

## **PROBLEMS AND PROSPECTS OF MECHANICAL ENGINEERING DEVELOPMENT IN KAZAKHSTAN**

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### **ABSTRACT**

Mechanical engineering is the most important branch of the economy of any industrially developed state. By producing all kinds of equipment, machines, machines, devices, as well as goods for the population, mechanical engineering ensures the stability of the activities of the agro-industrial complex, the energy and metallurgical sectors, transport and other key sectors of the economy. Sustainable development and reliable functioning of mechanical engineering largely determine the energy and material intensity of the economy, labor productivity, the level of environmental safety of industrial production and, ultimately, the economic security of the country. This article reviewed the development of mechanical engineering in Kazakhstan. The authors considered the dynamics of production of machine-building products, highlighted the main sub-sectors of development, determined the role of machine-building products in foreign economic flows. The article pays special attention to identifying the most acute problems in the development of the industry. To date, there are systemic problems in the Kazakh machine-building industry related to the insufficient level of investment attractiveness of the industry, the low level of competitiveness of products in the domestic and foreign markets, and a shortage of qualified personnel. Today, the industry needs further effective and high-quality development. Kazakhstan faces common tasks to preserve and develop the potential of mechanical engineering and import substitution of the main mechanical engineering products.

**Keywords:** mechanical engineering, modernization, competitiveness, investments.

### **INTRODUCTION**

An indicator of the technological level of national industry around the world is mechanical engineering. The engineering industry ensures the competitiveness of the economy as a whole and thereby increases employment of the population due to the huge effect on the development of related industries.

Kazakhstan mechanical engineering is the most important industry that ensures in the country's economy both the transition to new technological structures and the development of the already widespread fourth structure. However, mechanical engineering will be able to fulfill this role with the condition of rapid modernization and technical re-equipment of its production apparatus, which today is seriously worn out and little competitive. Solving this problem requires serious intervention by the state not only from the point of view of financing, but also from the standpoint of developing an effective policy for regulating these processes.

## **MATERIALS AND METHODS**

The theoretical basis of a research was made by works of domestic and foreign scientists, statistical data of Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan. Traditional content analysis of documents, statistical methods of the analysis of data, general and special methods of scientific cognition were used.

## **RESULTS AND DISCUSSION**

The state of industrial development of any country is due to the level of development of mechanical engineering, since this industry is characterized by the presence of modern complex production technology, equipment corresponding to it, highly qualified engineering and technical personnel and scientific and technical potential, scientific support and, finally, significant financial capital.

Until 1991, there were about 1,800 large and medium-sized machine-building enterprises in Kazakhstan, currently their number has decreased to 480 enterprises that mainly produce machine-building products, while others either completely stopped their production or turned into regional workshops.

In Kazakhstan, there are 13 sub-branches of mechanical engineering and metalworking. Today, the structure of machine-building production is dominated by industries: mining, metallurgical, agricultural, oil and gas, military and transport.

There are approximately 480 machine companies in Kazakhstan, of which approximately 200 are operational. Companies related to agricultural engineering make up the majority (about 120). There are about 40 companies of mining engineering, 20 companies for the production and repair of railway rolling stock and 20 companies for the production of processing equipment [1].

The share of machine-building production in Kazakhstan's GDP decreased from 15.9% in 1991 to 2.6% in 2020.

The volume of production of machine-building products from 2016 to 2020 increased 2.4 times, amounting to 1,823,922 million tenge in 2020.

Mechanical engineering products in 2020 accounted for 6.7% of the total volume of industrial products, 13.8% of manufacturing products, while the same indicator of Japan reaches almost 50%, Germany - 48%, Sweden - 42%, USA - 40%, France - 38%, Russia - 30%, China - 25% of industrial production [2].

Despite the increase in the number of enterprises and production of mechanical engineering, the number of people working for them is decreasing annually. Negative trends in recent years due to the pandemic have ensured a decrease in profit indicators.

Dynamics of production volume of machine-building products over the past five years and main indicators of development of machine-building of Kazakhstan are presented in Table 1 [3].

Table 1 – The main indicators of the mechanical engineering development in Kazakhstan

Indicators	2016	2017	2018	2019	2020	Growth for 2016-2020
Mechanical engineering production, million tenge	766 781	998 176	1 089 800	1 472 284	1 823 922	2.4 times
Share in the national volume of industry, %	4.0	4.4	4.0	5.0	6.7	+2.7%
Index of physical volume of production, %	84.7	109.2	114.4	124.1	116.4	-
Number of enterprises – total	1690	1845	2075	2394	2514	+48.8%
The number of personnel, thousand people	72.1	65.4	65.7	67.8	64.6	-10.4%
Average monthly salary of the staff, tenge	145 502	156 619	175 114	201 287	215 855	+48.4%
Profit before taxation, million tenge	132 595	49 657	125 896	143 242	154 270	+16.3
Profitability, %	6.9	4.1	9.2	8.3	7.2	+0.3%
Investments to fixed capital, million tenge	37 609	63 338	55 073	58 838	62 958	+67.4%

Fluctuations in the economic situation are characteristic of mechanical engineering to a much greater extent than in other sectors of the economy, as evidenced by the index of the physical volume of production. This sector of the economy is highly dependent on the investment activity of consumer companies of machinery and equipment. Such dependence constantly leads to the fact that mechanical engineering is subjected to cyclical changes in demand. As a result of this process, the machine-building complex is at the center of economic fluctuations, changes in crises and economic upswings. Thus, at the end of 2020, the physical volume index amounted to 116.4% compared to the level of 2019.

Despite the increase in the number of enterprises and engineering industries (their number increased by 48.8% in 2016-2020, amounting to 2514 enterprises in 2020), the number of employees for them is decreasing annually. Despite fluctuations in profit and profitability, in 2016-2020 profit increased by 16.3%, and profitability - by 0.3%

Increasing the export potential and competitiveness of Kazakh mechanical engineering is impossible without attracting large investments to the industry, and in turn it is problematic to attract them at the current low level of investment attractiveness of enterprises of the machine-building complex. The absence or insufficiency of real investments and innovations, which are mainly formed at the expense of their own funds, leads to a technical lag in industry enterprises and non-competitiveness of products compared to foreign counterparts. The

volume of investments in the engineering industry increased from 37,609 million tenge in 2016 to 62,958 million tenge in 2020, or by 67.4%. The share of investments in the engineering industry from the total investment in fixed assets of industry in Kazakhstan increased from 0.9% in 2016 to 1.0% in 2020, but remains insignificant.

Engineering of Kazakhstan is represented by six main sectors. The structure of the industry is dominated by the production of vehicles, including the automotive industry, in total occupies 46% of the total production of machine-building products. Repair and installation of machinery and equipment accounts for 30% of the total production. Electronics accounts for about 2% of engineering products, electrical equipment - 9%, machinery and equipment not included in other categories - 13% (Fig. 1, table 2).

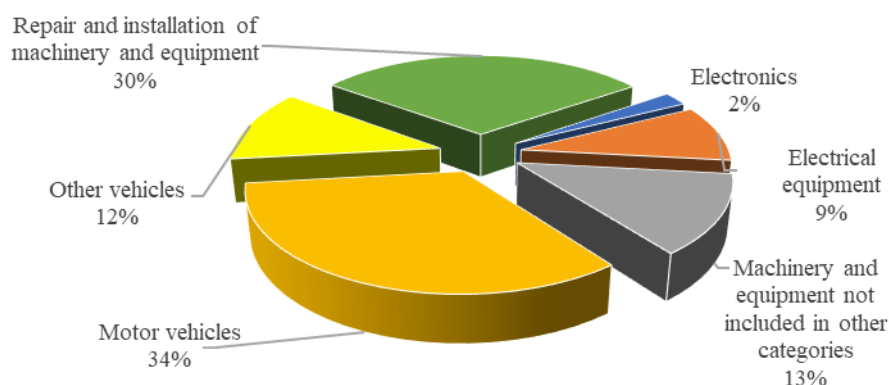


Fig. 1. Structure of engineering production in Kazakhstan in 2020

To a greater extent, the growth in the volume of mechanical engineering products is due to rising prices. A significant increase in production is observed in the production of vehicles, including vehicles, trailers and trailers.

Table 2 - Dynamics of production of the main types of machine-building products in Kazakhstan

Indicators	2016	2017	2018	2019	2020	Growth for 2016-2020, %
Mechanical engineering products, million tenge	766 781	998 176	1 089 800	1 472 284	1 823 922	2.4 times
production of computers, electronic and optical products - including index of physical volume of production, %	38 270	37 125	33 053	44 484	40 888	106.8
production of electrical equipment, - including index of physical volume of production, %	78.8	83.7	133.2	96.7	90.6	-
	101 077	119 433	134 545	166 156	167 969	166.2
	103.1	128.2	142.7	109.0	100.8	-

Table 2 continuation

production of machinery and equipment not included in other categories	117 344	123 364	154 114	201 643	234 127	2 times
- including index of physical volume of production, %	91.3	97,8	118.6	125.6	107.6	-
production of motor vehicles, trailers and semi-trailers	55 075	150 109	208 109	360 238	614 038	11 times
- including index of physical volume of production, %	63.8	138.8	117.4	168.8	158.3	-
production of other vehicles	55 157	101 039	88 539	124 563	216 571	3.9 times
- including index of physical volume of production, %	77.3	137.9	113.1	106.0	138.7	-
repair and installation of machinery and equipment	399 857	467 106	471 440	575 201	550 328	137,6%
- including index of physical volume of production, %	86,7	100,3	103,1	114,4	96,3	-

The development of oil engineering is entirely determined by the needs of the pipeline system of the oil and gas sector, oil refining and petrochemical enterprises in the products of mechanical engineering and metalworking.

Priority areas of agricultural engineering in the near future will be:

- 1) development of joint production of tracked and wheeled tractors with machine-building enterprises of the CIS countries;
- 2) organization of joint production of grain harvesters and forage harvesters with machine-building enterprises of the CIS countries;
- 3) development and organization of production of high-tech machines, equipment and spare parts for the production and processing of agricultural products.

Industry directions of Kazakhstan transport engineering include, first of all, railway engineering and the automotive industry. For railway engineering, the main priorities are: the production of locomotives, railway tanks, the production and repair of wagons, gondola cars, wheel sets, machinery for track work, containers, parts of the track topsides, equipment and spare parts for railway transport [4].

The utilization rate of production capacity in the industry averages 48%, although there are enterprises where it does not exceed 10-20%. The location of mechanical engineering enterprises in Kazakhstan directly depends on the nature of the products produced: the breadth of the nomenclature, the mass of products, the scale of production of products. A number of factors affect the efficiency of the placement of machine-building production: scientific and technological progress, specialization, cooperation, concentration, combination

of production, the presence of labor resources, proximity to sources of raw materials and materials, to consumers, transportation costs.

The production of mechanical engineering is concentrated in the north-east of the country - in the East Kazakhstan, Akmola and Pavlodar regions, as well as in the city of Almaty.

Also significant regions from the point of view of the development of mechanical engineering are Karaganda, Kostanay and Nur-Sultan. In these regions, production has developed historically, enterprises have the opportunity to hire qualified personnel, there is a developed infrastructure and capacity of metallurgical industries, which provides access to raw materials. In these regions, enterprises have significant areas with supplied infrastructure, there is a technopark on the territory of Astana, which is also a production site with infrastructure. The Caspian regions are also promising from the point of view of production development.

Five regions of Kazakhstan and two cities of republican significance generate 68.8% of the total production of mechanical engineering in Kazakhstan: Karaganda region 15.1%, Almaty 12.7%, East Kazakhstan 12.4% and Kostanay region 8.1%, Nur-Sultan 7.2%, Pavlodar region 6.7%, Akmola region 6.6%. These regions of Kazakhstan produce most of the goods of mechanical engineering due to the large concentration of the largest enterprises of mechanical engineering of the Republic of Kazakhstan in the territories of these regions. The historical condition, the presence of personnel and technical competencies, as well as the proximity to the sales market of their products, caused the concentration of engineering enterprises in these areas.

The largest mechanical engineering enterprises in Kazakhstan are:

- in the East Kazakhstan region – «Asia Auto» JSC, «Ust-Kamenogorsk Reinforcement Plant» JSC, «Ust-Kamenogorsk Condenser Plant» LLP, «Kamont» JSC, «Semey Engineering» JSC, «Daewoo Bus Kazakhstan» LLP, «Semipalatinsk Machine-Building Plant» JSC;

- Astana city – «Lokomotiv kыrastyru Zahuyty» JSC, «Tylpar-Talgo» LLP, «Eurocopter Kazakhstan Engineering» LLP;

- in Pavlodar region – «Pavlodar Machine-Building Plant» JSC, «Kazakhstan Carriage Building Company» LLP, «Kazenergokabel» JSC, «FormatMachCompany» Plant» LLP, «Prommashkomplekt» LLP;

- Almaty city – «LG Electronics Almaty Kazakhstan» JSC, «Almaty Heavy Engineering Plant» JSC, «Electrokabel» Plant» LLP, «S.M. Kirov Machine-Building Plant» JSC, «Belkamit JV» JSC, «Munayaspap» JSC, «Almaty Electromechanical Plant» LLP;

- in the Karaganda region – «Karaganda Foundry and Machine-Building Plant» LLP, «Kaztsentrelektroprovod» LLP, «Kurylysmet» LLP;

- in Akmola region – «Stepnogorsk Bearing Plant» JSC, «Tynys» JSC, «Kamaz-Engineering» JSC;

- in Kostanay region – «Agrotekhnash» LLP [5].

In the context of the sub-branches of mechanical engineering, it is necessary to single out the regions with the largest available production. In the production of agricultural engineering, the following regions can be distinguished: Northern Kazakhstan (tractors, piston rings, roller harvesters, hay harvesting units, grain separators), Central Kazakhstan (repair of agricultural machines), East Kazakhstan (tracked tractor conveyors), South Kazakhstan (trailers, feed distributors, spare parts for agricultural machines, mini-mills, mini-bakeries, mills).



The foreign trade turnover of mechanical engineering products, as an indicator of the competitiveness of production, indicates a weak export orientation of the industry. Kazakhstan is largely dependent on the import of engineering products, which also indicates the low development of the industry (Fig.2) [6].

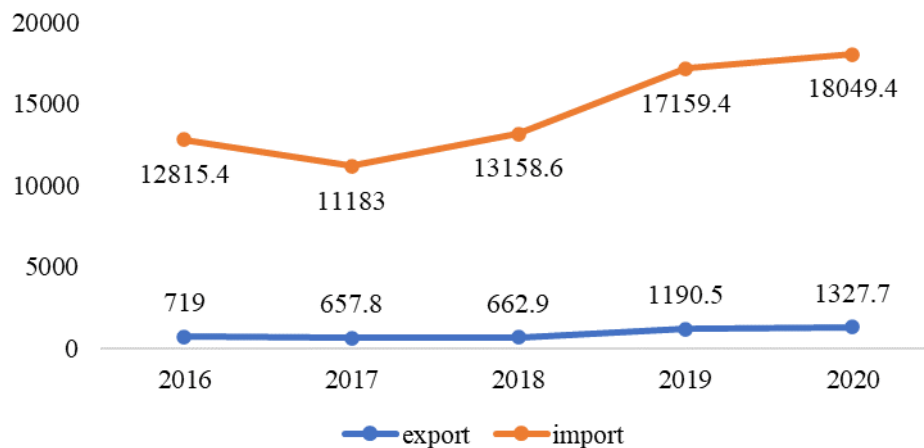


Fig.2. Dynamics of exports and imports of machine-building industry in Kazakhstan (millions of dollars)

Exports of mechanical engineering products in 2016-2020 increased from 719 million dollars. up to 1327.7 million dollars or 1.8 times. The main reason for the increase is due to the growth of exports for certain types of goods: batteries (1.6 times), bearings (1.2 times), supplies of three diesel-electric locomotives to Azerbaijan and Tajikistan. For many years, Russia has been the main export market for mechanical engineering products - 25% of Kazakhstan's exports. Accumulators and bearings have the greatest weight in the structure of Kazakhstan's exports to the Russian market. Other goods include transformers, shutoff valves, distribution boards, etc.

Imports of mechanical engineering products in Kazakhstan are 15-20 times higher than exports. Imports of mechanical engineering products for 2016-2020 increased from 12815.4 million dollars. up to 18049.4 million dollars or 40.8%.

In the structure of imports of mechanical engineering products, the main share is still occupied by valves for pipelines and telephones for wireless communication networks (4.4% and 4.1%), air or vacuum pumps (2.9%), cars (2.8%), electrical conductors up to 80 V and railway locomotives (1.8% and 1.5%).

25% of imports of the engineering industry of Kazakhstan fall on Russia in the amount of 2.4 billion dollars. USA. Basically, these are cars, aircraft, insulated wires, auto parts, computer equipment, refrigerators, etc. The second main exporter of mechanical engineering goods is China, with a 20% share. According to the results of 2020, China's income from imported supplies to Kazakhstan amounted to \$1.9 billion. USA. Basically, these are cell phones, computers, shutoff valves, centrifuges, insulated wires, liquid pumps, etc. In third place in the ranking of countries supplying imported products is the United States with a share of 8%. The main goods of American production are shutoff valves, agricultural machinery, air pumps, equipment for processing minerals, etc.

The main reasons for the lack of competitiveness of domestic mechanical engineering products compared to foreign analogues are its higher cost and low quality, associated with

the use of outdated production technologies at most enterprises of the republic, an excessively high share of the use of imported components, materials, energy carriers, etc. In addition, most of the products of domestic plants are morally outdated and are much inferior to foreign counterparts in terms of technical and operational indicators.

Machine-building enterprises of the republic practically do not have their own financial resources for the development, ensuring the necessary technical level and competitiveness of the products, do not have a full-fledged production and scientific and technical infrastructure, there is a shortage of highly qualified personnel of engineering and technical and working specialties.

For an objective assessment of the development and determination of further prospects for the development of the engineering complex of Kazakhstan, it is necessary to determine its strengths and weaknesses, as well as opportunities and threats. To this end, we will conduct a SWOT analysis of industry development (Table 3).

Table 3 – SWOT analysis of the mechanical engineering development in Kazakhstan

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>- own experience in the production of mechanical engineering products</li> <li>- high demand from the domestic market (agricultural, oil and gas and mining engineering);</li> <li>- positive dynamics of production growth in related industries</li> </ul>	<ul style="list-style-type: none"> <li>- high dependence on imports of raw materials and components;</li> <li>- high degree of moral and physical wear of technological equipment;</li> <li>- low degree of production facilities workload;</li> <li>- low investment attractiveness of the industry</li> <li>- shortage of highly qualified personnel at all levels of production;</li> <li>- low innovation potential;</li> <li>- low level of after-sales service of mechanical engineering products</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>- stable economic situation in the country</li> <li>- close geographical location of two major sales markets (Russia and China);</li> <li>- the growth of production in agriculture, the oil and gas sector, and the mining industry, therefore, the increase in demand for equipment</li> <li>- development of joint ventures, outsourcing, franchising and cooperation;</li> <li>- introduction of new technologies and updating of equipment on the basis of comprehensive state support;</li> <li>- competition between enterprises, which contributes to the growth of labor productivity and reduction of production costs</li> </ul>	<ul style="list-style-type: none"> <li>- increasing dependence on imports of engineering products</li> <li>- competition from machine-building enterprises of other countries</li> <li>- high technological equipment of competitors, higher product quality, brand awareness</li> <li>- tightening and complication of the international system of regulation and standardization</li> </ul>

For the development of mechanical engineering in Kazakhstan, it is necessary:

- creation of centers (technoparks, technopolises, specialized design and technological bureaus, business incubators, etc.) with branches in the regions to provide services to legal



entities and individuals in creating production facilities for the production of high-tech engineering products, including by transferring technological equipment for rent or leasing;

- assistance in advertising domestic mechanical engineering products;
- development of industrial zones, where the state will bring the infrastructure necessary for the development of mechanical engineering;
- formation of clusters in separate sub-branches of mechanical engineering;
- modernization of existing enterprises in order to create flexible industries to expand the types of machine-building products produced;
- development of moderate protectionism of domestic mechanical engineering enterprises.

### **CONCLUSION**

Thus, the study of the development of mechanical engineering in the Republic of Kazakhstan made it possible to identify the following problems:

- 1) a high level of equipment deterioration (43-80%), which prevents an increase in production efficiency;
- 2) low competitiveness of machine-building products, narrow nomenclature and low share of consumption of Kazakh machine-building products;
- 3) low technical condition of the active part of industrial and production funds and insignificant level of innovation activity in the industry;
- 4) incomplete use of existing production facilities;
- 5) investment non-attractiveness of the industry and insufficient working capital of enterprises;
- 6) unfair pricing policy of large metallurgical producers in relation to machine-building enterprises;
- 7) shortage of qualified personnel in the field of production and management of enterprises;
- 8) insufficient development of the infrastructure of the machine-building complex: loss of a significant part of the infrastructure (research institutes, design bureaus, experimental bases, test centers and technical control), lack of organizations for standardization, certification, etc.;
- 9) a low level of cooperation between machine-building enterprises of the republic with enterprises of neighboring countries and with leading world producers of similar products;
- 10) imperfection of regulatory legal acts in the field of public procurement in terms of the absence of long-term contracts;
- 11) lack of a technological forecasting mechanism;
- 12) a low share in the production of products of high-tech, high-tech products with high added value;
- 13) many enterprises continue to produce products in single sizes and small batches, which negatively affects the economic performance of enterprises (in price), which is the reason for the import of products of a similar variety and quality;
- 14) lack of modern quality management systems of enterprises, weak marketing and production management;
- 15) low level of after-sales service of machine-building products;
- 16) lack of information on plans for technical re-equipment of subsoil users of oil and other companies and organizations.

Solving these problems is the primary task of Kazakhstan for the development of the machine-building complex.

Eliminating the main development problems could increase its export potential and reduce dependence on imports, and due to the rapidly growing domestic demand for engineering products, it would be advisable for enterprises to focus on the domestic market.

Increasing the competitiveness and export potential of domestic engineering is impossible without attracting large investments to the industry.

One of the most important and real opportunities for the development of mechanical engineering in modern conditions is cooperation between the CIS countries. This will contribute to increasing the production and export of products, expanding the sources of attracting investment and the introduction of new technologies.

Over the past two years, 12 enterprises for the assembly of Belarusian equipment have been organized in Kazakhstan.

Thus, within the framework of the common economic space, the prospects for the development of Kazakhstani mechanical engineering have expanded due to more favorable conditions for the creation of new industries and the opening of a sufficiently large sales market necessary for the economically feasible large-scale production of machine-building products.

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