the Sturges formula:

$$n = 1 + 3,322 \lg N, \quad (2)$$

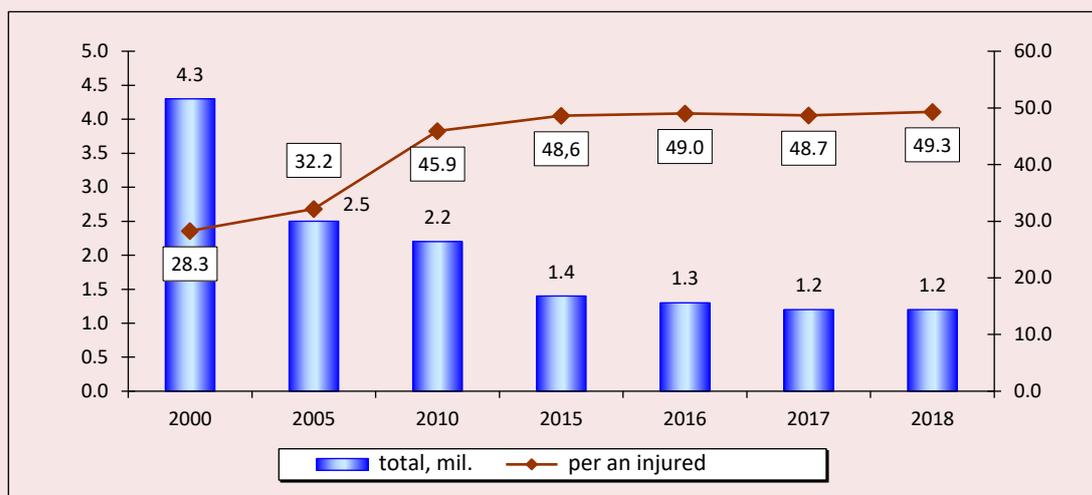
where n – number of groups;

N – number of population units.

The Northwestern Federal District includes 11 regions ($N = 11$), then the optimal number of groups (n) will be 4.4. As fluctuations in the value of labor productivity are low, we have identified 4 groups (with low, average, above average and high levels of labor productivity and levels of constant exposure to production factors).

To assign the region to a particular group, we have calculated the arithmetic mean based on three features that characterize working conditions: constant nervous tension, stress, exposure

Figure 4. Number of man days of disability for industrial injuries in RF



Source: data of the Federal State Statistics Service. Available at: www.gks.ru

Table 5. Impact matrix of unfavorable working conditions on labor productivity level in the regions of the Northwestern Federal District

Level assessment of constant nervous tension, stress, exposure to production factors and other inconveniences of workplaces	Labor productivity of the NWFD regions			
	High	Above average	Average	Low
High		Komi Republic	Archangelsk Oblast Vologda Oblast	
Above average	Nenets AO	Murmansk Oblast		Pskov Oblast
Average			Republic of Karelia Kaliningrad Oblast	Novgorod Oblast
Low		Leningrad Oblast St. Petersburg		

Source: authors' calculations based on Comprehensive Monitoring of living conditions of population (Rosstat). Available at: https://gks.ru/free_doc/new_site/KOUZ18/index.html (accessed: March 19, 2021); *Regions of Russia. Socio-economic indicators. 2020: stat. coll.* Rosstat. Moscow, 2020. 242 p.

of harmful production factors, and presence of other inconveniences. According to the results, the leading positions in this indicator are the Komi Republic, the Arkhangelsk and Vologda oblasts, the employed population of which, to a greater extent than in other regions, note unsatisfactory working conditions.

Comparing the estimated features of jobs and labor productivity level in the regions of the Northwestern Federal District (*Tab. 5*), we can see that the presence of jobs, characterized by situations of nervous tension, stress, adverse effects of production factors and other inconveniences⁸, affect the economic activity result. For instance, with the level of unfavorable background of jobs above average, the Pskov Oblast is in the group of regions with a low level of labor productivity, and the Leningrad Oblast and St. Petersburg, having a low level of stress and other negative factors in the workplace, occupies places in the group with above average level of labor productivity. It means that in regions with a high level of unfavorable working conditions, according to population estimates⁹,

there is a lower level of labor productivity. We should note that such trends are not observed in all regions (for example, with fairly high estimates of unfavorable working conditions in the Nenets Autonomous Okrug, labor productivity is high which is due to a single-industry economy with a high share of extractive industries). However, we assume that for more fundamental conclusions, it is necessary to analyze a larger number of survey points (in this case, we limited ourselves to one federal district in one year).

Industrial injuries are directly related to poor working conditions and occupational safety. Inattention to these factors leads to significant losses in the economy [15]. To confirm this assumption, we calculate possible damage to the economy of each of the NWFD entities from the number of man days of disability, i.e., we determine by how many percent of labor productivity level can decrease with decline in the gross regional product due to the disability of employed population. GRP losses from disability days of injured at work will be calculated according to the following formula:

⁸ Working conditions. Comprehensive monitoring results of population's living conditions. Available at: https://gks.ru/free_doc/new_site/KOUZ18/index.html (accessed: March 19, 2021).

⁹ The research uses the position of population's responses "I constantly experience nervous tension, stress, exposure to harmful production factors and other inconveniences (cold, damp, etc.)".

$$L_{grp} = \frac{GRP}{247} \times DA, \quad (3)$$

where:

L_{grp} – losses of gross regional product (*GRP*);

GRP – gross regional product;

247 – number of working days in 2018 according to production calendar;

$\frac{GRP}{247}$ – average daily output per employee;

DA – number of days of disability of injuries at work.

The calculation has proved that GRP losses from 17 to 26% in the presence of even a small number of disability days of industrial injuries, (*Tab. 6*).

The largest losses of gross regional product are in the Pskov Oblast (26.3%). The largest number of disability days (65 days) of injuries is recorded in industries characterized by a high level of injuries (production of non-metallic mineral products, mechanical engineering and metalworking). At the same time, the Pskov Oblast does not have the highest share of workers engaged in work with harmful and (or) dangerous working conditions (35%; *Tab. 7*). Accordingly, in this region, it is necessary to pay attention to labor safety.

The lowest indicators of losses from industrial injuries among the regions of the Northwestern Federal District are observed in the Republic of Karelia and the Vologda Oblast (on average, it is 3 percentage points lower than in the district).

Thus, the increase in labor productivity can be achieved by significantly reducing industrial injuries and losses from disability of injuries at work. The most important is to pay attention to labor safety and security, minimizing stress and other adverse factors of workplace, and generally improving the quality of working life of employees. According to a report by the Wellness Council of America, wellness programs for employees of organizations reduce medical expenses by almost 30% and significantly decline the number of absenteeism, and every dollar spent by a company on improving the employees' health is recouped 24 times¹⁰. This is all the more important in the context of existing demographic trends the main of which is a gradual decline in the number of working-age population. According to the forecast, the share of this group in the total

Table 6. Calculation of GRP losses in the Northwestern Federal District regions in 2018

RF entity	Actual GRP (in 2018 prices), mil. rub.	Average daily output per 1 employee, mil. rub.	Disability days due to industrial injuries	Losses in GRP, mil. rub.	Share of losses in GRP, %	Potential GRP (in 2018 prices), mil. rub.
<i>Northwestern Federal District</i>	9015190.0	36498.7	49	1788439.0	19.8	10803629
Republic of Karelia	280012.4	1133.7	42	47613.4	17.0	327625.8
Komi Republic	665735.7	2695.3	61	164412.5	24.6	830148.2
Archangelsk Oblast	514033.4	2081.1	44	91568.7	17.8	605602.1
Nenets Autonomous Okrug	305213.6	1235.7	50	61784.1	20.2	366997.7
Vologda Oblast	582630.4	2358.8	42	99070.8	17.0	681701.2
Kaliningrad Oblast	460854.9	1865.8	58	108216.9	23.5	569071.8
Leningrad Oblast	1104436.0	4471.4	48	214627.2	19.4	1319063
Murmansk Oblast	482547.9	1953.6	45	87913.6	18.2	570461.5
Novgorod Oblast	262008.0	1060.8	47	49855.8	19.0	311863.8
Pskov Oblast	164228.5	664.9	65	43218	26.3	207446.5
St. Petersburg	4193490.5	16977.7	48	814929.1	19.4	5008419

Source: authors' calculations based on Rosstat data.

¹⁰ World Health Statistics 2015. Available at: http://www.who.int/gho/publications/world_health_statistics/2015/en/ (accessed: March 23, 2021).

Table 7. Share of employees of organizations of agriculture, forestry, hunting, fishing and fish farming engaged in work with harmful and (or) dangerous working conditions, % of the total number of employees of organizations, without small businesses

Region	Employed in jobs with harmful and (or) dangerous working conditions	
	2017	2018
<i>Northwestern Federal District</i>	40.2	41.6
Murmansk Oblast	71.5	67.9
Archangelsk Oblast	56.9	62.1
Including Nenets AO	45.3	47.7
Vologda Oblast	48.6	48.4
Novgorod Oblast	43.0	46.3
Kaliningrad Oblast	30.0	39.3
Komi Republic	35.4	35.3
Pskov Oblast	30.6	34.7
Republic of Karelia	29.2	27.4
Leningrad Oblast	26.7	27.0
St. Petersburg	31.0	22.8

Source: labor and Employment in Russia, 2019: stat. coll. Rosstat. Moscow, 2019. 135 p.

population will decrease from 57% in 2017 to 53% in 2027 (or from 83.2 to 78.8 mil. people). In addition, there are serious problems of deterioration of the quality characteristics of population (health, professional and educational, qualification and intellectual potential).

Conclusion

Solving the problem of labor productivity growth is the most important task for all Russian regions. The study proves that it depends on a number of both external and internal factors. The latter are controlled, and, therefore, by influencing them, it is possible to influence labor productivity [41; 42]. Among such manageable factors are safe working conditions as one of the components of the quality of working life. Among the consequences of the lack of safety of working conditions is industrial injuries which are expressed in the number of days of disability for injuries at work. The analysis has showed that, on average, GRP losses range from 17 to 26% of the potential in the entities of the Northwestern Federal District, with the existing level of injuries.

Taking into account the objectives of the national project “Labor Productivity and Employment Support” (development of effective measures to increase labor productivity, dissemination of knowledge in the field of labor productivity improvement, stimulating interest in improving labor productivity on the part of enterprises, regional and federal authorities), heads of enterprises and state authorities should pay attention to improving labor safety. It is necessary to invest in modern equipment or technologies (currently, Russian enterprises have a very high depreciation of fixed assets, about 48%).

We can conclude that improving working conditions as a basic component of the quality of working life has the potential to increase productivity.

Thus, the comprehensive impact assessment of working conditions on productivity allowed gaining new knowledge about the aspects of the quality of working life considered in the regional context, and showed the need to pay special attention to the quality of jobs in developing management decisions.

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