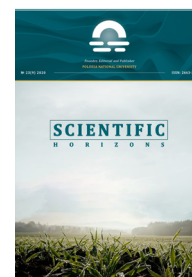


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State and Problems of the Machine-Building Complex of the Republic of Kazakhstan

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Abstract. The challenge of supporting a competitive position in the global market is acute for many countries, including Kazakhstan. In the current environment, the factors that could ensure greater competitiveness in the future are absent. The purpose of this study is to take an in-depth look at the state and issues of mechanical engineering in the Republic of Kazakhstan. The study employs the practices of advanced Western economies on resource, industry, and national economic competitiveness, and statistical data on Kazakhstan's mechanical engineering sector. The methods used included special theoretical approaches, such as comparing the mechanical engineering sector in Kazakhstan and other countries, analysing their current economic status, and naming the characteristics and shortcomings of the mechanical engineering sector of the countries in question. Factors that contribute to the rate of growth of mechanical engineering products were considered. Distinctive features and shortcomings of machine-building products of Kazakhstan were found. The influence of machine-building enterprises on the macroeconomic indicators of the region was studied. The main limitations for the further successful development of the mechanical engineering industries were also defined. The progressivity of structural transformations in the machine-building industry was assessed based on data on the production of the main types of equipment and machines for industry. The resulting conclusions are drawn as suggested measures to resuscitate Kazakhstan's present competitive capability in mechanical engineering. The findings include an assessment of the current economic situation and a forecast of potential future developments

Keywords: economy of Kazakhstan, mechanical engineering, competitiveness, development experience



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INTRODUCTION

The experience of developed Western countries in terms of resource, industry, and national economic competitiveness is particularly valuable since the creation of new competitive industries is closely tied to the national development strategy (Madiyev *et al.*, 2018; Makarenya, & Kazanskaya, 2018; Chashkov *et al.*, 2019). For Kazakhstan, the question of supporting a competitive position on the world market is particularly acute, as the factors that could have ensured an increase in competitiveness in the future are neglected in the current environment. Therefore, the state policy on the support and development of priority sectors of the economy, aimed at developing an adequate mechanism to provide a competitive advantage for Kazakhstan's economy, gains considerable importance (Vishnyakova & Tatarskih, 2019; NPP "Atameken" ..., 2019; Szczepaniak & Trojanowska, 2019). To develop the mechanical engineering industry of Kazakhstan and bring it to a new engineering and technical level, the government of the country has developed and approved a Roadmap for the Development of Mechanical Engineering of the Republic of Kazakhstan for 2019-2024 (Vishnyakova & Tatarskih, 2019).

The roadmap assumes a reboot of mechanical engineering by introducing innovative technologies and orienting enterprises towards exports. This will generate more jobs in the industry, increase salaries and ensure that a new pool of engineers is in demand (Suwarno *et al.*, 2018). The government foresees the provision of raw materials to enterprises, increasing the share of local content in procurement, improving technical regulation measures, and introducing economic incentive mechanisms. The desired results of the implementation of the Roadmap principles are as follows: The volume of production will double and amount to \$4.2 million, with a target of \$7.4 million by 2030. Labour productivity will double by 2024 to \$25,000 per person, and by 2030 to \$40,000. Export volume: current figure: \$720 million, 2024: \$864 million, 2030: \$1.08 billion (NPP "Atameken" ..., 2019).

In recent years, Kazakhstan's machine building sector has been running under conditions of forced economic growth and the formation of an active industrial policy at the state level (Statistical Yearbook of Kazakhstan, 2017). In the period between 2016 and 2019, political, economic, social, and macroeconomic sustainability was ensured, because of which the state became more active in supporting the country's core scientific and educational potential, and the elements of an innovation system were formed and began to appear (Szczepaniak & Trojanowska, 2019). However, an analysis of the capacity of the current state of mechanical engineering enterprises showed an increase in production, so according to the Kazakhstan Statistics Agency, for 2019 mechanical engineering enterprises generated output worth \$365,246 or 29.0% more than

in the corresponding period of 2018, with the entire industry increasing by only 5.8% (Chichkin, 2014; Mechanical engineering of Kazakhstan..., 2017). The current change in behaviour strategy between economic entities, the expansion of their organisational capacity in the process of forming partnerships and building integrated corporate structures, which allows partially solving the problem of restoring the cooperative ties that were destroyed with the transition to market relations (Kaur *et al.*, 2017; Park, 2017; Liu, 2019). Changes in the external and internal operating environment of mechanical engineering enterprises have led to structural changes in the mechanical engineering industry (Waibel *et al.*, 2018).

With the creation of a new economic zone within the Eurasian Economic Union (EAEU), Kazakhstan's machine building industry has received a new impetus for its development, which is characterised by the interactions of EAEU member states having reached a new stage of integration (Alekseieva *et al.*, 2018; Ermakova, 2021; Makoveev & Mukhametova, 2020). As noted, "One of the most important and promising mechanisms of the new stage of integration of the EAEU member states is industrial cooperation aimed at implementing a coordinated industrial policy in the Union to accelerate and improve the sustainability of industrial development, enhance the competitiveness of industrial complexes of the member states and their innovative activity" (Order of the Prime Minister No. 115-r, 2019). At the same time, several industry segments of the total market are dominated by imports from third countries: machinery and equipment (54.1%), electrical, electronic, and optical equipment (55.2%) and textile and clothing products (58.9%). This necessitates the creation of new innovative sectors of the mechanical engineering industry and the modernisation (technical re-equipment) of existing production facilities in the EAEU – the main condition for increasing the technical level of the mechanical engineering complex and its transition to the fourth technological mode (Suwarno *et al.*, 2018).

The purpose of this study is to investigate the state and issues of mechanical engineering in the Republic of Kazakhstan.

CHARACTERISTICS OF KAZAKHSTAN'S MECHANICAL ENGINEERING INDUSTRY

The East Kazakhstan region is one of the most developed centres of manufacturing industry in the Republic of Kazakhstan: the share of mechanical engineering and metalworking in the region's industrial output was 31.8% in 2019, so it should be given particular attention when carrying out structural and institutional reforms in the region (Bayomy *et al.*, 2021; Blazhchuk *et al.*, 2021). It is the leader in terms of its share in the structure of mechanical engineering output and its growth rate. At the beginning of the 21st century, mechanical

engineering accounted for 26-28% of Kazakhstan's industrial output (Karpuzov *et al.*, 2020). In the Republic

of Kazakhstan, steady growth in the mechanical engineering sector has been supported since 2013 (Table 1).

Table 1. The position of the mechanical engineering sector in the region's industry

Indicators	2013	2014	2015	2016	2017	2018	2019
1. Share of mechanical engineering and metalworking in industrial production	31.9	25.9	27.3	23.1	23.8	23.7	27.3
2. The share of the mechanical engineering sector in total employment in the industry	24.6	21.1	29.9	27.8	27.1	28.3	28.3
3. Physical output index (as % of the previous year): The industry as a whole	108.6	108.6	107.6	105.6	110.2	109.2	107.2
mechanical engineering and metalworking industries	118.3	108.6	121.5	96.8	112.5	111.2	108.3
4. Ratio of nominal wages of the mechanical engineering sector to industry	89.6	85.5	84.8	90.6	97.6	96.3	91.2
5. Growth rate of nominal wages, % of the previous year, adjusted for consumer price growth: the industry as a whole	85.1	120.3	122.2	109.7	109.9	109.8	110.1
mechanical engineering and metalworking industries	85.8	114.8	121.2	117.1	118.5	117.2	111.3
6. The ratio of labour productivity of the mechanical engineering sector to industry	0.71	0.63	0.68	0.61	0.64	0.65	0.67
7. Producer price indices (% of the previous year): the industry as a whole	140.5	136.7	128.5	112.3	114.5	116.8	118.9
mechanical engineering and metalworking industries	128.0	161.8	127.1	113.4	111.0	112.0	114.3
8. The efficiency of using the labour potential of the mechanical engineering sector. Labour productivity growth rates	129.0	112.3	122.4	101.8	116.5	117.2	118.3
Labour productivity growth rates	145.3	138.7	146.2	133.9	134.9	145.3	146.8

Source: (Statistical Yearbook of Kazakhstan, 2017)

The growth rates of mechanical engineering industry products are explained by the following factors:

1. Structural adjustment. In the engineering sector, the processes of liquidation and withdrawal from the market of struggling and failing enterprises as well as capacity optimisation and restructuring of the assets of existing enterprises have been completed. Many mechanical engineering industries have found their niche in the market and have started to develop effectively.

2. High solvent demand of the fund-consuming sectors based on improved financial conditions. A fair number of engineering companies have resuscitated their production and have concluded enough contracts for the supply of their products. However, the process is still ongoing and there are a lot of reserves for concluding mutually beneficial contracts.

3. Strengthening of import substitution processes, which predetermines the positive dynamics of production of most types of equipment and the development of new types of equipment.

4. Expansion of the market for engineering products, including through improved customs and tariff policies. Developing rapidly, driven by government support for the industry and a significant increase in import duty rates on imported cars under the Customs Union (CU). The development of automobile assembly plants in

Kazakhstan is being carried out through cooperation with Russian and other foreign automakers (Çakırgil *et al.*, 2020).

5. Formation of legislation to create favourable conditions for business as part of an active industrial policy. Support is given to promising industries: they are distributed funds from the budget to subsidise the interest rate on loans to adapt older facilities to the needs of the modern market.

6. A systematic, targeted effort by the authorities to contract out the supply of engineering products within the framework of the development policy.

The distinguishing features and disadvantages of Kazakhstan's engineering products include a strong focus on the domestic market, low quality compared to the best foreign products, and high production costs, explained by insufficient labour productivity in the industry. In 2018, domestic mechanical engineering production totalled \$3.1 billion. The oil and gas engineering sector accounts for 5% or \$112,5 million in the sector's structure (Kato, 2020). However, from 2010 to 2018, the Republic produced \$32.6 billion and imported \$123.7 billion worth of goods (Esmaeili-Najafabadi *et al.*, 2021).

The volume of production in the mechanical engineering industry in value terms for 2018 amounted to more than \$2.1 billion – 17.5% more than in 2017. The

index of industrial production by 2017 amounted to 114.1%. In January-April 2019, output in mechanical engineering was \$763,3 million, a 17.6% increase compared to January-April 2018. The industrial production index was 119.8% compared to the previous year (Saghiri & Wilding, 2021). A noticeable increase in production volumes in mechanical engineering was observed in the production of motor vehicles, trailers and semi-trailers (by 58.9%, up to \$178.1 million) and the production of other vehicles and equipment (by 62.9%, up to \$49.2 million). The highest index of industrial production against the reporting period of last year was recorded in the production of motor vehicles, trailers, and semi-trailers – 145.8% (Tahmasian, 2021).

Production of computers, electronic and optical products decreased significantly: by 39.1% to \$17.6 million. More than half of the production volumes in the engineering sector account for 4 regions: East Kazakhstan, Kostanay and Karaganda regions and the city of Almaty. The leading region is the East Kazakhstan Region (hereinafter EKR) with a production volume of \$134.8 million, with a 33.8% year-on-year increase, followed by Kostanay Region: \$106.8 million – 2.1 times

more than in the same period of 2018. It is noteworthy that in the East Kazakhstan region and Kostanay region, the production of motor vehicles, trailers and semi-trailers prevails in the field of mechanical engineering: \$86.6 million and \$81.3 million, respectively. Such major plants as AsiaAvto, SemAZ and Daewoo Bus operate EKR, while SaryarkaAvtoProm operates in the Kostanay region. Absolute wages for employees in the mechanical engineering sector have a steady upward trend but have not reached an elevated level. So far, the forefront of technological progress has fallen behind in the social process (Ren *et al.*, 2018).

Unfortunately, in the engineering sector, wage growth has outpaced productivity growth rates by five years. The influence of engineering enterprises on the region's macroeconomic performance is weakening, as showed by the ratio of labour productivity in the engineering to industry: it declined from 0.71 in 1999 to 0.56% in 2017, i.e., the output per worker in engineering enterprises grew at a slower rate than in industry in general. Many engineering industries are now facing severe constraints on their further successful development (Table 2).

Table 2. Constraints to further development of the mechanical engineering sector

Growth rate limitations	Efficiency growth limitations
<ol style="list-style-type: none"> 1. Underdevelopment of the domestic market for many engineering products. 2. Outstripping price growth for products and services of the natural monopolies. 3. Low product competitiveness: <ul style="list-style-type: none"> – due to the non-compliance of the technological level with modern requirements; – on terms and conditions of delivery: timing, settlement procedures, service, training of staff, etc. 	<ol style="list-style-type: none"> 1. Great wear and obsolescence of the active part of the fleet of operated equipment. 2. Insufficient structuring and lack of a unified technical policy. 3. Lack of working capital and investments. 4. Weak interaction with financial and credit institutions. 5. Personnel shortage.

Source: (Ren *et al.*, 2018)

The progressiveness of structural change in the mechanical engineering industry can now be assessed based on data on the production of major types of equipment and machinery for industry. The period between 2001-2006 finally clarified the situation by separating the successful mechanical engineering industries from those that failed during the 29 years of the market economy. The highest growth was in production of instruments and automation equipment and spare parts (2.9 times), machinery and equipment for livestock, poultry, and feed production (187%), electrical heating equipment (183.6), high voltage equipment (181.7) and electric welding equipment (163.9), oilfield, drilling and exploration equipment (161.5%) (Yan *et al.*, 2022).

The reorientation of consumers towards Kazakh food products has given a significant boost to the production of equipment for livestock, poultry, and feed production. The relative prosperity of oil and gas equipment

manufacturers has its roots in the favourable oil and gas price environment of recent years. The competitive advantage of certain types of Kazakh electrical equipment in the global domestic market and the growing demand from consumers have stimulated high rates of production at Kazakh enterprises (Yan *et al.*, 2022).

In other mechanical engineering industries, the picture was far from perfect. The production of generators for steam, gas and hydraulic turbines decreased from 5 to 3 units, mobile power plants from 135 to 83 units, and large electric machines from 270 to 250 units. When the output of technological equipment for light industry fell by 27%, there was a sharp reduction in the output of household appliances: the production of washing machines and televisions stopped, the production of radio receivers decreased by 50.3%, electric irons – by 32%, electric shavers – by 9.0%. The products of Novosibirsk enterprises producing household appliances have become uncompetitive (Yan *et al.*, 2022).

FEATURES OF THE IMPACT OF ECONOMIC DECLINE ON MACHINE OUTPUT

Kazakhstan has recently developed the production of vehicles (railways, motor vehicles), including in joint ventures with Belarusian and Russian companies supplying products to the common market. Manufacturers in the mechanical engineering sector generate 0.6% of the gross value added (GVA), for comparison, this indicator in Russia is 2.9%. However, this is insignificant compared to the leading countries in the production of engineering products. Thus, in Germany, it accounts for 8.1% of the GVA, and in Japan – 7.2%, in Belarus – 7.1% (Dong *et al.*, 2020). Currently, support for light industry enterprises is provided within the framework of systemic measures aimed at the manufacturing industry.

In 2018, the volume of textile products amounted to \$111.7 million, which in nominal terms is 21% higher than in 2017. Production in the textile industry in Kazakhstan in 2019 was \$67.3 million, up 25% in nominal terms from the same period in 2018. At the same time, production of domestic processing equipment (weaving machines) for the textile industry has declined sharply. One of the reasons for this is that domestic textile and knitwear manufacturers are not competitive with foreign companies. This is confirmed by data on exports and imports of such types of products. Thus, the import of knitted clothing in 2018 amounted to \$ 274 million, while its export is only \$ 67.8 million, and textile clothing – 345 against \$ 195 million, respectively. Especially alarming is the fact that, between 2000 and 2003, there was a significant drop in the production of machine tools and forging presses. The machine tool industry in the Republic of Kazakhstan has had no demand for new types of metal machining equipment, thus sharply narrowing the domestic base for technical re-equipment of the machine tool industry itself. The primary cause is the insufficient technical level of the metalworking equipment (Dong *et al.*, 2020).

The role of the investment part in the rise of the domestic engineering sector has been negligible. Low level of investment in mechanical engineering and metalworking in the republic does not leave much room for improvement in the competitiveness of its products and for overcoming the trend of degradation of the production-technological apparatus. On the other hand, the degree of investment attractiveness of enterprises decreases as the depreciation of fixed assets rises. The reluctance of investors to invest in capital-eating companies is more than understandable. By the end of 2017, the following serious issues had become dramatically clear in the mechanical engineering sector:

1. The need for urgent renewal of production assets, the introduction of innovative technologies. Mechanical engineering companies are trying to introduce innovative technologies, but not on the same scale as the time requires. In the past almost 17 years, there has been no renewal of the equipment fleet. Kazakh manufacturers

have lagged far behind their Western counterparts. The quality of the products is affected by wear and tear – it is obviously challenging to produce high-precision parts and modern machinery products on old equipment. The production capacity of most engineering companies is in a critical state and cannot be used to produce quality machinery. Moreover, their condition can no longer be a motive to upgrade and overhaul them. In terms of costs to be incurred and costs to be minimised, it is more profitable to completely dismantle old workshops and build new ones.

2. Lack of qualified personnel and low labour productivity. To date, universities are more oriented towards training specialists in the humanities. Over the past few years, young people's priorities have been directed away from heavy engineering in favour of other areas of the economy. Hence the ageing of the workforce, the lack of specialists, especially skilled workers. There are no lathe operators, milling operators, other machine operators, or toolmakers under the age of 30 at engineering enterprises in Kazakhstan. Many graduates of technical schools do not want to work in this industry due to low wages.

3. The need for financial restructuring of mechanical engineering enterprises, which is caused by certain financial problems:

- low level of investment in mechanical engineering, due to high macroeconomic risks;
- high lending rates;
- lack of “long and cheap money”;
- outstripping cost increases due to higher raw material and energy prices;
- the virtual absence of instruments to stimulate demand;
- shortage of working capital of commodity producers, as customers demand pre-payment of orders for the supply of raw materials and components for an extended period in advance (Order of the Prime Minister No. 115-r, 2019).

4. Lack of investment resources in mechanical engineering enterprises. The enterprises' own funds are clearly insufficient for the renewal of fixed assets and the implementation of new investment projects. Two-thirds of the fixed assets of mechanical engineering and metalworking have been in operation for 15-20 years, and new, with a period of use of up to 5 years, accounts for about 5%.

5. Insufficiently sustained protectionist policy of the state. Many countries are taking measures to support engineering companies: increasing import duties on equipment, organising tied loans for the sale of equipment, direct investment, and supporting research and development. In Kazakhstan, such measures are clearly insufficiently developed. Additionally, mechanical engineering products now must fight another competitor – used equipment and machinery from abroad. Many companies supplement and complete used imported equipment with automated control systems, and such upgraded equipment becomes cheaper than new Russian equipment (Kong *et al.*, 2020; Hernandez-de-Mendoza & Morales-Menendez, 2019; Wang *et al.*, 2018).

To keep the positive trends in the machine-building complex going, these must be strongly supported not only by proper investment and innovation activities of

the enterprises themselves, but also by an active industrial policy, whose key variables must consider short- and long-term goals (Table 3).

Table 3. Economic policy alternatives for the development of the mechanical engineering sector

Key variables	Choice based on current goals	Possibility dictated by strategic objectives
1. Market for implementation 2. Product Description	1. Development of domestic demand 2. High value-added products output	1. Export growth 2. Highly marketable knowledge-intensive products

Source: (Wang et al., 2018)

According to T.E.T. Dantas et al. (2021), Kazakhstan's engineering sector is extremely heterogeneous in its structure. It has both developing industries, which have access to foreign markets, but also depressed ones. Y. Huan et al. (2021) consider that over the past one and a half decades of transition to market principles of management and state-directed conversion, most of the scientific and production structures of the engineering industry have been forced to assimilate non-core products. The results of the presented study coincide with this statement because the reasons for the differences in the economic status of individual industries are due to the different state and dynamics of the markets to which engineering products enter.

A.P.M. Velenturf and P. Purnell (2021) convinced that the engineering industry employs more than a third of Kazakhstan's industrial and manufacturing workforce. At the same time, statistics show a significant reduction in the share of the engineering industry in the industrial workforce in Kazakhstan. The labour potential of the complex has decreased by 7.5% over the past five years (2015-2019) (Afshari et al., 2020). According to S. Liu et al. (2018), to assess the quality of performance of engineering companies, indicators of the growth rate of labour productivity (output) and wages are important. In methodological terms, the growth rate of labour productivity should outpace the growth rate of the wage bill. M.A. Fauzi & N. Paiman (2019) believed that intensification, and hence the competitiveness of the business entity, is otherwise not achieved. However, the reproduction strategies cannot ensure expanded production in either qualitative or quantitative terms.

The author of the presented study agrees with P. Saini & P. Chitrao (2021), as these scientists assert that today, the most promising sectors for Kazakhstan's machine building industry are car manufacturing, production of energy equipment for those in the fuel and energy sector, production of transport machinery, and means for the oil industry and agricultural machinery.

The growth of mechanical engineering in Kazakhstan in 2004 (Zemigala, 2019), as in previous years, was largely "compensatory" in nature and was caused by non-investment factors: idle capacity, "eating up" the resource of fixed assets. At the same time, these non-investment factors are interpreted in the economic literature as transitory or unsustainable growth factors. From 2018, economic growth in the mechanical engineering sector is characterised by the fact that although production is now gradually moving back from emerging markets, particularly China, back to developed countries, a greater role is likely to be played by emerging markets.

CONCLUSIONS

It is proved that despite ongoing economic growth, the overall situation in the domestic mechanical engineering industry, particularly in the agricultural sector, is still difficult. This is especially clear in the unequal conditions of competition between Kazakh and foreign manufacturers of agricultural machinery for farms. For example, the governments of Belarus and Ukraine seek to create various preferences for the companies engaged in the production of machinery and equipment for agricultural producers, and budgetary subsidies are allocated to these companies every year. This allows foreign producers to supply products at dumping prices to Kazakhstan's markets as well. Moreover, there are no customs barriers for imported foreign agricultural machinery at Kazakh borders, unlike, for example, Belarus, which is reluctant to allow foreign machinery into its market.

In addition, it was found that mechanisms and instruments of active industrial policy in Kazakhstan should be used to solve the fundamental issues of the development of regional mechanical engineering. To support positive trends in the machine-building complex, enterprises must be supported by an active industrial policy, the key variables of which must consider short- and long-term tasks.

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Стан та проблеми машинобудівного комплексу Республіки Казахстан

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Анотація. Проблема підтримки конкурентних позицій на світовому ринку гостро стоїть перед багатьма країнами, в тому числі і перед Казахстаном. У нинішніх умовах відсутні фактори, які могли б забезпечити підвищення конкурентоспроможності в майбутньому. Метою даного дослідження є поглиблений погляд на стан і проблеми машинобудування в Республіці Казахстан. У дослідженні використано практику розвинених західних країн з питань ресурсної, галузевої та національної економічної конкурентоспроможності, а також статистичні дані по машинобудівному сектору Казахстану. Використані спеціальні теоретичні підходи, такі як порівняння машинобудування Казахстану та інших країн, аналіз їх поточного економічного стану, виявлення особливостей і недоліків машинобудівного сектору країн, що розглядаються. Були розглянуті фактори, які впливають на темпи зростання продукції машинобудування. Виявлено відмінні риси та недоліки машинобудівної продукції Казахстану. Досліджено вплив машинобудівних підприємств на макроекономічні показники регіону. Визначено основні обмеження для подальшого успішного розвитку галузей машинобудування. Оцінено прогресивність структурних перетворень у машинобудівній галузі на основі даних щодо виробництва основних видів устаткування та машин для промисловості. Отримані висновки сформульовані у вигляді запропонованих заходів щодо реанімації нинішнього конкурентного потенціалу Казахстану в машинобудуванні. Висновки включають оцінку поточної економічної ситуації та прогноз можливого розвитку подій у майбутньому

Ключові слова: економіка Казахстану, машинобудування, конкурентоспроможність, досвід розвитку