

International Sanctions' Influence on the Functioning of Russian and International Machine Building

¹Galina V. Gavlovskaya, ¹Anton D. Volkov, ¹Yurii S. Baublis and ¹Raju Mohammad Kamrul Alam

¹ RUDN University, Moscow, Russia

Author Note

Correspondence concerning this article should be addressed to:

Galina V. Gavlovskaya ORCID: 0000-0002-9348-394X

RUDN University, 6 Miklukho-Maklaya str., Moscow, 117198, Russia

e-mail: gavlovskaya-gv@rudn.ru

Anton D. Volkov ORCID: 0009-0002-0941-910X

RUDN University, 6 Miklukho-Maklaya str., Moscow, 117198, Russia

e-mail: 1142220376@rudn.ru

Yurii S. Baublis ORCID: 0009-0006-6239-0624

RUDN University, 6 Miklukho-Maklaya str., Moscow, 117198, Russia

e-mail: 1042210318@rudn.ru

Raju Mohammad Kamrul Alam ORCID: 0000-0002-6117-8502

RUDN University, 6 Miklukho-Maklaya str., Moscow, 117198, Russia

e-mail: radzhu_mokhammad_k@pfur.ru

Abstract: The research aims to detect the consequences of international sanctions on the functioning of Russian and international machine building. The authors apply general scientific methods of statistical and structural analysis, classification method, generalization method, and other methods. As a result of the investigation, the authors conclude that sanctions pressure together with COVID-19 led to transformations in the global machine-building industry and the strengthening of such trends as the relocation of machine-building centers to China, displacement of European automobile companies in other regions (mostly to the USA and China), changing of industry products' export flows, and strengthening of deficit of some resources for machine building factories. This research considers the development features of the worldwide and Russian machine-building complexes in the context of international sanctions. The main problems of the worldwide and Russian machine building are identified, and trends of their development in the conditions of sanctions restrictions are determined. The authors substantiate that although economic sanctions had a negative impact on the Russian machine-building complex, they gave a powerful impetus to the industry's innovative development and increased the competitiveness of manufactured products in the Russian market. In this regard, it was emphasized that international sanctions should be considered not only in a negative but also in a positive way.

Keywords: Machine building complex, Machine building, Anti-Russian sanctions, Automobile industry, Sanctions pressure

JEL codes: L5, L16, L62

Serious transformations that have occurred in recent years in geopolitical and economic spaces have affected industries in most countries worldwide – from the service sector to oil and gas production. According to analytical company S&P Global Market Intelligence, the most affected areas include air transportation, production of auto components, oil and gas wells drilling, tourism, and the service sector. Consequences of the crises were also reflected in the machine-building complex as the most important part of the national economies of many countries in the world. Most negative consequences were associated with interruptions in components production, global logistics crisis, changes in export flows, and other problems. Problems were enhanced with the strengthening of anti-Russian sanctions in 2022, which affected not only the Russian economy but also the economies of other countries, including the industrial complex.

The research aims to identify the consequences of international sanctions on the functioning of Russian and international machine building. In accordance with the research objective, the following tasks were set:

- To check the industry specifics and geographical structure of the worldwide machine building;
- To identify trends of development of this industry under international sanctions;
- To determine the consequences of sanctions pressure on conditions of global and Russian engineering complex functioning.

Methodology

The authors applied general scientific methods of statistical and structural analysis, classification method, generalization method, and other methods. The authors used regulatory documents, information from official websites of specialized departments and organizations, and works of Russian and international authors related to the development of global and Russian machine-building complexes and the impact of international sanctions on them. Despite the relevance of studying the situation that has been developed in Russian and worldwide machine building and the importance of the development of a set of measures to resolve problems in the industry, this issue has not been sufficiently studied yet.

Certain aspects of the worldwide machine-building complex are discussed in the works of Zh. B. Zhambalov (2020) and A. N. Senko and O. S. Bliznyuk (2019). Features of Russian machine building, including its main problems, are considered by M. S. Abrashkin (2019), M. K. Izmaylov (2020), L. M. Putyatina and T. N. Barsova (2020), and I. I. Davletov (2021). Questions of sanctions' influence on the machine-building industry since 2014 are presented in international and Russian publications by A. Panibratov (2021), A. D. Petrova, N. M. Blazhenkova, and G. K. Aznabaeva (Petrova et al., 2018), I. Nusratullin, N. Sergeev, V. Kuznetsov (Nusratullin et al., 2020), and others. However, publications on the impact of the new 2022 package of international sanctions on the current situation in the global and Russian machine-building industry are rare. These publications include the works of A. V. Sokolov and

V. A. Bazhanov (2022), N. A. Dubrovina (2022), A. A. Maltsev (2022), and P. V. Simonin, I. Y. Litvin, N. A. Cherepovskaya, and A. A. Kuzmina (Simonin et al., 2023).

Results

1. Sectoral and geographical structure of the global machine building.

The machine-building industry is a key economic sector of many countries worldwide. It reflects the development of these countries. Moreover, it is the technological core of the world industry (Zhambalov, 2020). The share of the industry's products in GDP is 36%–45% for EU countries, 10% in the USA, and 6% in Russia. The share of the industry's products in total exports is 64% in Japan, 48% in Germany, 48% in the US, 44% in Sweden, 42% in Canada, and 15% in Russia.

The structure of the worldwide machine building includes more than 70 industries and more than 300 different areas that annually produce about 3 million products (Bakhchieva, 2018). The machine-building complex includes such industries as machine tool building; instrument making; agricultural machine building; radio electronics; power, chemical, and metallurgical machine building; automotive industry; and others. The leadership of countries in certain industry areas is clearly visible in global machine building. For example, the automotive industry is more developed in the USA, Japan, Germany, South Korea, China, etc. Machine tool building is more developed in Japan, Germany, the USA, Italy, and China (Table 1).

Table 1
 Leadership of the countries in certain industries of machine building

Machine building sector	Countries-leaders
Automotive industry	USA, Japan, Germany, France, South Korea, and China
Machine tool industry	Japan, Germany, USA, Italy, and China
Agricultural industry	Russia, Japan, India, USA, and Belarus
Consumer electronics industry	China, South Korea, the USA, Brazil, and Malaysia
Shipbuilding industry	South Korea, Japan, Germany, Brazil, and Taiwan
Power machine building	USA, Japan, and Germany
Chemical machine building	USA, Japan, and Germany
Metallurgical machine building	USA, Japan, France, Germany, and Russia

Source: Compiled by the authors based on Machine building: Rating of the countries of the world (Top ratings, 2022) and Atlas of New Professions and Competencies in the Republic of Kazakhstan (2020)

More than 35% of the value of global industrial production is accounted for by mechanical engineering. However, products of this industry are different in terms of mass production level. Thus, the annual world's production of some products is as follows: 1 thousand aircrafts, 1.2 million machine tools, 1.3 million tractors, 40–50 million cars, 150 million electronic equipment, and 1 billion watches (Bakhchieva, 2018).

Machine building is closely connected with other sectors of national economies, including metallurgical complex, mining and manufacturing sectors, chemical industry, and many others. The industry determines the development of such areas of the national economy as the fuel and

energy complex, construction, transport complex, and chemical industry. The most important indicators (material and energy intensity) of a country's GDP and the competitiveness of products depend on the development of machine building (Putyatina & Barsova, 2020). Thus, the role of worldwide machine building is enormous because this industry sets the pace and opportunities for developing the entire world economy (Senko & Bliznyuk, 2019).

Up to 80% of the products produced by the world machine building are produced by nine key countries: the USA, Japan, Germany, France, Great Britain, Italy, China, and Russia (Senko & Bliznyuk, 2019). However, the world-recognized centers of the industry are the USA, Japan, the EU, and China (Zhambalov, 2020). Most companies in heavy machine building are mainly from these countries. The largest enterprises in heavy engineering are mainly companies from these countries (Table 2).

Table 2
 World largest heavy machine-building companies

No.	Company	Country	Capitalization, \$ billion	Product
1	Caterpillar	USA	126.83	Construction and mining equipment, diesel and gas engines, industrial gas turbines, and diesel-electric locomotives
2	Deere & Co.	USA	119.58	Equipment used in agriculture, construction, forestry, and engines
3	Cummins	USA	38.31	Diesel and gas engines and related technologies
4	PACCAR	USA	32.5	Premium light, medium, and heavy trucks
5	Volvo AB	Sweden	26.3	Commercial vehicles, construction equipment
6	Sany Heavy Industry	China	23.3	Construction equipment, heavy lifting equipment, mechanical and electrical equipment, electronic products
7	CNH Industrial NV	UK	21.31	Agricultural machinery, commercial vehicles, trucks, buses, and construction machinery
8	Komatsu	Japan	18.2	Construction and mining equipment, household appliances, forestry machines, and industrial equipment
9	Kubota	Japan	15.4	Agricultural and construction machinery and equipment
10	CRRC	China	15.2	Locomotives, passenger cars, freight cars, and high-speed vehicles

Source Compiled by the authors based on (Information Portal "Holdings", 2023)

Thus, the geographical and sectoral structure of the world machine building industry is extremely heterogeneous, with the predominance of the USA, Japan, China, and the EU products in the world market.

2. Global machine building development trends in the context of sanctions restrictions.

Under the influence of negative factors related to the economic consequences of the COVID-19 pandemic and the tightening of anti-Russian sanctions, great changes are occurring in the worldwide machine building. For some countries, changes have negative consequences; for others, they become a factor in the positive development vector. Thus, due to the introduction

of unprecedented anti-Russian sanctions from February 24, 2022, Western European automobile concerns, which were forced to leave the Russian market, suffered greatly. On the contrary, Chinese corporations have expanded markets and increased production capacity. In this regard, there is an apparent trend of shifting the center of worldwide machine building to China, confirmed by the Industrial Development Report 2022 prepared by the Vienna International Center (Austria). The report emphasizes that three major trends should be expected in coming years: transition to digital technologies, greening of industrial production (decarbonization of the economy), and change in economic forces in the world (strengthening of China as the dominant center of industrial production) (UNIDO, 2022). These trends are considerably transforming global machine building, primarily the automotive industry.

As the world's leading machine-building industry, the automotive industry has been mostly damaged by sanctions. However, sanctions exacerbated an already deep crisis in the industry triggered by the COVID-19 pandemic. In general, the global automotive industry has been influenced by political, economic, environmental, logistics, resource, technological, and other trends in recent years. They adjusted the pace of the development of the global automotive industry and its structure. Before the pandemic, in 2019, the volume of world car production was estimated at just over 92 million units. In 2020, this indicator amounted to 77 million units. In 2022, production volume was recorded at 84 million cars, of which 50 million were produced in Asian countries (Association of Russian Automakers (OAR, 2023).

Anti-Russian sanctions influenced European manufacturers, who had to leave the Russian market and implement the replacement of their production facilities. For example, the most significant European automobile concern Volkswagen Group began transferring its production to the USA and China since 2022 due to the events that have begun in Ukraine and their consequences (fast-growing gas prices in Europe, strong shortage of raw materials necessary for the industry, etc.) (Aznavurov, 2022). Some resources for European automotive concerns were supplied from Russia and Ukraine, including nickel and palladium, used to produce automotive components. Growing energy prices led to increased production costs and, accordingly, decreased the economic efficiency of the automakers. Thus, the crisis associated with a military operation conducted by Russia and the subsequent tightening of anti-Russian sanctions disrupted supply chains in Europe, led to the shortage of resources for machine-building enterprises, changed the geography of markets for European manufacturers, and actualized other threats.

In the context of structural changes in the industries of the EU countries, including machine building, some researchers, even before the COVID-19 pandemic, called on European countries to change their industrial policy based on a progressive concept. Due to the crisis tendencies, the operational implementation of such a concept in Europe is questionable (Eder & Schneider, 2018).

3. Consequences of sanctions for Russian machine-building complex.

Machine building is the second largest sector of the Russian economy after the extractive industry. It is distinguished by capital intensity, fund intensity, and labor intensity of production (Abrashkin, 2019). The most developed Russian machine-building industries are the defense

industry, space industry, power machine building, aviation industry, automotive industry, railway machine building, and shipbuilding. According to the Raex agency rating, the largest machine-building enterprises in Russia are Rostec, United Aircraft Corporation, United Shipbuilding Corporation, Transmashholding, Avtovaz, Kamaz, Moskvich, Northern Machine-Building Enterprise, and several others (Raex Rating Agency, 2023). Many of them are included in the list of backbone enterprises of the country, including Rostec, Avtovaz, and Transmashholding (Ministry of Economic Development of Russia, 2020).

Radio electronics has become a vulnerable sector of the Russian economy in the context of sanctions pressure, along with the automotive industry (Maltsev, 2022). After the collapse of the USSR, this industry remains one of the lagging areas of machine building. With the tightening of anti-Russian sanctions on radio electronics manufacturers, problems of a shortage of micro schemes have accrued (previously, they were purchased mainly from Taiwan). Additionally, the largest Russian processor manufacturers, Baikal Electronics and MCST, fell under sanctions that completely suspended technological cooperation with European companies (there was a ban on ARM architecture from the UK) (Kotov, 2023). Simultaneously, Russia critically needs products from the radio electronics industry, which is especially demanded in the Russian consumer market (primarily computers and home appliances). The share of imports in the domestic market is significant: it was 60% until 2022. The country needs robotics, the production of which is practically not developed in Russia, for digitalization and automation of production (Sokolov & Bazhanov, 2022).

In general, the key manifestations of sanctions pressure on Russian machine building are as follows:

- Closure of foreign enterprises for the production of machinery, equipment, and components on Russian territory and occurrence of a critical shortage of such products in the domestic market;
- Ban on import of certain types of raw materials, equipment, machines, components, and technologies necessary for the smooth operation of machine building industries;
- Decrease in export volume of some Russian machine-building products to the markets of unfriendly countries;
- The need for fast reorientation to domestic manufacturers or companies from friendly countries due to the industry's high proportion of import dependence.

In case of further tightening of anti-Russian sanctions, we can expect more problems in the machine-building industry, which may be aggravated by additional factors related to capital outflow and higher interest rates and taxes. On the background of structural problems in the field of Russian machine building and the lack of state funding, sanctions can lead to failures in machine building production (Simonin et al., 2023). Under sanctions pressure, industry enterprises faced a necessity to search for alternative suppliers of raw materials, equipment, components, and technologies from friendly countries or the most optimal schemes for using parallel imports. Measures of improving the quality of equipment and components for machine building produced by Russian enterprises through, first of all, the creation of a powerful

innovation and technological potential based on enterprises producing advanced machines and developing advanced technologies are also becoming relevant.

However, despite restrictions on the activities of industrial enterprises caused by anti-Russian sanctions, they gave a powerful impetus to the innovative development of the industry, including increasing the competitiveness of products produced in the domestic market. Thus, for the Russian machine-building complex, sanctions led to negative and positive effects (Dubrovina, 2022).

Due to the tough sanctions policy against Russia, the Russian government has adjusted the Strategy for the development of transport machine building for the period up to 2030, adopted in 2017. The main goal of this Strategy is to create the conditions for the dynamic development of the industry and meet the country's needs for economical and highly efficient technology (Government of the Russian Federation, 2017). Along with the implementation of import substitution programs, an increase in the production of Russian electric motors, transformers, generators, instrumentation, and aircrafts was recorded already by the end of 2022 (AK&M News Agency, 2023). The Strategy for the development of the automotive industry of the Russian Federation for the period up to 2025 set a task to reduce the level of import dependence in the industry as one of the most serious risks: up to 30%–60% in the passenger car segment, up to 60%–70% in light commercial vehicles, up to 70%–85% for trucks, and up to 60%–80% for buses (Government of the Russian Federation, 2018). Sanctions had the least impact on the volume and structure of the export of products of the Russian machine-building complex because the key countries purchasing products of the industry are Belarus, China, Kazakhstan, and Uzbekistan; the share of exports to other countries is insignificant (Sokolov & Bazhanov, 2022).

Russian machine building has been facing several problems in recent years, including insufficient investment, obsolescence of the material and technological base, instability of the export flow, high level of dependence on imports, and loss of global market share. However, under the conditions of unprecedented sanctions, industry enterprises succeeded in systemically solving the most critical issues. Thus, the consequences of sanctions pressure on the Russian economy and, particularly on certain industries, should be considered not only in a negative but also in a positive way.

During studying the consequences of sanctions pressure on Russia, there is an interesting aspect in checking the experience of certain countries in the world that have been under sanctions for a long time. The example of Iran is indicative. Sanctions measures against Iran have been introduced since 1979. However, despite these restrictions, many industries are seriously developed in Iran, including the machine-building complex (Lazovsky, 2020). For example, the automotive industry is the second most important sector of the Iranian economy. In this regard, international sanctions, despite the restrictions they pose, are not an obstacle to developing industries if the country develops a set of measures to modernize them, reduce the level of import dependence, and stimulate exports of products manufactured in the domestic market.

Discussion

Economic sanctions had mostly a negative impact on Russian machine building. They have become an unfavorable factor that has increased the economic consequences of the COVID-19 pandemic. The end of 2022 recorded a recession in Russian machine building compared to 2021. Thus, the total turnover of enterprises in the industry in 2022 decreased by 7.8% compared to the previous period. For example, production decreased by 16.8% in railway machine building; the production of passenger cars decreased almost three times (AK&M News Agency, 2023).

Is it possible to ensure positive structural changes in the economy based on import substitution on a short-forecast horizon (three to five years)? Most probably not because sanctions pressure on the economy is increasing. In these circumstances, the opinion that effective mechanisms to counteract sanctions have been found in the field of state regulation is perplexing. It is more about the economy becoming more adaptive to external threats. However, these threats are mostly not neutralized, and their negative effect continues. Mobilization import substitution based on protectionism in foreign economic policy is a short-term measure. In the long term, large-scale private investments (including foreign ones) are required, the result of which will be the opening of markets, export expansion, and increased international competition (Aturin, 2019)

Conclusion

The worldwide machine-building complex has enormous potential for further development. However, sanctions imposed against Russia, which affected Russian industries and industries of other countries, along with global changes in the worldwide economy, led to serious transformations in global machine building. There are the following trends:

- Shift of the center of machine building to China;
- Relocation of European automotive enterprises to other regions (mainly the USA and China);
- Changes in the export flows of the industry's products;
- Increased shortage of certain resources for machine building industries.

Russian machine-building industry has been considerably affected by sanctions restrictions. This is primarily related to the reduction of imports of raw materials, equipment, components, and technologies necessary for enterprises in the industry. However, over the past year, the Russian government has managed to stabilize the situation by refocusing on suppliers from friendly countries, including China, as well as through parallel imports.

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