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FORMATION OF MECHANISMS FOR DIGITALIZATION OF THE OPERATIONAL AND LOGISTICS PROCESS OF NON-FERROUS METALLURGY BUSINESS ENTITIES

The metallurgical complex of post-Soviet countries determines the directions of development of national economies. The share of metallurgy in the formation of Ukraine's GDP is 3–4%, and industrial production in Ukraine is 20%. In the context of globalization and integration, the steel products market is the most important for our country. Ukraine has large reserves of iron and manganese ores, thermal coal, there are operating metallurgical enterprises with individual elements of modern technologies and still highly qualified personnel, as well as large potential needs for modernization of the country's existing metal fund. The metallurgical industry is a strategic component of national production, the main budget-forming and export sector of the ukrainian economy [1].

For many years, it has been proven that Ukraine has a powerful resource potential for the development of non-ferrous metallurgy [2], from which copper, zinc, lead and nickel industries can be distinguished, and there are also a significant number of deposits that can create conditions for the development of critical metals: cobalt, molybdenum, gallium, germanium [3].

In modern conditions of rapid innovation development, new material resources play a significant role: improved alloys of titanium, magnesium, aluminum and honey are used in the military and aerospace fields, permanent magnetic materials India, gallium and rare earth elements are necessary for wind turbines, tungsten, titanium, germanium provides acceleration of the development of high-temperature superconductor technologies, cobalt, manganese and lithium played a crucial role in the construction of electric vehicles. Thus, it can be argued that non-ferrous metallurgy is a significant part of scientific and technological progress.

The growing dynamics of production can be observed in light non-ferrous metals (aluminum, magnesium) and copper with titanium. During the entire study period (2014-2020), Ukraine produced an average of 1,531–1,701. 5 thousand tons of aluminum and 20.2 – 23.7 thousand tons of copper. 385.5–682.2 thousand tons of titanium and 1451.5–1826.8 thousand tons of magnesium ore products were consistently produced annually. During the study period, downtrends affect nickel, gallium, zirconium, and lead. Production of nickel for the period 2014–2020 decreased by almost 21%, gallium by 70%, zirconium and lead by 17–18% [4].

The mode of production and operation in the field of non-ferrous metallurgy has characteristic features: raw materials change frequently, production processes involve physical and chemical reactions, and the mechanisms involved are complex; the production process is continuous and cannot be stopped, and problems in part of the process will inevitably affect the quality of the final product. The composition of raw materials, the condition of equipment, process parameters, and product quality in some industries cannot be measured over time or comprehensively. The above-mentioned characteristics of the non-ferrous metallurgy industry are manifested in the difficulties of measurement, modeling, control and optimization, and decision-making. Therefore, it is possible to overcome these difficulties in the operational activities of industrial enterprises through digital technology tools (industry 4.0).

The key technologies of Industry 4.0 implemented in companies are a set of innovative solutions consisting of: the Internet of things, Big Data, Blockchain, Cloud Computing, human-machine interaction, robotics, open source software and artificial intelligence [5]. Digitalization of production processes of non-ferrous metallurgy subjects with the help of artificial intelligence will form the architecture of a new market economy, which will ensure vertical integration of intra-organizational production systems and increase their stability in the conditions of market dynamics.

Thus, we have proved the relevance of the development of the non-ferrous metallurgy economy based on digital tools of the Industrial Revolution 4.0. In general, it can be argued that there is a two-tier strategic cross-industry value chain: the upward part of the production chain of new metal materials mainly includes the extraction and smelting of non-ferrous metal resources, and the lower part is associated with the production of advanced metal materials products that are needed in key applications. The use of Industry 4.0 tools to form the operational and logistics system of non-ferrous metallurgy subjects will provide an opportunity to create vertical cross-industry integration and provide flexibility in designing sales

opportunities in response to constant changes in consumer needs and market uncertainty.

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