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M. V. NIKOLAEV (Doctor of Economic Sciences, Professor, Director, Institute of Regional Economy of the North at the Ammosov North-Eastern Federal University)

E. E. GRIGORIEVA (Candidate of Economic Sciences, Leading Researcher, Institute of Regional Economy of the North at the Ammosov North-Eastern Federal University), elena.grigoreva80@mail.ru

P. V. GULYAEV (Candidate of Economic Sciences, Associate Professor, Chief Researcher, Institute of Regional Economy of the North at the Ammosov North-Eastern Federal University)

ASSESSMENT OF RISKS INFLUENCING INNOVATION ACTIVITY OF INDUSTRIAL ENTERPRISES (ON EXAMPLE OF DIAMOND-BRILLIANT COMPLEX)*

Introduction

The diamond-brilliant complex of Russia is an oligopoly, part of which in a diamond mining segment, represented at a level of 95% by the diamond mining company JSC "ALROSA" (PJSC), is a natural monopoly, successfully competing with world producers of natural diamonds. Experience of many years of development of deposits of mineral resources by the domestic mining industry is a significant part of potential of diamond mining industry, including in part of innovative component.

The innovative potential of diamond mining industry is largely determined by presence and normal functioning of following main elements of innovation system [1]:

- an industrial scientific and research complex;
- a national scientific and research complex;
- an innovation infrastructure;
- an aggregate of relations, communications, and relations between components of system.

A developed scientific and research complex functioning as a part of JSC "ALROSA" (PJSC) during a very long period of time and integrated into a system of production relations of the company is the main subject in the innovation system of diamond mining industry.

It should be noted that the functioning of scientific and research complexes as part of large corporations ensures a solution of applied problems with the purpose of increase of production efficiency and sale of products. In connection with this a high degree of commercialization of results of these applied researches is obvious, and in a majority of corporate structures, as a rule, there are science centres providing part of innovation potential. However, it is necessary to note that successfulness of applied researches and developments by and large is provided by results of fundamental researches. At the same time the fundamental researches are traditionally carried out in scientific and research organizations of the Russian Academy of Sciences, which is a key element of national scientific and research complex. Thus, one of the most important components of strategic management of innovation development of diamond processing industry is an ag-

Effective integration of different components of innovation system ensuring growth of innovative potential of industry depends, among others, on quality of innovation infrastructure and diversity of relations "serving" innovation processes. From the point of view of theory of state regulation of economy any infrastructure cannot be developed without active government intervention. Thus, there arises a problem of state regulation of development of innovative infrastructure in a diamond processing industry.

Currently, JSC "ALROSA" (PJSC) implements a long-term multicomponent program of innovation development aimed at modernization of technologies of geological exploration, mining, concentration and processing of rough diamonds, production and sales of finished products, and so on. For a long time the company does not reduce a number of workers employed in R&D and Research and Advanced Development, protection documents of results of intellectual work are annually registered. Apart from direct "real" investments in scientific and research projects the company finances at the expense of its own funds venture programs, programs of grant support of scientific studies, educational programs, cofinances construction of objects of innovation infrastructure, objects of educational system on the territory of the Republic of Sakha (Yakutia), and so forth.

This article considers potential risks of implementation of programs of innovation development of enterprises of diamond-brilliant complex of Russia against a background of system changes of main tendencies of development of global diamond-brilliant market. There are proposed measures for minimization of risks of implementation of programs of innovation development of industrial enterprises. It is determined necessity to provide stimulation and government support for the industry for its lead on a globally competitive level by a continuous increase of technological level of industries. Mechanisms of support from a state budget, state corporations and institutions of innovation development are offered.

Key words: innovative development, risks, diamond-brilliant complex, state regulation, funding.

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gregate of state measures aimed at reinforcement of integration of industrial and national inter-industry scientific and research complexes. At the same time it is necessary to optimize a system of funding of researches on the basis of project-oriented approaches, use of mechanisms of state-private partnership, expansion of list of used instruments of state regulation and state support of industrial scientific and research complex.

Analysis of programs of innovation development of enterprises of diamond-brilliant complex of the Russian Federation.

Currently, among the enterprises involved in work of mining and processing of diamonds, there are elaborated innovation de-

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Table 1. Indicators of finance of IDP of participants of market

	R&D			Capital investments			Others			TOTAL		
	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
Actual amount of finance of IDP												
JSC «ALROSA» (PJSC)	539	674	874	539	1334	748	642	986	418	2971	2694	2041
OJSC «Kristall Production Corporation»	8	5	N/A	4	115	N/A	19	11	N/A	31	131	N/A
Planned amount of finance of IDP												
JSC «ALROSA» (PJSC)	516	465	873	1786	1542	530	659	675	721	2962	2681	2125
OJSC «Kristall Production Corporation»	12	8	14	49	52	41	53	69	51	114	128	106
Implementation of plan, %												
JSC «ALROSA» (PJSC)	104.5	145.0	100.1	30.2	86.5	141.2	97.4	146.1	58.0	100.3	100.5	96.0
OJSC «Kristall Production Corporation»	64.1	58.2	—	9.1	224	—	36	15.6	—	27.4	102	—

Source: [4, 5].

development programs (IDP) in the companies JSC “ALROSA” (PJSC) [2] and OJSC “Kristall Production Corporation” [3].

For the first time the innovation program of JSC “ALROSA” (PJSC) was approved in 2011 and it reflected development prospects of the most important directions. An updated Innovation Development and Technological Upgrade Program of JSC “ALROSA” (OJSC) (hereinafter IDaTUP) for a period of 2016–2023 takes into account changes happened in the innovation and business activity of the Company during a period of 2011–2015 from a moment of approval of the first version of Program. A carried out estimation of level of innovativeness of technological development of JSC “ALROSA” (OJSC) allows soundly evaluating effectiveness of introduction of innovations into the production and determining a level of innovation activity of company.

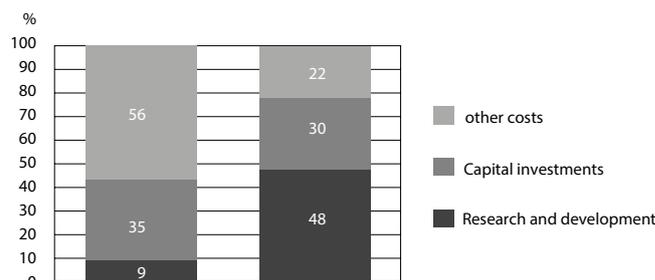
The innovative development program of OJSC “Kristall Production Corporation” for 2012–2018 was approved by the Board of Directors of OJSC “Kristall Production Corporation” on 19 October 2012.

An actual amount of finance of innovation development program of JSC “ALROSA” (PJSC) for the period 2013–2015 was reduced by 31% (a reduction of investments with a planned value was 28%), which is due to savings of investments in a period of market instability. At the same time the diamond mining company demonstrates stability of implementation of plan of finance of program in contrast to the diamond processing enterprise, where it is observed implementation of plan for only 27.4% in 2013 (**Table 1**).

The implementation of plan of finance of programs of innovation development of enterprises is carried out by own efforts. Difficulties in the finance of programs of innovation development of diamond processing enterprises are due to low margin revenue during the market instability in crisis conditions.

Distinctness of costs of diamond processing enterprise is in a high proportion of costs of capital investments (35%) with a low proportion of costs on research and development (9%) (**Fig. 1**). This cost structure is typical for all enterprises of diamond processing industry.

It should be noted that program documents defining the innovation development of individual enterprises and the industry of diamond mining and processing as a whole do not contain any recommendations for use of various formal approaches and methods for implementation of pithy analysis. In connection with this for an assessment of dynamics of key indicators of innovation activity of participants of diamond-brilliant market a set of indicators was selected, which is used in active programs of innovation development of enterprises (**Table 2**).



OJSC “Kristall Production Corporation” JSC “ALROSA” (PJSC)

Source: programs of innovation development of enterprises.

Fig. 1. Structure of average annual costs of program of innovation development

Table 2. Dynamics of main indicators of innovation activity of participants of market of polished and rough diamonds

Indicators	Kind of production	2013	2014	2015
Amount of funding of R&D, % of revenue	mining	0.34	0.36	0.4
	processing	0.06	0.04	0.04
The number of R&D projects and patents developed and integrated into production, pcs. a year	mining	13	36	24
	processing	3	5	6
The number of personnel employed in Research and Advanced Development, % of average number of industry	mining	2.75	2.79	2.9
	processing	2.9	3.0	3.3
The increase of labor productivity, % to the previous year	mining	9.9	16.9	17.2
	processing	-6	7	7
The increase of return on assets, % to the previous year	mining	0.4	7	-3
	processing	-32	-4	-3
The decrease of ratio of cost price in revenue, % to the previous year	mining	0.5	-5.6	-5.9
	processing	2	-1.7	
The number of new projects implemented in cooperation with external organizations	mining	3	3	3
	processing	1	1	1

Source: [4, 5].

Costs of technological innovations, research and development of JSC “ALROSA” (PJSC) in 2015 amounted to RUB 1 921.3 mln. For conducting and implementing Re-

Table 3. Plan of finance for implementation of innovation programs, mln RUB

Enterprises	2015	2016	2017	2018	2019	2020	2021	2022	2023
JSC «ALROSA» (PJSC)	2 124.7	2610.6	2253.2	1913.8	1972.00	1405.7	1360.3	1478.8	1517.7
OJSC «Kristall Production Corporation»	106.35	129.68	109.7	114.1					

Source: [2, 3].

search and Advanced Development by the enterprise OJSC «Kristall Production Corporation» in 2014 it was spent RUB 4.79 mln. A ratio of volume of finance of R&D to revenue is 0.04%, which characterizes a low level of innovation activity of diamond processing enterprises to conduct scientific work.

A plan of finance of measures of innovation programs of JSC «ALROSA» and «Kristall Production Corporation» are presented in **Table 3**.

In JSC «ALROSA» a predictive assessment of finance of innovation programs is calculated till 2023. An amount of investments of program for the period of 2016-2023 will be 14 512.1 mln RUB.

Risk factors associated with innovation activity of diamond mining enterprises

The main risks of implementation of program of innovation development of diamond mining enterprises are:

1) scientific and technical risks associated with presence of a high degree of uncertainty regarding final practical results at the initial stage of innovation research and development;

2) financial risks associated with a possible lack of Company's funds for financing of IDaTUP as a result of possible realization of various risks-reasons:

- risks of deterioration of industry market situation;
- Company credit risks;

— macroeconomic risks — crisis phenomena in the global and domestic economy that may affect the financial position of Company;

— risks of rise of higher priority for the Company investment and financial needs approved by shareholders of Company (in the first place approved by the state);

3) marketing risks of current supply of resources needed for the implementation of innovation project. In some cases for its realization unique equipment or high-quality components or materials are required. Therefore, in some cases it arises a problem of finding suppliers able to develop such unique resources for the innovation project;

4) risks of increased competition:

— a leakage of confidential information either through the fault of employees or as a result of competitive intelligence undertaken by competitors;

— a slow introduction of innovations compared to the competitors due to a lack of necessary funds for carrying out R&D and introduction of new technologies;

5) risks associated with an insufficient staffing level;

6) risks associated with enforcement of rights of ownership of innovation project arising due to various reasons:

— a risk of failure to ensure conditions for patenting of technical solutions appears as a result of inadequate patent protection of inventions and technologies;

— a risk of protest of patents protecting fundamental technical solutions in case of announcement of invalidity of patent rights

on the basis of which the innovation project is already implemented;

— risks of legal and illegal imitation by competitors of patented by the company innovations in “parallel developments”, when on the basis of information obtained from the open literature about pat-

ented technical solutions the competitors realize the same developments, but with slight differences, which also allow them to patent their innovations.

From 2015 in the Company a risk management system in JSC «ALROSA» (PJSC) is introduced [6] with the aim of development and introduction of a united model of organization of risk management process including realization of a full cycle within a framework of risk management system encompassing processes of identification and assessment of risks and preparation of reporting. Within the framework of risk management system it is carried out identification of risks covering all processes of activity of the Company. A registry was compiled that allows ranking risks according to a level of importance and identifying key risks that are subject to priority management.

Risk factors associated with innovation activity of diamond processing enterprises

Currently, a whole complex of factors can adversely affect the diamond processing enterprise: a forced temporary reduction of production growth, an excess of prices for domestic jewelry over foreign analogues and their low competitiveness in the price, stimulation of import and development of shadow market. In particular, a higher prime cost of Russian producers in comparison with analogous products of foreign producers is due to a high tax burden. All the above problems narrow down possibilities of development of Russian diamond-brilliant market.

Key factors of risks influencing the activity of diamond processing enterprises of Russia are sourcing risks directly having an effect on a reduction of margin revenue in the production of brilliants. Risks, which are next in importance, are financial and tax and legal risks that impede the financial and economic activity of enterprises and hinder sustainable development of enterprises, restrict investment and innovation activities [7].

Risk factors associated with the innovation activity of diamond processing enterprises

1. The lack of competition among domestic producers of diamond processing equipment. A small amount of demand for specific equipment and tooling of diamond cutting production has led to degradation of competition among the domestic producers. The only producer of domestic equipment and tooling of diamond cutting production is LLC «Almaz Service», a subsidiary enterprise of OJSC «Kristall Production Corporation».

2. Production of high-technology equipment used for marking, sawing and bruting of diamonds is only possible on large machine-building enterprises. But at the same time a limited demand for this equipment causes absence of commercial interest among potential producers.

3. A high cost and the cruellest demands for technical provision of R&D and Research and Advanced Development. Specificity of production, an insufficient number and a high cost of experimental and test samples of natural diamonds substantially restrict and increase a cost of research

and development in the field of diamond processing. Use of complex measuring technologies, diamond processing technologies in conducting studies, experiments, in designing new tools, the high cost of prototypes cause huge amounts of research funding with relatively low effectiveness of studies.

4. A lack of highly skilled personnel (industrial and production personnel, researchers). Initiation of innovations, getting on to complex technological processes and production of new products requires personnel of appropriate qualifications. At the same time educational institutions cut programs of training of specialists with a profile “diamond processing” as a result of a low demand in a labour market. Specificity of educational programs with the profile “diamond processing” is also influenced by a high cost of material and technical base necessary for quality training of specialists, small amounts of state order for the training of personnel for the diamond processing industry.

Upper-level analysis of risk factors of implementation of innovation programs of diamond processing enterprises of Russia is presented in **Table 4**.

Sources of finance of programs of innovation development of diamond mining enterprise can be:

- own funds of JSC “ALROSA” (OJSC);
- the funds of subsidiary companies participating in the implementation of IDaTUP;
- state subsidies.

Measures of innovation program in the subsidiary enterprises are financed out of funds:

- Research and Production Enterprise (RPE) “Bourevestnik” (JSC) (an investment plan is presented in a Program of innovation development of RPE “Bourevestnik”);
- PJSC “Severalmaz”;
- JSC “Almaz Anabara”.

The sources of finance of innovation development programs of diamond processing enterprise are:

- own funds of OJSC “Kristall Production Corporation”;
- funds of a subsidiary — LLC “Almaz Service”.

It is necessary to note that the crisis phenomena in the global economy [8, 9, 10] and in the diamond-brilliant industry demanded from OJSC “Kristall Production Corporation” introduction of strict financial control over expenses of nonproductive character, which made corrections to the process of implementation of planned measures. The low margin revenue of enterprise does not allow increasing the amount of finance of innovation program. At the same time the main focus of enterprise was concentrated on an increase of quality of finished products, preservation of a high portion of innovations, as well as on the maximally possible implementation of program measures, in particular in the direction of Research and Advanced Development.

Table 4. Upper-level analysis of risks of implementation of innovation programs

Risk factors	Estimation of degree of influence	Comments about estimation of risk influence
Risks of research implementation		
The reduction of margin revenue of producers of brilliants		It will result in limitation of financial support of innovation programs leading to nonfulfilment of some program measures
Limited access to experimental samples of diamonds		The increase of cost of R&D (Research and Advanced Development) is due to additional costs ensuring implementation of special requirements of storage, movement, use of rough diamonds
Difficulties of purchase of experimental samples of rough diamonds of desired quality, shape, color		Absence or lack of experimental samples of rough diamonds leads to impossibility of implementation of R&D
A low supply of modern high-technology equipment for conducting studies in scientific research institutes, universities		Absence of specific laboratory equipment for study of properties of diamonds, brilliants limits a level and effectiveness of scientific work.
An insufficient level of quality of studies		There is an insufficient scientific reserve in studies in the field of diamond processing
Risks of organization of program measures		
Absence of innovation infrastructure in the diamond processing industry		Weak partner relationships «university-business-state»
Absence at enterprises of specialized subdivisions for generation and promotion of innovations		An undeveloped system of management of innovation development. Weak susceptibility to the innovations at the enterprises, unreadiness of employees of enterprises to the innovations
Absence of system of stimulation and motivation of creation of workers		Absence of stimulus and motivation of personnel to active participation in the introduction of innovations into the production and a search for new ideas and methods of increase of labour productivity
 — High importance, it can result in significant costs  — Average importance, it can lead to significant financial losses  — low importance, an impact on activity is not significant		

Directions of state support of innovation activity

The stimulation of innovation activity of industrial enterprises in Russia is carried out via a number of through instruments provided in various federal and regional programs, but this is not enough and modern political and economic challenges require necessity of provision of effectiveness of state policy for strengthening the innovation potential of economy [11]. A necessary condition of one of their main priorities of development of industrial enterprises is purposeful state participation in the implementation of programs of innovation development of enterprises and the use of support mechanisms from the state budget [12], state corporations and institutions of innovation development (Vnesheconombank, “Skolkovo” Foundation, the Russian Foundation for Technological Development, etc.).

For the stimulation of innovation activity of Russian industrial enterprises it is necessary:

1. Organization of co-financing of programs of innovation development from the funds of regional and federal budget in the form of:

— allocation of budget credits, investment loans, realization of leasing operations and other forms of financing on a repayable basis;

— issue of warrants and guarantees;

— introduction of direction of industrial studies of industrial enterprises in a list of priority directions at regional competitions for realization of R&D with financial support of scientific funds: RSF, RFH, RFBR and a state task of the Ministry of Education and Science of the Russian Federation;

— guarantee support of export (customs duties, simplification of customs clearance, etc.).

2. Support of non-financial assistance in implementation of measures and innovation projects:

— project management, expertise of project documentation, expertise and monitoring of investment projects, consulting and audit;

— consulting and educational services, carrying out scientific and technical and technological expertise of innovative projects;

— help in finding investors, patenting, registration of trademarks, conducting marketing research, preparing business plans, etc.

3. Creation of conducive and competitive conditions for attracting investments in Russian science, technologies and innovations, including:

— an income tax exemption in formation of intangible assets, acquisition of rights for results of intellectual activity from a developer, donations to funds of support of scientific, scientific and technical and innovation activity, co-financing of scientific projects, including projects with the state participation on conditions of further profit earning from the project implementation;

— minimization of duties on importation of products made primarily on the basis of protected intellectual property owned by Russian right holders;

— a decrease of interest rates on loans for modernization and/or development of new industries created for the purposes of implementation of priorities of scientific and technological development.

4. Implementation by federal bodies of executive power of a coordinated program of measures of correction of normative and technical, tariff and non-tariff regulation for the purposes of:

— stimulation of transition of economic entities to the best technologies developed by domestic science;

— removal of barriers and limitations hindering from introduction of technologies;

— orientation of state order for the supply of products (goods, services) primarily created on the basis of Russian developments corresponding to a world level.

Conclusion

1. The program of innovation development of JSC "ALROSA" (PJSC) de facto has the status of industry program as it covers all aspects of operation of diamond mining sector and thus affects the development of entire diamond processing industry.

2. In the assessment of risk factors and their degree of influence on the implementation of programs of innovation development of industry it is determined that the risk of insufficient funding remains significant.

3. The state support in the implementation of measures of innovation program will allow changing the model of operation of sector of research and development by the transition of science to a suprasectoral source of development of economy being in close communication with the society, business and government.

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