

Public-private partnership between Satbayev university and SK Geoservice LLP: enhancing collaboration in technological innovation and production

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Abstract. The article provides a detailed examination of public-private partnerships between Satbayev University and drilling tool manufacturer SK Geoservice LLP. It begins by discussing the underlying reasons for this collaboration, such as the demand for innovation and the advancement of drilling tool production. Subsequently, the article analyzes the partners' interactions and their respective roles in enhancing the design and production processes of drilling tool manufacturing. Successful instances of the university's research groups' scientific endeavors being implemented by drilling tool manufacturing experts from the private sector are cited, indicating a high level of cooperation and mutual benefit. The article concludes by highlighting the partnership's positive impact on the drilling tools market's development, private entrepreneurship support and growth in the region, and the training of highly skilled personnel. It suggests that these outcomes create new opportunities for further cooperation and growth. Overall, the article underscores the significance of public-private partnerships in advancing science and technology and advocates for their continued deepening and expansion in Kazakhstan. It also notes that such partnerships contribute to enhancing the quality of education in drilling-related fields and bolstering the competitiveness of Kazakhstani companies in the global market.

1 Introduction

Public-private partnership (PPP) in Kazakhstan has gained momentum since the enactment of Law No. 379-V "On Public-Private Partnership" on October 31, 2015. This legislation aims to distribute financial responsibility, risks, and costs between state entities interested in industrial production development and private entrepreneurs.

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The production of goods and services in the scientific and innovative sphere is inherently high-risk, necessitating state support. Conversely, the state benefits from the entrepreneurial expertise and skills of private partners. PPP in research and production fosters synergy between science and practical manufacturing, stimulating innovation development and enhancing economic competitiveness.

2 Materials and methods

Following the law's adoption, Kazakhstan's leading universities actively sought partnerships with private sector entities possessing production experience, qualified personnel, and material and financial resources. The primary mode of operation involved contracting for technology development, prototype production, bench and production testing, thereby fostering innovation and technology creation.

Specialists from Kazakhstan's leading technological university, Satbayev University, led by Dr. RATOV B.T. and with the participation of Dr. Fedorov B.V., are deeply involved in scientific research concerning the development of various drilling tools. This team has achieved several patents and successful tests, particularly in the development of diamond drill bits and "point bit" type bits. Their scientific endeavors in this field are conducted in collaboration with professors from the Institute of Superhard Materials named after V.N. Bakul (ISM NASU). These professors provide theoretical support to enhance the design parameters and compositions of cutting elements.

Since 2019, specialists from Satbayev University have been collaborating with SK Geoservice LLP, an organization involved in the development, manufacturing, and sale of drilling tools since 2004. SK Geoservice LLP boasts extensive experience in manufacturing diamond, carbide, and non-standard products, and has established partnerships throughout Kazakhstan, including with Kazakhmys Drilling LLP, GRK Iskander LLP, Kazzinc JSC, Vostokpromgeo LLP, Almatavzvryprom JSC, Karagandageologiya LLP, Karaganda Steel Works LLP, and others [1].

3 Results

During the initial stages of cooperation in 2019-2020, SK Geoservice LLP's role was to manufacture the developments created by specialists from Satbayev University. Meanwhile, the practicing specialists utilized their developments in vacuum sintering technology and hot pressing. They also adjusted the design of pilot products, enhancing their manufacturability and cost-effectiveness. As a result of this collaboration under the PPC agreement, a pilot batch of "point bit" type bits was produced. These bits were aimed at addressing known issues with the tool at that time, such as excessive load in the near-axial area of bit rotation and periodic "hang-up" of the tool, which led to decreased productivity and increased energy consumption during the drilling process [2] (Figure 1). Additionally, a patent application was submitted for this bit [3].

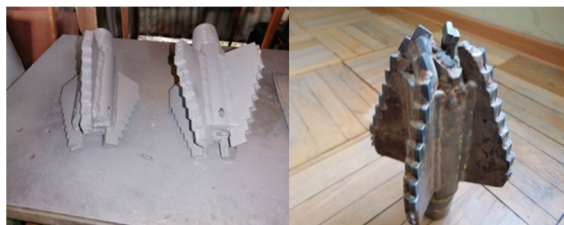


Fig. 1. Pilot samples of "point bit" type bits before and after field tests.

In 2020-2021, building upon scientific research initiated in 2010 by Professors Ratov B.T., Fedorov B.V., and Kudaykulov S.K. as part of a Satbayev University project, the scientific group collaborated with specialists from the Institute of Structural Macrokinetics of the National Academy of Sciences of Ukraine (ISM NASU) and SK Geoservice LLP to refine and enhance the design and composition of the matrix layer of the multilayer screw diamond drill bit KCB [4]. This process involved both theoretical research and experimental work, leading to improvements in production processes and increased drill bit efficiency.

In spring 2021, SK Geoservice LLP manufactured prototypes of the upgraded KCB-3 drill bit. Production involved the use of vacuum infiltration technology and modern equipment with computer numerical control (CNC), enabling the creation of complex volumetric shapes of the matrix layer (Figure 2) and enhancing manufacturing accuracy and product quality.

The design enhancements of the modernized crown address issues of uneven loading on the cutting matrix's end and facilitate self-sharpening during operation. These improvements increase productivity and reduce wear.

Tests conducted in the summer of 2022 confirmed the efficiency and reliability of the new design, garnering a positive recommendation from one of the leading companies in the mining industry, Kazakhmys Barlau LLP.



Fig. 2. Multilayer screw diamond drill bit KCB-3 before and after testing.

Since 2023, Satbayev University has been collaborating with SK Geoservice LLP on a new project aimed at developing and enhancing the efficiency of oil bits. In this project, LLP's involvement extends beyond the design and manufacturing of scientific developments; they also co-finance the works, contributing 10% of the state funds allocated to the projects. The project entails the development and production of experimental samples of bits equipped with diamond-hard-alloyed PDC inserts (Figure 3) for use in oil field operations. It addresses the issue of cutting element wear along the bit diameter through the original bit design and the use of special additives in the composite material of cutting inserts [5-16].



Fig. 3. Model of a promising bit equipped with diamond-hardfacing PDC inserts.

In 2023, alongside their involvement in state-financed projects, specialists from Satbayev University and SK Geoservice LLP embarked on an innovative initiative to establish a research and production laboratory for manufacturing drilling tool prototypes within the university's premises. This collaborative effort was underpinned by the invaluable expertise of LLP specialists, who played a crucial role in defining the laboratory's objectives, selecting essential technologies for development and manufacturing, and identifying the necessary equipment and tools (Figure 4).

SK Geoservice LLP played an active role in preparing the premises, acquiring and installing equipment, and overseeing its commissioning. They also contributed significantly to refining the technological processes and manufacturing prototypes. This collaborative endeavor culminated in the establishment of a cutting-edge research and production laboratory, serving as a pivotal platform for further advancements in drilling tool research and development.

The establishment of the laboratory has enabled the smooth integration of theoretical research and practical application, facilitating the implementation of modern, relevant drilling technologies. Additionally, it functions as a training facility for students, offering them practical experience and aiding in the development of skilled personnel in the drilling tools industry.

Moving forward, the partnership between Satbayev University and SK Geoservice LLP is poised to drive further innovation in drilling tool research and development. Through their continued collaboration, the two entities aim to address the evolving challenges in the drilling tools industry, enhance the competitiveness of Kazakhstani companies, and contribute to the sustainable development of the industry.



Fig. 4. Drilling tools laboratory equipment: hot pressing unit and vacuum furnace for matrix layer infiltration.

4 Conclusion

The collaboration between Satbayev University and SK Geoservice LLP serves as a prime example of how active public-private partnerships can significantly impact scientific development, production, and private entrepreneurship in Kazakhstan. By leveraging the combined strengths of Satbayev University and the specialized expertise of SK Geoservice LLP, the partnership has successfully advanced the development and enhancement of drilling tools. This collaboration has resulted in the creation of new drilling tool samples, the improvement of existing ones, and the modernization of manufacturing technologies [6].

The establishment of new research and production laboratories has further bolstered these efforts, providing cutting-edge facilities for the development and testing of innovative drilling technologies. These laboratories also serve as important training grounds for the next generation of specialists, fostering the growth of a skilled workforce in the country.

SK Geoservice LLP's extensive commercial and production experience has been instrumental in simplifying technological and production cost challenges for Satbayev University. This collaboration has made their products more competitive in the modern market, enhancing the global competitiveness of Kazakhstani companies in the drilling tools sector [7].

Overall, the partnership between Satbayev University and SK Geoservice LLP not only drives innovation in the drilling tools industry but also contributes to the sustainable development of the industry by facilitating the training of qualified personnel and enhancing the global competitiveness of Kazakhstani companies.

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