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## Innovative development of the export- and raw-material-oriented region

The East Kazakhstan region of the Republic of Kazakhstan with the prevailing share of mining and metallurgical production is one of the main industrial regions of the country. The territory of the region has a large share of the mining and smelting industry concentrated, as well as the domestic engineering enterprises. Within the framework of this article, the general social and economic situation of the East Kazakhstan region will be analyzed with determination of the mining sector role in the regional economy. There are many models of innovative development. Thus, it is suggested to propose an innovative development model of the region taking into account the economic specifics of the region. The abstract is devoted to the need for economic growth and the welfare of the region through the innovative activities development. The need for innovative development of the economy of the export- and raw-material-oriented region is due to the problems of domestic social and economic development related to low growth rates of the gross regional product, a notable drop in quality and living standards, an unfavorable environmental situation, and a growing population outflow outside the region. Some aspects of the social and economic situation of the East Kazakhstan region have been reviewed, and a model of innovative development has been proposed with due account for the specifics of the regional economy. Taking into account the specifics of the region, the challenges requiring solution have been identified. At the same time, the conditions to facilitate the establishment of innovation-driven economy of the region have been defined.

*Keywords:* mining, metallurgy, diversification, raw materials, economic growth, innovative development.

The average monthly salary in the East Kazakhstan region is 13.6 percent lower than the republican level on average. This difference is probably conditional with the developed industry in the region (Fig. 1-3).

*For reference:*

The average monthly salary in the mining and smelting industry is one of the highest in Kazakhstan (Fig. 1).



Figure 1. Average monthly salary level in the mining industry (nationwide data) (source: [1])

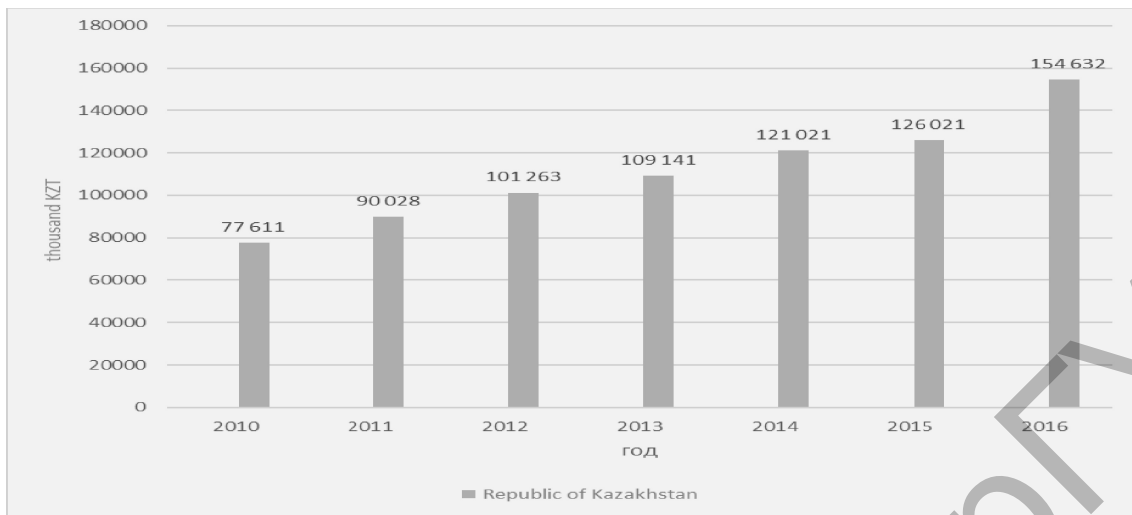


Figure 2. Average monthly salary across Kazakhstan (source: [1])

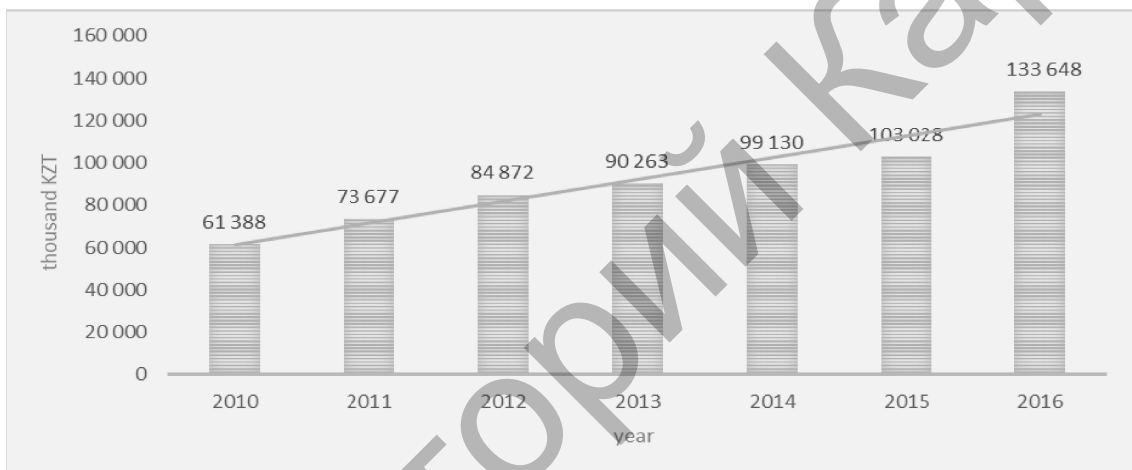


Figure 3. Average monthly salary across East Kazakhstan region (source: [1])

A polymetallic layer of Mining Altai goes through the territory of the East Kazakhstan region ensuring the unique deposits of polymetallic ores with the content of such non-ferrous metals as lead, zinc, copper to be discovered and exploited.

According to the quantity and variety of useful components contained in polymetallic ores, the East Kazakhstan region's fields reign supreme in Kazakhstan and the CIS.

The precious and rare earth metals such as silver, gold, titanium, tantalum, magnesium, cadmium, tellurium and other metals are won concurrently. In addition, there are deposits of antimony, mercury, brown and bituminous coal, oil shale, limestone, granite, marble, ornamental stones, graphite and other minerals on the territory of East Kazakhstan region.

The territory of the East Kazakhstan region has a large number of explored deposits of minerals with reserves that provide the region's needs in the mineral resources of non-ferrous metals (Ridder-Sokolnoye, Tishinskoye, Maleyevskoye, Nikolayevskoye, Artemievskoye, Orlovskoye, etc.), gold (Bakyrchikskoye, Suzdalskoye, Mizhek, placers at the Kurchum river, etc.), rare metals (Bakennoye, Belaya Gora, Jubileinoye, Akhmetkino), coal and oil shale (Karazhira, Kendyrlykskoye, Bobrovsko-Belokamenskoye), nonmetallic feed (refractory raw materials, ceramsite and bentonite clay, limestone, brick and cement loams, glass raw materials and construction materials), mineral ground water and potable water (Ust-Kamenogorskoye, Leninogorskoye, Bogatyrevskoye, Kuludzhunskoye fields) [2].

23.4 % of the balance sheet reserves of lead, 44.4 % of zinc and 44.5 % of copper (of the republican reserves) are concentrated in the territory of the region. At present, there are 250 subsoil use facilities in the region, including 227 for solid minerals, 1 for hydrocarbon raw materials (oil) and 22 for groundwater and common minerals.

This list is constantly updated. For example, in 2014, as a result of additional site exploration, promising deposits were discovered: Tokchurinsky (gold), Zhosaly (gold, polymetals), Verkhne-Espensky, Issorsky (rare metals, rare earth metals), Unbet (molybdenum), Changskoye (gold) and Arsenievskoye deposits (copper, molybdenum, gold).

Special attention is paid to rare earth metals - tantalum, yttrium, niobium, rhenium and other types highly anticipated in the field of nanotechnology. The Zharma-Saursky and Chingiz-Tarbagataysky geological areas of the East Kazakhstan region are very promising in this respect. The most studied one is the above Verkhne-Espinskoye deposit in Ayagoz district. There is a site «Sandyktas-1» seven kilometers away from it (on one ore field), as well as a rare-earth mineral occurrence similar to it called «Anomaly-308». The same group includes rare-earth sites such as Rakhmanovsky in Kurchum and Kalbinsky in Ulan districts.

Priority is given to deposits associated with the development of the single-industry cities of Zyryanovsk and Ridder, which core of the economy is the mining industry. In the near future, geological exploration is planned to identify additional gold and polymetal resources in the Zyryanovsk district (Paryginsky site, Revnyushenskaya texture, Narymskaya metallic geochemical area), as well as geological exploration at the East Starkovskoye field in Ridder [3].

However, the availability of such diverse natural resources does not limit the population of the region to carry out labor activity exclusively in this area, and furthermore, the development of the raw material orientation does not ensure economic growth. In this connection, it is necessary to diversify the production activities of the region.

Following conditions should be ensured to establish the innovation-driven development of the region:

- Given the region specifics, the further development of the machine-building complex as an industry that determines the technical development status of other industries, as well as the availability of conditions for production engineering of innovative products;
- Innovation typically requires investment, thus, a favorable investment climate;
- Developed scientific and educational capacity.

In the East Kazakhstan region, the machine-building complex is one of the rapidly growing industries in the region. There are 158 enterprises operating in the industry, including 12 large, 9 medium-sized and 137 small enterprises.

The largest share in the structure of industrial production of all types of enterprises is occupied by large and medium-sized enterprises, their contribution to the volume of machine building exceeds 80 %.

The leading enterprises are Asia Auto JSC, Kazzincmash LLP, Ust-Kamenogorsk Valve Plant JSC, Vostokmashzavod JSC, Ust-Kamenogorsk Capacitor Plant LLP, KEMONT JSC, Semmashzavod JSC, Semey Engineering JSC, Hydrosteel LLP, KazElectroMash LLP, SemAz LLP, Mashzavod LLP, etc.

Machine-building enterprises produce oilfield, mining and metallurgical equipment, cars and trucks, buses, wheeled tractors, capacitors and other electrical products, pumps of various modifications, cable and other products

ASIA AUTO JSC, being a member of the BIPEK AUTO-Asia Auto group of companies, is the largest machine-building enterprise in the region and one of the largest enterprises in Kazakhstan.

Asia Auto Kazakhstan JSC implements the project named «Construction of a Full-Cycle Car Factory and a Technology Park for Production of Automobile Components in Ust-Kamenogorsk», which provides for 4,000 jobs.

SemAz LLP

The main activity of the enterprise is assembly of vehicles and agricultural machinery.

Currently, the enterprise has mastered the assembly and serial production of nine models of the «Belorus» tractor and «Shacman», «Ural», «Foton», «Gazelle» and «FAW» trucks.

The main market outlet for products is the regions of the Republic of Kazakhstan.

Within 2009-2016, 8066 units of the «Belarus» tractors and 2234 trucks have been manufactured.

According to the Kazakhstan Industry Development Institute, there was a decline in the output of the whole machine-building industry in 2016 (IFO 85 %) [4].

In addition, the main driver of technological modernization and complication of the world production sector so far is the penetration of digital and information and communication technology in the industry, which shapes the basis for the world trend «Industry 4.0», which was born in the German industry.

In addition, it should be noted that tangible engineering increases the pace of application and introduction of software in production cycles as a link with other production processes, equipment and machines to increase the efficiency of using production resources and complete internetization of engineering. Moreover,

the long-term plans for the development of machine-building industry in Kazakhstan are oriented, in particular, taking into account the world trends, to this sector.

According to forecasts of a number of marketing companies, such as Strategy & PwC, KPMG, Technavio, the world concept of «Industry 4.0» influences the market of the industry sectors, apart from the motor vehicle industry, such as aerospace and defense industry, electrical and electronic equipment, medical devices and industrial machinery [5].

The following trends will have an influence within the «Industry 4.0» program:

– distribution of manufacturing automation: a growth of investment in global process automation is expected to continue (about 6 % per annum), and up to \$120 billion by 2019, according to some estimates;

– use of additive technologies: it allows to reduce consumables from 30 % to 70 % in comparison with conventional technologies;

– augmented reality - existing solutions already cover many areas, such as tools for process automation and increasing productivity, training employees, reducing product defects, increasing the efficiency of logistics processes, and ensuring occupational safety. This solution is already being applied at the Fiat Chrysler Automobiles concern (FCA);

– Internet of things (IoT) - the ideology of the Internet of things is aimed at increasing the efficiency of the economy by automating processes in various fields of activity while a person drops out of the process. (Preliminary Report of the Ministry of National Economy of the Republic of Kazakhstan «Preparing Kazakhstan for the Fourth Industrial Revolution»).

### *Conclusion*

Taking into account the above and analyzing the possibilities of innovative development of the export- and raw-materials-oriented region, we may conclude that the current level of development of the machine-building complex of the region, the investment climate, the level of development of the scientific and educational capacity do not allow establishing a cluster of high-tech enterprises in the near future. This does not mean that the innovative development of the economy with the priority development of extractive industries is impossible at all; it is possible, but with on its own innovative development path.

As a rule, a high-tech model is applied for innovative development, but there is an alternative method for the development of innovation, which is the high-hume model [6].

This model is most acceptable for Kazakhstan specificity due to the fact that it is based on borrowing and distribution rather than the creation of new technologies in all areas of activity; and it provides for the development of separate industries, including light and food industries, creative industry and recreation based on innovation.

An alternative model of innovative development does not imply the investment of significant funds in the development of the basic and sectoral science of the region. It is based on the practical application of regional scientific developments and the borrowing of technological and product innovations from the outside to introduce them in all areas of activity, including in extractive industries.

The advantage of the imitational innovative development model is that it allows the fastest possible transition of the region's economy to innovative development; it does not lay a significant increase in capital expenditures, and directs the development of science and education to the applied nature of research that gives the maximum commercial effect.

The high-hume model is aimed at the creation and application of science-intensive, multifunctional, multipurpose technologies that may cause a chain reaction of innovations and ensure the development of high-tech industries [7].

This model is the most acceptable for regions of Kazakhstan lacking of highly developed, high-tech scientific and educational capacity, but with a sufficiently shaped production complex, potentially attractive for domestic and foreign investors, allowing efficient development of industrial production and extraction of minerals through the introduction of technological and product innovations.

Thus, the following challenges should be solved for the transition of the economy of the East Kazakhstan region to innovative technologies, the achievement of sustainability of the main economic indicators regardless of changes in the raw materials market:

- 1) development the region's labor potential;
- 2) improving the quality of workforce;
- 3) achieving a balance between vocational education and labor demand.

In turn, the implementation of the challenges will require:  
 optimization of directions and levels of professional training taking into account the supply and demand in the regional labor market;

harmonization of the system of requirements by the government and business structures to the qualification component in the system of personnel training at various levels;

forecasting the additional demand for labor in the vocational compliance with the innovative development directions of the region's economy as a whole and individual enterprises in part;

determining the directions for improving the personnel training in compliance with the strategic directions of the region's economy development;

development of measures to improve the vocational education system in order to ensure the correspondence between demand and supply for skilled labor.

Following conclusions may be drawn from the results of the research carried out.

Selection of the region's innovative development model is crucially depends on the production profile established, the level of high-tech industry development, investment attractiveness and the condition of the scientific and educational complex development;

Depending on the type of region's economy, we may suggest a model based on high-level development of basic science and the system of higher education, which serve as the basis for high-tech industry (high-tech model), or for the imitational model of innovative development (high-fume model);

The most acceptable model for the region having a developed sector of extractive industries and oriented to development of mineral production is the innovative development model based on practical introduction of regional scientific developments and borrowing of high-tech from outside (high-fume model);

Shaping of innovation economy in the region with a developed sector of extractive industries is a long-term process, which must include the preliminary stage. The main role at this stage of economic development is devoted to state regional authorities, which must provide the legal base for such a transition;

The nascent stage of innovative economy must have a system of tax incentives of innovative activity and private-public partnership in development of high-tech production developed, the framework for venture capital funding of innovations established and the economic growth areas shaped;

The stage of innovative economy development should make the main emphasis on implementation of the state target programs of the profile branch development and the shaping of a training system oriented at innovative development of the region's economy.

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## Экспорт-шикізаттық бағыттылықтағы аймақтардың инновациялық дамуы

Тау кен-металлургиялық өндірістің үлесі басым келетін Қазақстан Республикасының Шығыс Қазақстан облысы елдің негізгі өнеркәсіптік өңірлерінің бірі болып табылады. Өңірдің аумағында тау кен-металлургиялық саланың үлкен үлесі, сондай-ақ отандық машина құрылысының кәсіпорындары шоғырландырылған. Осы мақаланың шеңберінде өңірдің экономикасындағы тау-кен секторының рөлі анықталған. Шығыс Қазақстан облысының жалпы әлеуметтік-экономикалық жағдайы талданатын болады. Инновациялық дамытудың көптеген үлгілері бар. Осылайша өңірдің экономикалық ерекшелігін

ескере отырып, өңірдің инновациялық дамуының үлгісін таңдау болжанды. Мақала инновациялық қызметті дамыту арқылы өңірдің игілігі мен экономика өсімінің қажеттілігіне арналған. Экспорт-шикізаттық бағыттылығы бар өңірдің экономикасын инновациялық дамытудың қажеттілігі жалпы өңірлік өнім өсімінің төмен қарқынымен, өмір сүру деңгейі мен сапаның елеулі құлдырауымен, қолайсыз экологиялық жағдаймен, өңірдің шегінен тыс халықтың кетумен байланысты ішкі әлеуметтік-экономикалық дамудың мәселелерімен шартталған. Шығыс Қазақстан облысының әлеуметтік-экономикалық жағдайының кейбір аспектілері қарастырылды және өңірдің экономика ерекшелігін ескере отырып, инновациялық даму үлгісі ұсынылды. Өңірдің ерекшелігін ескере отырып, шешуді талап ететін міндеттер айқындалды. Сонымен бірге өңір экономикасының инновациялық рельестерге ауысуына ықпал ететін шарттар белгіленді.

*Кілт сөздер:* пайдалы қазбаларды өндіру, металлургия, диверсификация, шикізат өнім, экономикалық өсу, инновациялық даму.

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## Инновационное развитие региона экспортно-сырьевой направленности

Восточно-Казахстанская область Республики Казахстан, с преобладающей долей горно-металлургических производств, является одним из основных промышленных регионов страны. На территории региона сконцентрирована большая доля горно-металлургической отрасли, а также предприятия отечественного машиностроения. В рамках данной статьи проанализировано общее социально-экономическое положение Восточно-Казахстанской области, с определением роли горно-рудного сектора в экономике региона. Существует множество моделей инновационного развития. Таким образом, предполагается предложить выбор модели инновационного развития региона с учетом экономической специфики. Показана необходимость роста экономики и благосостояния региона посредством развития инновационной деятельности. Необходимость инновационного развития экономики региона экспортно-сырьевой направленности обусловлена проблемами внутреннего социально-экономического развития, связанными с низкими темпами роста валового регионального продукта, заметным падением качества и уровня жизни, неблагоприятной экологической обстановкой, растущим оттоком населения за пределы региона. Рассмотрены некоторые аспекты социально-экономического положения Восточно-Казахстанской области и предложена модель инновационного развития с учетом специфики экономики региона и выделением задач, которые необходимо решить. Определены условия, которые будут способствовать переходу экономики региона на инновационные рельсы.

*Ключевые слова:* добыча полезных ископаемых, металлургия, диверсификация, сырьевые товары, экономический рост, инновационное развитие.

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