“New workplace forecasting in the industrial sector of the Ukrainian economy”

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NEW WORKPLACE FORECASTING IN THE INDUSTRIAL SECTOR OF THE UKRAINIAN ECONOMY

Abstract

Creating new workplaces and modernizing the existing ones to provide appropriate and highly-efficient employment of able-bodied citizens is one of the most acute economic and social issues at the current stage of development in Ukraine.

The article deals with the problems of creating new workplaces in the Ukrainian industrial sector, considers the main tendencies and suggests approaches to partially solve problems coming from the development of the workplace creation factors in order to increase workplace efficiency and its technological capacity.

The model of the number of new workplaces dependence on the impact factors system (labor, capital, research and technology developments, management quality) was developed using 19 one-factor and multi-factor equations, among which six most relevant were selected for industry as a whole and five for the processing industry.

The calculations, according to the proposed model, have shown a tendency of increasing the number of new workplaces both in industry in general and in the processing industry in particular. However, there are decreasing tendencies of the growth rate. This can be explained by the fact of the labor productivity increasing, as well as decreasing tendency in the need for new workplaces in order to restore the pre-crisis rate of production.

Keywords employment, industry, processing industry, forecasting, workplace efficiency, regulatory policy, labor productivity

JEL Classification J20, J40, L60

INTRODUCTION

State of industrial production and its development in Ukraine often become the subject of critical discussions in recent times. Nowadays, following the economic growth that lasted during the 2000s and in some years after the 2008–2009 and 2014–2015 financial and economic crises, stagnant tendencies are emerging. According to experts, preservation of the raw material orientation of the Ukrainian economy, low innovation processes and modernization, as well as insufficient investments in industry are the main reasons for the decline in the industrial sector development. In addition, the following factors have a negative impact on the industry development: consumer demand decline, unfavorable situation in foreign markets in some sectors, annexation of the Crimea, and military events in Eastern Ukraine. The development of approaches to solve the above-mentioned problems of accelerating industrial development of the country poses an objective need to create new highly-productive workplaces to ensure sustainable labor productivity growth in industry.

The industrial sector development based on workplaces growth is not explicitly a positive process and depends on many other parallel social, scientific and technical trends in the economy. Ukrainian industry is

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now undergoing a phase, in which both intensive (labor productivity growth) and extensive (workplace growth) development are required. Creating and modernizing workplaces while ensuring optimal and highly-efficient employment of able-bodied citizens is one of the most acute economic and social problems of the current stage of shaping economic and other relations. The influence on creation and modernization of highly-efficient workplaces should be complex.

Thus, the problems of finding sources for investments increasing, the assessment of the industrial sector development priorities, and the provision of highly skilled human resources require further research.

1. LITERATURE REVIEW

A number of academic studies focus on the analysis, estimation and forecasting of employment rates and new workplace creation.

For example, Blyzniuk (2016) investigated global trends and peculiarities of the labor market development, including employment in Ukraine.

Lisohor (2015) substantiated the trends of labor market transformation in Ukraine towards the development of an employment information model taking into account the existing foreign experience.

Kulikov (2013) analyzed the current trends and problems of creating new workplaces, proposed a system of measures to stimulate creating highly-efficient workplaces, and substantiated the need to create a statistical base on the availability, structure and movement of workplaces.

Petrova (2018) identified the main problems of state regulation of employment and workplace creation. The recommendations were also made for the workplace creation in industry.

Kolieshnia and Anishyna (2014) examined the processes of creating new workplaces and existing problems in the regions during the implementation of relevant state target programs and infrastructure projects.

Ensuring the full and efficient employment of the population to 65% in 2030 by creating new workplaces is one of the priorities of the Sustainable Development Strategy for Ukraine by 2030 (2017).

The Law of Ukraine "On Stimulation of Investment Activity in Priority Sectors of the Economy for the Creation of New Workplaces" outlines basic concepts of the state policy in the investment field during 2013–2032 with a view to stimulate attracting investments in priority sectors of the economy to create new workplaces (Верховна Рада України [Verkhovna Rada Ukrainy], 2012).

Paľová and Vejačka (2018) analyzed employment in the EU according to Europe 2020 Strategy Targets. The results have shown the positive impact of GDP growth and average gross earnings on employment growth. Also, a negative impact of remittances on employment was detected confirming the neoclassical view that received payments are deterring people from the willingness to work.

Arltová et al. (2016) profoundly studied the ageing of the population in the developed countries and its economic consequences using the Czech Republic as an example.

Blanco-Encomienda and Ruiz-García (2017) assessed the sustainability of the Spanish social security system. They revealed the current economic trends in Spain in order to demonstrate the need for structural reforms of the system. They concluded that it is necessary to change the financing model to a mixed one where the capitalization method plays a significant role, and also to implement urgent measures in order to reduce the barriers to business and employment development.

Cohen (2017) investigated the correlation level between immigration and local unemployment by examining three prominent immigration destinations: Greece, Germany, and the United States.

Zalk (2014) studied the role of manufacturing in boosting economic growth and employment in South Africa. He concluded that a nuanced un-

derstanding of the direct and indirect linkages through which diversified manufacturing growth can boost economy-wide employment is essential.

Zaied et al. (2018) examined a causal relationship between waste tonnage and employment in France. The authors called for the adoption of various waste management practices to preserve employment in the waste collection sector.

2. METHODS AND DATA

For forecasting, the factors were divided into two groups (according to positive and negative impact on the new workplace creation) in order to make a model of the number of new workplaces dependence on factors influencing the work of the industrial sector and its resource support (labor, capital, research and technical development, management quality).

As noted above, the system of state regulation (stimulation) of industrial development (industrial policy) operates in the labor market, which consists of the following components:

- providing macroeconomic stability;
- stimulation of domestic demand for industrial products of national commodity producers;
- stimulation of manufacturing export;
- providing conditions for domestic and foreign investments in industry;
- staff training for industry at all levels;
- developing scientific and industrial clusters and innovation;
- engineering work development;
- preparing the appropriate level of human capital (education, health, practical experience);
- creating new highly-efficient workplaces of the modern high-tech level.

The development of industry based on investment and innovation processes the creation of new workplaces according to the dynamics of the relevant indicators. It can be represented by a system of dependencies between the new workplaces creation and factors influencing this process.

Table 1 systematizes such factors in the respective groups combined with the general impact on industry and the demand for labor (the number of new workplaces).

A group of macroeconomic factors (conditions for the industry development), a group of the industry development factors and a group of factors influencing the workplace demand are allocated. Each factor corresponds to a certain set of indicators, which quantify the factor changes.

The system of factor dependencies, represented as mathematical equations, makes a certain model

Table 1. Systematization of factors (X_i) in order to build an econometric model for creating new workplaces (Y_i)

Source: Developed by the authors.

No.	Group of impact factors	Factors influencing the workplace creation	Indicators measuring the factor change
1	Industry's macroeconomic conditions	financial stability at the macro level; economy-wide and political environment	consumer price index; GDP growth rate; the growth rate of actual average monthly wages
2	Growth in demand for industrial products	growth rate of industrial products; general business activity in the economy; labor use intensification; other factors saving on labor costs, which counteract new workplace creation	growth rate of industrial products; growth rate of industrial exports; producer price index; growth rate of labor productivity; growth rate of workplace capital employment ratio
3	Investment processes of industry development	capital investment in manufacturing development; expansion of existing production; introduction of new production facilities	capital investment growth rate; foreign investment growth rate; staff growth rate; growth rate of fixed assets in industry

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Source: Developed by the authors.

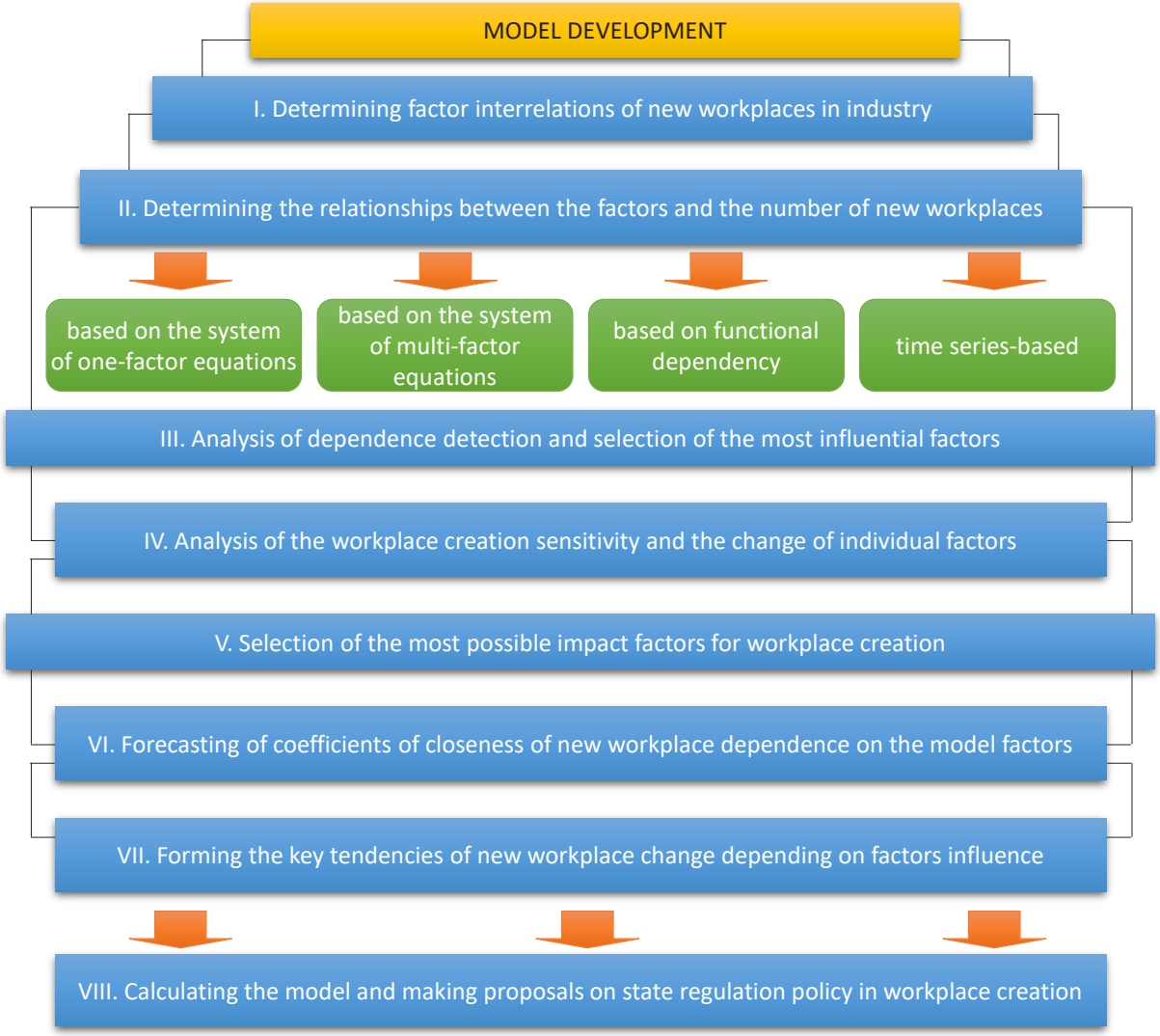

Figure 1. A model for assessment of new workplace dynamics in industry

for the development of creating the workplaces, depending on the factor conditions. For the selected research object (workplace creation), a model is proposed that has the following logical structure (see Figure 1).

At the first stage, the information base of factors is formed in the model, which is used to determine the dependence of the number of new workplaces in industry in general and the processing industry in particular, depending on the level of indicators (in this case, 2010–2016 data are used) (see Tables 2-3). After constructing one-factor and multi-factor equations, the most influential and logical factors in terms of the tightness and logic of the connection are selected.

All the equations used in this model are of the same type and reflect the dependence of the new workplace growth rate on the factors identified in Table 1 (in practice, dependence on the indicators). The dependencies were analyzed by means of one-factor and multi-factor linear equations.

Out of the constructed 19 one-factor and multi-factor equations, six most logical dependencies for industry and five for the processing industry were selected. The set of such equations (six equations for industry in general and five for the processing industry) allows to determine the change in the demand for new workplaces when changing one or another indicator. For

Table 2. Information base for modeling the volumes of the new workplaces in the Ukrainian industry for 2010–2016

Source: Calculated based on State Statistics Service of Ukraine (2018).

Indicators	Reporting period						
	2010	2011	2012	2013	2014	2015	2016
Physical quantity of labor productivity in industry (% of the previous period)	n/a	111	100	98	103	99	108
Capital employment ratio in industry (% of the previous period)	n/a	92.44	107.09	93.16	142.88	247.25	112
Capital investment in industry (% of the previous period)	90.5	141.6	107.5	100.3	74.3	80.1	118.7
Foreign direct investment in industry (% of the previous period)	n/a	113.48	92.56	104.20	98.06	70.24	79.66
Regular staff in industry (% of the previous period)	n/a	98.9	99.2	95.3	85.9	88.8	96.1
Industrial products (% of the previous period)	n/a	109	100	100	105	98	107
Wage of one full-time employee in industry (% of the previous period)	121	112.1	121.1	105.7	120.1	123.2	121
Rate of the fixed assets renewal intensity, %	21	20	18	12	37	9	11
Relative share of gross fixed capital formation in fixed assets, %	9.55	12.65	15.81	16.18	11.28	6.33	8.83
Rate of fixed assets introduction, %	3	2	5	6	3	2	2
Capital investment per one employed in industry (% of the previous period)	n/a	147.1	119.3	108.6	99.3	112.0	137.7

industry, the most important and, accordingly, selected factors were labor productivity, capital employment ratio per 1 employed, capital investment, rate of fixed assets introduction, wages of one full-time employee, and the number of employed in the industry. For the processing industry, labor productivity, capital employment ratio, capital investment, and wages are the most important.

The schematic block diagram of using the developed model to forecast the number of workplaces created in industry is shown in Figure 2.

Table 3. Information base for modeling the volumes of new workplaces in the Ukrainian processing industry for 2010–2016

Source: Calculated based on State Statistics Service of Ukraine (2018).

Indicators	Reporting period						
	2010	2011	2012	2013	2014	2015	2016
Physical quantity of labor productivity in the processing industry (% of the previous period)	n/a	111	100	98	103	99	108
Capital employment ratio in the processing industry (% of the previous period)	n/a	92.44	107.09	93.16	142.88	247.25	112
Capital investment in the processing industry (% of the previous period)	86.6	124.6	95.6	107.7	79	86.3	114.4
Foreign direct investment in the processing industry (% of the previous period)	n/a	93.15	97.11	104.08	93.06	73.29	85.61
Regular staff in the processing industry (% of the previous period)	n/a	98.8	98.2	95	88.2	88.6	96.6
Wage of one full-time employee in the processing industry (% of the previous period)	121.1	111.76	106.91	107.82	125.41	123.81	121.1
Fixed assets in the processing industry (% of the previous period)	n/a	100.4	102.9	104.9	101.1	101.4	101.7
Capital investment per one employed in the processing industry (% of the previous period)	n/a	147.1	119.3	108.6	99.3	112.0	137.7

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Source: Developed by the authors.

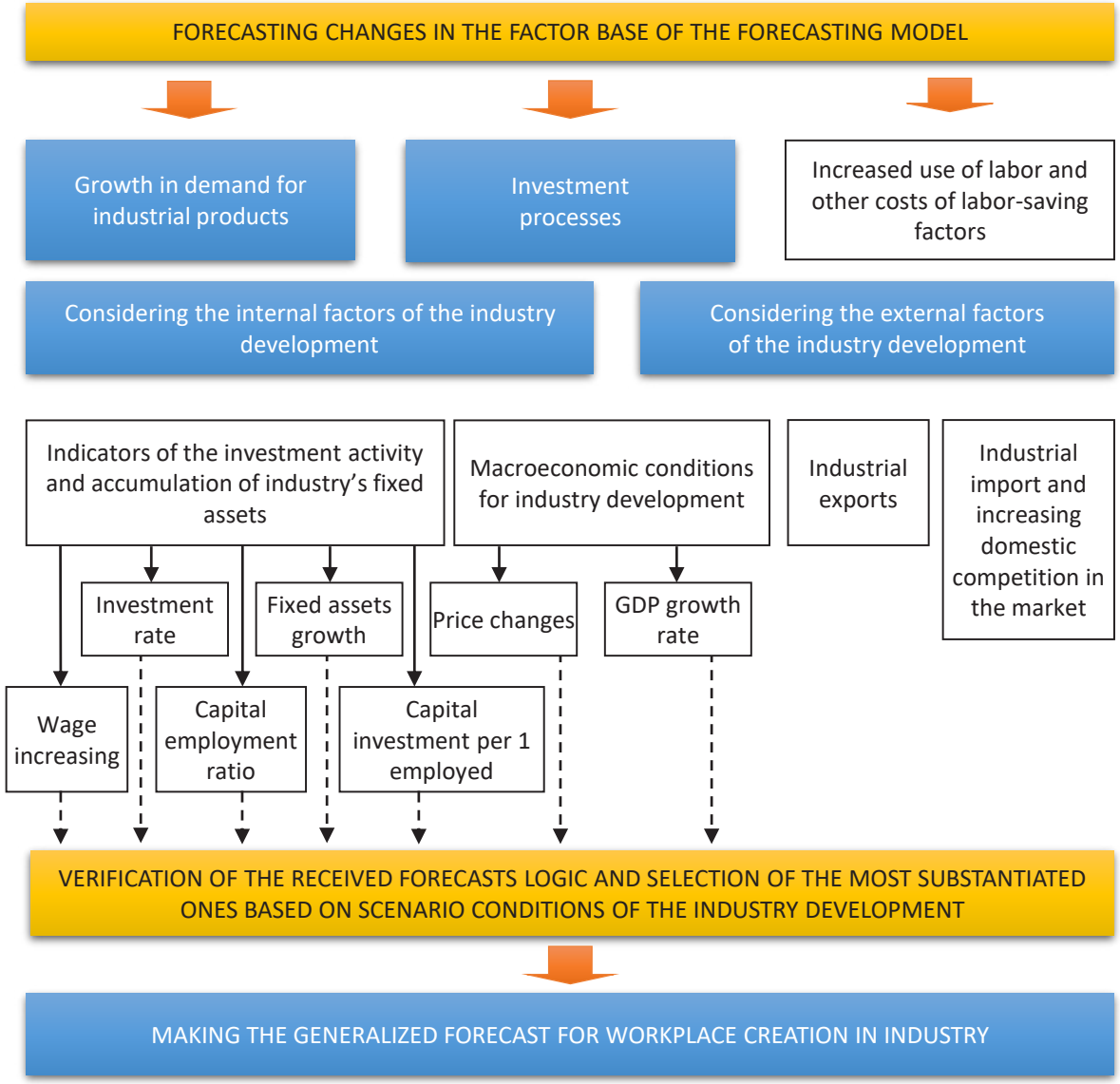

Figure 2. The scheme of new workplaces forecasting in industry

3. RESULTS

In order to use the equations of the proposed model for predicting the number of new workplaces by the horizon period years, data are required for the forecast of changes in indicators. At this stage, the data of the state forecast of macroeconomic indicators for 2019–2021 were used. These data are contained in the Resolution of the Cabinet of Ministers of Ukraine No. 906 dated December 1, 2017 concerning the adoption of a revised forecast of macroeconomic indicators for the 2018 budget, and in the Main Directions of Budget Policy for 2019–2021 (Ministry of Finance of Ukraine, 2018; Cabinet of Ministers of Ukraine, n.d.; Cabinet of Ministers of Ukraine, 2018).

At the same time, the trends of the government forecast by 2021 were extended to 2022–2023 (by the end of the horizon period of the expected workplace growth in industry, which is used in the study). All macro- and sectoral indicators that were calculated up to 2023 as an information base for the forecast of the workplace growth are given in Tables 4-5 for industry and for the processing industry, respectively.

Table 4. Forecasting factors for calculating the number of new workplaces in industry (as a whole) in 2019–2023

Source: Authors' calculations.

Impact factors	2017	2018	2019	2020	2021	2022	2023
	Fact	Expectation	Forecast				
Labor productivity in industry (in % of the previous period in prices compared)	101	104	104	104.9	104.6	104.4	104.3
Capital employment ratio (in % of the previous period)	103.0	102.2	101.5	100.7	100.5	100.3	100.0
Capital investment in industry (in % of the previous period)	104.0	104.1	104.6	105.1	105.6	106.2	106.5
Foreign direct investment in industry (in % of the previous period)	101	102	103	104	104.5	105	105.6
Number of full-time employees in industry (% of the previous period)	99	100	101	102	102.6	103	103.4
Industrial products (% of the previous period)	100	104	105	106.6	107.2	107.6	108
Wage of one full-time employee in industry (% of the previous period)	109	109.7	110.1	110.5	111.2	112.1	113
Rate of the fixed assets renewal intensity, %	10	10.5	11	11.6	12.1	12.8	13.5
Relative share of gross fixed capital formation in fixed assets, %	9	9.3	9.6	9.9	10.0	10.2	10.5
Rate of fixed assets introduction, %	3	4	4.7	4.9	5.1	5.2	5.3
Enterprises' demand for employees to fill vacancies, thousand people	6	7	7.5	7.6	7.7	7.8	7.9
Capital investment per one employed in industry (% of the previous period)	105.1	104	103.6	103	103	103.1	102.9

Table 5. Forecasting factors for calculating the number of new workplaces in the processing industry in 2019–2023

Source: Authors' calculations.

Impact factors	2017	2018	2019	2020	2021	2022	2023
	Fact	Expectation	Forecast				
Labor productivity in the processing industry (% of the previous period)	101.0	104	104	104.9	104.6	104.4	104.3
Capital employment ratio in the processing industry (% of the previous period)	103	102.2	101.5	100.7	100.5	100.3	100
Capital investment in the processing industry (% of the previous period)	104	104.2	104.5	105.0	105.5	106.2	106.5
Foreign direct investment in the processing industry (% of the previous period)	101.1	102.1	103.0	104.1	104.5	105	105.5
Number of full-time employees in the processing industry (% of the previous period)	99	100	101	102	102.5	103	103.5
Wage of one full-time employee in the processing industry (% of the previous period)	109	110	110	110.5	111	112	113
Fixed assets in the processing industry (% of the previous period)	102	102.2	102.5	192.7	103	103.3	103.5
Capital investment per one employed in the processing industry (% of the previous period)	105.1	104	103.6	103	103	103.1	102.9

Based on the model factors and model equations forecast, the prognosed number of new workplaces were calculated (see Tables 6 and 7).

Each of these forecasts considers the dependence on the individual factor and reflects its own specific dependence on this factor. At the end of the ta-

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Table 6. Forecast of growth (slowdown) rate of new workplaces in industry (as a whole) for 2019–2023

Source: Calculated by the authors based on the model developed.

Indicators-factors	2018	2019	2020	2021	2022	2023
	Expectation	Forecast				
One-factor equations						
Considering the new workplace dependence on the growth of the physical quantity of labor productivity in industry (% of the previous period)	123.4	123.4	118.8	120.4	121.4	121.9
Considering the new workplace dependence on the capital-employment ratio growth in industry (% of the previous period)	99.7	99.4	99.2	99.1	99.0	98.9
Considering the new workplace dependence on the capital investment growth in industry (% of the previous period)	120.4	119.8	119.2	118.6	117.9	117.5
Considering the new workplace dependence on the increase in the rate of fixed assets introduction, %	126.0	126.0	126.0	126.0	126.0	126.0
Considering the new workplace dependence on the growth of the enterprise needs for employees to fill vacancies, thousand people	142.4	135.9	134.5	133.2	131.9	130.6
Considering the new workplace dependence on the growth of industrial product volumes (% of the previous period)	118.3	113.2	105.0	102.0	99.9	97.9
Multi-factor equations						
Considering the simultaneous dependence of new workplaces on the growth of: number of full-time employees in industry; capital investment in industry; physical quantity of labor productivity in industry	120.4	119.8	119.2	118.6	117.9	117.5
Considering the simultaneous dependence of new workplaces on the growth of: wage of one full-time employee in industry; capital investment in industry; physical quantity of labor productivity in industry	120.4	119.8	119.2	118.6	117.9	117.5
Generalized forecast	121.4	119.7	117.7	117.1	116.5	116.0

Table 7. Forecast of growth (slowdown) rate of new workplaces in the processing industry for 2019–2023

Source: Calculated by the authors based on the model developed.

Indicators-factors	2018	2019	2020	2021	2022	2023
	Expectation	Forecast				
One-factor equations						
Considering the new workplace dependence on the growth of the physical quantity of labor productivity in the processing industry (% of the previous period)	124.0	124.0	119.3	120.8	121.9	122.4
Considering the new workplace dependence on the capital-employment ratio growth in the processing industry (% of the previous period)	99.7	99.4	99.1	99.1	99.0	98.9
Considering the new workplace dependence on the capital investment growth in the processing industry (% of the previous period)	120.1	119.6	118.8	118.0	116.8	116.3
Multi-factor equations						
Considering the simultaneous dependence of new workplaces on the growth of: number of full-time employees in the processing industry; capital investment in the processing industry; physical quantity of labor productivity in the processing industry	120.1	119.6	118.8	118.0	116.8	116.3
Considering the simultaneous dependence of new workplaces on the growth of: wage of one full-time employee in the processing industry; capital investment in the processing industry; physical quantity of labor productivity in the processing industry	120.1	119.6	118.8	118.0	116.8	116.3
Generalized forecast	116.8	116.4	114.9	114.7	114.2	114.0

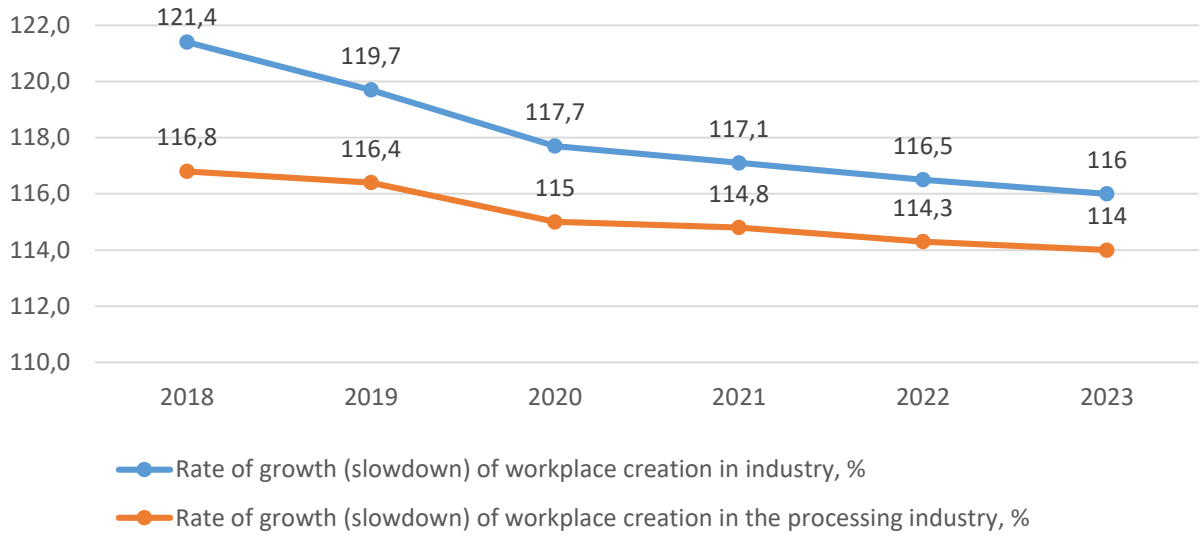

Figure 3. Forecasting of the new workplaces in industry as a whole and in the processing industry during 2018–2023

ble (last row) (see Tables 6-7), individual forecasts for the selected model equation are summarized in one forecast by a simple method of arithmetic mean. Consequently, the meaningful value of each of the predictions listed in the tables was recognized equally and calculated as arithmetic-mean in each forecast year. At this stage, a more complex methodology for calculating the growth rate of new workplaces as a weighted average can be used when determining the equation's significance and its corresponding ratio in the general forecast.

Forecast calculations on the proposed model showed a tendency to increase the number of new workplaces both in industry as a whole, and in the processing industry. At the same time, there are tendencies of the growth rate decreasing. A similar trend can be explained due to an increase in the labor productivity and a decrease in the need for new workplaces in order to restore the pre-crisis rate of production.

Figure 3 shows a general forecast of the workplace growth in industry in general and in the processing industry in particular.

Projected calculations on the proposed model showed a tendency to increase the number of new workplaces both in industry in general and in the processing industry in particular. At the same time, there are tendencies to decrease the growth rate. A similar trend can be due to a labor efficiency growth and a decrease in the need for new workplaces when industry restores pre-crisis rate of production.

Figure 3 shows a general forecast of the increase in the number of new workplaces in industry as a whole and in the processing industry in particular.

The trend of changes in the workplace creation is conditional (estimated) and is based on considering the fulfillment of the forecast scenario conditions used in the forecast calculations (in these calculations, this is the general economic GDP growth by 4-5%). At higher growth rates of the domestic economy (according to the Government's projections contained in the Main Directions of Budget Policy for 2019–2021, the GDP growth rate is expected to be 6-6.5% in 2021), the increase in the number of new workplaces in industry will be proportionally larger.

CONCLUSION

Thus, in the next 3-5 years, as a result of business activity revival and the investments in the development of the economy as a whole, and industry, in particular, one can expect improvement of labor market conditions and its industrial segment, the constant growth of production volumes and the needs for labor forces.

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The industry will develop subject to the structural adjustment with the predominance of more efficient and less labor-intensive sectors. It is necessary to develop high-tech industries, with a high level of labor and products intellectualization.

Using the developed model of new workplace reproduction in industry and the constructed forecast of this process in the medium term makes it possible to shape certain macroeconomic conditions for promoting a positive trend:

- taking measures on state industrial policy of rapid economic growth with a rate of 2-3% more than the annual GDP growth;
- holding the industry's leading position in the domestic economy (the ratio growth of industrial products by 0.4-0.5% annually);
- a faster growth of capital investment in industry in relation to the growth rate of industrial products by 0.2-0.3% annually;
- improving conditions for investment activity and capital formation in the real sector based on increase in sources of funding, primarily at the expense of own funds due to the stable demand for industrial domestic products and the growth of the profitability of industrial products, foreign investment in the industry, and the bank lending availability;
- ensuring the labor market development in industry through the proper training of skilled labor force.

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