Innovations in the mining sector of the Kyrgyz economy

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Abstract. The article analyzes the existing challenges and innovative approaches in the mining sector at macro and micro scale.

1. Introduction
The present-day economic development to be successful in Kyrgyzstan needs investment of capital in the mining sector as a locomotive of the national economy. Kyrgyzstan features high-mountain and difficult-to-access mineral deposits, complex tectonics and violent temperature fluctuations, which necessitates specific approaches both at macro and micro scales.

Currently there are a few approaches to introduction of innovations in the mining sector at micro and macro scales. The micro scale means technological innovations at all stages of productive processes in mines. The macro scale is the national policy route in the mining sector toward introduction of the world standards in the regulatory and legal framework of the country, innovations and state aids for mining companies in terms of optimized and transparent taxation, preferential crediting and subsidization, automation and productivity improvement.

2. Features of the mining sector development
The key problems faced by mining companies at the micro scale include:
> Investment of money in production costs;
> Introduction of expensive technological innovations at small-size companies [1];
> Not easy accessibility of mineral deposits;
> Overrun of initial cost of investment projects after their actual implementation;
> Problematic integration of companies to co-operate innovation potentials;
> Automation;
> Staffing;
> Creation of nano geomaterials for modern testing facilities [2];
> High cost of introduction of innovative technologies;
> Problematic logistic and infrastructure [3];
> High uncertainty and risk of mining operations;
> Volatile content of useful components [4];
> Need for general-duty criteria for innovation activities of mining companies [5].

All these problems can be grouped into natural-and-geological, investment-and-cost and managerial challenges.

Natural-and-geological challenges are:
— inconsistent content of components in rocks;
— high operational uncertainty and risk of mineral mining;
— problematic logistic and infrastructure;
— inaccessibility of mineral deposits, which impedes market supply.

**Investment-and-cost challenges are:**
— the need to invest in costs to keep process flow maintained;
— impossibility for small-size companies to implement expensive technological innovations;
— overrun of initial cost of innovation projects after their implementation;
— high cost of introduction of technological innovations.

**Managerial challenges are:**
— problematic integration of companies to co-operate their innovation potentials;
— automation of mining;
— staffing;
— creation of nano geomaterials for modern testing facilities;
— the need to have general-duty criteria for innovation activities of a mine.

The macro scale challenges represent:
- The change in the state policy in the field of innovation activity;
- Stable demand for minerals by financially unsecured developing economies;
- Promotion of companies engaged in innovations;
- Flexible and transparent taxation;
- Introduction of RMQ index in common feasibility studies to reduce the tectonics-caused risks in mining of difficult high-mountain deposits;
- Preferential crediting of companies concerned with innovative management of production;
- Government aid to follow-up exploration;
- Growth of state contracts and state aids for purchasing innovative equipment through transparent bidding;
- Creation and introduction of uniform appraisal procedure for the entire mining sector in compliance with international standards.

All these routes can also be grouped as follows: national policy and legislation improvement; taxation and crediting in the mining sector; governmental support and partnership.

**National policy and legislation improvement** in in the mining sector means the change of the governmental attitude to innovation activity; support of economies which need minerals but lack finance; introduction of RMQ index in the common feasibility study procedures to reduce tectonics-caused risks in mining of hard-to-approach high-mountain deposits; creation and introduction of a unified appraisal procedure in compliance with the international standards in the mining sector of the country.

**Taxation and crediting in the mining sector** is a system of preferential for companies which introduce innovations; flexible and transparent taxation; preferential crediting of companies which introduce innovations in the in-process and labor protection management.

**Governmental support and partnership** assumes that state aid for the follow-up exploration of mineral deposits; growth of state contracts with private companies and support of innovative equipment purchase through transparent bidding.

The figure 1 offers a flow chart capable to help identify macro and micro economic indices and select certain routes of the mining sector management.

**National policy and legislation improvement.** The introduction of the common appraisal procedure using RMQ index can have certain effect on the micro scale challenges. Namely, regarding investment and expenditures, the cost of innovations will shift to the initial costs as per feasibility studies owing to the reduced risk of mining operations. Concerning nature and geology, uncertainty of mining will decrease as the market offer will increase for the difficult-to-access deposits. With reference to management, the introduction of the common appraisal criteria will facilitate integration and cooperation of innovation potentials of mining companies.
Figure 1. Block schematic diagram reviewing of the essence of invention.

**Taxation and crediting.** Flexible and preferential crediting of innovative companies will lower the cost of innovation and will enable small-size companies to pursue innovations with minor finance. Regarding nature and geology, logistics and infrastructure will get simplified. Concerning management challenges, automation and upgrade of operations will raise the level of staffing.

**Governmental support and partnership.** In terms of costs and investment, small- and medium-size companies will introduce more innovations thanks to the governmental support. Furthermore, the government can assist in promotion of market offer for the difficult-to-access deposits. This is the field of the nature-and-geology challenges. As regards the management, the introduction of the international appraisal standards will improve transparency of innovation activity evaluation at companies and will facilitate the international market penetration.

3. **Conclusions**
The scope of innovations in the mining sector of the Kyrgyz economy embraces introduction of international standards of mineral resource appraisal for the attraction of international investments, the public–private partnership targeted at technological innovation at all stages of production toward enhanced efficiency, as well inclusion of RMQ index in feasibility studies of mining projects in order to reduce the risks associated by active tectonics and inaccessibility of mineral deposits.

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