



NATIONAL AGENCY
OF INVESTMENT
AND PRIVATIZATION
Republic of Belarus

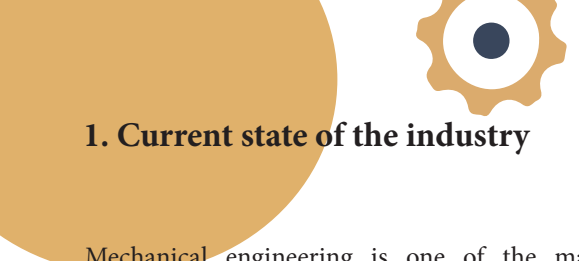
MECHANICAL ENGINEERING OF THE REPUBLIC OF BELARUS

2024



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1. Current state of the industry

Mechanical engineering is one of the main industries determining the development of the national economic system. Its technological level dictates the price and quality parameters of the products of industrial enterprises and related industries, ensures their competitiveness.

The machine-building complex of Belarus includes the production of electrical equipment, machinery and equipment, computing, electronic and optical equipment, as well as vehicles, including cars and automotive components, agricultural machinery and machine tools, complex devices, elevators, household appliances and electronics.

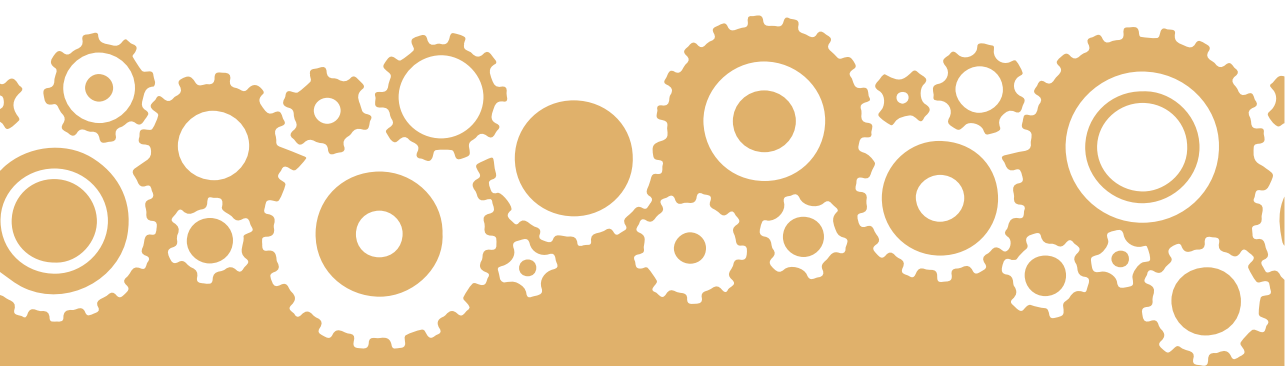
Modern innovation processes in the machine-building industry of Belarus are based on technologies of higher technological structures (bio-, nanotechnology, information and communication, aerospace), the use of the latest materials with specified properties, achievements of micro- and photoelectronics, which form the technological basis of the economy knowledge.

The production potential of the machine-building industry in Belarus is characterized by a highly skilled workforce and a well-developed

infrastructure, the elements of which include accumulated experience, scientific organizations, supply and distribution channels.

In 2023, more than 80% of machine-building products were sold abroad, and Belarusian machine-building enterprises received every third ruble of their revenue from the sale of innovative products. Tractors of JSC «MTZ», mining dump trucks of JSC «BELAZ», tractors and buses of JSC «MAZ», passenger cars of JSC «BELGEE», household appliances of JSC «Horizon», JSC «Vityaz», CJSC «ATLANT», elevators of JSC «Mogilevliftmash», combines of JSC «Gomselmash», road construction The logging equipment of JSC «Amkodor» and other numerous products of the domestic flagships of mechanical engineering are annually supplied to more than 130 countries around the world.

Globally, Belarus accounts for about 8% of tractors, 30% of heavy mining dump trucks and 17% of combine harvesters. Minsk Tractor Plant is one of the 8 largest manufacturers of wheeled tractors in the world.





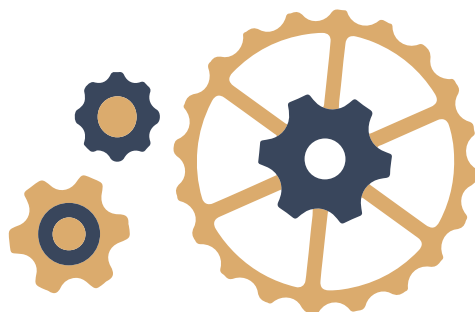
1.1. Key industry indicators

The machine-building complex of the republic has more than 1,200 organizations, including 249 large and medium-sized enterprises that play a significant role in the country's economy. The industry's flagships are:

- JSC «Amkodor». One of the leading manufacturers of specialized machinery and equipment both in Belarus and among the CIS countries.
- JSC Belarusian Automobile Plant is the world's main manufacturer of large and especially heavy-duty dump trucks.
- JSC Minsk Tractor Plant is considered one of the world leaders in the production of agricultural machinery.
- JSC Minsk Automobile Plant specializes in the production of trucks and passenger vehicles.
- JSC «Integral» is a developer, manufacturer and exporter of microelectronic components and electronic products.
- JSC Minsk Motor Plant is the country's leading diesel engine manufacturer.

As of 2023, 193.4 thousand people worked in the industry, which accounted for 19.4% of the total number of people employed in industry and 4.7% of the total number of people employed in the country's economy. Mechanical engineering provides 15% of the total industrial production. Over the period from 2021 to 2023, the increase in industrial production in mechanical engineering amounted to almost 40%, while the growth in 2023 compared to 2022 was 113%, reaching the level of 9.97 billion US dollars.

In January-June 2024, the industry's contribution to GDP amounted to 5.4%, investments in the industry amounted to 227.4 million US dollars (+57.6% compared to the same period in 2023) and amounted to 12.1% of the total investment in industry.



1.2. Legal environment

The management of the machine-building industry is carried out by the Ministry of Industry of the Republic of Belarus. The development of the machine-building complex is carried out in line with the following government programs:

- The State program of innovative development of the Republic of Belarus for 2021-2025;
- The State scientific and technical program «Innovative Mechanical engineering and engineering technologies». The program involves the creation and development of production of competitive automotive, mining, tractor, combine harvester and other self-propelled machinery of a new generation, its components, lifting and transport, electric machines, mobile mechanisms, metalworking equipment, metal cutting tools, optical devices, machine tools, development and implementation of advanced technologies with deep digitalization and automation, meeting modern industrial requirements.;
- The state scientific and technical program «Micro- and Nanoelectronics Industry». The program involves the creation of innovations in the field of microelectronics and equipment for the production of high-tech products, the development of the national electronic industry and the expansion of the range of electronic component base and technological equipment.;
- The state scientific and technical program «Intelligent Instrument Engineering». The program involves the development of promising areas of the domestic radioelectronic industry based on advanced achievements of science and technology, the development of new types of radioelectronic and instrument-making products, reducing the need for imports of radioelectronic and instrument-making products.;
- The scientific and technical program of the Union State «Intelauto» (STP «Development

of intelligent, high-tech digital and electronic components and systems for special and dual-use vehicles»). The Intelauto program is aimed at creating advanced import-substituting components, competitive control, safety and driver assistance (ADAS) systems, modern control systems for electric and hybrid power plants of highly automated vehicles, as well as ensuring the technological independence of enterprises in the Russian Federation and the Republic of Belarus.

Mechanical engineering is included in the list of priority areas of scientific, technical and innovative activities for 2021-2025, including developments in such areas as

- mechanical engineering and machine science;
- automated production complexes;
- electric and unmanned vehicles;
- laser, plasma, optical technologies and equipment;
- micro, opto, and microwave electronics, photonics, and microsensors;
- radio-electronic systems and technologies, instrumentation;
- metallurgical technologies;
- additive technologies;
- composite and multifunctional materials;
- nanomaterials and nanotechnology, nanodiagnostics.

A comprehensive program for the development of electric transport for 2021-2025 should be highlighted separately. As part of the implementation of the Comprehensive Program,;

- creation of production facilities for cargo, passenger, specialized, passenger and individual electric vehicles, as well as its components;
- organization of scientific support, standardization, certification and conformity assessment of electric vehicles (basic components) for their safe operation on public roads;
- creation of charging infrastructure for electric vehicles based on a nationwide network of electric charging stations (1,200 charging stations are operating as of 05/17/2024);

- formation of a set of measures to stimulate the development of electric transport.

The comprehensive program is aimed at the systematic development of the machine-building industry based on the creation of electric transport facilities for various functional purposes and their component base to solve the tasks of gradually increasing the use of electric energy in passenger and freight transportation.

1.3. Scientific research base

A fairly strong scientific base has been created in the system of the Ministry of Industry. In addition to universities, science develops within the framework of manufacturing enterprises, holdings and industry laboratories. Therefore, 23 organizations have received scientific status (accreditation) in the system of the Ministry of Industry, and 17 industry laboratories have been established on their basis. The integration of science and production is carried out within the framework of such holdings as «BELAZ-HOLDING», «Belarusian Metallurgical Company», «MTZ-HOLDING», «HORIZONT», «BELAVTOMAZ», «GOMSELMASH», «Avtokomponents», «MINSK MOTOR PLANT», «Mogilevliftmash», «METP named after V.I.Kozlova», «INTEGRAL», «Belkommunmash», «Bobruiskagromash», «BelOMO», «AMKODOR», «Planar».

There are several leading scientific organizations in Belarus that are engaged in research and development in the field of mechanical engineering:

- Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus. It is one of the largest scientific research institutions in the country, engaged in the development of new technologies and equipment for various industries, including mechanical engineering.
- Belarusian National Technical University (BNTU). One of the leading technical universities in the country, which conducts research in the field of mechanics, materials science, automation of production processes and other areas of mechanical engineering.

- Academician's O.V. Roman Institute of Powder Metallurgy of the National Academy of Sciences of Belarus. Specializes in the development and creation of new and improved existing powder and composite materials based on metallic and non-metallic powders, diamond powders and superhard materials, effective manufacturing technologies for structural, antifriction, friction, electrical, magnetic, wear-resistant machine parts and devices, as well as diamond tools.

- Institute of Physics and Technology of the National Academy of Sciences of Belarus. He is engaged in research in the field of new materials, metalworking by pressure, foundry technologies, industrial surface engineering technologies.

- State Scientific Institution «Institute of Metal Technology» of the National Academy of Sciences of Belarus. He conducts research in the following areas: technologies for obtaining the structure and properties of powdered hard alloys based on tungsten, titanium, tantalum carbides with cobalt as a binder; methods for recycling and hardening hard alloys in order to improve their quality performance; recycling processes of scrap from high-speed steel in order to obtain material for tool products; development of theoretical foundations

for controlling the processes of formation of the structure and properties of metals and alloys during their crystallization and solidification; thermophysics and hydrodynamics of special types of casting; creation of new materials and resource-saving technological processes for their production, processing and hardening.

- Scientific and Production Center of Multifunctional Unmanned Complexes of the National Academy of Sciences of Belarus (SPC MFUC). Carries out scientific research and development on the creation and modernization of unmanned aircraft systems as a whole and their individual components; develops on-board and ground avionics, methodology for the construction of unmanned aircraft systems and simulators.

- Republican Unitary Enterprise «Scientific and Practical Center for Materials Science of the National Academy of Sciences of Belarus». The Center's main research area is condensed matter physics; the creation of new magnetic, ferroelectric, semiconductor, metallic, superconducting, superhard and optical materials in the form of crystals, ceramics, disordered systems, nanomaterials and nanostructures.



It is also worth noting the work of the Ministry of Industry (in particular, the digital office of the Central Research and Design Technology Institute of Organization and Management Engineering) within the framework of the state program «Digital Development of Belarus». It creates:

- A digital industry management platform;
- architecture of the trade and cooperation platform;
- a mock-up of a domestic platform for the formation of «digital twins» of products, production for Belarusian enterprises and

replacement of foreign manufacturers of MES, PLM, ERP systems.

The above-mentioned organizations play a key role in the development of the machine-building industry in Belarus, ensuring the introduction of advanced technologies and solutions into production.



1.4. Staffing

The leading Belarusian university for training specialists in the industry is the Belarusian National Technical University. The training is carried out at such faculties as:

- Mechanical engineering – the faculty consists of 6 departments, 4 scientific research laboratories (SRL) and the Information Technology department, training is underway in 9 specializations, 2,400 people are studying;
- Automotive engineering – the faculty consists of 8 departments, training is conducted in 14 specialties. The faculty has more than 4,700 students of various forms of education. The faculty operates the Research Institute of Hydropneumoseystems and Petroleum Products, the Research Institute of Vehicles and the Scientific Research Center (SRC) of road Traffic;
- Mechanics and Technology – it consists of 6 departments and 9 branches: at the NASB Institute of Physics and Technology, at the Atlant CJSC branch - Baranovich Machine Tool Factory, at the Gomel Foundry «Centrolit», JSC «BelNIILlit», JSC «MAZ», 2 branches at MTZ, at JSC «BMZ», at JSC «Beltsvetmet». The faculty has 6 research institutes (foundry technologies; hardening of steel products; welding, related technologies and non-destructive testing; pressure treatment of materials; theory and technology of metallurgical processes; materials Science and Foundry Technology) and the Innovation and Production Center for Medical Equipment and Products. The BNTU Polytechnic Science and Technology Park was established on the basis of the Metolit Educational, Scientific and Production Center, which was part of the faculty. Training is carried out in 7 specializations;

- Faculty of Instrument Engineering – the faculty consists of 7 departments, training is carried out in 10 specializations, 1,400 people study there. The faculty has a research center for optical materials and technologies, research laboratories for optoelectronic instrumentation, semiconductor technology and innovative devices of MEMS technologies (technologies of microelectromechanical systems).;

- Faculty of Transport Communications – the faculty consists of 5 departments, training is carried out in 4 specializations;

- Faculty of Information Technology and Robotics – the faculty consists of 5 departments, training is carried out in 6 specializations, 2,500 students study there. There is also a research and innovation laboratory for production automation. Specialists are also trained at universities in the country such as the Belarusian State University of Transport (Faculty of Mechanics, Faculty of Electrical Engineering), the Belarusian State Agrarian Technical University (Faculty of Agromechanics), the Belarusian State University (Faculty of Radiophysics and Computer Technology), Baranovichi State University (Faculty of Engineering), the Belarusian-Russian University (Faculty of Engineering Correspondence Education, Faculty of Mechanical Engineering), Brest State Technical

University (Faculty of Mechanical Engineering), Yanka Kupala Grodno State University (Faculty of Engineering), P.O. Sukhoi Gomel State Technical University (Faculty of Mechanical Engineering), Vitebsk State Technological University (Faculty of Information Technology and Robotics), Polotsk State University (Faculty of Mechanics and Technology, Faculty of Computer Science and Electronics).

Belarus is among the top ten countries in the world according to the Global Innovation Index's Training of Specialists in Science and Technology. According to the indicator «Human capital and research», it is among the top 40 countries in the world. According to the Science and Technology subindex, Belarus ranked 34th out of 169. According to the human development index, the country ranks 60th among 191 countries in the world.





1.5. Technologies

To date, a scientific and engineering school has been formed and design methods for electric power plants of vehicles and their basic components have been mastered, taking into account the technological capabilities of domestic enterprises, design documentation has been developed using these techniques, various components of electric power plants have been manufactured and tested in bench conditions and as part of vehicles.

Over the past year, scientists have created three new models of electric vehicles – the MAZ 4381EE electric cargo vehicle with a load capacity of 12 tons, a frame-panel electric vehicle with a load capacity of up to 1 ton, and the Electro Roadster sports electric vehicle. All of them use a domestic component base – electric motors, power electronics, battery control electronics. The refinement, debugging and acceptance tests of the experimental model have been completed for the MAZ truck. It received a certificate of safety of the vehicle structure and allowed to drive on public roads. Prototypes of seven types of diesel engine («MMZ» JSC) have been manufactured. The development of new models of BELAZ mining dump trucks with various lifting capacities, technical means of robotization of mobile machines as part of an unmanned BELAZ mining dump truck, and an electric motor generator with a capacity of 1,500 watts using composite materials based on iron-containing micropowders has been completed.

A modular electric energy storage system based on lithium-containing cells has also been developed, designed for installation on commercial vehicles or stationary storage installations.

A methodology for designing high-speed gearboxes has been developed. They will be used in electric vehicles, both passenger and cargo. The methodology allows, depending on the category

of vehicles, to select kinematic schemes for the value of gear ratios that provide specified traction and economic characteristics, determine the loading modes of gearboxes, calculate and design the main parts and assemblies.

Among the important developments are prototypes of a high-performance image generator using spatial-light modulation technology, a laser micro-processing plant for electronics materials (JSC «Planar»). BSU has created a unique complex for optical remote sensing of the Earth (the orientation system of the «SOVA-2-426» video spectral equipment and the «VSS» video spectral system), which has no world analogues.

In the field of technical sciences, a photodetector device for laser rangefinders operating in the spectral range that is relatively safe for vision, a microwave photodiode module for radar and electronic security systems, and an unmanned aircraft monitoring system for invasive plants have been developed.

«Busel MKR» and «Hexakopter-1» unmanned aerial vehicles have been created, equipped with the latest hardware and software complex of domestic development combining artificial intelligence technologies.

In the field of microelectronics and instrument engineering:

- Republican system of automated environmental monitoring;
- a system for recording the presence of subjects in a controlled area based on neural network methods of face recognition;
- A multifunctional training complex for training rescuers and firefighters in emergency response



operations involving electric vehicles is used to improve the level of training of students and employees of emergency management agencies and departments.

- automated system for continuous monitoring of the technical condition of load-bearing structures of high-rise buildings and large-span structures;

- a set of optoacoustic monitoring devices for materials and structures (including welded ones) that detect defects of several microns in size.

1.6. Industrial and territorial clusters

Together with the National Academy of Sciences, the innovation and industrial cluster «Electric Transport» was created (for the implementation of the «Electric Transport» program). It includes «MAZ», «BELAZ», «MTZ», «Belkommunmash», «Mogilevliftmash», «Izmeritel», Joint Institute of Mechanical Engineering NAS of Belarus, BNTU and «ETON-ELTRANS». The main objectives of the cluster are to ensure the production and

development of new competitive types of electric vehicles and components. Its participants will also coordinate effective cooperation in scientific, technical, educational and industrial spheres. Over the next five years, the share of public electric transport is planned to increase to 30%.

Within the framework of the program, electric trucks with a load capacity of 4 and 10 tons, a



90-ton dump truck powered by rechargeable batteries, and a 220-ton dump truck with a diesel-trolleybus design will be developed and put into production. An electric garbage truck with a lifting capacity of 12 to 16 tons, an electric bus for transporting passengers at airports and a traction electric motor with a capacity of 130 kW will also be mastered. In addition, production facilities for already developed equipment, including new models of MAZ and Belkommunmash electric buses, and power electronics products, will be created or modernized.

In 2017, seven commercial organizations engaged in the development and production of innovative high-tech instrument-making products initiated the creation of a specialized association, «The Innovative Instrument Engineering Association» (hereinafter referred to as «The Association»). A cluster of instrument engineering in Minsk and the Minsk region has been created on the basis of the Association. The main activity of the Association's members is manufacturing activities in the field of instrument engineering related to the commercialization of innovative technologies and the production of high-tech products. Today, the Association is actively developing the instrument industry in cooperation with the State Committee for Science and Technology, the Ministry of Economy and the Hi-Tech Park, holding public events and startup competitions. To coordinate the efforts of scientists from Belarusian universities, academic institutes, design centers and enterprises in our country, an innovative industrial cluster «Micro-, opto-, and microwave Electronics» was created and is

actively operating in 2017 at the initiative of the leadership of the National Academy of Sciences. It includes JSC «INTEGRAL» and JSC «Minsk Research Institute of Radio Materials», aimed at creating an electronic component base, as well as JSC «Planar», working in the field of precision electronic engineering.

The Republican Association of Industrial Enterprises «BelAPP» also provides assistance in the development of mechanical engineering. The Republican Association of Industrial Enterprises «BelAPP» was established in 2006 as a result of the reorganization through the transformation of «Belarusian Association of Radio Electronics, Computer Science and Instrument Engineering Enterprises» (BelRECSI), established in 1990, and is the legal successor to all its rights and obligations. The Association unites 202 enterprises of the Ministry of Industry of the Republic of Belarus, the State Military-Industrial Committee of the Republic of Belarus, the State Committee for Standardization of the Republic of Belarus, «Belneftekhim», «Belresursy», «Bellegprom», «Belfarmprom» holding, on a voluntary basis.

2. Resource and raw material base

Mechanical engineering is a key sector of the Belarusian economy. Due to the complex structure of its sub-sectors, it is a consumer of a wide range of raw materials. The main types of raw materials include ferrous metals (rolled steel, pig iron and ferroalloys), non-ferrous metals (aluminum and its alloys, copper and its alloys, zinc, nickel metal), polymers (polyethylene, polypropylene, polyamides, polycarbonate), rubber compounds

(natural and synthetic rubber), chemical raw materials (greases, oils, solvents, paints, anti-corrosion coatings), electronic components (microchips, resistors, capacitors, wires, cables), optics (glass, lenses, optical materials), energy carriers (electricity, gas, fuel oil).

Secondary raw materials

The main raw materials are metals. Belarus provides itself with metals both through its own production and imports from various countries, which allows it to maintain a stable supply for its industry. The main supplier of metals to the Belarusian market is PLC “Belarusian Metallurgical Plant” (BMP). BMP is a national treasure of the state and is included in the state register of companies of the republic with high-tech production, it belongs to the category of modern mini-plants of European level. Today the company is structurally composed of four production facilities connected by one

technological chain - steelmaking, rolling, pipe and metalware.

Two electric steelmaking workshops functioning at BMP have increased their production potential to 3 million tons of steel per year due to modernization. At present, Electric Steelmaking workshop No. 1 smelts and casts ordinary steel grades, while Electric Steelmaking workshop No. 2 produces structural and alloyed steels. Electric steelmaking workshops are equipped with three modern electric arc furnaces with the capacity of 100 tons each. All necessary elements of steel



finishing technology available in the workshops are thoroughly controlled by computers, which makes it possible to produce high quality metal.

BMP's long product rolling operations are represented by two workshops. Long Products workshop No. 1 produces large and small sections and wire rod. The workshop is equipped with a modernized small section mill, wire mill and reversing mill. Long Products workshops No. 2, which was launched in September 2015, is equipped with a modern small section wire rod mill with a total capacity of 700,000 tons per year with the prospect of increasing production to 1 million tons per year.

Pipe production is represented by a pipe-rolling unit, which includes a Kosoval piercing mill, a 4-stand PQF® mill and a reduction and stretching mill for the production of pipes primarily oriented to the oil and gas industry and machine building. Metalware production at the Belarusian Metallurgical Plant is represented by three steel wire workshops (No. 1 - Micord; No. 2 - Pluscord and No. 3) and an auxiliary tare and fiber shop. The list of their products includes the following items: metal cord, flatbed bronze wire for automobile tires, brass wire for reinforcing high-pressure hoses, reinforcing, welding, spring, spoke, nail wire, general purpose wire and steel fiber (anchor, wave and microfiber).



Primary Raw Materials

Two iron ore deposits have been identified in the depths of the Republic of Belarus (they are undeveloped):

1. Okalovskoye deposit of iron quartzites;
2. Novoselkovskoye deposit of ilmenite-magnetite ores.

The industrial reserves of the Okalovskoye deposit amount to 145.4 million tons of ore with

an average iron content of magnetite ranging from 14.9% to 31.7%. The preliminarily explored reserves of iron ores amount to about 21.5 million tons, while the forecasted reserves reach nearly 170 million tons. The deposit is ready for industrial development.

The preliminarily explored reserves of iron ores at the Novoselkovskoye deposit are estimated at 130.0 million tons with an average total iron content of 24.7%. They contain: magnetite iron



– 20 million tons, titanium dioxide (TiO_2) – 5.175 million tons, vanadium pentoxide (V_2O_5) – 0.163 million tons. The content of accompanying useful components is: TiO_2 – 2.63% to 8.75%, V_2O_5 – 0.04% to 0.47%. The deposit requires detailed exploration.

The industrial reserves of the Okalovskoye deposit ensure an operational period of 34.45 years for the mining enterprise. Based on the deposit, it is possible to construct a mining and processing plant with a capacity of:

- for ore – 4.0 million tons per year,
- for concentrate – 888.9 thousand tons per year,
- for oxidized pellets – 847.8 thousand tons per year,
- for metallized pellets – 597.0 thousand tons per year,
- for construction gravel – 489.4 thousand m^3 per year,
- for coarse sand – 136.2 thousand m^3 per year.

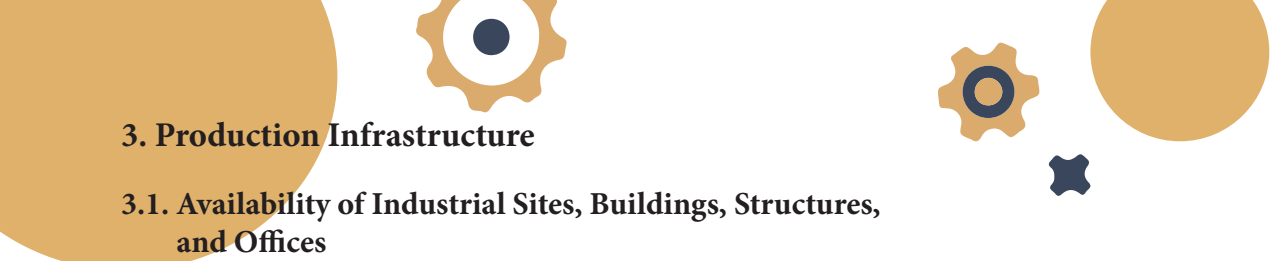
Total investment costs are estimated at 1,625.3 million dollars. The production cost of metallized pellets is 630 dollars per ton.

Based on the Novoselkovskoye deposit, it is possible to construct a mining and processing plant with a capacity of:

- for ore – 4.0 million tons per year,
- for concentrate – 1,334.8 thousand tons per year,
- for oxidized pellets – 1,254.5 thousand tons per year,
- for metallized pellets – 862.4 thousand tons per year.

Total investment costs are estimated at 1,474 million dollars. Detailed exploration of the deposit and the development of ore enrichment technology are necessary.

In accordance with the Decree of the President of the Republic of Belarus dated October 16, 2014, No. 494, the Okalovskoye and Novoselkovskoye iron ore deposits have been included in the list of objects proposed for concession transfer.



3. Production Infrastructure

3.1. Availability of Industrial Sites, Buildings, Structures, and Offices

In order to accelerate the innovative development of industry organizations and improve the investment climate in Minsk and the regions, free economic zones, industrial sites, and technoparks have been established. Currently, there are 6 FEZs operating:

- FEZ “Brest”
- FEZ “Minsk”
- FEZ “Gomel-Raton”
- FEZ “Vitebsk”
- FEZ “Mogilev”
- FEZ “Grodnoinvest.”

One of the most promising sites for implementing production in the industry is the China-Belarus Industrial Park “Great Stone.” One of the main areas of activity of the park is the development of manufacturing in the fields of machine engineering, new materials, and electronics. Currently, more than two dozen residents are registered in the park, working in the field of machine engineering:

- LLC “ZUMlion BEL-RUS” – production of specialized equipment with auxiliary equipment “ZOOMLION” based on domestically produced chassis;
- LLC “Falcon Power” – production of internal combustion engines in the Republic of Belarus;
- LLC “RESIF TECHNOLOGIES BEL” – the company provides services for high-precision small-batch machining: produces metal and plastic parts and assemblies according to customer drawings;
- UNITARY PRIVATE PRODUCTION ENTERPRISE “KUVOS” – highly automated production of glass for all types of ground transportation;

- CJSC “AVIATION TECHNOLOGIES AND COMPLEXES” – development and production of aviation equipment and its components;

- LLC “Fast Transmission Europe” – production of gearboxes;

- LLC “NPP ORION-VC” – production of air conditioners and ventilation system components;

- LLC “HESS GREAT STONE” – production of electric passenger transport;

- LLC “EES-GROUP” – production of electric transport and charging stations;

- LLC “Axiom Group” – production of special and specialized vehicles for agricultural and forestry purposes;

- LLC “Scientific and Technical Company BPAL Tianyuy Changyin (MSC)” – organization of production of universal unmanned aerial vehicles;

- LLC “HomeLand Group” – organization of innovative production of multifunctional soundproof cabins Aerocapsule with an automated control system based on the IoT (Internet of Things) concept;

- LLC “NPC Metalworking” – experimental design developments and technologies for the production of aluminum containers, complex mechanical devices, and components for unmanned aerial complexes;

- LLC “FarmAgroService” – organization of science-intensive production of equipment and materials for veterinary and agricultural needs;

- LLC “Rontek Machine Tools” – construction of a modern high-tech factory for the production of computer-controlled machines;

- LLC “United Industrial Technology Company” – provision of engineering, service, and training services for technological equipment in machine engineering production;

- LLC “GammaComponent” – production of auto components made of fiberglass and metal;

- NP LLC “Composite Structures” – scientific and production enterprise for engineering and production of composite material products;

- LLC “Solidpipe Systems” – production and application of innovative protective coatings on steel pipes for drilling equipment;

- LLC “BELEV” – production of innovative computers;

- LLC “IPD Group” – development, serial production of science-intensive materials, technologies, high-tech devices, and systems;

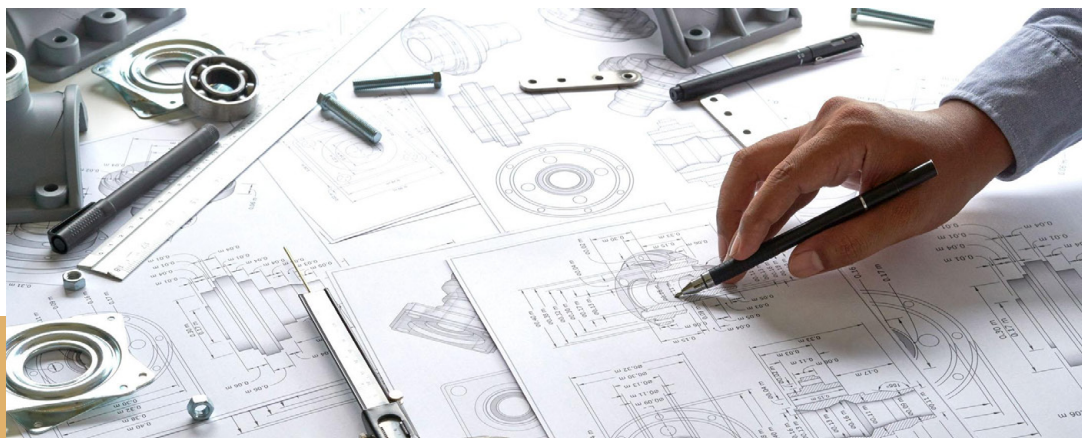
- LLC “Strategic Technologies” – production of modern multispectral electro-optical devices;

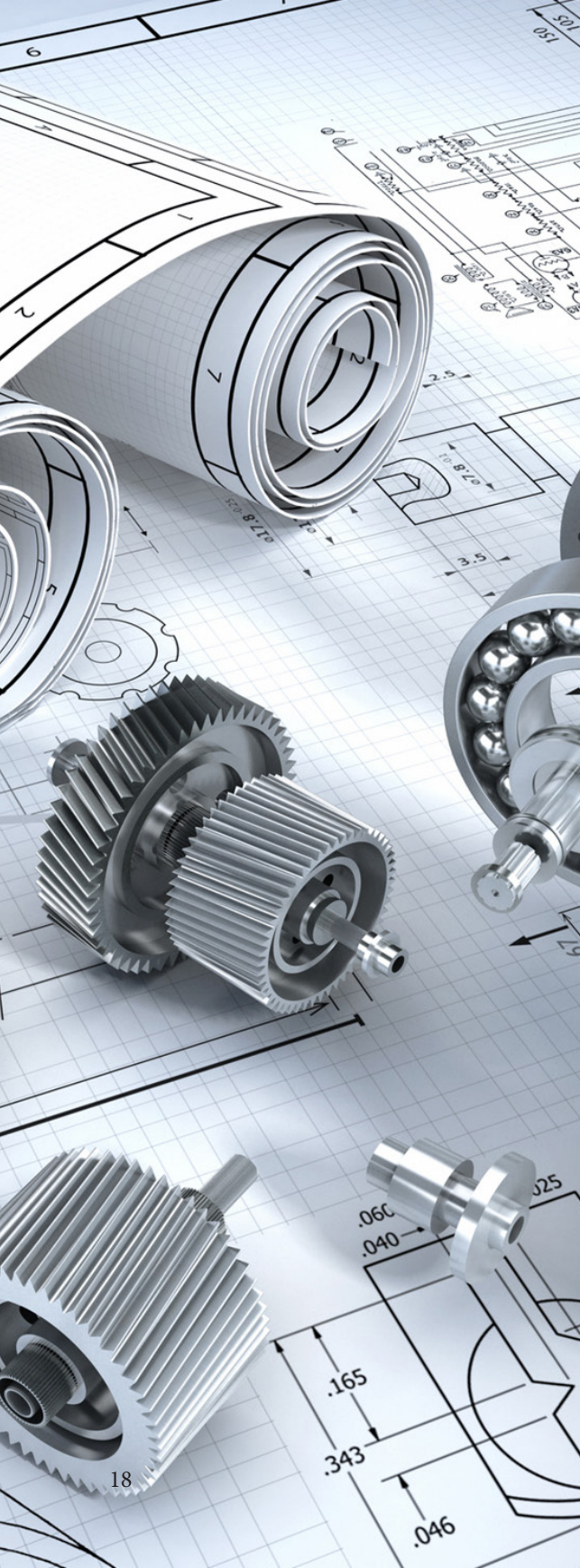
Also in the field of machine engineering, the

Scientific and Technological Park of BNTU “Polytechnic” operates in areas such as: metal processing and multifunctional coatings; the Minsk Regional Technopark – production of diesel generators, pumping stations, front loaders, trolleybuses, electrical equipment for trolleybuses, electric buses, import-substituting technological equipment; the Minsk City Technopark – machine tool construction, machine engineering, microelectronics, optoelectronic systems; the technopark Law and Order – instrument engineering; the technopark Korall – software development, production of robotic complexes, automation of production; the technopark Inkata – development of electronics, mechanics, new products, and non-standard equipment.

A project is also being implemented in Belarus to create a network of industrial parks. The network will cover 11 cities across all regions of the republic. Currently, new industrial parks are being created in the cities of Baranovichi and Pinsk. They will be ready to accept the first residents in early 2025.

The area of the start-up zone of the industrial park in Baranovichi is 13 hectares, with the possibility of expanding to 83 hectares. The area of the start-up zone of the industrial park in Pinsk is 12 hectares, with the possibility of expanding to 50 hectares. The selected sites are either included in





or planned to be included in the free economic zone “Brest,” which guarantees developers and residents a range of special tax preferences.

There are 16 technoparks operating in the republic with a total area of over 145,000 square meters. The number of residents in the technoparks exceeds 250. The total number of employees of technopark residents increased by 448 in 2023, or more than 9% compared to 2022, totaling 5,323 people. The production volume in 2022 amounted to 190 million US dollars. The production volume in 2023 grew almost 1.5 times, amounting to 275.83 million US dollars. Residents of the technoparks exported products (goods and services) worth over 116 million US dollars, which constitutes 42% of the total output, and this indicator has more than doubled compared to 2022.

Technoparks have been established in all regional centers, as well as in Novopolotsk, Pinsk, Horki, Bobruisk, and Molodechno. It is worth noting the significant role of technoparks in the development of innovative entrepreneurship in the regions of the Republic of Belarus. Technoparks regularly organize and hold startup events, including forums, investment weekends, master classes, seminars, and more. Technoparks actively participate in the development of local startup schools.

In total, there are currently 24 entities of innovative infrastructure operating in the Republic of Belarus, which include:

- 16 scientific and technological parks (technoparks);
- 6 technology transfer centers;
- Belarusian Innovation Fund;
- National Center for Intellectual Property.

Real Estate

The market for manufacturing and logistics real estate in the Minsk region (Minsk + 25 km from the MKAD) accounts for over 80% of the total manufacturing and logistics real estate market in Belarus and has maintained a stock level of 1,612 thousand square meters since 2023. In the total stock, more than 35% of the space is attributed to built-to-suit properties (this refers to the construction of a building to meet the client's requirements, where after completion, the client and developer become the tenant and landlord).

During 2024, approximately 225 thousand square meters of space are planned to be put into operation (including 125 thousand square meters in the Wildberries logistics center in the Great Stone Industrial Park).

Throughout 2023, two new large modern warehouse facilities were introduced in Minsk and its suburbs, with a total area of 36.5 thousand square meters (in 2022, 151.5 thousand square meters of warehouses were introduced). The project for the warehouse complex "G13," with a total area of about 20 thousand square meters, has

started in the "Sukharevo" business center. Two new warehouses are under construction in the "Prilesye" logistics center.

A notable trend in the market development for 2024 is the increasing demand for warehouse spaces of classes C and D. In the context of low vacancy rates and a lack of wide-ranging space offerings in the Minsk region, there has been a rise in rental rates and a further decrease in vacancy rates down to 1%.

The highest rental rate growth is observed at the lower end of class B (+25%), while the lowest is at the upper end of the same class (+3%). The highest rates are recorded for spaces starting from 3.5 thousand square meters, with maximum requested rates reaching 10 euros per square meter per month during the period.

Key factors driving demand for large warehouse spaces include the active development of e-commerce companies, the growth of traditional retail companies, and changes in the logistics pathways and conditions for goods.

3.2. Logistics Opportunities

In 2022, there were 69 logistics centers operating in Belarus. By 2023, this number decreased to 67. Eighteen logistics centers are state-owned or have more than 50% state shares. The remaining centers are private.

Out of these, 51 logistics centers were established with the participation of national investors (such as "Evrotorg," "A-100," "Tabak-Invest,"

"Belinterprodukt," "Darida," "ALIDI-West," Alitread-ALMI, "Vitalur," "ELECTROSILA," "MILLENNIUM GROUP," "BelVillesden," "Romax," "Astomstroy," "Libretik," M&M) and foreign investors from Azerbaijan, Belgium, Germany, Iran, China, Lithuania, Poland, Russia, Ukraine, Serbia, Turkey, and the Czech Republic. Logistics centers such as "Brest-Beltamozhservice," "Kolyadichi," "Transit," "Bremino-Orsha,"

“Ozerco-Logistic,” “Borisovintertrans,” “Dominik,” “Belsotra,” and “Great Stone” have temporary storage warehouses, customs warehouses, and free warehouses. According to experts, the logistics centers owned by “Beltamozhservice,” “Brestvneshtrans,” joint venture “Transit,” and joint venture “Dominik” lead in the number of services provided.

Eighteen logistics centers are multimodal: Brest-Beltamozhservice, Brest-Beltamozhservice-2, Beltamozhservice (Minsk), Beltamozhservice-2, Beltamozhservice-Mogilev, Beltamozhservice-Gomel, Beltamozhservice-Bobruisk, TLC “Kolyadichi,” Cold Storage Khatezhinsky, Ozerco-Logistic, Great Stone, Bremino-Orsha, Bremino-Berestovitsa, Mikhanyovich Logistics Center, Euro Warehouse, Eurasia, Dobrada, and National Airport “Minsk.” Economic entities also operate 13 container terminals for handling various types of containers.

Several logistics centers in Belarus either lease storage spaces (fully or partially—without defining a “key” tenant) to third parties without providing them with any services, or have organized economic activities of a production or service nature in these spaces. In terms of services provided:

- about 20 specialize in transport and logistics services;
- about 20 offer distribution and warehousing functions;
- the rest operate in the niche of warehouse services and goods handling for their own needs or lease spaces for production.

In 2021, there were 14 logistics providers operating (“TUT and TAM Logistics,” Pradius Nova, “Vladprodimpor” (“AgroStalStroy”), “Beltamozhservice,” “SLC “Twenty-four,” “Alpha Logistic,” “Dobrada,” “Capital Logistic,” “Vitrum Logistic,” Ypl, “Bug-Market,” “ALIDI-West,” “Karavan-Logistic,” “VIT-LOGISTIC”).

By 2023, the number of active companies decreased to 9 (-35%): “TUT and TAM Logistics,” “ALIDI-West,” Pradius Nova, “Vladprodimpor” (“AgroStalStroy”), “Beltamozhservice,” “Bug-Market,” “Karavan-Logistic,” “VIT-LOGISTIC,” “New Logistics.”

Among these 9 companies, only 6 currently provide logistics services with delivery across Belarus.

It is also worth noting that Belarus ranked 79th on the Logistics Performance Index published in 2023. Kazakhstan, Georgia, and Ukraine also ranked 79th. China ranked 19th, Poland 26th, Latvia 34th, Lithuania and Turkey 38th, and Russia and Uzbekistan 88th. Compared to the last year the index was published (2018), the country improved its index by 24 positions. Belarus holds the highest rankings in infrastructure development related to logistics and transport, the efficiency of customs border crossing procedures, and adherence to delivery timelines.





4. Market overview

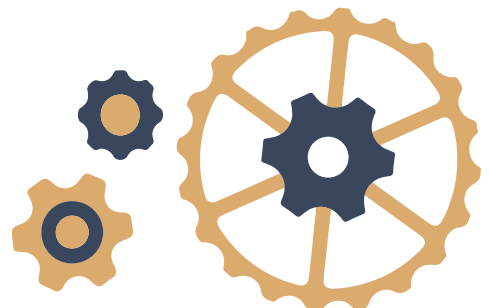
4.1 Key Trends

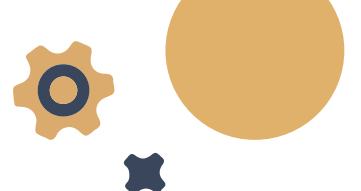
Global trends in mechanical engineering

1. Digitalization and Industry 4.0 – the integration of digital technologies into industrial and manufacturing processes, the introduction of smart sensors and devices, the Internet of Things (IoT), robots. By connecting machines and devices to the Internet and allowing them to communicate with each other, IoT makes it possible to collect and analyze vast amounts of data in real time. This data can be used to monitor the performance of mechanical systems, predict maintenance needs, and optimize operations for maximum efficiency.
2. Additive manufacturing using 3D printing, including rapid prototyping – creating physical objects from digital models by printing them layer by layer using a variety of materials, including plastics, metals, and even ceramics. This technology has opened up new possibilities for product design and customization, as it allows engineers to create complex shapes and structures that would be impossible to produce using traditional methods.
3. Advanced Materials and Nanotechnology – Design and manufacture advanced materials with exceptional properties, such as carbon fiber composites and advanced alloys. Nanomaterials with exceptional strength, conductivity, and thermal properties have applications in many industries, including electronics, energy storage, and biomaterials.
4. Artificial Intelligence and Machine Learning – Optimizing design processes and creating more efficient and effective mechanical systems; creating intelligent control systems that can autonomously adjust operating parameters in real time to achieve optimal performance; enabling the operation of autonomous machines such as self-driving cars, drones, and robotic systems; automating work that requires high precision.
5. Advanced Materials and Nanotechnology - the development and creation of advanced materials with exceptional properties, such as carbon fibre composites and advanced alloys. Nanomaterials with exceptional strength, conductivity and thermal properties have applications in many industries including electronics, energy storage and biomaterials.
6. Artificial intelligence and machine learning - optimising the design processes and creating more efficient and effective mechanical systems; creating intelligent control systems that can autonomously adjust operating parameters in real time to achieve optimal performance; enabling the operation of autonomous machines such as self-driving cars, drones and robotic systems; and automating precision-intensive work.
7. Digital twins and CAD - the development of a virtual model of a physical object or process created for the purpose of detailed analysis, optimisation and control of manufacturing operations, as part of the automation of design processes (e.g. design of a complex assembly / mechanism).
8. Environmental engineering and sustainable development - implementation of environmentally friendly engineering technologies. This trend involves a range of strategies, from the use of renewable energy and recycled materials to optimising designs to improve energy efficiency and reduce waste.

Famous startups in mechanical engineering

1. Zap Energy is developing a scalable fusion energy system using Z-pinch (plasma confinement system) technology. The company's goal is to create a commercial zero-emission power plant by 2030.
2. ANYbotics creates autonomous robots that can perform routine industrial inspections and maintenance tasks. The company's flagship products are the ANYmal and ANYmal X robots, two fully autonomous four-legged robots.
3. Virtual Flow is a mechanical engineering startup specialising in computational fluid dynamics (CFD) simulation software. Their software uses advanced algorithms to model and analyse fluid behaviour, allowing engineers to optimise the design of complex systems such as HVAC (air maintenance technologies), aerospace and automotive systems. Virtual Flow technology can help reduce costs and increase efficiency by identifying potential problems and enabling rapid design iteration prior to physical prototyping.
4. Boston Materials is a materials science startup specialising in carbon composites. The composites the company produces are used in the manufacture of a wide range of mechanical structures, including aeroplanes, wind turbines and electric bicycles.
5. Aerospace startup DASH Systems, now known as Farcast, provides precision airdrop solutions (in other words, delivering cargo to inaccessible areas). Their technology consists of guidance systems and mechanical components that control the trajectory of cargo dropped from aircraft.
6. Agility Robotics is a manufacturer of mobile manipulation robots. Their humanoid robots work alongside humans to perform basic tasks such as picking up materials, carrying heavy containers, stacking boxes, and more.
7. Machina Labs develops software-driven factories using AI and robotics. Their core technology RoboForming is an AI-powered robotic system that can mould, scan and finish sheet metal without tools.
8. A robotics-focused mechanical engineering startup, Nuro creates autonomous electric vehicles that can make local deliveries. They serve local commercial businesses such as restaurants, grocery shops, and pharmacies.
9. Shield AI provides AI-based solutions designed to protect civilians and military personnel. In particular, their AI technology is designed to enable drones to behave and manoeuvre like humans.
10. SimScale, a 3D modelling company, provides a digital platform for product design. Design engineers can use their web-based software to see how products will behave in real life. They use high-fidelity physical modelling technology for this purpose.





4.2. Production and consumption in the industry

The structure of machine building output (for 2021, more recent data are not available) was as follows: machinery and equipment accounted for 40.4% of production, vehicles and equipment - 31.3%, electrical equipment - 17%, computing, electronic and optical equipment - 11.3%.

According to the results of 2023, there is a significant increase in the output of electronics, cars, lorries and combines.

Since 2000, products have been produced in the following volumes:

- 1,1 million tractors
- 385 thousand different trucks
- 242 thousand passenger cars
- 22 thousand combines
- 18 thousand buses
- 124 thousand elevators
- 22 million refrigerators
- 19 million TVs
- 23 million tons of rolled metals

4.3 Foreign trade

In recent years, the foreign trade of the organizations of the Ministry of Industry has been characterized by an increase in exports on the one hand and a forced withdrawal from Western markets on the other. In 2023, the industry gave away a record \$6.5bn in exports over the last decade. The increase to the level of 2022 is almost half a billion, or about 8%. Moreover, exports have steadily increased for 3 consecutive years. Supplies are reoriented to the markets of friendly countries. First of all, the traditional market of Russia and other CIS countries.

The situation in the far abroad is somewhat different. The sales volume was less than 20% compared to the pre-sanction year 2021. The plans for exports to friendly far-away countries have not been fulfilled. Exports of Belarusian tractors in 2023 decreased by 18%. The share of Belarusian tractors in Russian imports dropped to the lowest for the last decade 10.5%, while the share of trucks - to 6%. Nevertheless, according to the plans, the constituent entities of the Russian Federation are to purchase about 40,000 buses, trolleybuses, trams, and electric buses by 2030,

which significantly increases the sales potential of the Belarusian industry.

Exports of knowledge-intensive, high-tech products account for 80% of the total exports of the organizations of the Ministry of Industry. Innovative products in the volume of production for 2023 amounted to 46.5%. Every 2 years the model range of manufactured products is completely changed.

The markets of Africa, Latin America and Asia look promising. Agricultural machinery and equipment are in particular demand there. Today there are agreements on deliveries of over 3 thousand tractors, 80 combines and 30 dump trucks to Zimbabwe. More than 150 tractors to the Republic of Togo. In 2024, there are plans to supply machinery to Nicaragua, Vietnam, Iran and Pakistan.



4.5 Key players

Avtokomponenty Holding. As of today, the structure of Avtokomponenty Holding includes:

- OJSC 'BATE' - managing company of the holding 'Avtokomponenty', Borisov (starters, generators);
- OJSC 'Borisov Plant "Avtogidroushilitel", Borisov (steering mechanisms, hydraulic booster pumps, hydraulic boosters, hydraulic booster cylinders);
- OJSC 'Belkard', Grodno (hydraulic shock absorbers, cardan joints, shafts, cab and seat suspensions, brake chambers, gas springs, flanges of transmission units);
- OJSC 'Remiz', Zhodino (air filters).
- OJSC 'VZEP', Vitebsk (devices for on-board network of cars, instrument panels, indicators, speedometers, tachometers, tachospidometers);
- OJSC 'EKARAN', Borisov (anti-lock braking systems, sensors, windscreen washers, mass switches, electronic interrupters of direction indicators);
- OJSC 'Prema', Gorki (heaters, fans, electric motors of low power);
- OJSC 'Pruzhany Radio Components Plant', Pruzhany (wire harnesses, seals, electrical connectors, splitters).
- OJSC 'Rudensk', the town of Rudensk (headlights, lanterns, reflectors);
- OJSC 'Shchuchin Plant "Avtoprovod", Shchuchin (wires and motor-tractor harnesses);
- OJSC 'Radiotekhnika', Oshmyany (lighting devices for automotive tractors, electromagnets, sensors, switches, connectors and pins).

AMKODOR Holding. Priority activity is production and sale of special machines for road construction, logistics, peat mining, municipal, forestry and agricultural industries.

ATLANT Holding. ATLANT is a high-tech, dynamically developing enterprise, a manufacturer of popular refrigerators, freezers and washing machines.

BELAZ Holding. The company specialises in the development, manufacture and marketing of large and extra large capacity dump trucks, special and specialised vehicles, as well as other heavy transport equipment used in mining, construction, metallurgical and other industries.

Holding "Belstankoinstrument". The company manufactures metal-cutting machine tools, modernizes technological equipment of its own and foreign production; provides metalworking services. It is the only enterprise in the Republic of Belarus producing heavy multifunctional metal-cutting machine tools and CNC machining centres with different levels of automation for processing large-sized parts up to 5 m wide and 30 m long.

Belarusian Metallurgical Plant. This is a unique enterprise in the metallurgical industry of Belarus, which belongs to the category of modern mini-plants of European level. Today, the enterprise is structurally comprised of four production facilities - steelmaking, rolling, pipe and metalware - and infrastructure workshops.

Bobruiskagromash Holding Company. At present JSC 'Bobruiskagromash Holding Management Company' is the largest manufacturer of agricultural machinery and equipment in Eastern Europe. A wide range of products - more than 150 items, combination of the latest trends in advanced engineering with high reliability and affordable price allows the company to take leading positions in the market segments of mounted and semi-trailed agricultural machinery.

Bobruisk Machine Building Plant - manufacturer of centrifugal pumps for the refining, petrochemical, mining, metallurgical, pulp and paper, power, cement industries, as well

as for pumping wastewater liquids at municipal, industrial and rural water supply companies.

VITYAZ is one of the largest industrial multi-industry enterprises in the Republic of Belarus. The production area is represented by various types of products: television equipment; household and medical equipment; plastic products; special equipment and accessories, as well as charging batteries of other vehicles with electric cars.

Gomselmash – One of the largest manufacturers of agricultural machinery, among the leaders in the world market of combine harvesters and other complex agricultural machines. Produces model series of grain harvesters and forage harvesters, crop harvesters and potato harvesters, mowers and other agricultural machinery.

Horizont – is a modern open production ecosystem of full-cycle with a wide range of business areas represented in B2B and B2C markets, such as consumer electronics, industrial electronics and components, lighting.

Integral – The largest manufacturer of integrated circuits, semiconductor devices, electronic and medical products, liquid crystal indicators and modules.

Lidselmash. OOO «Managing Company of holding «Lidselmash» is one of the largest producers of agricultural machinery (potato planting and potato harvesting machinery, soil-handling equipment, seeders, equipment for grass and feed harvesting, forestry machinery, public utilities), grain cleaning and drying facilities and

grain storage facilities in the Republic of Belarus.

Minsk Automobile Plant. Minsk Auto Factory - the flagship of the automotive industry of RB. The company specializes in production of freight, passenger, special and trailer equipment, minibuses. Today under the logo of Minsk Automobile Plant (MAZ) are produced saddles, passenger cars, chassis for installation of various types of equipment, buses - more than 500 models and modifications of «MAZ» car machinery. The MAZ equipment meets the accepted world standards of Euro-3, Euro-4 and Euro-5. The MAZ Dumper is one of the most popular types in the company's model range. Minsk Automobile Factory produces various models of MAZ dump trucks with different technical characteristics. Differ from the MAZ model, mainly by type of body and load capacity.

Minsk motor plant is the largest producer of diesel engines and special equipment in CIS countries. The company produces more than 40 engine modifications in the range of 26 to 312 kW, which are intended for installation on agricultural, road construction and forestry equipment, cars and buses, Power plants and other aggregates with diesel adaptation to customer requirements. The company's car engines comply with environmental standards Euro 4 and Euro 5, tractor engines meet the standards of Stage 3A, Stage 3B, Stage 4. In its work uses own designs and original design and technological solutions, as well as the experience of world manufacturers.

Mogilevliftmash – The leading Belarusian company producing elevator equipment. Currently, the production program of OJSC



ГОМСЕЛЬМАШ



ВИТЯЗЬ



ИНТЕГРАЛ

«Mogilevlittmash» has about 180 basic models of elevators, including passenger, freight, hospital and cottage elevators. Also produced a wide range of spare parts and equipment for the modernization of morally obsolete and physically worn elevators. In addition to the lifts, we produce lifts for physically weak persons, escalators and conveyors, construction lifts and shredders (mulchers), as well as consumer goods.

Minsk tractor plant develops and manufactures wheeled and tracked tractors, motor blocks, trailer and suspension tools for agricultural, construction, forestry and communal works, spare parts, consumer goods, organizes on a license basis their production, provides services for the establishment and implementation of service.

First Battery Company successfully operates in several areas: own production of starter batteries; import and distribution of batteries from leading

foreign manufacturers; sales and promotion of lubricants, as well as lead processing and alloy manufacturing based on it.

Planar – the leader in electronic engineering, produces a wide range of special technological equipment for the production of integrated microcircuits and other micro- and nanoelectronics.





5. Investment potential and prospects for the industry

5.1. Investment and innovation in the industry

Engineering is a complex industry that serves as the material and technical basis for the development of other sectors of the economy. Investment in engineering enhances the innovation potential of the industry and its investment attractiveness. Embracing a wide range of innovation, technology the demand of the global market for the production of the machine-building complex has made it possible to ensure in 2023 the proportion of shipped innovative products in the total volume of shipped products by manufacturing industry organizations under the Ministry of Education at 46, 5 %. The leading industrial enterprises directed their investments as follows.

JSC «BELAZ» developed and manufactured prototype samples of mining dumpers with a load capacity of 55 tons, 110 tons, 180 tons and 220 tons, hybrid quarry dumper with a load capacity of 220 tons; excavator with a weight of 200 tons. Towing trucks are delivered in different versions. In 2023, prototype models of 16-ton, 30-ton and 50-ton loading and transport trucks were developed and manufactured in anti-fill design.

At the Belarusian metallurgical plant, technology for continuous cast blank (blumma) from rail grades has been introduced, and production of wire for welding electrodes for welding carbon and low-alloy steels has been developed (copper plated and polished without coating of 3.0 and 4.0 mm diameter), as well as high-tech steel wire with diameters 0.14, 0.15 and 0.20 mm for cutting mono- and polycrystals of silicon (the only manufacturer of such wire in the CIS). High strength wire for cutting solid brittle materials is in demand in the photovoltaic industry (up to 90% consumption) and microelectronics, where thin (0.12-1.50 mm) The mono- and polycrystalline silicon plates are used as raw materials for the production of solar panels, LED

chips and integrated circuits. In total, 128 types of new innovative products were developed in 2023. In 2024, BM3 plans to continue implementing investment projects. Now they are mainly aimed at improving the environmental aspect of production, so-called green metallurgy, energy saving, and concern dust and gas extraction plants. It is planned to complete such a project on one of the stoves and start the second installation.

At the holding «MTZ-HOLDING» developed, manufactured prototype models and mastered in production tractors of increased technical level with modernized transmission, reinforced cab, updated design and lighting equipment; tractors of increased weight capacity with a central drive; Garden tractor with new design based on modernized transmission; high-clearance tractor with wheels of the breakaway construction with narrow-section tires; forestry tractor. On the basis of a pilot project, the development of components and details on the methodology of contextual design is carried out, followed by the design of annotated 3D models. Within the framework of the implementation of the project on organization of production of modern metal cutting and auxiliary tool OJSC «Orshan Tooling Factory» in 2023, the technologies for production of monolithic carbide tools have been mastered: cutter, end, Spherical end, solid drill bits and COJ-type drilling bits, the technologies of wear-resistant coating application have been mastered. Production of end mills with interchangeable hard alloy plates of different diameters is well established.

Within the holding «HORIZON» of JSC «MPOT» in 2023, a new production for the production of telecommunication and visualization means was created, products (notebooks H-book, monitors, mini PCs H-top) were put into production,



developed and manufactured prototype samples of a number of products (lock of electromechanical door, switching equipment units with LED safety light).

In 2023, the main efforts of «BELAUTOMAX» holding were directed to the creation and development of new models of cargo and passenger equipment MAZ with engines of production of OJSC «Zhirkovichi Bridge Construction Plant» and PJSC «Autodiesel», as well as gearboxes of variable gear production of OJC «Minsk factory gear» instead of engines Daimler and ZF SHIFT. In 2023, the following tractor units were built: three-axle, 52 t full-weight road train, 65 t full-weight road train; chassis (3-axle high-maneuvrability; 4-axle full-mass chassis with three versions (50 t, 44 t, 36 t); two-axle medium-capacity rail (12.5 t full-weight); Dump truck (with rear unloading platform of P-shaped section (full weight 44.8 t; load capacity 30 t and full weight 50 t); three-axle dump truck full weight 33.5 t); Truck crane 16 t with light weight equipment, double axle container garbage truck; Buses (urban 10-meter middle class; suburban average passenger capacity; three-axis tourist high capacity; urban especially large passenger capacity).

OJSC «The holding company «MINSKY MOTOR PLANT» delivered for production of gas engine

MMZ-262NG, 6-cylinder diesel engine with a working volume of 7.12 l. capacity 146.3 kW (199 hp).

The «INTEGRAL» holding organizations delivered for production products: 16-bit dual transceiver microcircuit (MS), integrated circuits (IMS) of operating amplifiers with low input currents; MIS sources of reference voltage; Set of fast-acting multi-purpose EMC and etc. Developed and manufactured prototype products and systems: quartz generator, linear stabilizer MS, 4-channel fast signal sampling and storage device with common control for all channels; MS four-channel voltage comparator; MS multi-standard RFID tag; time counter for SB-1 recirculators and others. The JSC «Electric module» has implemented additive technology of three-dimensional printing for obtaining a physical object from an electronic three-dimensional model.

Within the holding «AMCOR» in 2023 delivered to the production of caterpillar excavator single-bucket universal with nominal capacity of the bucket 1.0 cubic meter and operating weight from 23 tons to 25 tons; manipulator presurader; Loading equipment with a set of interchangeable working units; Tandem driving bridge series 30T; Vibratory roller double-blade. Developed and

manufactured the prototype samples: crawler bulldozers, trencher, timber loader, harvester, forward, vibratory double roller; universal loader, advance manipulators, head of the chisel.

Planar conducted preliminary and acceptance tests of a prototype of a high-performance image generator using spatial-light modulation technology, as well as a laser micromachining unit for electronics materials. New energy- and resource-saving technologies were developed and introduced: technology of manufacturing of tooth structures of linear stepper motor stators for coordinate tables of products by flat profile grinding on a longitudinal grinding machine with numerical control; technology of manufacturing quartz test-templates with submicron structures for the complex of automatic verification of phototemplates. Planar-SO OJSC mastered production of electronic dynamometer and ultrasonic transducer instead of purchased ones. The technology of titanium waveguides production was introduced, which allowed to obtain the necessary frequency characteristics of the ultrasonic transducer. A prototype of the robotised scientific laboratory complex was developed and manufactured.

OJSC «Vityaz» production of: a range of stationary electric charging stations; station

models in plastic wall-mounted cases of Mode 4 DC electric charging stations with updated design and additional charging cable of GB/T standard; super-fast DC electric charging stations with capacity of 120, 300, 350 kW; electric vehicle charging controller.

As part of the implementation of the task of the subprogramme 'Auto-tractor and machine-building' of the State Scientific and Technological Programme 'Innovative machine-building and machine-building technologies', in 2023, BELJI SZAO carried out work on the introduction of the Geely SS11 passenger car into serial production. In 2023, the following was developed: terms of reference, technological documentation, a set of software for technological equipment, programmes and methods of preliminary testing of prototypes with further testing to create a reliable passenger car.

OJSC «Stankozavod «Krasny Borets» the following machines were delivered to production: a CNC depth plane profile grinding machine, a CNC universal cylindrical grinding machine of particularly high precision. The following prototypes were developed and manufactured: grinding centre and CNC spline grinding semi-automatic machine.



A total of 65 investment projects at 54 industrial enterprises worth over USD 1.5 billion were planned for 2024. The Veliky Kamen industrial park alone is implementing 25 projects in the mechanical engineering sector. This year, the Fakel Park of the Chinese Sinomach Corporation was put into operation, which is now being actively filled with new participants leading developments in optical technologies, mechanics, electronics and new materials.

The main vectors of economic development of mechanical engineering for the next few years will be digital transformation and intellectualisation of mechanical engineering sub-sectors, improvement of production organisation based on smart devices and lean manufacturing technologies. The government's industrial policy will be oriented towards the transition to a new technological mode and the implementation of breakthrough high-tech projects. Machine-

building on a new technological basis with elements of the Industry 4.0 concept, as well as those industries that will ensure an increase in the depth of processing of local raw materials, will receive priority development.

New conditions for investment activities are emerging in the country. Cooperation with Russia (programmes within the framework of the Union State) and China (signing of an agreement on the creation of a free trade zone for services and investment) is intensifying. The most significant areas for investment in the country now are those related to technological sovereignty, import substitution, digitalisation, logistics, agro-industrial complex.





5.2. The export potential and prospects of the industry

Increasing the level of production localization is the key trend in the machine-building industry. In the coming years, BELAZ intends to modernize the technological processing complexes. Significant projects are being implemented at “Gomselmash” in terms of creating its own component base.

OJSC “Minsk Motor Plant” Holding Managing Company” is currently developing an innovative project focused on the technology implementation and organization of modern automated production of cast iron blocks and cylinder heads. The project of the first stage construction of the facility “Production of high-precision, high-strength iron casting” has already been realized.

Within the framework of the program “National Electric Transport” the development of the component base of electric transport is carried out, which includes electric and hybrid propulsion systems (based on asynchronous engines), accumulators of energy (lithium-ion and sodium-graphene accumulators), electric charging stations.

In addition, it should be noted that the Union State roadmaps have been signed. A total of 27 joint import substitution projects have been approved, 19 of which are already being implemented. Among the top priority sectors within the joint development are aircraft engineering, modern unmanned system development, machine building (including machine-tool building), and microelectronics.

Belarus and Russia are also actively unifying technical standards and regulatory acts governing the use of new technologies. This facilitates the creation of a unified legal framework for innovative development, which is particularly important given the growth of the high-tech

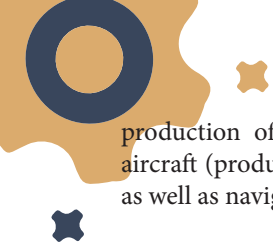
sector and the emergence of new legal challenges related to artificial intelligence, cybersecurity, and data management.

Recently, the field of digital technologies, including developments in artificial intelligence (AI) and cybersecurity, has been gaining increasing significance. Both countries see great potential in leveraging AI and digital solutions to modernize various sectors of the economy, such as energy, logistics, and agriculture.

Belarusian-Russian collaborative projects are being implemented at the interstate level to develop control and data analysis systems for optimizing and adapting production processes. Artificial intelligence can be applied in the agro-industrial complex and in ensuring food security. Thanks to the introduction of AI, automated control systems for agricultural machinery, weather conditions and product quality can significantly improve crop yields and the quality of produced raw materials.

Digitalization and AI development raise important challenges for cybersecurity. In particular, Belarus and Russia are in the process of developing common cybersecurity standards, approaches and technologies to ensure the protection of government and corporate data. Belarusian-Russian cooperation is carried out not only at the state level, but at the regional level as well.

For the last few years Ulyanovsk region has been an active partner of Belarus in the sphere of aircraft construction and microelectronics, for instance, in cooperation with Minsk Civil Aviation Plant No. 407, Orsha Aircraft Repair Plant and Aircraft Repair Plant No. 558. The Belarusian side intends to continue developing cooperation with Ulyanovsk region in the



production of components and electronics for aircraft (production of control elements, sensors, as well as navigation and control systems).

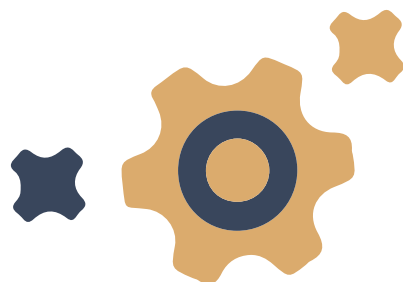
Ryazan region is actively developing cooperation with Belarus in the production of high-tech products and unmanned systems. These systems have a broad range of possible applications: starting from agriculture and logistics up to the defense sector and infrastructure monitoring. The projects involve both the production of aircraft and the development of artificial intelligence systems responsible for autonomous control. The unmanned systems project includes not only direct production, but additionally the development of supporting technologies, such as video surveillance systems, data processing and large-scale data analysis.

Within the framework of integration in high-tech manufacturing, Belarus and Russia are also focusing on the development of co-production of various components such as semiconductors and microchips used in a number of industries, ranging from automotive and aviation to household electrical appliances. In terms of the microelectronics industry, Belarus already has the competence to develop unique products with a high degree of precision. This brings Belarusian microelectronics to the level of international manufacturers, giving them the opportunity to compete in the CIS market and beyond.

Automotive industry, which covers the production of trucks, tractors, and agricultural machinery, is another promising area of cooperation. The Republic traditionally holds leading positions in this industry, exporting machinery to Russia, CIS and other foreign countries. Collaborative projects with Russian enterprises contribute to optimizing logistics processes, reducing production costs and introducing new automated solutions that make transport more efficient and cost-effective in operation.

Noteworthy is Decree No. 356 of November 15, 2023 “On the Draft of International Treaty”, which approved the draft agreement between the Government of the Republic of Belarus and the Government of the People’s Republic of China on trade in services and investment. The agreement is aimed at creating a free trade in services zone between Belarus and China, a transparent, liberal and favorable investment regime for attracting investments. This is particularly of significance for the development of the Great Stone Industrial Park, whose one of the directions of work is machine building. The total volume of investments declared by the park residents exceeds 1.4 billion U.S. dollars. More than 50% of all investments in the park are from China. Exports of goods amounted to almost 100 million dollars. Currently, there are 55 companies from the People’s Republic of China as residents of the park.

Apart from that, this year a major strategically important document has been signed – a comprehensive strategy of Belarusian-Chinese joint industrial development. This offers an opportunity to establish joint enterprises not only in Belarus, but in China as well. Such cooperation will enhance the competitiveness of companies and contribute to the promotion of goods and services to the markets of third countries.



6. Investment Climate

6.1. Macroeconomic Indicators of the country

Indicator	2019	2020	2021	2022	2023
Gross Domestic Product (GDP), billion USD	64.41	61.38	69.69	72,80	71.82
Population (end of year), thousand people	9410.30	9349.60	9255.50	9200.60	9155.98
Average annual number of employed population, thousand people	4334.20	4319.60	4284.50	4215.90	4152.20
Nominal accrued average monthly salary, USD	522.57	514.39	568.67	620.35	632.18
Average assigned pension (end of year), USD	206.23	197.87	202.65	239.94	230.14
Industrial output, billion USD	55,32	48.54	61.42	64.51	62.23
Agricultural output in all categories of farms, billion USD	10.38	9.68	10.28	12.10	11.01
Retail turnover, billion USD	23.72	21.94	23.68	25.68	25.38
Paid services to the population, billion USD	6.12	5.13	6.03	6.50	6.71
Fixed capital investments, billion USD	13.77	12.14	12.21	10.57	11.88
Foreign trade turnover of goods and services, billion USD	84.40	72.40	94.90	89.20	86.67
Exports	42.00	37.20	49.40	46.80	43.70
Imports	42.40	35,20	45.50	42.40	42.97
Trade balance	-0.40	2,00	3.90	4.40	0.73

6.2 Preferential regimes

General guarantees

Belarusian legislation provides the following basic guarantees to investors:

- the right of private property and its protection without discrimination
- protection against illegal actions of state bodies, which violate rights of investors and/or cause losses
- equality of rights for national and foreign investors
- free repatriation of profits
- protection of investments against nationalization and requisitioning

By law, nationalization can only be carried out on the basis of public necessity and subject to appropriate compensation. Compensation for nationalized property must be paid in a timely manner and include the value of the nationalized property and other losses caused by nationalization. The legislation also establishes a number of circumstances under which requisitioning is possible. These are mainly emergencies such as natural disasters, accidents, epidemics and epizootics, as well as when the public interest requires these measures.

Investment agreement

- VAT deduction in full amount
- exemption from import duties and taxes on import of technological equipment, raw materials and materials into the territory of the Republic of Belarus
- exemption from reimbursement of losses in forestry and agricultural production

Small and medium-size cities, rural territories

- exemption from income tax for 7 years
- exemption from real estate tax for 7 years
- exemption from import customs duties on imported (imported) goods contributed to the statutory fund, from the date of manufacture of which not more than 5 years have passed for some commodity items
- exemption from profit tax in the part of profit received from sale of goods of own production; exemption from income tax for 7 years

Bremino-Orsha

- 0% VAT and duty on customs
- 0% corporate tax for 9 years
- 0% property tax for 20 years
- 0% VAT for 15 years at realization, rent (leasing) to residents of real estate objects till 1 January 2033
- 0% income tax, tax on dividends and similar income for 5 years from the announcement of profits (for the founders of resident companies and joint ventures)
- 0% tax on dividends and similar income from the date of declaration of profits up to 1 January 2033 (for joint ventures if accrued from a management company)
- 5% on royalties until January 1, 2028

Free economic zones (FEZ)

- exemption from profit tax when selling products for export and to other FEZ residents
- exemption from real estate tax on properties in FEZ within three years of registration
- exemption from land tax and land lease for the period of design and construction, but for no longer than 5 years from the date of registration. Exemption irrespective of the direction of their use (if sold for export or to other FEZ residents)
- exemption from payment for the right to conclude a land plot lease agreement

Industrial park «Great Stone»

- exemption from income tax on revenue from the sale of goods (works, services) of own production within ten years from the date of registration as residents
- exemption from property tax on properties
- exemption from tax on land plots
- until 1 January 2027, the income tax rate is 9%
- full deduction of VAT amounts charged for imported goods (works, services) as well as property rights used in designing, construction and equipping of buildings and structures in the Industrial Park
- exemption from customs duties and VAT on goods (production equipment, components and spare parts, materials and raw materials) imported to Belarus for the implementation of investment projects

The choice of preferential treatment will depend on a number of factors and components of the investment project, such as the need to create infrastructure facilities, export orientation of the project, implementation of innovative technologies and many others.

More detailed information about the business environment, investment opportunities in the Republic of Belarus can be found on the website of the National Agency of Investment and Privatization of the Republic of Belarus at www.investinbelarus.by/en/business-environment, as well as to get necessary advice and assistance in implementation of the investment project in Belarus by contacting representatives of the Agency at the contacts specified on the website www.investinbelarus.by/en/contacts.

National Agency of Investment and Privatization

The Agency is a state institution that provides assistance at no cost or foreign investors interested in launching a business in Belarus:

- provision of information about investment opportunities, preferential regimes and benefits granted, economic sectors and legislation
- provision of up-to-date information about investment projects
- assistance in selection of sites and premises
- search for prospective partners for investment projects, arranging meetings and negotiations for establishing cooperation
- providing a platform for negotiations and support during negotiations
- organization of visits to the Republic of Belarus (schedule development, visa support)
- representation of investor's interests during negotiations with governmental representatives concerning implementation of investment projects, as well as improvement of investment climate in the Republic of Belarus
- aftercare

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