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Innovative Transformation of the Russian Industry in the Framework of Digital Technologies

Transformación innovadora de la industria rusa en el marco de las tecnologías digitales

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Content

ABSTRACT:

The article analyzes the current status of the industrial sector in Russia, the fundamentals of the traditional economy transformation into an innovative economy with the application of digital technologies, using all the key levers of value creation by means of "Industry 4.0" technologies. Industry in Russia can gain a sustainable competitive advantage and will be able to strengthen its position in both the domestic and the international market.

Keywords: digital economy, industry modernization, information technologies, investments, startup, digital technologies, industry.

RESUMEN:

El artículo analiza el estado actual del sector industrial en Rusia, los fundamentos de la transformación de la economía tradicional en una economía innovadora con la aplicación de tecnologías digitales, utilizando todas las palancas clave de la creación de valor por medio de las tecnologías "Industria 4.0". La industria en Rusia puede obtener una ventaja competitiva sostenible y podrá fortalecer su posición tanto en el mercado nacional como en el internacional.

Palabras clave: economía digital, modernización de la industria, tecnologías de la información, inversiones, startup, tecnologías digitales, industria.

1. Introduction

Today, the significant effect from the implementation of digital technologies can be obtained only in the manufacturing industry due to its high labor intensity and technological lagging of Russia from advanced countries. There is an increase in intra-industry competition, markets are expanding, and the competitiveness of individual industries in world markets is increasing (Petrova 2007). Here, efficiency gains are possible in all areas of the value chain – from accelerating the development and marketing of new products, synchronizing the

production and supply chain of components, up to significantly improving the efficiency of planning, production, quality control and service level of the final product. Due to the modernization of Russian machinery-producing industry based on the principles of "Industry 4.0", it is possible to significantly increase labor productivity in this industry, as well as to reduce the backlog from the most industrialized countries. The digital inequality generated by the existing economic and social gap between the capital city and the regions contains also certain opportunities to overcome it through the rapid and relatively inexpensive scaling inherent in digital solutions and services (Alekseev 2016).

2. References Review

Today, Russia has a unique chance to unlock its potential in the course of the digital revolution and take its rightful place among leaders. The industrial revolution has enabled individual countries to achieve impressive economic growth. This is clearly evidenced by the works of T. Mauerhoefer, S. Strese and M. Brettel (2017), which describe the impact of information technology on the development efficiency of new products, the growth of intra-industry competition, market expansion, improving the competitiveness of industries in individual countries on world markets.

The digital economy breaks the usual patterns of industry markets. It increases marketability of their participants. Thus, digitalization determines the growth prospects of companies, industries, and national economies in general (Chatzoglou and Chatzoudes 2018).

Today, the boldest economic forecasts are associated not only with the effect of automation of existing processes, but also with the implementation of fundamentally new, breakthrough business models and technologies. The scientific works of researchers such as B. Dachs, M. Hud, Ch. Koehler and B. Peters (2016), F. Zhang, L. Wei, J. Yang and L. Zhu (2018) et al. consider digital platforms and ecosystems, in-depth analytics of large data sets, and "Industry 4.0" technologies.

The works of researchers D. Schallmo, Ch.A. Williams, L.Boardman (2017), T. Mauerhoefer, S. Strese and M. Brettel (2017) et al. are widely known. The authors of these works indicate that in the coming decades, when developing new products, automation and information technologies will significantly affect the labor market.

3. Methods

The research process of the "Industry 4.0" technologies implementation in the Russian industry was accompanied by the collection, review and systematization of statistical materials and data, which allowed identifying contemporary technologies allowing building a preventive maintenance system that operated on the basis of predictive models using real-time data. Research results were processed using statistical methods such as data collation and grouping, index method, correlation and regression analysis, as well as tabular and graphical methods. The methodological basis of the study was a systematic approach, cause-and-effect analysis, and logical and mathematical modeling. The information base of the research included analytical and statistical data of Rosstat (Rosstat 2016) and its territorial subdivisions, data of the Ministry of Industry and Trade of the Russian Federation. The works of leading Russian and foreign researchers and specialists in the field of theory and methodology, linking logistics processes in various functional areas, served the theoretical basis of the present research.

4. Results

4.1. Analysis of industrial and innovative development level of Russian industry

Currently, the Russian economy remains largely resource dependant. Basically, this component determines moderate economic growth in Russia. Other economy sectors either

stagnate or freeze their growth. Russia's economic performance, especially against the backdrop of industrial shifts in the US and China, is showing signs of deindustrialization. The proportion of Russia in the value added of globally manufactured products either stands still or falls even in traditionally "our" industries such as metallurgy. Without productivity growth this indicates a large-scale deindustrialization and primitization of the economy over the years of market transformation. It is necessary to realize that the transition of Russia to the post-industrial stage is impossible without passing the stage of industrialization, that is, currently important target function of the national economy is the transition to the so-called industrial and innovative model based on the high level of development of the manufacturing industry.

However, statistics shows the technological backwardness of the country: the depreciation ratios by industry sectors are increasing, while the renewal and retirement coefficients of fixed assets are very low (Table 1).

Table 1
Coefficients of depreciation, renewal, and retirement of fixed assets in Russia

Indicator	2008	2009	2010	2011	2012	2013	2014	2015
Depreciation ratio of fixed assets, % incl.	**45.3**	**45.3**	**47.1**	**47.9**	**47.7**	**48.2**	**49.4**	**47.7**
extraction of minerals	50.9	49.6	51.1	52.2	51.2	53.2	55.8	55.4
manufacturing industry	45.6	45.7	46.1	46.7	46.8	46.8	46.9	47.7
Coefficient of renewal of fixed assets, % incl.	**4.4**	**4.1**	**3.7**	**4.6**	**4.8**	**4.6**	**4.3**	**3.9**
extraction of minerals	6.9	7.1	4.9	6.0	6.4	6.8	5.8	6.9
manufacturing industry	6.9	6.2	5.9	6.4	6.5	6.9	6.9	6.3
Retirement rate of fixed assets, % incl.	**1.0**	**1.0**	**0.8**	**0.8**	**0.7**	**0.7**	**0.8**	**1.0**
extraction of minerals	1.1	1.2	1.2	1.1	0.9	0.8	0.8	1.1
manufacturing industry	1.4	1.1	1.0	1.0	0.8	1.1	1.0	1.0

In addition to the ageing of fixed assets, there has been a clear decline in the share of active fixed assets (machinery and equipment) in industry (Table 2), which is also a factor indicating reduction of economic efficiency due to the low level of implementation of new more productive equipment.

Table 2
Dynamics of the active part of fixed assets ratio in Russia2

Indicators	2008	2012	2016
Extractive industry	24.4%	21.6%	20.1%
Manufacturing industry	55.1%	55.0%	53.0%

Today in the circles of economists (Osipov and Skryl 2016) attention is drawn to the low levels of the capital-labor ratio in Russia, which characterizes the technical equipment of workplaces and, therefore, the potential level of labor productivity. The density of production robotization at Russian enterprises is more than 20 times lower than the world average. Capital-labor ratio of the workplace in Russia is many times lower than that in the industrialized countries (for example, just 15% from the US level). Currently Russian companies still have a chance to reduce the backlog from world leaders. However, achieving target level of capital-labor ratio comparable to the level of developed countries needs investments of more than 12 trillion US dollars that equals to approximately 36 annual investment budgets of Russia.

The significant effect from implementation of digital technologies can be obtained in the manufacturing industry due to its high labor intensity and technological gap between Russia and the advanced countries (World Economic Forum, 2016). Here, efficiency gains are possible in all areas of the value chain – from accelerating the development and marketing of new products, synchronizing the production chain and the supply of components, all the way down to improving significantly the efficiency of planning, production, quality control and service level of the final product. Due to the modernization of Russian machinery-producing industry based on the principles of "Industry 4.0", it is possible increasing significantly labor productivity in this industry, to reduce the backlog from the most industrialized countries. Under these circumstances, the rapid reduction of the technological gap requires a progressive increase in investment in fixed assets. However, at the moment, the analysis of official statistics shows a reduction of investment in manufacturing enterprises (Table 3).

Table 3
Dynamics of investments in fixed assets in the manufacturing industry in Russia, % of the previous year (in comparable prices)

Years	2005	2010	2013	2014	2015	2016
Dynamics of investments in fixed assets in the manufacturing industry in Russia, %	112.4	101.5	107.3	103.4	90.6	90.2

Practice shows that for industries that are lagging behind in terms of digitalization, it is difficult later to overcome the gap with the leading industry sectors. This is due to the fact that companies with low digital culture are unattractive for the relevant professionals. In addition, lagging companies lack the skills and resources to develop, implement and scale out new digital tools, products and services. In order to eliminate this backlog, enterprises are moving ahead with the implementation of digital technologies into their production activities. This is especially true for “Industry 4.0” technologies and particularly important for industries, such as mining and manufacturing, transport and logistics. These sectors are at the initial stage of digitalization that opens up great opportunities for changing the current situation on the market. Priority rates of development pace do not imply the gradual "catching up" implementation of the previous generation technologies, for example, solutions for process automation, that were actively implemented at the end of the XXth century.

Leading companies in the mining, manufacturing, and transportation sectors identify the most promising (in terms of improving business efficiency) areas for the application of Industry 4.0 technologies. They develop long-term strategies for digitalization, ensure the

development of digital culture, and actively attract and train specialists in digital technologies, including through the creation of corporate venture funds, business incubators and digital factories, as well as holding technology competitions. It is important for companies to make the necessary transformations in order to increase interfunctional interaction, reducing layers of management and simplifying decision-making process. It is difficult to predict, how technologies will develop, so companies should experiment with different solutions and discard those that are ineffective.

5. Discussion

Today, Russia is still far behind the European countries in terms of digitalization of basic industries. Even the technologies of previous generations, such as automated design and production management systems, electronic document flow, automation of management and accounting, planning and supply chain management, are poorly mastered in many industries, and therefore, there is a significant potential for improving efficiency.

Russian enterprises use a small number of industrial robots for industrial automation: according to statistics of the International Federation of Robotics, in Russia there are just 3 industrial robots per 10 thousand workers, while the average worldwide figure amounts to 69, and in the countries with the highest level of digitalization, this figure is more than 100 [World Robotics Industrial Robots, 2016]. The share of the Russian market of industrial robots is only 0.25% of the global volume, while the main consumers of industrial robots are China (27%), South Korea (15%), Japan (14%) and North America (about 14%) (Chatzoglou and Chatzoudes 2018). There is also a lag in the share of computer numerical control machine-tools (CNC): in Japan, more than 90% of machine-tools belong to this class, in Germany and the United States – more than 70%, in China – about 30%, while in Russia in 2016, the share of CNC machine-tools was only 10% with a forecast to 33% by 2020 (National Association of Robotics Market Participants 2016).

However, due to the use of digitalization of industry, new social elevators are emerging. Geographical horizons of opportunities are expanding. The living standard of the population in the regions is enhanced, the availability of public services is increasing, and conditions of everyday life of citizens are improving. States that are committed to innovation and research, as a magnet attract qualified personnel, which is a key resource of digital economies.

6. Conclusion

With the current investment dynamics, it is impossible raising the level of capital equipment per unit of labor at workplaces and, consequently, increasing labor productivity due to the digital production technology factor (RVCA 2016, 2017).

At the moment, there are no definitely identified countries which are leading in implementation of "Industry 4.0" technologies. The pioneers of these technologies will be able to gain an advantage over competitors due to the effect of early start and even set standards for industry solutions of the new generation on a global scale. This applies both to players in the industrial sector and manufacturers of "Industry 4.0" digital instruments. The demand for it from Russian enterprises will stimulate the supply from the leaders of the domestic IT sector and innovative startups.

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