

Integration experience of Belgorod State National Research University into innovation system of Belgorod Oblast and its leading regional industrial mining and metallurgical cluster

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This article gives the results of development of Belgorod State National Research University as leading Russian university, with its integration into innovation system of Belgorod Oblast by expansion of the range of education and research services, and by realization of innovative projects for the region. Belgorod State University started to establish a university world-level self-developing industrial-financial complex. There is considered the efficient interaction of the University with mining enterprises of Belgorod Oblast, which allows to unlock the innovative potential of the participants and significantly promotes the social-economic and commercial development of the region.

The profile research priority of Belgorod State National Research University is to strengthen its position as a leading platform for outsourcing research for iron ore industry enterprises of Belgorod Oblast, and to increase the University applied research competences for the benefit of innovative development of the latter.

High-qualified personnel is another contribution of Belgorod State National Research University to regional economy, which is exceptionally important for its successful modernization and technological development.

Key words: national research university, regional innovation system, regional industrial clusters, university innovation infrastructure, "education-science-production" integration, improvement of university competitiveness.

Nowadays, development intensity and competitiveness of leading Russian universities are determined by efficient integration of science, education and industry, which can be efficiently used as an instrument for building of new institutional model of university: an "education – scientific – industrial" complex, which activity is to shoulder the main burden in human resources provision and scientific support for innovative development of Russian economy. Among the important peculiarities of such complex, there is considered its advanced cooperation with real economy sector, and its leading role in regional scientific and industrial clusters (including industrial enterprises, technical innovation zones, engineering organizations, technology transfer centers, design offices, etc).

After obtaining a national research university status in 2010 (within the National Selection of Best University Development Programs), Belgorod State University started to establish a university world-level self-developing industrial-financial complex.

Belgorod State National Research University has the following priority areas:

- high technologies for creation and processing of nano-materials for technical purposes;
- nano-technologies and nanomaterials in biology, medicine and pharmacy;

- space, geoinformation, information and telecommunication technologies for efficient management of sustainable social-economic development of territories.

Growth of regional innovation component is carried out not only by cooperation of the University with regional business in implementation of large-scale projects, financed from the state budget, but also by the University, providing the outsourcing services of research and development on contractual basis. Thus, since 2007, the University Research Laboratory of Ion-Plasmatic Technologies Development and Implementation has been carrying out the intensive research, aimed at modernization of special technological equipment for thin coatings, laying on cutting tools, commissioned by LLC "SKIF-M" (one of leading metal-working enterprises in the region). The University scientists created a special production floor for application of vacuum hardening coatings. The use of "SKIF-M" cutters with nano-structured super-hard coatings, developed by the University scientists and "SKIF-M" specialists, allows to improve the productivity of titanium and heat-resistant nickel alloy processing products by 1.4 times (in comparison with the best world analogs). Currently, the "SKIF-M" cutters are used at most Russian aircraft plants during processing of high-strength titanium alloys. These cutters are also exported for the needs of aerospace and machine-tool industries to 50 countries, including the United States (Boeing, MAG Cincinnati), Germany

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(Airbus, Handtmann A-Punkt Automation GmbH, Chiron-Werke GmbH & CO KG, Hermle AG), Belgium (ASCO), India (Hindustan Aeronautics Limited), etc.

The Agreement on Cooperation between the University and the Association of Mechanical Engineers of the Belgorod Oblast was signed in 2013. High demand of the University for a number of members of the Belgorod engineering cluster was the precondition of this agreement.

Nowadays, several joint projects are implemented as a part of this agreement:

- development of experimental products and carrying out of experiments for definition of efficiency of sealing elements and billets, made of wear-resistant fluorine-complexes for stop and control valve of oil-and-gas complex of chemical and energetic industries (together with JSC “Energomash – Belgorod Power Machine Building Plant”);

- production tools (casting molds) for manufacturing of serial industrial products, made of polymer and composite materials; improvement of protective polymeric coating formation technologies for metal-constructions, applied in agro-industrial complex; and development of technologies of obtaining of soil-cultivating equipment materials.

Taking into account the fact that Belgorod Oblast has more than 50% of Russian iron ore reserves, which social-economic development is basically determined by established and functioning mining and smelting cluster, Belgorod State National Research University makes special efforts to further profiling in the sphere of mining and geological education and to increasing of demand for its scientific achievements by mining and smelting enterprises of Belgorod Oblast [1, 2]. In order to develop the design integration, Belgorod State National Research University signed the agreements on mutual cooperation with large regional mining enterprises: JSC “KMAruda”, JSC “Stoilensky Mining and Beneficiation Plant”, JSC “Lebedinsky Mining and Processing Plant”, JSC “Belgorod Mining Machinery Plant”, etc. Besides, the University steadily increases the volume of its cost accounting agreements, concluded with the considered companies; and improves the quality of specialists’ training, required in mining complex.

The most efficient work is carried out by the Faculty of Mining and Natural Resource Management of Belgorod State National Research University, which has recently introduced a number of new training areas and specialties, commissioned by regional mining enterprises. Introduction of new training areas and specialties in the field of geology and mining is exceptionally significant for provision of mining complex of the Belgorod Oblast with required human resources, balanced in numbers, training areas, qualification and age structures, taking into account their renewal. Nowadays, the Faculty of Mining and Natural Resource Management carries out training of over 800 students, educated in six specialties, five undergraduate and three graduate programs [3, 4].

High quality of training at the Faculty of Mining and Natural Resource Management of Belgorod State National Research University is supported by the sophisticated material

and technical base, which includes specialized laboratories for advanced training and research: Landscape-Geochemical Training Laboratory; Computer Simulation Laboratory; Laboratory of Ecological Diagnostics and Monitoring Studies; Regional Environmental Research Laboratory; Laboratory of Geographic Information Technologies (GIS); Soil Mechanics Laboratory; Mineralogy and Petrology Laboratory; Spectroscopic Laboratory; Engineering Geology Laboratory; Laboratory of Complex Subsurface Development and Quality Management of Mineral Resources.

In addition, the academic activities at the Faculty are carried out by the Institute of Geography of the Russian Academy of Sciences (Moscow) and JSC “VIOGEM” (Belgorod). The Faculty also works closely with the following enterprises: Center of Collective Use of Scientific Equipment “Federal and Regional Centre for Aerospace and Ground Monitoring of Objects and Natural Resources”; small innovative enterprise LLC “GeoStroyMonitoring BelSU”; self-supporting Research Laboratory of Mineral Processing. Moreover, the scientists of Belgorod State National Research University, together with the scientists of National University of Science and Technology “MISIS” and Tula State University, work jointly on geoecological aspects of the development of mineral deposits [5, 6]. At the same time, together with Scientific and Technical Center “NOVOTEK”, the University carries out the researches for improvement of underground mining technologies [7].

In order to improve the practical orientation of training and specialists’ training quality for mining complex of Belgorod Oblast by obtaining of feedback in the “production-university” chain, the Faculty of Mining and Natural Resource Management of Belgorod State National Research University made the practical training agreements with over 50 enterprises and agencies, including JSC “VIOGEM”; JSC “Stoilensky Mining and Beneficiation Plant”; LLC “Belgorodgeologiya”; JSC “Belgorod Mining Company”; State Enterprise “Belgorodgeomonitoring”; Federal State Institution “Centre of Agrochemical Service” Belgorodsky” etc.

The profile research priority of Belgorod State National Research University is to strengthen its position as a leading platform for outsourcing research for iron ore industry enterprises of Belgorod Oblast, and to increase the University applied research competences for the benefit of innovative development of the latter. Research and technical activities of the University scientists for increasing of mining complex benefit in the region have the following results: development of production schedules and optimal parameters of beneficiation process, using the high-production equipment at JSC “Lebedinsky Mining and Processing Plant”; development and validation of crushing scheme at crushing and concentration plant; development of production schedules for manufacturing of fluxed pellets and magnetite concentrate for JSC “KMAruda”; development of methods for forecasting of vertical and horizontal deformations of retaining wall of JSC “Stoilensky Mining and Beneficiation Plant”, etc.

Together with Industrial Group “EkoTon”, the University was the participant in the project of mining development with increasing of production capacity of Mikhailovsky unoxidized ferruginous quartzite ore pit (up to 50 million tons per year) in the part of research of exogenous processes, soil, vegetation and fauna. According to this, the design integration, aimed at sustainable relationships between Belgorod State National Research University and its industrial partners, is the most efficient and attractive form of their available resources joining, including their innovative potentials. In general, expansion of joint R&D, carried out by the University and its business partners, contributes to research efficiency both at the University and at particular enterprise. Besides, it contributes significantly to achievement of considerable social-economic and commercial effects. Moreover, it encourages the interdisciplinary collaboration among various University scientists.

Interaction of the University centers of collective use with industrial enterprises of Belgorod Oblast leads to various positive effects for the region:

- generation of additional output by regional enterprises;
- improvement of competitiveness of regional businesses by improvement of product quality, sales increasing and product markets expanding;
- generation of tax revenues for regional and local budgets by expansion of output by regional industrial enterprises;
- creation of new jobs and retaining of productive capacity of Belgorod Oblast enterprises.

High-qualified personnel is another contribution of Belgorod State National Research University to regional economy, which is exceptionally important for its successful modernization and technological development. For this purpose, the University carries out the constant monitoring of needs of regional labor market and uses the results in the time of formation of education development strategy, allowing the University to pursue a preemptive tactic by licensing of new specialities and training areas, and by expansion of the range of education services, offered at various education levels.

The industrial-financial complex, set up by the University, includes not only education, scientific, technical and material resources, but also financial ones. Emphasis is placed on the following formations: budget-independent sources funding for further sustainable self-development of the University as national research university; University's own funds for financing of the most promising business projects of the University of both federal and regional levels at all innovation cycle stages in particular.

The results of scientific-industrial, education and economic activities should provide a basis for continuous im-

provement of human capital quality. Investment in human resources is considered as the most efficient way of funds' spending, thus high qualification of academic and research staff of Belgorod State National Research University becomes a key manufacturing resource and main drive of the University sustained innovative development, aimed at promotion of social-economic and financial welfare of Russian Federation and Belgorod Oblast.

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