

TRANSFORMATION OF THE INNOVATIVE DEVELOPMENT VECTOR OF AUTOMOBILE INDUSTRY IN THE CONTEXT OF NEO-INDUSTRIALIZATION OF ECONOMY

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Abstract: The paper is devoted to the transformation of the innovative vector of the automotive industry development in the context of the neo-industrialization of the Russian economy. The relevance of the topic is due to the need to move from the export-raw material model of the Russian economy to the neo-industrial one. The paper deals with the conceptual issues of new industrialization based on the revival of industrial production in the context of the introduction of the sixth technological cycle mode. The subject of the analysis is the automotive industry as one of the most innovative and capital-intensive industries with long-term development plans. The most important technological direction of neo-industrialization is additive technologies.

Keywords: Neo-Industrialization of the Economy, Automobile Industry, Additive Technologies, Unmanned Vehicles

1 Introduction

The relevance of neo-industrialization issues is due to the need to form a new growth model for the Russian economy, which will be based on the revival of industrial production in the context of the global transformation of the world industrial system and under the influence of the large-scale introduction of technologies of the fourth industrial revolution. The goal of the new industrialization is the technological re-equipment of production based on the latest technological developments, which is the most important condition for the successful development of the Russian economy and ensuring the country's economic and technological security.

As the outstanding German economist Gerhard Mensch showed, the best way to overcome the crisis phenomena and protracted depression caused by the change of Kondratieff cycles is an innovative and technological breakthrough through the timely development and dissemination of basic technologies of the next (sixth) mode of the Kondratieff cycle. Russia has a good chance to make this innovative and technological breakthrough on the upward wave of the upcoming sixth N.D. Kondratyev's cycle (2018-2042) (Sadovnichy et al., 2016). Those countries that can take advantage of this moment will face an economic recovery on the new upward wave of the sixth technology cycle.

This study is devoted to the conceptual foundations of the neo-industrialization of the Russian economy based on the revival of industrial production in the context of the onset of the sixth mode of the technological cycle. Also, within the framework of the study, it is planned to consider the main trends taking place in the global automotive industry and their impact on the development of the automotive industry in Russia.

Industry experts still predict a slow transition to widespread use in the United States. Despite a pandemic, perhaps the driverless robotics like the Waymo One service (Waymo is an American auto technology development company. Alphabet is a parent company of Google. It runs a commercial auto taxi service in Phoenix, Arizona. Called Waymo One), seems to be an important

issue. But laws in the field of this technology and experiments will not accelerate this process just because of the sudden acceptance and new norms of social distance.

In July, National, a new brand of Optio and Hyundai car startups, surveyed more than 1,000 American adults about self-driving cars (AVs). More than 60% said AVs are the "future route" of transportation. A quarter of respondents said they were interested in experiencing the technology. A year ago, the American Automobile Association (AAA) surveyed a group of about the same number of Americans and found that 71 percent were afraid to drive a car.

Of course, in the next five years there will probably be a re-emergence of how we think about automotive technology. Although self-driving will not be normal, more people are experiencing this technology on the road. "By 2025," if you have not experienced self-driving, at least you know someone who has done it, "said Carl Ignema, CEO of National.

1.1 Safety

The long-term effects of the epidemic change our definition of safety. Ignema pointed out that users also emphasize special health issues. Each car option must reassure its passengers and feel that they have some control over their environment.

Frank Manchaka, Senior Director at SAE International Automotive Engineering Group, emphasized that pollution was a new concern, especially for passengers using a shared vehicle. So that disinfection laws must be enforced.

Partitions in lift and Uber vehicles have now become a way to separate passengers in shared vehicles, such as Origin, which is Ron Cruise's own car and was unveiled just months before the outbreak.

1.2 Delivery

Anthony Townsend, author of a recently published book, *Ghost Road: Beyond the Driverless Car, Beyond Understanding Personal Travel*. Shortly after the publication of his book in June, he said: "There is a consumer demand for non-contact delivery and will continue for a long time." "E-commerce is exploding right now, so instead of visualizing how we move humans with Robo cars, scale the logistics for safe, secure and cost-effective transportation during this process," he said. We must consider automatic.

That's why Amazon seems to have bought the Zoox auto startup: it has automatically provided the process of sending all online orders to buyers' homes.

Townsend wrote in his book, considering that Amazon shipped 5 billion items in 2017. During the epidemic, this number could increase by 2020.

Manchaka, of SAE International, says automation is more important for cargo handling, online shopping and the culture of working from home. "We have to accept that people will not be willing to buy a lot in person in stores," he said. While the pressure is on increasing deliveries in the form of e-commerce. Katherine Zimmermann, CEO of TLGG Consulting, predicts that self-driving cars will become part of our daily lives.

Dylan Jones, who is in charge of Jensler Transportation Lab, sees flying taxis such as Uber Air as an alternative, but believes that AVs should be replaced by passenger cars. Eventually, as a pilot vehicle for Uber's four-passenger low-altitude electric helicopter, Uber predicts that by 2023, joint flights will be available in Dallas, Los Angeles and Melbourne. . Uber says it starts at \$ 5.73 per mile for passengers, but ends up costing less

than \$ 2 per mile. So an 86-mile flight from Sacramento to San Francisco would cost about \$ 150. A similar flight at United Airlines can cost between \$ 150 and \$ 250.

Access to air taxis allows people to work from home and wherever they are, and to attend occasional face-to-face meetings. With the possibility of flying for occasional commutes, the problem of staying close to work for some passengers is solved. When we start using cars regularly, life is possible everywhere and not just in the city center.

"He once predicted that self-driving vehicles would allow us to live far from urban centers," said Townsend, who explores different scenarios for automobiles in his book. But Covid 19 combines the limitations of working from home with autonomous options, making it possible where it is not.

"He expects more robots to be used in everyday life in the next few years," said Jeff Linnell, CEO of Formant, a robotics management company. This can be a delivery robot. But this does not mean that there is no need for human beings. "I think the next decade, the robots that will be built and provide services will depend on human support," he predicted.

2 Methods

The conceptual foundations of neo-industrialization as a science-intensive digital technocratic industrialization were substantiated by S. Gubanov and consistently developed in the works of domestic scientists: S. Tolkachev, S. Bodrunov, S. Glazyev, and other authors (Gubanov, 2016; Bodrunov, 2015; Andrianov et al., 2015; Glazyev, 2019). The works of these scientists have repeatedly emphasized that any effective strategy for the development of Russia should be based on the development of the industrial component of the economy as its basic, priority part. Many publications have investigated the impact of modern industrial technologies on the future of the labour market and the development of the world economy, determining the place and role of various countries in the global change of technological order (Klaus, 2017; Maksyutina et al., 2018; Kuznetsov et al., 2015; Safiullin et al., 2013; Maksyutina et al., 2014).

Despite a significant amount of research devoted to the issues of new industrialization, economic science has not formed an unambiguous understanding of the term "neoindustrialization"; the definitions used are improving as the world economy develops. In recent years, publications have appeared in which the authors try to distinguish between the concepts of "neo-industrialization" and "re-industrialization", highlighting their distinctive properties (Tarash & Golodnyuk, 2018). We believe that there can be no rigid distinction between these concepts. Today, we believe that the quantity of products manufactured is the main criterion. For the automotive industry, this is the number of cars produced. For example, at the beginning of 2000, PJSC "AVTOVAZ" succeeded in producing approximately 960 thousand cars and auto kits for "Lada" cars. Now the situation is different, and it's good if the output this year would be 350 thousand. Here, it would seem that it is necessary to talk about the process of re-industrialization, catch-up, restoration of production, but over time, conditions have changed. Car-sharing appeared, due to which the production of cars decreased. The development trend of unmanned vehicles is also gaining momentum. There is no answer to the question when PJSC AVTOVAZ will again start producing 960 thousand cars and auto kits. Most likely, never. It just isn't necessary. So, the reindustrialization will never end? But, despite all the difficulties at the manufacturing plants, the innovative processes are going on (Maksyutina & Golovkin, 2017).

The processes of innovative development do not stop, despite all the structural changes taking place at enterprises. Big Data technologies are being introduced into production. They have shown their effectiveness in design developments. Digitalization is being introduced into all technological production chains. Electronic circulation of technical documentation and

mathematical models of car parts are introduced. There are programs that allow one to track the execution of orders and directives. We can say that, to some extent, artificial intelligence helps to manage an enterprise. There are also programs for warehousing, accounting, and other areas of production. Digitalization is being implemented on a large scale in the production process, and this helps companies to stay afloat, despite the quantitative decrease in car production.

And here, in our opinion, we have the right to talk about the processes of neo-industrialization. New shoots of the sixth mode are sprouting from the old modes of production. And this process cannot be divided, it is continuous. Time will tell whether the enterprise will remain after being reborn into something new, or will stop working. Therefore, we are talking about neo-industrialization, as a technological re-equipment of production, without affecting the indicator of the amount of products produced.

The most important technological direction of neo-industrialization is additive technologies. We have developed our own classification of future additive enterprises, which differs from the "Factories of the Future", since the method of production there is not only additive. The National Technology Initiative divides Factories of the Future into three categories:

- 1) "Digital Factory" is characterized by the use of digital modelling and design technologies.
- 2) "Smart Factory", which is formed on the basis of the "Digital Factory" with the addition of 3D printers, CNC machines, robotic systems, and other high-tech equipment.
- 3) "Virtual Factory" is formed as a distributed network of "Digital" and "Smart" Factories, as well as service providers and components.

The purpose of these factories is to design and manufacture highly competitive technological products.

We tried to expand this classification and introduce a gradation of future additive enterprises:

- Large enterprises - created mainly on the basis of factories of the industrial era, which are formed on the basis of robotic complexes, hybrid CNC machines, unmanned workshops and industries with a maximum variety of raw materials;
- Medium-sized enterprises - additive ateliers or bureaus characterized by high performance and precision additive equipment. They release niche products. The variety of raw materials in them is small. The company employs several people;
- Individual entrepreneurs and self-employed citizens. They use low-cost equipment. Usually one or more raw materials are used. The quality of their products is low. They release products for themselves or for small trade.

But the most interesting thing about this classification is that all these enterprises, being originally digital, can use the network structure of the Internet. They will collaborate as a "Virtual Factory".

3 Results

The global automotive industry stands on the verge of dramatic changes. The last are associated with the onset of the sixth mode of the technological cycle. In his book, Jeremy Rifkin identified five principles or columns on which a new development strategy should be developed: 1) the transition to renewable energy sources; 2) transformation of all buildings into mini-power plants; 3) use of hydrogen energy; 4) use of Internet technologies; 5) production of electric vehicles (Rifkin, 2014). Despite the fact that the realities of the third industrial revolution have not yet spread around the world, it is developing into the fourth industrial revolution.

All these principles will influence the development of the global automotive industry to varying degrees. And we'll start with the

first renewable energy technology. In February 2018, Lockheed Martin was able to obtain a patent for a 100 MW compact fusion reactor that can fit in the back of a truck. The creation of a working prototype of this reactor by 2024 is announced.

But significant results have also been achieved in the use of hydrogen energy. So researchers at Ben-Gurion and Technion University (Israel Institute of Technology) discovered a chemical mechanism that will help develop a new and more efficient photochemical process for creating hydrogen fuel from water. This discovery could seriously affect attempts to replace carbon fuels with a more environmentally friendly fuel of hydrogen. Automobile manufacturers want to make cars that run on hydrogen because they are considered more powerful, greener, and, unlike electric vehicles, they can be quickly refuelled and travel at longer distances. All this suggests that we are one step away from the end of the era of hydrocarbons (Maksyutina et al., 2019).

But there are other challenges for the global automotive industry. This is car sharing, which can significantly affect the mass production of cars downward, and the growing trend towards unmanned vehicles.

Moving on to Russian realities, we need to understand where we are in comparison with other global manufacturers. According to Harald Grübel, the former vice president for engineering of PJSC AVTOVAZ, the Russian automotive industry has rolled back to the first level of development, which is that the country has almost no own engineering left; car factories are assembling cars on foreign platforms with a certain level of localization (on average, 40%). The auto industry of the USSR was at the third stage of development (there were its own know-how, engineering and production), and modern developed countries are at the highest fourth level, which involves not only their platforms and production, but also mass export. But the most important thing that Harald Grubel did, he was able to express the idea of reforming the Russian car industry proposing to produce cars of different brands on a common platform in Russia, with the unification of the chassis, units and components. This initiative was not supported. Harald Grübel was fired.

But we believe that the potential of this idea has not yet been exhausted, and it will be possible to return to it when the processes of regionalization will begin. Now there are no significant changes in the design of cars, with the exception of design developments. We can talk about the processes of stagnation in the passenger car industry in Russia.

But not everything is so sad in the Russian car industry. We are pleased with the success of the innovative development of KAMAZ PTC. The company is successfully developing, and this is helped by the global tendency to shift the innovative focus towards freight transport. The flagship of this movement is unmanned control technology.

Recently, KAMAZ PTC and the state scientific centre of Russia in the field of automotive industry development "NAMI" showed a new car called "Shuttle". This is something between a bus, a taxi and a passenger car, which will be used as an unmanned vehicle to deliver passengers from the entrance of the house to their destination. The idea of the project is aimed at reducing traffic congestion in cities. With the introduction of such vehicles, fixed routes and public transport stops will become unnecessary. The artificial intelligence will calculate rational traffic flows and thus reduce traffic congestion. However, for the time being, such cars as Shuttle and other unmanned vehicles will not be released on public roads. The world has not yet developed a regulatory framework for the use of unmanned vehicles. But such an opportunity appears in closed areas.

Thus, test drives of the unmanned vehicle KAMAZ-4308 began on the territory of the KAMAZ PTC plant. The project was named "Odyssey". A driverless truck will supply cabins from the frame press plant to the automobile plant. These races will take

place on the in-house territory. In addition, such races can become the first step towards the robotization of industrial equipment, including those operating in the extreme conditions of the Far North, in mines, quarries, etc.

KAMAZ PTC began to implement such a project in one of the open pit mines at the Listvyazhnaya mine as part of another large-scale project of Digital Mining Enterprise. Its result should be the creation of a whole system of unmanned coal transportation in Kuzbass by December 2020.

Recently, it has become important for KAMAZ to develop the production of passenger vehicles due to the difficult market conditions for commercial vehicles in Russia. For this reason, the production of electric buses is being mastered; the first 100 units are already in operation in Moscow. Also, special attention will be paid to the production of gas-fuelled trucks and garbage trucks.

The focus of innovative activity in the automotive industry is shifting to the cargo segment, but we observe particular activity in agricultural engineering.

4 Discussion

One of the flagships of the industry is the Russian company Rostselmash. Since 2004, the Research and Production Association of Automation has been cooperating with Rostovites by developing and supplying digital control systems. And if KAMAZ PTC takes part in the Digital Mining Enterprise project, Rostselmash also participates in the large innovative Smart Agriculture project. This project is aimed at the massive use of unmanned technologies and high-precision navigation in agriculture. The emergence of such an innovative system in the fields will significantly reduce the number of people involved in the management of agricultural machinery, while labour productivity in the countryside should increase several times.

We believe that the direction of the development of unmanned vehicles, along with other breakthrough technologies, can become an entrance ticket for Russia to the sixth technological order. The use of digital systems and high-precision navigation in agriculture should be accompanied by an increase in indicators in the space industry, robotics, additive technologies, accelerate the transition to renewable energy sources, and significantly improve the environmental situation in the country. We also believe that if we manage to implement such initiatives, then the difference in the quality of life in the city and the countryside will gradually level out. As a result, we will get an innovative, high-tech "digital village" of the sixth order.

Neo-industrialization is viewed as a technological re-equipment of production in the conditions of the onset of the sixth order of the technological cycle. The subject of the analysis is the automotive industry, as one of the most innovative and capital-intensive industries with long-term development plans.

Trends in the global automotive industry and their impact on the development of the Russian automotive industry are considered. As a result of the research carried out, a conclusion was made about the stagnation phenomena that have occurred in the Russian passenger car industry. At the same time, the focus of innovative development has shifted towards freight transport and especially agricultural machinery, which is primarily associated with unmanned control technologies.

5 Conclusions

Modern industrial technologies are widespread in the world, and Russia should not lag behind in this area. Russia has sufficient potential to count on the creation in the medium term of conditions to secure its footing among the leading states in the world economy on the basis of a new industrialization of the economy, increasing its global competitiveness and ensuring the advanced development of exports.

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