Zinaida M. Nazarova
Olga E. Roshchina
Iuriy V. Zabaikin
Dmitriy V. Lyutyagin
Mikhail F. Kharlamov
Mikhail Yu. Bogachev
Ekaterina V. Knyazeva
Mikhail A. Yakunin

Improving the management mechanisms of enterprises of the mineral resource complex

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Under the general editorship of Doctor of Economics, Professor, Honorary Worker of Higher Education, Head of the Department of Production and Financial Management of the Russian State Geological Exploration University **Zinaida M. Nazarova**

Reviewers:

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Organizational and economic sustainability is financial and economic stability (sustainability), namely, the ability of an industrial enterprise to maintain its financial stability while constantly changing market conditions by improving and purposefully developing its production, technical and organizational structure using logistic-oriented management methods. Sustainable development of a socio-economic system is understood as its development, whereby management structures can achieve planned results while preserving the properties inherent to this system and realizing its ability to innovate changes in order to achieve positive economic changes consistent with social interests. Sustainable development is development that corresponds to the parameters of socio-economic efficiency. Analysis of presented definitions allows us to conclude that they are of different quality and diversity. Often, researchers are trying to adapt the category of resistance to specific scientific problems, which reduces the level of generalization required by scientific abstraction.

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Content

Introduction

Currently, mineral raw materials in the total world balance of natural raw materials used by the industry is 75 %. Without minerals, the existence of human civilization is impossible. And human civilization itself emerged and developed through the use of new types of minerals. The economic well-being of all countries depends to a significant extent on the diversity and wealth of mineral resources, as well as the development of the mineral resource complex. Under the mineral resource complex (MSC) refers to the totality of all mining and mineral processing enterprises (mining complex), mineral resource base, as well as serving the mining industry exploration industry. Mineral resources are the basis of human production activities. These are energy, metallurgy, chemical production, defense industry, agricultural and construction complexes, radio electronics, rocket science, engineering, etc. New types of mineral raw materials (tantalum, niobium, rare earths, etc.) push scientific and technical progress. In this regard, in the world there is a steady trend of increasing the amount of mining. However, unlike other natural resources, mineral resources are non-renewable, cyclical, not repeatable, not repetitive. Therefore, the predatory exploitation, untimely preparation of reserves, the wrong definition of the future situation for certain types of minerals in the history of human society have led to and lead to mineral crises. Extraction and processing of mineral resources is one of the most profitable industries, and mineral resources themselves are the most important national treasure and an important export item. Therefore, in the vast majority of countries in the world, the activities and development of the mineral complex is among the most important national priorities. Russia is currently the largest mineral resource power in the world.

Russian President Vladimir Putin said that the exit of the Russian economy from the crisis is the main result of 2017. He believes that the recession has entered the stage of sustainable development and growth, reports «national news service». But there are still a number of unfavorable conditions for the development of domestic production. These are international sanctions and aggressive policy of NATO countries. internal problems of the country's enterprises. The task set by the government to increase GDP at the level of developed market countries can not be solved without the intensification of production. Therefore, in the development strategies of large companies at the forefront of the challenges of intensification of production. So the company «Rosneft» the main objectives in its «strategy 2022» set tasks «intensification, that is, greater impact, increased efficiency, motivation of management and employees, use of modern management practices». The monograph considers the management aspect of the intensification of production. Leaders of the Russian economy believe that labor productivity is 70% dependent on the person and his work and only 30% of the equipment (technology). It is known that on the same equipment can be increased productivity several times without investment, but only at the expense of control mechanisms. Such an example will be given in section 2 of the monograph. The monograph consists of two sections. The first section describes the current state of the mineral complex and the adverse conditions in which it is located. The second section provides management mechanisms that contribute to the intensification of production.

Chapter 1. Mineral and raw materials complex and characteristics of adverse circumstances

1. Mineral resource complex in the Russian economy

1.1. The state of mineral resources in Russia

Socio-economic development, geopolitical position and role of Russia in the world community today are largely determined by its mineral potential and the state strategy of its use. [2,3,4,5,10]. Geology has always played an important role in the development of the domestic mineral complex and thus our economy. Russia inherited from the USSR the position of the country, the world's richest in mineral resources. Russia's share in the world's oil reserves is 13%, gas – 32, coal -11, lead, zinc, cobalt, Nickel, iron from 10 to 36%, etc. The gross value of explored and pre-estimated reserves is about 28.5 trillion. dollars'. The mineral resource complex in the country's economy occupies a leading place - in the sphere of subsoil use, about 40% of all fixed assets of industrial enterprises and 13% of the book value of all fixed assets of the Russian economy are concentrated. At the same time, mining and exploration industries provide an average of 30% of GDP and about 50% of exports. The export of mineral raw materials and products of its processing provides about 80% of the country's foreign exchange earnings [14, 15, 18, 19, 20].

In recent years, foreign policy has somewhat overshadowed the acute problems of Russia's internal life, and, above all, the progressive degradation of the country's economy. The main contribution to the degradation is not the economic sanctions of the West, but the actions of the Russian government. This, in particular, is clearly seen in the following example. In February this year, the government approved the privatization program for the next three years. It is planned to privatize 477 joint-stock companies and 298 Federal state unitary Enterprises, the shares of which to some extent belong to the state. Revenues from privatization planned for this year (5.8 billion rubles) will be only 0.03% in relation to budget expenditures. A lot or a little? For example, the profit of ALROSA for the first half of 2016 alone amounted to 186.7 billion rubles, in foreign currency equivalent it is about 3 billion dollars. Therefore, the calculation for the year is about 6 billion dollars. «ALROSA» is the world's largest producer of diamonds, the company accounts for about a quarter of their world production. The state's share in this company has already been reduced, and it has fallen to a critical 33%. By 2019, the state's share is planned to be reduced to 29% + 1 share. But among its shareholders are the Republic of Yakutia and the municipalities of the Republic on the territory of which the company operates. Apparently, these shareholders will also come out of the capital of ALROSA. Thus, the effectiveness of its privatization is in flagrant contradiction with real life and will not give anything good to the country [12,14].

As a result of the next stage of privatization of state property, the state may lose control over many profitable companies and lose considerable income. Meanwhile, the situation with budget revenues raises serious concerns.

In his address to the Federal Assembly in December 2016, President Vladimir Putin actually said about the exhaustion of the inertial model of economic development: «If we do not fully launch new growth factors, we can hang near zero for years. And so we have constantly squeezed, to save, to delay or postpone their development. And we can't afford that.»[14].

The President instructed the government to ensure the relative growth of our economy in excess of the world average by 2019. This, presumably, is about the growth of the corresponding GDP. This means that our GDP will have to grow by about 4% per year, as according to the IMF forecast, the world economy will increase by about 3% annually. By may 2017, the government was instructed to submit a plan for the intensive economic development of the country. But such development will require significant private investment and low-interest Bank loans – no more than a few percent per annum. Today, industrial enterprises provide no more than half of the necessary investments, construction - about 20%, which is clearly not enough even for the simple reproduction of the economy. The banks ' Deposit is scanty. [37,40].

The three-year Federal budget, developed by the Ministry of Finance for 2017-2019, is calculated based, in particular, on the projected annual investment growth of 1.8% of GDP. According to some estimates, in order to achieve even the relative rates of economic growth prescribed by the President, the share of investments relative to GDP - they differ significantly in absolute values between us and «them» - should exceed 25%. This means that, taking the base GDP of 2015, which amounted to 80412.5 billion rubles, investments in 2019 should increase to 20.103 trillion. rubles'. According to the Central Bank, investments of organizations of all forms of ownership in fixed assets (without small businesses) in 2015 were half - 10,277 trillion. RUB or 91.6% of the investment volume of the previous year. At the same time, Bank loans granted to enterprises and organizations of all forms of ownership (except small enterprises) for the creation, reproduction and acquisition of fixed assets in 2014 amounted to almost 1.099 trillion. rubles, and in 2015 - 849.8 billion. rubles, or only 1.41% and 1.02%, respectively, of the funds placed by the banks on the side of their own and borrowed funds. The remaining funds were used for financial speculation.[33].

In 2016, investments decreased compared to the previous year. There is a clear tendency to reduce investments in the real sector of the economy and transport. Investments, if they are not stolen, turn into production only after some time, which, depending on its complexity, months and years.

Revenues of the consolidated budget in 2016 amounted to 14482.4 billion rubles, including taxes, fees and regular payments for the use of natural resources amounted to 2951.8 billion rubles. Oil and gas revenues came to the Federal budget 4844 billion rubles, or almost 36% of all revenues amounting to 13460.1 billion rubles. The Federal budget deficit in 2016 amounted to 2956.3 billion rubles.

It is obvious that in order to comply with the President's instruction on the intensification of economic development, the budget recently adopted by the state Duma will soon need to be significantly changed. But what measures, if necessary, can be urgently proposed by the government within a few months, especially to attract private investment in such large amounts with minimal investment risks, and what guarantees can it offer for this?

Ensuring sustainable development of Russia in the context of globalization of resources and environmental problems requires, in particular, understanding the role of the mineral resource base in this process. The problem of meeting the growing needs of the world economy in mineral raw materials is becoming more acute and intractable every year. The state of the mineral resource base and the availability of mineral resources – today one of the global problems, as a whole of the world economy and individual countries.

According to the data of the international analytical group «EY Global oil and gas reserves study 2014», the world's 75 largest companies spent on exploration for hydrocarbons in 2013 was estimated at 87.9 billion dollars against 83.4 billion in 2012. Of these, the US accounted for 26% or 23.1 billion, the countries of the Asia-Pacific region – 25% (21.3 billion), South and Central America – 19% (16.6 billion), Africa and the Middle East – 8% (7.1 billion), Europe – 6% (5.7 billion), Canada – 4% (3.7 billion), other countries – 12% or 10.7 billion dollars.

Over the past five years, the cost of exploration for hydrocarbon raw materials in the world increased by 57%. Solid minerals global exploration for deposits, with the exception of iron ore, coal, bauxite and some non-metallic types, according to the canadian analytical group SNL Metals and Mining, which annually determines the volume and structure of expenses for exploration in the world, for the period from 2000 to 2010 increased from 2.7 billion to 12.1 billion in 2011 to 17.3 billion, and in 2012 reached 21.5 billion dollars. The increase in exploration costs reflects the significant consumption of mineral resources in the world, especially in China, which required the exploration of new fields in more remote regions with their deeper occurrence. Most of the proven reserves and production of mineral resources belong to unique and large basins, regions, deposits and countries. In particular, almost 90% (222.4 billion tons) of the world's proven oil reserves are concentrated in the fields of 12 countries. [25,29].

Russia's mineral resource base has entered a phase of a progressive crisis and is being used inefficiently from the point of view of state interests. Assessing the situation, it should be noted that oil and gas give relatively much revenue to the budget, but little in GDP growth. The share of GDP growth due to oil and gas exports is about 10%. Therefore, it is unlikely that the Russian economy will continue to grow at the same pace on exports and rising prices for raw materials.

Maintaining or further increasing the imbalance in the «production-consumption-export» chain of extracted raw materials and products of its processing actually strengthens the status of Russia as a raw material appendage of the industrialized countries of the West.

We should not forget that there is a constant redistribution of influence on oil prices in the world. American shale companies announced projects to increase production. Recently, a representative conference on the global energy market CERAWEEK was held in Houston. Their plans threaten to undermine OPEC to stabilize the world oil market and restore commodity prices.

Complications with oil reserves in Western Siberia, Tatarstan, the Volga region and Eastern Siberia have led to the fact that in 2017 our country may face problems in maintaining the achieved level of production. As the first steps, trump, elected the 45th President of the United States, promised to liberalize the American oil market as much as possible, including the lifting of the ban on offshore drilling and hydraulic fracturing, which will provide a significant increase in the production of shale and offshore oil in the United States. I have not seen Russian plans not only for shale oil, but also for the Bazhenov Suite, which have been discussed for more than thirty years. But the rating Agency Fitsh proceeds from the provisions that the average price of Brent crude oil in 2017 will be 52.5 dollars per barrel, that is, below the price level in January and February this year.[29,34].

Another example is the collapse of domestic demand, in particular for non-ferrous metals. The decrease in demand is mainly due to the decline in production in the main industries consuming them, such as engineering and defense industry, which account for more than 85% of the total consumption of these metals. Their consumption in the electrical and radio engineering industries, as well as in the automotive industry, has significantly decreased, due to the saturation of the domestic market with better imported products of these industries.

The current tax system does not take into account the level of liquidity of mineral deposits, the technical condition of existing enterprises, as well as the special geopolitical interests of the country, does not provide the maximum possible use of the existing mineral resource base and therefore requires further reform. Meanwhile, the funds invested in the search, exploration, development and arrangement of deposits in the Soviet period are transferred in the form of unearned income to the pockets of the owners of subsoil companies. New subsoil users were not only given free hundreds of thousands of wells, fields, buildings, structures and other facilities built at the fields, but also allowed them to amortize these facilities. As a result, subsoil users assign in cash the revalued value of capital investments that were made earlier in the development and arrangement of existing fields. Thus, in the conditions of the market, Russian citizens, since 1992, reimburse for the second time the past, once they paid, the cost of field development.

Analyzing the existing mechanisms of distribution, use and assignment of mining and price rent in our country, doctor of Economics S. Kimelman States that in the modern Russian economy only the part of rent that goes to the Federal and regional budgets is more or less accurately known. However, there is no transparency in the use of rental tax revenues. Of these significant revenues (up to 40-50% of budget revenues), only a meager share is directed to the reproduction of the mineral resource base. Since 2005. the budget began to be considered non-oil and gas, as the oil and gas rent was sent to the Stabilization Fund, later divided into the Reserve Fund and the national welfare Fund, from which part of the funds in the form of transfers came to the budget. Today, these funds are almost entirely spent on covering the Federal budget deficit.

For most of the main mineral resources, Russia may face a large-scale problem of deficit of profitable reserves in the future, if radical measures in the field of strategic subsoil exploration, subsoil use and the creation of effective economic mechanisms are not implemented in the near future.

It is easy to guess how rapidly the black market for trading deposits and geological information has flourished. Through intermediaries and secret data cards being traded under the counter. 90% of all proven resources of oil, Nickel and diamonds, 80% of gas, 70% of gold and platinum were distributed. It can be stated that the Soviet system of prospecting, exploration and evaluation of deposits is almost destroyed. We did not notice or did not want to notice how the state «dragged» the most profitable deposits.

The lack of a scientifically developed state strategy for the development and use of the mineral resource base, based on the principles of self-sufficiency with the necessary share of exports and limited imports, has created a threat to the national security of the country and leads to the loss of Russia's geopolitical priorities in the mineral sector of the world. After the collapse of the Soviet Union, the problem of self-sufficiency in mineral raw materials faced Russia: 21 of its kind formed or almost complete (manganese, chromium, strontium, mercury, zirconium, etc.), or very significant (lead and zinc, fluorite, barite, kaolin, etc.) deficit.

The system of strategic exploration of mineral resources does not meet the requirements of ensuring the mineral security of the country. This was emphasized in their decisions by the Interdepartmental Commission of The security Council of the Russian Federation on economic security in March 2001 and the Interdepartmental Commission of the security Council of the Russian Federation on environmental safety on the issue, which in June 2014 discussed measures to develop the exploration industry in the interests of national security. The importance of urgent solutions to the urgent problems of the development of the mineral and raw materials complex of Russia has been repeatedly stressed at all levels of government, including the State Duma, the Federation Council, at various forums of the scientific community.

The volume of mining in Russia in recent decades has decreased significantly: gas, Nickel, zinc, iron ore – by 7-17%, oil, coal, uranium, copper, bauxite, platinum, potassium salts – by 20-35%, chromium ores, lead, tin, molybdenum, antimony, niobium, gold, silver, Apatite - by 40-60%, tungsten, titanium, phosphorite, fluorspar - by 3 or more times.

Not so long ago, the Ministry of energy adopted the «Strategy for the development of the oil industry until 2035». In it, both scenarios - «basic» and «conservative» provide for a drop in the volume of processing of «black gold», and the planned drop in processing will significantly exceed the reduction in oil production. But we are talking about the strategic state program of development of the most important industry for our country.

In 2016, the next Congress of geologists was held. It was supposed to discuss the above-mentioned problems in the field of strategic subsoil research. Unfortunately, the Congress adopted an empty document on «Strategy...», which gives nothing, which once again emphasized the depth of the fall of scientific and organizational search for mineral deposits. The role of Geology in recent years has fallen through the fault of public administration and the main result is the destruction of the training system. Never in the history of the country was not so low authority geologist, as in the last 25 years.

The destruction of the system of strategic research of mineral resources along with the loss of reproduction of resource potential is the hardest political and economic mistake of the post-Soviet period.

The current system of management of subsoil exploration processes has not justified itself. It led to a decrease in the scientific and practical potential of Geology, the loss of a serious scientific reserve, the collapse of territorial geological organizations and production and technical support, the loss of qualified personnel. Therefore, it is necessary to ensure a fundamental change in the state policy in the field of geological exploration, reproduction of mineral resources, the structure of the geological service of the country and its public sector, in the management of geological research and exploration.

The main objectives of the future management structure, according to representations, Kozlovsky E.A. should be [10,11,12,13,14]:

– restoration of the system of strategic subsoil research to create a promising reserve for providing the country with the most important types of minerals;

– scientific and analytical development of mineral policy for the long term (20, 50 years);

– analysis and evaluation of prospects of consumption, export, import of mineral raw materials and development of proposals to cover its deficit;

– development of proposals for the creation of reserves of mineral raw materials and materials to ensure the activities of the state in special conditions, etc.

This will need to change the management structure of the exploration of mineral resources, the reproduction of the mineral resource base and subsoil use in General, recreating the Ministry of Geology and mineral resources of the Russian Federation. The Ministry should represent a vertically integrated system, including sectoral Federal Executive bodies and research and production enterprises and associations subordinated or coordinated by them.

In November 2015, UNESCO published a report «towards 2030». It follows that Russia's contribution to world science is significantly different from that of China and the United States. And our contribution is provided by traditional Soviet branches of knowledge, such as theoretical physics. In today's promising areas of science that require expensive equipment, our contribution is close to zero. It should be noted that in the US 80% of investments in science are private. But there is a progressive scale of income tax, which allows the rich payer a choice: to give to the budget or to donate something. The authorities oppose the adoption of such a law.

1.2. The activity of mineral resources in the conditions of economic sanctions

The problem of escalation of sanctions against Russia and the calculation of possible consequences for the further development of business is the most hotly discussed topic and affects the interests of both Russian companies and their international partners. In earlier press statements, the US proposed a strategy for using a scalpel rather than a hammer, that is, applying sanctions to the most vulnerable segments of Russian business, banking, mining, energy, defense, and other sectors.

If after the introduction of Russia's embargo on the supply of agricultural products from a number of countries that have adopted trade sanctions against Russia, the results were immediately noticeable - some types of food were lost from the shelves, the damage to other sectors of the economy is less obvious.

In a previously published analytical study, Bank of America Merrill Lynch analysts calculated the possible damage to Russia from the sanctions imposed by Europe in the oil and gas industry. According to the Bank's experts, the industry may lose about $ 500 billion of direct investment, the economy - $ 300 billion, and the budget will lose from 27 to 65 billion dollars. In the study of the likely impact of restrictions on the oil and gas industry in Russia, experts believe that the sanctions will not put pressure on the current production, but can strike in the future; the state is threatened with the loss of a multibillion-dollar multiplier effect. Experts in particular say that it was necessary to invest about 500 billion dollars for the development of the Arctic shelf until 2020. The multiplier effect of the development of offshore and hard-to-reach oil fields could add another $ 300 billion. If the geopolitical situation worsens, and European oil companies are forced to reduce their activities in Russia, plans for the development of the Arctic shelf and exploration of hard-to-reach fields will be threatened.[26].

In a study of the mining industry, recently published by another American Bank - Morgan Stanley, experts believe that sanctions against the largest representatives of the Russian mining and metallurgical industry will not have a significant impact on commodity markets. Even if sanctions are imposed, companies will be able to shift to other markets. However, investors are concerned that the world's major producers of Nickel and platinoids (Norilsk Nickel), aluminum (RUSAL) and diamonds (ALROSA) may be subject to a new round of sanctions by the US, EU and Japan, Morgan Stanley said in his review of the possible impact of sanctions on trade flows in the mining and metals industry.

In this case, Russian companies will redirect supplies to other destinations, and the prices of their products in Europe and the United States can rise sharply, analysts conclude.

The Russian Federation is the main supplier of non-ferrous metallurgy and diamonds. The country accounts for about 49% of total exports to the world market of Nickel, 26% of aluminum, 42% of palladium, 13% of platinum, 33% of diamonds, 7% of steel and 4% of copper. If new restrictive measures are introduced, the cost of these products will increase significantly, which will benefit companies from Russia, which will be able to reorient exports to the countries of the Asia-Pacific region, the Middle East and Latin America.

According to experts, metallurgists from Russia do not rule out such a scenario and prepared for it in advance. Analysts emphasize that the cost of metals against the backdrop of the inflamed Ukrainian conflict and the application of sanctions against Russia has not yet grown due to the fact that the world supply of products of the mining and metallurgical industry has not been affected.

The Eurozone remains the largest trading partner of the Russian Federation, and the US ranks third (second - China). Deliveries to the EU will provide 55% of Norilsk Nickel's revenue in 2014, 44% of RUSAL's revenue, 46% of ALROSA's revenue, 15% of Severstal's revenue and 10% of Evraz, MMK and NLMK's revenue. NorNickel, RUSAL, ALROSA and Severstal (MOEX: CHMF) are the most dependent on us demand and will suffer the most from the ban on their exports.

According to estimates of Morgan Stanley analysts, referring to data of the World Bureau of Metals Statistics, Bloomberg, Thompson GFMS, in terms of a ban on Russian supplies to European countries, America and Japan, the price of metals will rise in the range of 6% to 61%.

The maximum upside (61%) provided the level of reserves remains unchanged - Nickel, minimum (6%) - diamonds. Palladium prices may rise by 34% in the short term and platinum prices by 16%. Aluminum can rise in price by 14%, copper - by 7%. Finally, steel in the long term may rise by 15%, according to Morgan Stanley.

Despite the limited access to the European and American equity markets, Russian mining and metallurgical companies will be able to successfully attract financing through international Bank syndicated loans and, in the future, on the Asian stock exchanges. The successful refinancing of Evraz in the amount of $425 million, held with the participation of the international syndicate Deutsche Bank AG, Raiffeisen Bank International AG, ING Bank N. V., OJSC Nordea Bank, Société Générale and ROSBANK, is another confirmation that the sanctions against the mining and metallurgical industry and individual companies are ineffective.[26,27,28].

In an environment where there is a global economy, it is impossible to imagine a state that is not involved in the system of global and economic relations, since only they affect the speed of development of the state economy and its success.

The Russian economy has been in a state of financial crisis for the last two years, in addition, it is experiencing enormous international pressure, manifested in the introduction of tough sanctions against Russia by foreign countries. Thus, the imposition of sanctions against Russia is connected with Russia's political position regarding the Ukrainian crisis. Western States found unacceptable the actions of the Russian authorities in relation to the Crimea, including the Eastern regions of Ukraine. In June 2014, due to the impact of sanctions, oil prices fell significantly by 50%, therefore, the Russian economy, which depends on the export of energy resources, began to run into new problems. The ban on imports of products to Russia from the EU and the US led to an increase in the consumer price index in Russia to 8%. If there is a devaluation, the burden of the external debt of Russian companies and commercial banks also increases. In 2014, inflation was around 10 % and has continued to increase in 2015. The sanctions themselves are political and economic in nature. Economic is manifested in respect of various kinds of embargo - a ban on the import and export of foreign goods, on the use of property belonging to a foreign state. Economic is expressed in relation to any kind of embargo - a ban on the import and export of foreign goods, on the use of property that belongs to a foreign state. Political is the inclusion of legal entities and officials in the relevant sanctions lists. Experts believe that the consequences of the sanctions for the Russian economy in greater complexity can affect the import. The Russian economy is heavily dependent on imports of science-intensive technologies, machine-building products, medicines, to a high degree, and food. The EU countries that have applied sanctions against Russia are mainly the main import partners. V. Malinovskaya in his article «How sanctions will affect the Russian economy» says that the impact of sanctions can be clearly seen in the aspect of attracting foreign investment. Russia's involvement in the Ukrainian incidents provoked panic in the stock market. After all, by mid-summer, the outflow of foreign capital from the country amounted to $ 75 billion.

In the future, this «flight» of capital means that a lot of major projects in Russia will be postponed until better times. In addition, Russia's credit ratings, which are tempting for foreign capital, may lose out. Economists believe that the result of a reduction in investment inflows may be a slowdown in GDP growth. The Russian economy today is largely dependent on foreign capital. Nevertheless, it is likely that the place of investors from the EU and the US will be taken by capitalists from the BRICS countries. BRICS is a group of five countries: Brazil, Russia, India, China, South Africa. BRICs members are characterized as particularly rapidly developing large countries. The convenient position of such countries guarantees the presence in them of a huge number of significant resources for the world economy: Brazil - rich in agricultural products; Russia - rich mineral resources; India - cheap intellectual resources; China - a powerful production base; South Africa - natural resources. Therefore, a downgrade in the methodologies developed in the US and the EU may not play a significant role in attracting investment [27].

Also, foreign sanctions have had a significant impact on the banking system, as the Russian banking system is so connected with the world that foreign financiers actually have access to the basic mechanisms of its management. Accounts of American and European banks are actively used by Russian businesses. Russian businesses are actively using the accounts of American and European banks and, according to experts, if the credit and financial enterprises of Western countries decide to freeze the relevant assets, it can cause significant damage to Russian enterprises that work with foreign banks. Sanctions were imposed on the largest Russian credit and financial institutions: VTB, Sberbank, VEB.

For example, EU citizens from the beginning of August was forbidden to purchase some types of securities of these institutions. According to experts, this means that these Russian banks cease to have access to capital markets. Therefore, they may have problems with the payment of current debt, registration of new loans. In addition, it is important to say about the blocking of the largest payment systems in the world-VISA and MasterCard – Bank cards of several credit and financial institutions of Russia, such as Sobinbank, JSCB Russia, SMP Bank. However, experts agree that visa and MasterCard will not completely disconnect from the Russian market, if this happens, there will be a threat to the stability of the EU financial system. It should be said about the consequences of «anti-sanctions» for the EU, affecting one of their most vulnerable areas – foreign trade [28, 29].

The most significant impact was the ban on the import into Russia of a large range of food products, mainly produced by the EU industry. In early August, the President of Russia issued a Decree according to which, within one year, «it is prohibited or limited to the implementation of foreign economic operations involving the import into the territory of Russia of certain types of agricultural products, raw materials and food from countries that have imposed economic sanctions against Russian individuals and (or) legal entities or joined such a decision.» Many experts believe that European farmers have suffered greatly from the embargo. Deliveries to Russia for many of them were a guarantee of profitability, and for some businesses and at all the main sales channel. To find buyers in other markets, analysts believe, food industry enterprises from the EU will be able very soon. And because in the near future their business is likely to be unlikely to be profitable. In monetary terms, the total volume of relevant imports, as analysts have estimated, at the time of the introduction of countermeasures was equal to $ 9 billion. It should be said about the positive aspects of the sanctions. According to some economists, the EU sanctions - a good excuse to build the economy of the Russian Federation, which, due to a strong focus on the export of oil, growing, not as fast as I could.

The greatest potential is present in the field of import substitution. Russia has sufficient resources - both in terms of production capacity and raw materials, and in terms of the scientific component to produce the bulk of goods imported from abroad. Some experts believe that the food embargo against producers from the EU has opened up huge opportunities for farmers of the Russian Federation. Many segments have opened up market niches, or at least become significantly less saturated. Another positive aspect is the decision of the Russian authorities to intensify work on the development of a national payment system, as well as to attract Chinese MPs to the Russian market-UnionPay, which could become a serious competitor to the current world leaders. This would cause VISA and MasterCard significant damage - hundreds of millions of dollars. Thus, we can conclude that the current state of the economy in Russia is in a stagnant period.

Western sanctions are negative and in many ways their effect has a negative impact on future prospects and in the current circumstances, the government should either negotiate with the countries that have introduced and joined the sanctions, or revise the economic model of the whole country. In the long term, if current trends continue, sanctions may adversely affect both the Russian economy and ordinary Russians.

1.3. The impact of the development of mineral resources on the economic development of the Russian regions

Mineral resources are the most important potential for the economic development of the country. The successful operation of the mineral resource complex, especially in recent years, provides the state with the opportunity to solve social and political problems, to service foreign debt, to invest in the real sector, to carry out technical re-equipment and development of the entire national economy, to continue the conversion and thus to ensure an increase in the share of high-tech products competitive in world markets.

Speaking of natural resources, it should be noted that Russia is the greatest country in the world. It owns 1/9 of the land, 1/8 of the land inhabited by people, 13% of water spaces. Currently, the world looks at Russia as a supplier of mineral raw materials. For example, according to academician D. Lvov, the resource potential of Russia is 340-380 trillion. dol. If it is compared with the population, the average Russian national wealth accounts for 2 times more than in the United States, 6 times - than in Germany and 22 times more than in Japan. The availability of rich and effective natural resources provides a wide scope for the economic development of the state. Let us consider the overall importance of the mineral resource complex for our country, as well as a more detailed comparative assessment of Russia's resources with other countries. Mineral resources have and are of great importance for the Russian economy. This fact is confirmed by the history of the state. The study of mineral resources occupies an important place in modern economic science.

Mineral resources complex plays an important role in all spheres of life of the Russian Federation:

– provides a sustainable supply of mineral resources to the sectors of the economy and contributes to the formation of a solid industrial base that meets the needs of both industry and agriculture. Enterprises that are part of the mineral complex provide more than 50% of the gross domestic product of the country. Extraction of raw materials brings demand to dozens of related industries - in particular, mining engineering, production of drilling and power equipment, etc. Metallurgical cargoes account for about 35% of the turnover of domestic Railways, ferrous and nonferrous metallurgy consumes 25% of the fuel and energy consumed by the industry;

– makes a significant contribution (more than 50%) to the formation of the profitability of the country's budget. Mining and processing of minerals is the basis of the economy of the prosperous territories of the Russian Federation. The volume of export revenues to the state budget, which are directly or indirectly provided by the development of mineral resources of the country, is about 70%, the mineral resource complex provides 100% of the stabilization Fund of Russia;

– is the basis of the defense power of the country. The developed raw material base is a necessary condition for the improvement of the military-industrial complex of Russia and creates the necessary potential. The development of mineral resources creates the necessary prerequisites for the further development of the country's infrastructure. The strategic importance of mineral resources inevitably attaches to the geological and economic study of the subsoil the role of an instrument for the development and observance of the state geopolitical interests of Russia. This applies both to the strategy of development of the largest deposits in Russia and the consolidation of Russian priorities on the continental shelf in the Caspian, Black, Barents, Okhotsk and Bering seas, the Oceans, the Arctic and the Antarctic. It is the mining enterprises in remote uninhabited areas that create conditions for the development of infrastructure, increasing the employment of local and migratory populations in the main production and service sectors. Increase the flow of funds to the budgets of all levels, strengthen national security through the presence of state and non-state structures of the population in remote border areas;

– it is the basis of large domestic business. An important factor in the development of the mineral resource base is also the position of Russia in the world market of mineral raw materials. Mineral companies play a decisive role not only in the Russian economy. Of the world's 200 largest companies, about half belong to the mineral sector, accounting for 80% of total sales. In the context of the transition economy, there is another function that stimulates the globalization of the world economic system, the transition to corporate cooperation and the development of adequate market infrastructure. Stock prices of such energy companies as JSC «Gazprom», RAO «UES of Russia», OAO «NK LUKOIL», etc. determines the business rating of Russia;

– it occupies an important place in the socio-economic development of a number of Russian regions and ensures social stability. The fuel and energy complex of Russia is the most important infrastructure factor that provides the constant needs of the population and the state in heat, electricity, gas, coal and fuel. In Russia, almost all large companies that are part of the mineral resource complex are city-forming. In some regions of Russia, the extractive industry is the main industry and, including service industries, provides up to 75 % of jobs. Stabilization and improvement of the socio-economic situation in the crisis subjects of the Russian Federation (North Caucasus), areas of special geopolitical interests (Kuril Islands, Chukotka, Chukotka auth. district, Magadan region, etc.), in the depressive regions of the Far North, including the territories of residence of small peoples of Siberia and the Far East. Thus, the development of this sector of the economy will ensure an increase in the welfare of the population and reduce social tension;

– contributes to the development of integration processes between the countries. Russian oil and gas exports significantly shape the global energy market and play an important role in ensuring the energy security of Europe, where the share of Russian gas is more than 60%.

Thus, the development of the mineral sector in the Russian economy simultaneously affects all other developing areas and sectors of the state. Therefore, the study of its problems and trends helps to determine the long-term perspective of our country's economy.

In Russia, mineral resources are an important factor in the formation of the budget, the well-being of the population and the competitiveness of the national economy. Today, the development and production of mineral resources creates socio-economic conditions for sustainable economic growth of the country and its regions [21, 36, 37, 38].

The development of processing industries, including on the basis of advanced technologies, is unthinkable without the widespread use of mineral raw materials as a source product. The most industrialized countries are also the countries with the highest per capita consumption of primary energy resources and mineral products. Per capita consumption of mineral resources is positively correlated with the level of economic development of the countries. Developed countries (USA, England, Germany, France, Japan), which account for 16 % of the world's population, use more than half of the world's minerals. The picture for certain types of raw materials is even more impressive.

Developed countries consume more than 80 % uranium, about 77 % copper, 72 % lead, 59 % zinc, 67 % Nickel, 50 to 80 % tin, tungsten, molybdenum, more than 50 % phosphate raw materials.

Russia does not lag behind the developed countries in the extraction of mineral raw materials per capita - about $ 700. per year, compared to $ 500. with the USA. But the US imports about the same amount of raw materials as it produces itself and consumes about 7 times more oil per year than in Russia, although we are 2 times behind the US in terms of population.

Russia ranks among such countries as Saudi Arabia, Brunei, Kuwait, Bahrain, Venezuela, Chile, South Africa and others in terms of the high share of exports of raw materials in the country's GDP.

The industry of many commodity countries is one-sided, but the standard of living there is high due to the small population and high mountain rents. Norway sells 90 % of produced gas and oil but ranks first in the world in terms of electricity generation per capita (29 thousand kWh - 2 times more than in the US). The money received from the sale of raw materials is returned to the economy by investments in science-intensive production and social sphere.

Taking a leading position in the provision of MSR, per capita and per 1 km2 of area, Russia is in 3-4 dozen of producing countries. Over the past 10 years, the absolute consumption of mineral products has decreased significantly. For example, in the global volume in 1991, Russia consumed 10.1 % of aluminum, and now - only 1.1 %, copper consumption decreased from 5.8 % to 0.7 %, and Nickel - from 18.9 to 1.6 %.

An important factor in the analysis of demand for mineral products is the intensity of use. The US, for example, with only 1.9 % of the world's proven oil reserves, annually produces more than Russia, which has more than 13 % of the world's reserves. In the United States annually produce almost as much as in Russia, natural gas, while its reserves are 3.4 % of the world, against 34 % in Russia. Coal in the US is mined almost 3 times more than in Russia.

The economic development of the country and the region is determined not so much by the amount of raw materials produced as by the ability to use them rationally, competently and innovatively.

Indeed, Russia ranks first in the world in proven reserves of gas, Nickel, silver, gold, platinoids and diamonds. But the country is not able to fully process raw materials: it needs 2 times more energy. In Russia, a little more than 5 thousand kWh of electricity is produced per capita. According to this indicator, the country is not even among the top twenty countries in the world.

Many of the deposits have an unfavorable geographical position. The cost of production of even gold in the Northern regions is higher than it can be purchased on the London metal exchange.

30% of the world's natural gas reserves, 50% of diamonds, 25% of Nickel reserves, 17% of tin, 10% of oil are concentrated in the depths of Russia. As a result, Russia occupies a leading position in the production of major types of minerals. Until recently, the development of mineral resources in the national economy determined: more than 50 % of the budget revenues, more than 70 % of exports and foreign exchange earnings, 100 % of the stabilization Fund, about 60 % of industrial production.

In addition, the development of mineral resources determines the development of all basic sectors of the Russian economy, contributes to the creation of new jobs and is a necessary condition for the improvement of the military-industrial complex of the state and the creation of the necessary strategic reserve and potential; creates the necessary prerequisites for the further development of Russia's infrastructure, strengthening the national presence in remote regions and the protection of domestic geopolitical interests [22, 13, 14].

In modern economic conditions in Russia with special sharpness there was a problem of reconstruction of strategic stocks among which fuel and energy resources, noble metals, ores of nonferrous and rare metals and nonmetals used at production of special alloys, in military equipment and the latest technological processes are carried. According to the information of the Interdepartmental Commission of The security Council of the Russian Federation on economic security, the provision of proven reserves has reached a critically low level in the vast majority of mining enterprises, the strategic reserve of many types of raw materials in existing fields is not reliable. The situation is aggravated by the fact that for most types of raw materials, work on the creation of new mining capacities has been stopped, there has been a sharp reduction in the volume of geological exploration. The state of raw materials bases of many major mining regions and operating enterprises in Russia has deteriorated significantly due to depletion of reserves, reduction of their quality and economic characteristics, the complexity of working conditions as a result of long and intensive operation. The quality of ores from a number of deposits does not ensure their profitable development due to the low level of technologies used.

The problems of the mineral sector of the Russian economy are the problems of the entire economy. Their solution is the main task for the state. Consider the current state of the mineral complex of Russia, to determine the specifics and evaluate the proposed ways of development.

2. Unfavorable circumstances for the enterprises of the mineral complex

2.1. Prerequisites and causes of adverse circumstances for the enterprises of the mineral complex

At this stage of development of market relations in Russia, the most relevant measures aimed at protecting industrial enterprises from adverse situations, preventing bankruptcy or liquidation in the event of inefficiency of its further functioning.

Any competent management decision should be the result of a balanced perception of reality, in which risks and threats are minimized, profits and revenues are maximized. The correspondence of existing knowledge and skills in the field of management to the challenge of time is a key factor in the confident development of the organization. Management in adverse conditions occurs in many areas. Many believe that the main reason for its birth is the reform of the Russian economy, as well as the emergence of a sufficiently large number of commercial and other enterprises, the situation of which is unenviable – they are at the stage of bankruptcy. Of course, the crisis of enterprises is quite a normal process, which some companies simply cannot avoid, and in the market, as in life, always win only the strongest. Thus, if the enterprise does not have the ability and ability to «fight» the unfavorable situation, it simply disappears, but otherwise the enterprise can use all its resources and overcome the unfavorable circumstance.

Despite the success of the development of the country and as noted by Vladimir Putin, Russia's withdrawal on sustainable development, does not rule out the ingress of domestic enterprises in adverse circumstances.

Management in adverse conditions – this, first of all, should be a kind of «rehearsal» of possible adverse situations that may arise during the operation of any enterprise, which in turn necessitates the development of advanced management in the enterprise. (see section 2). Russia has accumulated experience in crisis management and now it must be transferred to management under adverse conditions.

The most optimal approach is also voiced in the book A. G. Gryaznova «Crisis management»: «Crisis management – such a system of enterprise management, which has a complex, systematic nature and is aimed at preventing or eliminating adverse events for business through the use of the full potential of modern management, development and implementation of a special program at the enterprise, which has a strategic nature, allowing to eliminate temporary difficulties, maintain and multiply market positions under any circumstances, relying mainly on their own resources. In this case, we would replace the term «crisis management» with «management in adverse circumstances»

The underlying causes of adverse circumstances are many different factors. These factors can be divided into two main groups: [35]. External (not depending on the activities of the enterprise);

Internal (depending on the activity of the enterprise).

External factors of occurrence of adverse circumstances can in turn be divided into:

1. Socio-economic factors of the overall development of the country:
   - inflation growth;
   - instability of the tax system;
   - instability of regulatory legislation;
   - decline in real incomes;
   - rising unemployment;
2. Market factor:
   - reduction of the internal market;
   - increased monopoly in the market;
   - the instability of the currency market;
   - increased supply of substitute goods;
3. Other external factors:
   - political instability;
   - natural disasters;
   - worsening of the crime situation.

Internal factors of the crisis:

4. Managerial:

– high level of commercial risk;
– lack of market knowledge;
– inefficient financial management;
– poor management of production costs;
– lack of flexibility in management;
– insufficient quality of accounting and reporting system.

5. Production:

– unsecured unity of the enterprise as a property complex;
– obsolete and worn-out fixed assets;
– low productivity;
– high energy consumption;
– overload objects of the social sphere.

6. Market:

– low competitiveness of products;
– dependence on a limited number of suppliers and buyers.

All of the above factors may be the basis for the development of adverse circumstances for the enterprise, but more influence on the state of the enterprise have management factors. It is the inefficiency of management that should be attributed to the most characteristic problem for timely enterprises, which prevents their effective functioning in the conditions of the existing market relations. This problem is caused by the following factors:

1. Lack of strategy in the company's activities and focus on short-term results to the detriment of medium and long-term;
2. Low-skilled and inexperienced managers;
3. The low level of responsibility of the company's managers to the owners for the consequences of decisions, for the safety and effective use of the company's property, as well as for the financial and economic results of its activities. The struggle of enterprises for survival in crisis conditions will require the interconnection of organizational, legal, financial and managerial aspects. So, based on all of the above, you can give errors in the management, or more specifically, the lack of this very management.

2.2. The system of problems for enterprises in adverse conditions

At any time there is a danger of adverse circumstances, even when they actually do not. This is determined by the fact that in management there is always a risk that the socio-economic system is developing cyclically, that the ratio of managed and unmanaged processes is changing, the person, his needs and interests are changing.

To a certain extent, the management of the social and economic system must always be based on the prevention of unfavourable circumstances.

The problem of management in adverse circumstances is wide and varied. The diversity of management issues in adverse circumstances can be distinguished by a combination of the following four groups:

The first group of problems includes problems of recognition of adverse situations. It is not an easy task to see the onset of an unfavorable circumstance in time, to detect its first signs, to understand its character. On this depends the prevention of adverse circumstances. But not only that. Mechanisms to prevent adverse circumstances should be built and put into action. And this is also a management problem.

The second group of problems of management in adverse conditions is associated with key areas of the organization. This is primarily a methodological problem of its life. In the process of solving them, the mission and purpose of management are formulated, the ways, means and methods of management in an unfavorable situation are determined. This group includes a set of financial and economic problems. For example, there is a need to determine the types of diversification of production or conversion.

The third group includes in the most General form the problems of forecasting unfavorable circumstances and options for the behavior of the socio-economic system in an unfavorable state, the problems of finding the necessary information and developing management decisions. Problems of analysis and assessment of adverse situations are also important. In the same group, it is possible to consider the problems of developing innovative strategies that contribute to the conclusion of the organization from an unfavorable circumstance.

The fourth group of problems includes conflict situations and selection of personnel, which always accompanies unfavorable situations. You cannot ignore the governance structures in adverse circumstances and problems of investments, measures to overcome adverse circumstances, marketing and the problems of bankruptcy and reorganization of enterprises.

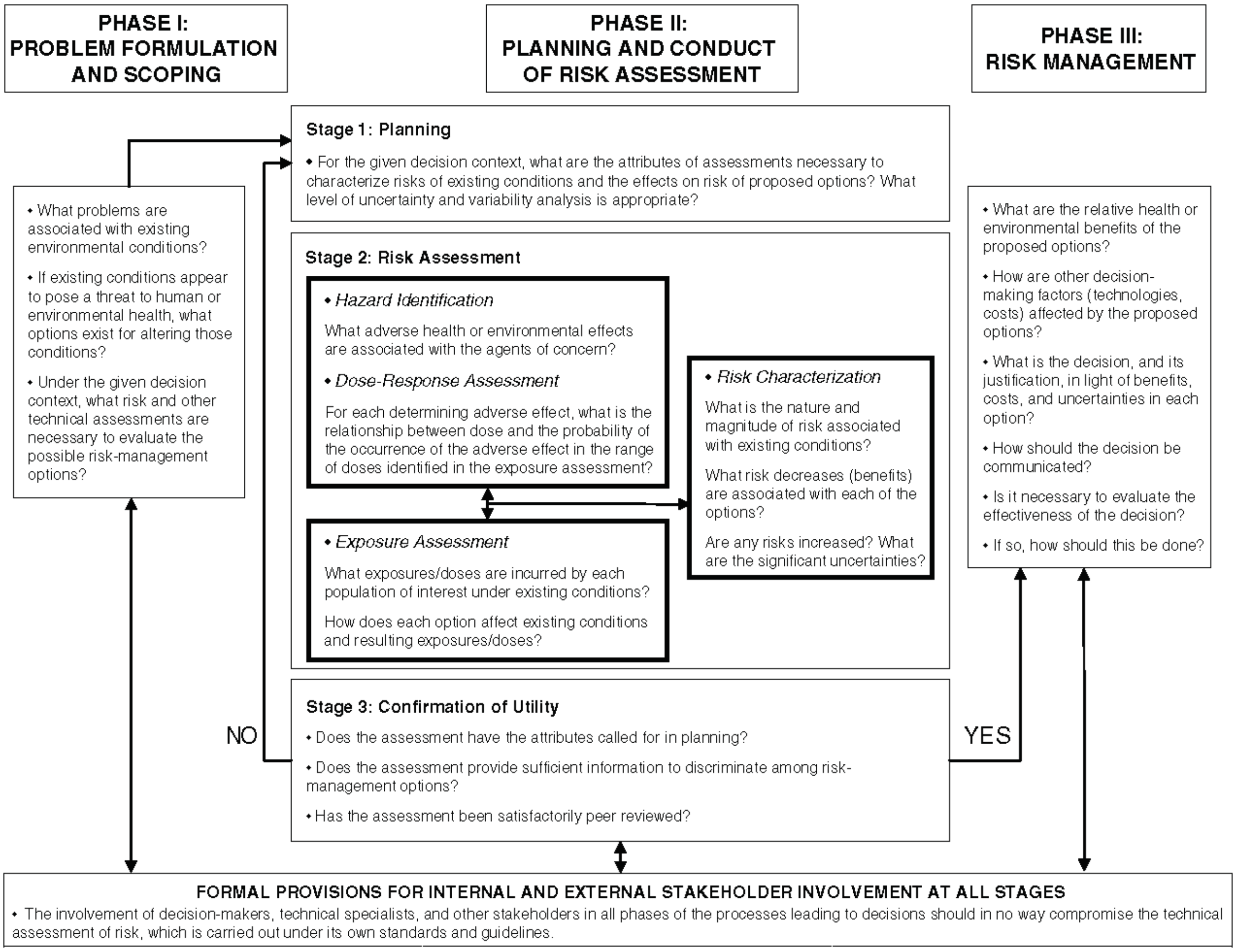


Fig. 2.1. Problems of management in adverse conditions

Management in adverse circumstances, the composition of its typical problems reflects the fact that it is a special type of management that has both common features and specific characteristics.

Management in adverse circumstances is the subject of the impact of the problem and the anticipated and real adverse factors of the situation, ie all manifestations of excessive aggregate aggravation of contradictions, causing the danger of the extreme manifestations of this deterioration, the onset of adverse circumstances.

2.3. Principles of management in adverse conditions

The main principles should include:

1. Early diagnosis of adverse events in the financial activities of the enterprise. Given that the occurrence of adverse conditions in the enterprise threatens the very existence of the enterprise and is associated with tangible losses of capital of its owners, the possibility of adverse

conditions should be diagnosed at the earliest stages in order to timely use of the possibilities of their neutralization.

2. Urgency to respond to adverse situations. Each emerging adverse phenomenon not only tends to expand with each new economic cycle, but also generates new accompanying phenomena. Therefore, the earlier the mechanisms for overcoming adverse circumstances are applied, the greater the opportunities for recovery will be available to the enterprise.

3. The adequacy of the company's response to the degree of the real threat of bankruptcy is largely associated with financial costs or losses. At the same time, the level of these costs and losses should be adequate to the level of the enterprise bankruptcy threat. Otherwise, either the expected effect will not be achieved or the enterprise will incur unreasonably high costs.

4. Full implementation of the internal capabilities of the enterprise out of an unfavorable state.

In the fight against the threat of bankruptcy, the company should rely solely on internal financial capabilities.

The control system in adverse conditions must have special properties:

– flexibility and adaptability that are most common in matrix management structures;

– tendency to strengthen informal management, motivation of enthusiasm, patience, confidence;

– management diversification, search for the most appropriate typological features of effective management in difficult situations;

– reduction of centralism to ensure timely situational response to emerging problems;

– strengthening of integration processes, allowing to concentrate efforts and more effectively use the potential of competence.

Management has features in terms of its processes and technologies. The main ones are:

– mobility and dynamism in the use of resources, changes, implementation of innovative programs;

– implementation of program-target approaches in technologies of development and implementation of management decisions;

– increased sensitivity to the time factor in the management processes, the implementation of timely actions on the dynamics of situations;

– increased attention to pre-and post-assessments of managerial decisions and selection of alternatives of behavior and activity;

– the use of anti-crisis criteria for the quality of solutions in their development and implementation.

In the mechanism of crisis management in adverse conditions, priorities should be given:

– motivation, focused on measures to prevent adverse conditions and overcome them in case of occurrence, saving resources, avoiding mistakes, caution, in-depth analysis of situations, professionalism, etc.;

– attitudes to optimism and confidence, social and psychological stability of activity;

– integration according to the values of professionalism;

– initiative in solving problems and finding the best development options;

– corporatism, help, search and support of innovations.

3. Insufficiency of material assets base – loss of intensification.

3.1. Analysis of the current state and problems of the use of intangible assets in the activities of enterprises of Moscow time

Intangible assets (IA) are the most important component of the property of modern enterprises. Intangible assets include patents, licenses, know-how, software products, etc. the Involvement of intangible assets in economic turnover is widely developed in international practice, which brings companies and firms tangible profits. Thus, according to the British trademark protection Institute, the ratio of tangible and intangible assets in a number of large foreign firms is: «British Petroleum» – 29/71; «Coca-Cola» – 4/96; «Hires» and «Crash» – 9/91. [36, p. 9-41].

Intangible assets occupy a small share in the assets of Russian enterprises. The difference between the market capitalization of Western companies and the value of their tangible assets is on average 70%, while Russian enterprises have only 0.2%. In domestic practice, there is no sufficient experience of accounting and valuation of intangible assets. The vast majority of Russian enterprises, including those in the mineral and raw materials complex (MSC), have not even started to form their base of intangible assets.

However, it should be noted that in recent years there has been a noticeable increase in the share of intangible assets of MSK enterprises in their property complex. Thus, for the period from 1993 to 2013, the share of intangible assets in the economy of individual enterprises of the mineral complex rose from zero percent to 1.0-2.0% and higher (10-12%). The growing understanding of the importance of intellectual property by Russian entrepreneurs is eloquently evidenced by such facts as the valuation of the trademark rights of JSC Norilsk Nickel. Such types of intangible assets as the brand of the enterprise, the trademark of the company or the trademark of the product directly affect the demand of buyers, product prices, and, consequently, the main economic indicators of activity.

Enterprises operating in the field of subsoil use, to realize the potential of intangible assets in order to improve the efficiency of activities and maintain its stability, it is necessary to fulfill at least three conditions: to have intangible assets on the balance sheet of the enterprise, to correctly determine their commercial value and to enter into economic turnover in a timely manner to

Unfortunately, to date, the issues of recognition of specific types of IA in MSK, assessment, accounting and development of methods for transferring the value of intangible assets to production costs have not been fully worked out. Due to the lack of methodological developments on the participation of intangible assets in financial and economic activities, in a number of cases, even with very capital-intensive intangible assets, subsoil use enterprises do not put them on the balance sheet. The latter circumstance significantly reduces not only the assessment of the business, but also does not give a complete picture of the actual cost of capital of enterprises.

As follows from the analysis [12, 36, 42, 58, 66, 94, 120], there are many reasons why IA are currently one of the underutilized reserves to improve the efficiency and intensity of production by enterprises in subsoil use.

The main reason is that intangible assets are one of the most problematic issues at present, both in Russian and foreign accounting methodology. Their account differs in complexity of a subject, definition of criteria of classification, recognition and an assessment. The Russian legislation still does not have an unambiguous position even on the definition of tangible assets, on the relationship of this category with the concept of intellectual property.

Since January 1, 2008 the new Regulation on accounting «Accounting of intangible assets» (PBU 14/2007) came into force in the Russian Federation. [103]. In General, the new PBU is not fundamentally different from PBU 14/2000, although in some respects this document is undoubtedly a step forward for the convergence of domestic accounting with the international financial reporting system (IFRS).

Unlike the previous one, PBU 14/2007 does not even provide a definition of «intangible asset». The definition of IA is given in the «Regulations on accounting and financial reporting» [102], where intangible assets are understood as «intellectual property (exclusive rights to the results of intellectual activity)» plus the business reputation of the enterprise (goodwill).

Intellectual property – in a broad sense means the statutory rights to the result of intellectual activity in the industrial, scientific, artistic, industrial and other fields. Legislation that defines intellectual property rights is based on the right of everyone to own, use and dispose of the results of their intellectual, creative activity, which, being not a material good, are reserved for its creators and can be used by others only in agreement with them, except in cases determined by law. The definition of the term «intellectual property» in the Russian legislation is given in art. 138 part one of the civil code of the Russian Federation as a generalizing concept of the results of intellectual activity and equated to them means of individualization of a legal entity, individualization of products, works or services.

According to Russian law, intellectual property is divided into:

– copyright - copyright regulates the relations that arise in the process of creation and use of literary, musical and artistic works, works of cinematography, scientific works, among which it is necessary to distinguish computer programs and databases;

– related rights - the purpose of these rights is to protect the legal interests of specific individuals and legal entities that contribute to the creation of works available to the General public;

– trademark;

– geographical indication;

– industrial design;

- patents;
- international registration system;
- unfair competition (the right of trade secrets) - a system of rules that establish the protection of formulas, processes, developments, tools or collections of information used in business to gain superiority over competitors. Trade secrets are protected by unfair competition laws (for example, such laws may prohibit industrial espionage);
- -protection of new plant varieties.

In January 2007, the fourth part of the Civil Code of the Russian Federation «Rights to results of intellectual activity and means of individualization» came into force, which regulates not only intellectual property, but also all actions and consequences associated with it [24]. Legal entity can register (patent) and provide legal protection (protection) of the following objects of intellectual property: objects of industrial property; trademarks (trademarks); inventions; utility models; industrial designs; objects of copyright; written and oral works; sound and video recording; image; three-dimensional form of the work and other forms (computer programs and databases, topology of integrated circuits).

In international practice, according to IFRS 38 «Intangible assets» [73], «an intangible asset is an identifiable non-monetary asset that has no physical form, serves for use in the production or provision of goods or services, for lease to others or for administrative purposes». From the IFRS perspective, an intangible asset is an identifiable controlled asset that has no tangible form. The standard defines an asset as «a resource controlled by the company as a result of past events and from which economic benefits are expected to flow to the company».

According to PBU 14/2007 «Accounting of intangible assets» [103] for the recognition of the object as intangible assets, the following conditions must be met at one time:

- absence of material (physical) structure (according to IFRS 38 important, but not obligatory condition);
- the possibility of identification (isolation, separation) organization from other assets (under IAS 38 goodwill is unlike 14/2007 does not apply to intangible assets);
- use in the production of products, in the performance of works or services, or for the management needs of the organization (in accordance with IFRS 38);

– long-term use, i.e. useful life, longer than 12 months or the normal operating cycle, if it exceeds 12 months (according to IFRS 38 this condition is not necessary and is determined by the organization itself);

– the organization does not assume the subsequent resale of this property within 12 months or the usual operating cycle if it exceeds 12 months (corresponds to IFRS 38);

– ability to bring economic benefits (income) to the organization in the future (in accordance with IFRS 38);

– availability of properly executed documents confirming the existence of the asset itself and the exclusive right of the organization to the results of intellectual activity (patents, certificates, other security agreements, etc.) – (according to IFRS 38 this condition is not necessary);

– the actual (initial) cost of the object can be reliably determined (corresponds to IFRS 38).

Almost all criteria for the recognition of IA provided for in the international standard are also available in PBU 14/2007. It should be noted, however, that the classification of intangible assets under IFRS is based on their economic content, while PBU 14/2007 prioritizes legal form over economic content.

If the obtained intellectual result or other intangible resource available to the enterprise is not subject to legal protection in accordance with the laws in force in the country, it is impossible to talk about the existence of exclusive rights to the results of intellectual activity.

An important point according to PBU 14/2007 is the condition: if IA does not meet the definition of an intangible asset (identifiability, control, future economic benefits, etc.), it should be recognized as an expense as it arises.

It is not easy for practical application is such a criterion in the Russian legislation classifying assets as intangible, as the ability to generate income to the enterprise. The introduction of such a criterion in our country can cause the requirements from the regulatory authorities to provide additional evidence about the ability of IA to generate income. Otherwise, there may be doubts about the legality of accounting for certain rights in intangible assets, which means that there may be certain tax consequences. For example, income tax - if the property is not recognized as intangible assets, its depreciation will be regarded as an overestimation of cost and a decrease in the tax base. In Western practice, in contrast to the Russian accounting firm itself granted the right to determine the moment from which a particular type of intangible asset ceases to be profitable and therefore must be liquidated and written off the balance sheet.

According to PBU 14/2007, intangible assets include: intellectual property objects (exclusive right to the results of intellectual activity); exclusive right of the patent owner to the invention, industrial design, utility model; exclusive copyright or other right of the owner to the topology of integrated circuits; exclusive right of the owner to the trademark, service mark, name of the place of origin of the goods; production secrets (know-how); exclusive right of the patent owner to selection achievements; business reputation arising in connection with the acquisition of the enterprise as a property complex (in whole or in part) (according to IFRS 38 this does not apply to IA)

Organizational expenses related to the formation of a legal entity, recognized in accordance with the constituent documents as part of the contribution of participants (founders) to the authorized capital of the organization, in PBU 14/2007, unlike PBU 14/2000, do not apply to IA, which corresponds to international practice. Intangible assets are also not the intellectual and business qualities of the staff, their skills and ability to work, because they are inseparable from their carriers and can not be used without them.

However, it should be noted that such an important object of accounting, which according to IFRS 38 refers to IA as a license, in accordance with PBU 14/2007, is not included in intangible assets. This is one of the reasons why IA are currently one of the underutilized reserves for improving the efficiency of production of enterprises in subsoil use – completely inconsistent with international standards and contrary to common sense, the exclusion of licenses for certain activities from intangible assets.

International financial reporting standards make it possible to qualify licenses for certain activities as intangible assets. According to the international standard (IFRS 38, paragraph 33), the government may transfer to the company «intangible assets such as airport boarding rights, broadcasting licences, import licences or quotas or rights of access to limited resources». Thus, the Russian legislation (PBU 14/2007) has not come close to international standards with regard to such a common type of resources for organizations in the field of subsoil use as licenses for certain types of activities. But the most numerous and significant types of

IA in subsoil use are the costs incurred by enterprises to obtain a wide variety of licenses, without which it is impossible to carry out either geological exploration or mining.

However, it should be noted that the range of domestic accounting standards has been supplemented by the new PBU 24/2011 «cost Accounting for the development of natural resources», which entered into force on January 1, 2012. This standard, of course, is a positive step towards the reflection of industry-specific cost accounting. As well as for the transition of Russian subsoil user organizations to international financial reporting standards (IFRS). PBU 24/2011 is an analogue Of the international standard IFRS 6 «Search and evaluation of minerals», which was put into effect on the territory of the Russian Ministry of Finance. The use of IFRS for reporting by subsoil users is a necessary procedure when entering international markets, thus allowing to expand the range of potential investors, including foreign participants.

PBU 24/2011 introduces new terminology into accounting, which for the first time reflects the industry specifics. For example, such a new concept as search costs - the cost of search, evaluation of mineral deposits and mineral exploration. Exploration costs should relate to a particular subsoil area and arise in conditions where the organization has not yet decided on the commercial feasibility of mining on this site. This stage may temporarily not generate income or even be in principle ineffective.

Commercial feasibility of mining - a new concept in PBU 24/2011 - is an established and documented probability that the economic benefits of mining in a certain subsoil area will exceed the costs incurred, provided the technical feasibility of mining and the availability of the organization of resources necessary for the extraction of minerals. Subsoil users should take care of the documentary confirmation of the commercial feasibility of mining in the subsoil area or the recognition of the futility of mining. This will require the involvement of other services of the organization, not just accounting.

The main issue that was resolved with the entry into force of the domestic standard PBU 24/2011 is the possibility of capitalization by mining companies of expenses incurred in the course of prospecting, exploration and evaluation of mineral deposits (mineral deposits). Prior to the entry into force of PBU 24/2011, movable and immovable property (structures, special drilling rigs, pumping units, vehicles, etc.) acquired in the course of search and evaluation and exploration works were generally capitalized as assets of the MSC organizations. The acquired rights to conduct exploration for exploration, evaluation and exploration of mineral resources, confirmed by the relevant license, could be reflected in intangible assets. Other expenses (labor costs, depreciation, material costs) were recorded on the basis of PBU 10/99 «cost Accounting» using account 97 «Deferred expenses». But it was impossible to keep this accounting policy because of the change in the Situation of accounting and reporting in the country. For example, in 2011. even the cost of the licences under which the organizations conducted prospecting, evaluation and exploration activities was not taken into account.

In the new PBU 24/2011 there are three groups of costs:

– expenses of the organization carried out until the receipt of the license, which gives the right to perform work on the search and evaluation of mineral deposits in this subsoil area;

– search costs, including license costs;

– costs of extraction of minerals in respect of the subsoil plot, which are incurred after the commercial feasibility of production is established, and for geological exploration carried out on the subsoil plot, in respect of which the commercial feasibility of production is established.

PBU 24/2011 establishes the procedure for the formation of information on search costs in the accounting and disclosure in the financial statements of organizations.

Search costs should be classified by the organization as follows:

1.Recognized as non-current assets (search assets).

With the introduction of the new PBU in the capitalization of costs, subsoil users will have to conduct a separate analytical accounting of search assets, classifying them not only by type, but also on the basis of the criterion of materiality. On this basis, structures and equipment (drilling rigs, pipelines, vehicles) should be considered as searchable material assets. Intangible prospecting assets will include: information obtained as a result of topographic, geological and geophysical studies; results of exploration drilling; the results of sampling; other geological information about the subsoil; evaluation of commercial feasibility of production.

Search the assets with the recognition in the accounting records are valued at the sum of actual expenses on their acquisition (creation). The list of such costs is generally similar to those given in PBU 6/01 and PBU 14/2007. It should be noted that they may also include depreciation of other non-current assets (including search assets) used directly in the creation of the search asset; obligations of the organization in respect of environmental protection, land reclamation, liquidation of buildings, structures, equipment arising in connection with the performance of works on search, evaluation of mineral resources and exploration associated with recognized search assets.

Applying PBU 6/01 «Accounting of fixed assets» and PBU 14/2007 «Accounting of intangible assets» the organization could not earlier recognize the search costs as non-current assets, because until the determination of commercial feasibility is unclear, for example, the ability of these costs to generate income (economic benefit) in the future. It was PBU 24/2011 that made it possible for subsoil user organizations, taking into account their industry specifics, to recognize search costs as search assets.

2.Recognized as expenses for ordinary activities.

The organization independently determines which search costs relate to the costs of the main activities (ie, to its current costs), and which – to the search assets.

When the commercial feasibility of production is confirmed, the entity should: re-examine the search assets for impairment and, if appropriate, record the impairment; transfer the search assets to property, plant and equipment or intangible assets at residual value; write off the search assets that are not suitable for further use in the same manner as the write-off of property, plant and equipment or intangible assets.

If the production is considered unpromising, then the search assets are written off, and the income and expenses from such write-off are related to the financial results of the organization.

If search assets will be used in the activities of the organization, they are taken into account at residual value as part of fixed assets or intangible assets.

PBU 24/2011 does not apply to costs associated with regional geological and geophysical works, geological surveys, engineering and geological surveys, research, paleontological and other works, geological works on earthquake prediction and volcanic activity research, creation and monitoring of the natural environment, control over the regime of groundwater.

In IFRS 38, intangible assets are initially measured at cost. IFRS 38 establishes approaches to determining the actual cost depending on the method of acquisition of an intangible asset, which include: a separate purchase; acquisition in the process of merging companies; exchange of assets; acquisition through a government grant; creation of intangible assets within the company.

Examples of situations in which an asset can be acquired through a government grant are gratuitously obtained airport boarding rights, broadcasting licences, import licences, access rights to limited resources granted by the state. In this case, the organization, according to the basic accounting procedure of government subsidies, may recognize an intangible asset at fair value with simultaneous recognition of the subsidy or in accordance with an alternative accounting procedure to recognize an intangible asset at face value. In the latter case, any costs directly attributable to the preparation of the asset for intended use will also be included in the cost of the intangible asset.

To determine when an internally created intangible asset can be recognized in the financial statements (e.g., R & d expenditures), the process of creating an intangible asset in IFRS 38 is divided into two stages: the research and development stage.

Research is original and planned scientific research undertaken with the prospect of obtaining new scientific or technical knowledge. Development is the application of research findings or other knowledge to the planning or design of production of new or substantially improved materials, devices, goods, processes, systems or services prior to their commercial production or use (Fig.3.1.).

The standard clearly States that «research costs should be recognized as an expense when incurred». Thus, the fact of implementation of research costs does not entail the fact of recognition of an intangible asset. According to IFRS 38, the first step is to determine whether an internally created intangible asset meets the recognition criteria. After the recognition of an asset intangible assets, the company divides the process of creating the asset into two phases: a research phase; the stage of development.

Costs incurred at the research stage are not capitalized (not included in the cost of future IA), and are recognized as expenses of the period in which they were produced, because at the research stage the company can not demonstrate confidence in obtaining future economic benefits.

As examples of scientific activities whose costs do not give rise to an intangible asset, IFRS 38 provides the following: «activities aimed at acquiring new knowledge; the search, evaluation and final selection of applications of research results or other knowledge; the search for alternative materials, devices, products, processes, systems or services; and the formulation, design, evaluation and final selection of possible alternatives for new or improved materials, devices, products, processes, systems or services».

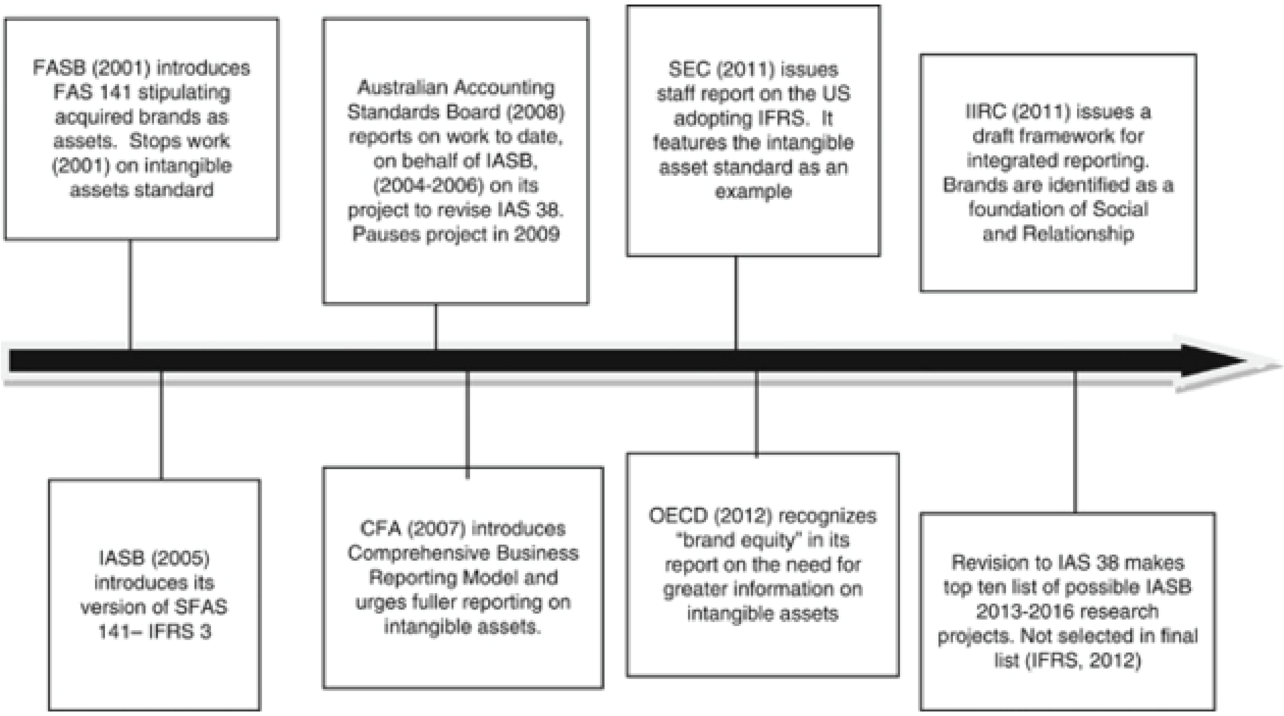


Fig. 3.1. Recognition scheme of an intangible asset created within the company in accordance with IFRS 38. [21]

In accordance with IFRS 38, the «development phase» begins when a company can demonstrate the simultaneous fulfilment of a number of criteria, namely: «the technical feasibility of completing an intangible asset so that it is available for use or sale; its intention to complete the intangible asset and to use or sell it; its ability to use or sell the intangible asset; and how the intangible asset will create probable, future economic benefits. Among other things, the company must demonstrate the existence of a market for the results of the intangible asset or the intangible asset itself or, if it is to be used internally, the usefulness of the intangible asset; the availability of sufficient technical, financial and other resources to complete the development and to use or sell the intangible asset; and the ability to reliably estimate the costs relating to the intangible asset during its development.»

The international standard highlights the following examples of development activities:

– design, construction and testing of pre-production samples and models;

– design of tools, templates, moulds and dies incorporating new technology;

– design, construct and test selected alternative materials, devices, products, processes, systems or services.»

From the moment all of these conditions are met, the costs associated with the creation of the asset are capitalized. Previously incurred expenses related to the creation of the asset and recognized in the income statement are not recoverable and are not included in the value of the intangible asset.

Starting from the moment of recognition of the asset, the cost of self-created intangible assets will include all costs necessary for the creation of the asset and its preparation for its intended use, which include costs: for materials and services; wages of employees; for the registration of legal rights; depreciation of patents, licenses used in the creation of the asset.

In PBU 14/2007, intangible assets are initially recorded at cost. It establishes different approaches to determining the initial value of intangible assets depending on the method of acquisition of intangible assets: acquisition of intangible assets for a fee; receipt of intangible assets under a contract of donation; receipt of intangible assets as a contribution to the authorized (share) capital; receipt of intangible assets under a contract providing for the performance of obligations by non-monetary means (in particular under a barter agreement); created within the company.

An intangible asset created within the company according to PBU 14/2007 is considered to be created if:

– the exclusive right to the results of intellectual activity received in the course of performance of official duties or on the specific task of the employer belongs to the organization - employer;

– the exclusive right to the results of intellectual activity received by the author (authors) under the contract with the customer who is not the employer belongs to the customer organization;

– the certificate on the trademark or on the right to use the name of the place of origin of goods is issued in the name of the organization.

The initial cost of the IA created within the enterprise is defined as the amount of actual costs for its creation, production (spent material resources, wages, services of third-party organizations under contractual (co-Executive) contracts, patent fees associated with obtaining patents, certificates, etc.), except for value added tax and other recoverable taxes (except as provided by the legislation of the Russian Federation).

Unlike PBU 14/2007 under IFRS 38, the first step is to determine whether the intangible asset created within the company meets the recognition criteria. After the recognition of an asset intangible assets, the company divides the process of creating the asset into two phases: a research phase; the stage of development. The cost of the IA created within the company includes costs that have entered the development stage, and costs that were not recognized in the previous periods in the income statement - this is a significant difference between the Russian and international accounting of IA. According to the Russian standard, all R & d costs, in case of a positive result and documented R & d results, are included in the initial cost of the created IA.

PBU 14/2007 established that «the useful life of intangible assets is determined by the organization when taking the object to accounting».

The useful life is determined on the basis of the duration of the enterprise's intellectual property rights and the period of control over the asset, as well as the expected period of use of the asset during which the enterprise can receive economic benefits. The useful life of an intangible asset may not exceed the life of the enterprise.

PBU 14/2007 establishes two criteria for determining the useful life of intangible assets, but does not allow a clear priority to be established between external constraints (the duration of the asset) and the ability to independently determine this period (based on the period of time during which the organization can receive economic benefits from the use of the object).

IFRS 38 in paragraph 7 defines useful lives as: «the period of time over which a company expects to use an asset; or the number of products or similar items that the company expects to receive from the asset.»

In contrast to PBU 14/2007, IFRS 38 provides eight factors to be considered in determining the useful life of an intangible asset. Among them, there are economic and legal factors:

– the expected use of the asset by the company and whether another management team can effectively manage the asset;

– typical asset life cycle and public information on useful life estimates of similar asset types that are used in a similar manner;

– technical, technological and other types of obsolescence;

– stability of the industry in which the asset is used and changes in market demand for goods and services received from the asset;

– the period of control over the asset and legal or similar restrictions on the use of the asset, such as the expiration dates of the relevant lease agreements;

– whether the useful life of the asset depends on the useful life of other assets of the company, etc.

Thus, IAS 38 approaches the limit of useful life is not as categorical as 14/2007.

In PBU 14/2007, two possible types of changes in the initial cost of IA contained in the balance sheet of enterprises are of fundamental importance from the accounting point of view:

– in connection with a change in the market value of similar assets (revaluation initial value, that is, the devaluation and revaluation surplus);

– in case of impairment of intangible assets.

According to PBU 14/2007, the value of intangible assets is amortised. Intangible assets with an indefinite useful life are not depreciated.

IAS 38 «Intangible assets» defines depreciation as «the systematic allocation of the depreciable amount of an intangible asset over its useful life». The depreciable amount is understood to be the «initial cost of the asset or other value substituting it in the financial statements, less its liquidation value».

According to PBU 14/2007, the determination of the monthly amount of depreciation on IA is made by one of the following methods: linear method; method of decreasing balance; method of writing off the cost in proportion to the volume of production (work). The choice of the method of determining the amortization of an intangible asset is made by the enterprise based on the expected receipt of future economic benefits from the use of the asset, including the financial result from the possible sale of the asset.

PBU does not provide for suspension of depreciation charges during the useful life of intangible assets. Depreciation ceases only in case of full repayment of the value of the intangible assets or to decommission the asset to accounting.

The methods of amortization of intangible assets permitted by PBU 14/2007 are the same as those provided for in IFRS 38. At the same time, it should be noted that PBU does not prefer any method of depreciation, while in the international standard the priority is given to the method of uniform depreciation.

The international standard, like PBU 14/2007, considers the disposal of an intangible asset or the absence of future economic benefits from the asset as the reasons for the write-off of the intangible asset. Disposal of IA, according to PBU 14/2007, takes place in the case of: termination of the right of the enterprise to the result of intellectual activity or means of individualization; transfer under the agreement on alienation of the exclusive right to the result of intellectual activity or means of individualization; termination of use due to obsolescence; transfer in the form of a contribution to the authorized (share) capital of another organization; transfer under the contract of exchange, donation; making a contribution to the joint venture agreement; identify the shortage of assets in their inventory, etc.

Income and expenses from the write-off of intangible assets are recorded in the accounting records in the reporting period to which they relate. Income and expenses from write-off of intangible assets are related to the financial results of the organization (p. 23 PBU 14/2000).

B. Leontiev [21] in 2001 (table. 3.1.) the comparison of intellectual property objects (according to the current international and domestic legal framework) and the assessment of the share of non-included in the balance sheet of Russian intellectual property enterprises due to the backlog of Russian legislation from the international in the field of accounting of intangible assets. Although this assessment was carried out on the basis of PBU 14/2000, the introduction of PBU 14/2007 has changed little in modern Russian business practice.

Thus, from the analysis and comparison, we can draw the main conclusion that the international financial reporting standards related to the accounting of intangible assets are more consistent with market conditions and provide businesses with greater opportunities to obtain economic benefits (income) when used in financial and economic activities than the Russian legal framework.

Table 3.1. Comparison of intellectual property objects (in accordance with the current international and domestic legal framework) [21]

Intellectual property		
In accordance with the wording of the Stockholm Convention of 14.07.67, intellectual property includes mores relating to:	In accordance with the wording of the Stockholm Convention of 14.07.67, intellectual property includes mores relating to:	Ood. Weight not included under with PBU 14/2000 to the balance sheet enterprises
literary, artistic and scientific works (this includes all research reports, design and technological documentation of research institutes, design bureaus and enterprises) rights to computer programs, databases, topology of integrated circuits approximately	literary, artistic and scientific works (this includes all research reports, design and technological documentation of research institutes, design bureaus and enterprises) rights to computer programs, databases, topology of integrated circuits approximately	literary, artistic and scientific works (this includes all research reports, design and technological documentation of research institutes, design bureaus and enterprises) rights to computer programs, databases, topology of integrated circuits approximately
presentations by performers,	presentations by performers,	presentations by performers,
inventions in all areas of human activity rights to inventions, utility models, selection achievements	inventions in all areas of human activity rights to inventions, utility models, selection achievements	inventions in all areas of human activity rights to inventions, utility models, selection achievements
scientific discoveries 100%	scientific discoveries 100%	scientific discoveries 100%
industrial designs industrial designs rights	industrial designs industrial designs rights	industrial designs industrial designs rights
trademarks, service marks and trade names and designations of right to a trademark, service mark, name of place of origin of goods* 20%	trademarks, service marks and trade names and designations of right to a trademark, service mark, name of place of origin of goods* 20%	trademarks, service marks and trade names and designations of right to a trademark, service mark, name of place of origin of goods* 20%
suppression of unfair competition (including illegal use of know-how) 100%	suppression of unfair competition (including illegal use of know-how) 100%	suppression of unfair competition (including illegal use of know-how) 100%
business reputation organizations, organizational expenses		

3.2. The main types of intangible assets in subsoil use and their role in the financial and economic activities of exploration and mining enterprises

Mining, which is a process of material production in which a commodity product is obtained by extraction from the depths of minerals, as an area of business has a number of specific features. As follows from the research of domestic specialists, the main features of entrepreneurship in mining are the following: [21, p. 9-41].

- the objects of entrepreneurial activity in mining are deposits, which determine in the first place the specifics of mining: MPI are real estate; the resources of deposits are irreplaceable; each field has its own individual characteristics that affect the technology and economy of the mining enterprises created on their basis; quantitative and qualitative characteristics of deposits hidden in the subsoil and which are the initial data in the design of mining enterprises can be determined only on the basis of previous geological studies and only approximately;
- great dependence of the mining industry on the state of the mineral resource base;
- in this sphere of business, state regulation plays a greater role than in other industries;
- the subsoil, which is the primary material basis for the formation and production of the mining enterprise, belongs to the state, which introduces additional difficulties in the implementation of the mining business;
- unresolved to the end and the lack of elaboration of a number of legal aspects in the issue of ownership, including the extracted minerals, which complicates the development of business in the mining industry;
- unlike other industries, developers of non-renewable resources (minerals) often have to decide on an alternative issue: the immediate use of mineral reserves (to expand current consumption and accelerate the initial accumulation of capital) or the conservation of deposits (to use resources in the future, when their development may be more valuable and profitable);
- as the depletion of natural resources like nonrenewable resources, the cost of their units for future grows;
- each mining company due to the characteristics of each field in its technical and economic indicators individually;

– the term of existence of the mining enterprise is limited due to the exhaustion of mineral reserves and their irreplaceability;

– the absence, as a rule, of objective conditions for the development and continuation of the life of the mining enterprise (it is not always possible for the natural conditions of additional exploration of the Deposit, transfer of off-balance reserves to the balance sheet, geological exploration for the search and exploration of other deposits of this or other types of minerals in the area of the mining enterprise, etc.).);

– often the conditions of the territories where the deposits are located are not favorable for the construction of mining enterprises, which leads to a rise in the cost of production;

– the construction of the mining enterprise itself is associated with additional costs for the formation of the infrastructure of the area where the Deposit is located, due, as a rule, to its underdevelopment;

– in similar mining and geological conditions, standard technologies and technical means are used, the choice of which is limited;

– mining due to the specifics of the objects of entrepreneurial activity – deposits, is one of the technologically conservative industries;

– to determine the technical and economic possibilities of mining should be carried out a significant amount of work and research;

– it is difficult to introduce new, advanced technologies and modern technology;

– -unlike other industries, it is difficult for a mining company to achieve a significant advantage in production efficiency due to technological and technical improvements;

– mining - capital-intensive production, with long terms of return on investment. Even for relatively small enterprises, annual capital turnover is usually measured in millions of dollars;

– mining requires a large land allotment (for quarries, dumps, tailing dumps, etc.).);

– mining enterprises, to recoup capex, characterized by large volumes of production (large enterprises occupy the largest share in the industry);

– the income received by a mining enterprise in the course of development of deposits is economic rent (or mountain rent) due to the fact that minerals are characterized by a completely inelastic supply (limited amount of minerals) in the long-term time intervals. From the point of view of the totality of factors operating in the economic system, the mining process has no alternative value, and any income they bring is an economic rent;

– a sharp differentiation of incomes of mining companies;

– discrepancy between the profit calculated at the design stage when deciding on investment in the development of a particular field, and the profit received by the mining enterprise at the end of its development;

– at the stages of investment decision-making mining companies always act as objects of increased risk;

– little room for maneuvering with its production facilities;

– mining has a high operational inertia (it is not able to respond quickly to changes in market conditions) and is therefore interested in the stability of the market;

– the mining enterprise almost does not lend itself to conversion;

– diversification of mining production is almost impossible;

– due to the natural features of the deposits, mining enterprises do not have great opportunities to differentiate the products (for example, it is difficult or impossible to change the content of the useful component in the ore, the presence of moisture, harmful impurities, etc.). Mining companies produce in the physical sense of the same type (standardized) products, which significantly reduces the marketing capabilities of manufacturers when the market situation changes;

– mining products in most cases have a stable, stable demand due to the rarity and limited reserves of minerals created by nature. The irreplaceability of mineral resources creates a certain guarantee of preservation and even growth of this demand;

– production of mining enterprises plays a fundamental role in the development of the economy, as it provides raw materials to other industries;

– demand for mining products is often characterized by low elasticity;

– as a rule, long-term contracts prevail in the sale of products of mining enterprises;

– mining enterprises are characterized by low liquidity of their fixed assets, including residual;

– mining is one of the environmentally harmful (in particular. due to transportation of minerals and products of their processing);

– it is usually associated with significant costs for environmental protection and restoration activities (remediation), which increases the cost of production;

– the price of the final product entering free circulation in the market, i.e. metals, chemical products, etc., usually significantly exceeds the price of raw materials supplied by mining enterprises, and as a result, a significant part of the total profit of mining, metallurgical, mining and chemical and other similar industries, is formed and remains at the final stages of production;

– limited opportunities for choice of strategies in pricing;

– there is no need to advertise the products of the mining company, the company is advertised, its image;

– insignificant marketing costs in comparison with other industries;

– the study and forecasting of the market conditions of the produced products is of crucial importance for the payback of field development due to the «conservatism» of mining production, its capital intensity and other features;

– due to the specifics of the products produced, the development of a marketing strategy is important for the successful operation of the mining enterprise;

– the types of markets emerging in the mining industry (usually oligopolies, often monopolies) are often characterized by weak competition from producers. The company, which has already taken its place in the current system of manufacturers of these products, for some time can count on stable working conditions and little pressure from competitors. The equilibrium of such systems is disturbed and competition is exacerbated only with a drop in demand or with the emergence of a new manufacturer claiming a place in the existing market, which may be due to the discovery of a new field, and this is not a frequent event [21 p. 9-41];

– entering the existing market of a new producer of mineral products usually leads to the restructuring of this market, forcing the worst in its economy, the company to stop its activities (conservation of deposits) or reduce volumes. The real ratios of returns across the system are changing;

– the mining industry, due to its importance for the development of processing industries and export opportunities, enjoys some support from the government (tax and customs benefits, state participation in investment projects, etc.), etc.

One of the significant features of the production of geological exploration and mining is that each object (field) is unique, both in terms of geological structure, technology of extraction of minerals, and geographical location. The interest of investors in a particular object in subsoil use depends primarily on the availability of information on the amount of future costs, as well as on the property of the future mining enterprise, including the presence of IA.

Intellectual property (IP) and intangible assets are of particular importance in the field of subsoil use. First, the enterprises of MSK have a wider range of assets than the enterprises of other industries, in their economic essence related to intangible: from the granting of rights to the use of subsoil and ending with the use of a large number of copyright objects for geological information (geological and geophysical reports, maps, sections, geological and geophysical models of deposits, software, databases, etc.), as well as objects of industrial intellectual property (new technologies of mining, inventions, utility models, industrial designs, know-how, trademarks and other innovative developments).

At the same time, intangible assets of exploration and mining industries have a specific composition and structure, a significant part of which is absent in other sectors of the economy, and their importance for the effective financial and economic activity of exploration and mining enterprises is of key importance.

If the company has geological information (information about the geological structure of the subsoil located in the bottom of minerals, the conditions of their development, as well as other qualities and features of the subsoil), has a modern technology of extraction and processing of mineral raw materials, owns all the necessary permits, it will be much higher evaluated and have a significantly higher investment attractiveness. However, the current practice of exploration and development of deposits is such that a significant part of the costs incurred by geological and mining enterprises and related in its economic essence to intangible assets is not estimated as IA. These costs are now simply written off as either current or deferred expenses.

Today, when many geological and mining enterprises have intellectual property, and hence intangible assets, there is an urgent need for their comprehensive market assessment, accounting and use in production activities.

As follows from the analysis, the intangible assets available at the enterprises of the mineral complex are not estimated at the true market value. IA of exploration organizations under the Ministry of natural resources account for less than one percent of the value of all assets. In the mining industry, the situation is not much different from exploration. We have studied the financial statements of more than 30 mining companies over the past two years: 6 gold mining; 8 enterprises for the extraction of ferrous metals; 12 enterprises for the extraction of non-ferrous metals and 5 for the extraction of non-metallic raw materials. In all cases, intangible assets do not play a significant role in the capitalization of assets of enterprises (table.3.2).

Recognition of IA, their assessment, accounting and development of methods for transferring the value of intangible assets to production costs affect three major areas of the subsoil use economy: and.) Subsoil use system (subsoil use that does not require a license, and on the basis of licenses).

Table 3.2. Intangible assets of mining companies

p/n	Enterprises on extraction useful fossils'	Number enterprises'	Cost basic means', thousand rubles	Cost intangible assets, thousand rubles	Ratio of intangible assets and basic means, in %%
1.	Black ore metals'	8	149600	1362	0,91 : 100
2.	Non-ferrous metals'	12	314950	4029	1,28 : 100
3.	Ore gold	6	171080	1920	1,12 : 100
4.	Non-metallic minerals	5	45450	543	1,19 : 100

B) Feasibility study of the effectiveness of investments in the development of deposits (investment design).

C.) Financial and economic activities of existing exploration and mining enterprises.

Intangible assets play a special role in improving the efficiency of financial and economic activities of existing exploration and mining enterprises. We have identified the following main areas of this impact:

1). To determine the true cost of exploration and mining enterprises, which will allow the proper use of the property potential of enterprises. For example, as inflation in the country declines, debt – loans should become an increasingly common source of investment financing. The material potential of the enterprise can act as a collateral for a Bank loan (secured lending), which will facilitate enterprises to obtain a loan.

2). To determine the true value of shares of exploration and mining companies, their quotation, which will allow for a different dividend policy in the enterprise.

3). Increase the share of equity, which will increase the financial stability of enterprises and their solvency, as well as the overall financial condition.

4). It will be easier to solve the issues of insurance of risks of production activities of exploration and mining enterprises.

5). The formation of the authorized capital of exploration and mining enterprises will be carried out, including through the contribution (contribution) of IA operating in subsoil use.

6). The investment attractiveness of mining enterprises, primarily for foreign investors, will increase. The basis of this activity will be the initiative of the enterprises themselves, and its incentive – full responsibility for their own production, its economic and material potential.

7). The commercial efficiency of contractual agreements on production sharing within the framework of a joint investment project involving foreign capital will increase.

8). There will be an additional source of accumulation of own funds through the system of amortization of intangible assets, tax-free, including for solving the most complex social problems facing the workforce at the moment (the mechanism of tax protection).

9). New opportunities in the field of cost management will be identified, as the increase in the share of fixed costs has a positive impact on the overall level of costs.

10). New prospects will open up in the formation of a rational tax and depreciation policy at the enterprise.

11). There will be additional income from the use of potential opportunities for both buying and selling IA.

12). It will increase the validity of the calculation of the starting price for the nomination of objects of mineral resources for auction, the privatization of subsoil use objects, audit, etc.

Thus, the identified features of mining business urgently require recognition, full accounting, objective valuation and application in the production activities of enterprises of subsoil use of the entire range of existing intangible assets.

This position primarily concerns specific (sectoral) intangible assets. This is the largest group, which includes such types of assets, the presence of which is closely related to the peculiarities of exploration and mining enterprises (geological and geophysical reports, maps, geological databases, geological and geophysical models of deposits and other materials, as well as the granting of rights to use the subsoil, etc.) In their economic essence, they are intangible.

Assessment of the main directions of improving the efficiency of financial and economic activities of exploration and mining enterprises using all types of IA, including industry, led to the conclusion that only the presence of a single state concept of the legal framework for working with IA will give enterprises one of the main wealth of the economy – intellectual property.

3.3. Primary problems of recognition, accounting, evaluation and use of intangible assets by exploration and mining enterprises

The study of international and Russian systems of accounting and valuation of intangible assets has allowed us, first of all, from the point of view of the role and importance of intangible assets in the enterprises of the subsoil use to divide them into three groups:

1 group – IA, which operate in any field of activity, including subsoil use, and their role in the MSC is also great, as in other industries. These are, first of all, inventions in all areas of human activity. For example, inventions related to new methods of exploration and mining technology, patents, utility models, industrial designs, know-how and other innovative developments, rights to computer programs and databases related to the implementation of the enterprise management process, for example, programs for accounting, business reputation, etc.

2 group IA – intangible assets that operate in any field of activity, including subsoil use, but due to the specifics of the sphere of subsoil use,

their role is not as great as in other industries. These are, for example, trademarks, service marks, appellations of origin, trade names and designations, suppression of unfair competition (including illegal use of know-how), etc.

Finally, group 3 - specific (sectoral) types of assets, the presence of which is associated with the peculiarities of exploration and mining enterprises. These are assets related in their economic essence to the intangible (granting of rights (licenses) for the use of subsoil, the use of a large number of copyright objects for documented geological information (geological and geophysical reports, geological software, geological databases, maps, sections, geological and geophysical models of deposits), etc.). This is the largest group of intangible assets, closely related to the peculiarities of exploration and mining enterprises. From our point of view, this group is of primary economic interest for exploration and mining companies. If exploration and mining companies put these intangible assets on the balance sheet, correctly determining their commercial value and timely entering into economic turnover to generate income, they would have an additional significant potential to improve the efficiency of their financial and economic activities.

Of the intangible assets included in the third group, the most important for exploration and mining companies are IA related to ownership of geological information and the right (permits, licenses) to conduct activities in the field of subsoil use.

For fig. 3.2-3.4 the process of step-by-step study of the geological object, which is accompanied by the process of obtaining a variety of geological information, its processing and storage. The process of step-by-step study of the geological object is also accompanied by the receipt of all kinds of permits, providing exploration and mining enterprise rights (permits, licenses, etc.) to conduct certain activities.[21 c.9-41].

At the stage of search and evaluation works (Fig.3.2.) obtaining permits is 1-2 years, geological exploration and interpretation of the information – 2-3 years, and the development and approval of conditions – 1-2 years.

At the stage of exploration (Fig. 3.3) obtaining permits is 1-2 years, geological exploration and interpretation of the information received – 2-3 years, technological tests 1-2 years, and the development and approval of conditions – 1-2 years.

At the stage of field operation (Fig. 3.4) obtaining permits is 2-3 years, development of the project for the construction of the GOK is 1-2 years, the construction period lasts about 4 years, and the term of development of the field depends on the size of mineral reserves.

Right to use land
Right to conduct exploration
The resolution of ecological examination

Prospecting and prospecting-evaluation works	Interpretation of the received information provided by the regulations on geological exploration by stages and stages	Development and approval of temporary conditions and calculation of reserves at the appropriate stage categories (C_1, C_2, resources PI)
Geological assignment for object works	Accepted by the customer and VGF report on the work performed	Document confirming the quantitative and qualitative characteristics of the Deposit

Fig. 3.2. Geological information and obtaining permits at the stage of search and evaluation works

As follows from the above data, to obtain geological information at any stage or stage of work requires a large set of permits. At the same time, the more detailed exploration, the set of permits more.

The right of ownership to geological information. Geological information containing information about the geological structure of the subsoil, the minerals contained in them, the conditions of their development, as well as other qualities and features of the subsoil obtained in the process of exploration, is a fundamental factor in the success of the future mining enterprise. This is one of the key features of the mining industry. Indicators of its activities are almost 100% dependent on natural conditions, so the main technical and economic indicators of the future mining enterprise in most cases are determined by geological data. For other industrial enterprises, the owner himself can choose where the enterprise will be located, what it will produce, to what extent, what nomenclature and quality.

Right to use land
Right to conduct exploration
The right to a fair testing of minerals
The resolution of ecological examination

↓

Geological exploration at the stage of field exploration	Interpretation of geological data. Obtaining of geological information provided by the regulations on geological exploration by stages and stages	Carrying out of semi-industrial technological tests, selection and justification of technology for obtaining products from minerals of the field	Development and approval of conditions and calculation of reserves for higher categories (B, C_1, C_2)
Geological task for the object	Accepted by the customer and VGF report on the work performed	Conclusion on the system of technological processing of reserves	Document confirming the quantitative and qualitative characteristics of the Deposit

Fig. 3.3. Geological information and obtaining permits at the exploration stage

A consistent study of the subsoil with more reliable geological information also helps to reduce risks in the future development of the field. Geological study of the subsoil with a certain degree of reliability includes not only the study of the Geology of the object, but also engineering-geological, hydrogeological, technological and other studies of the Deposit, its rocks and ores, the possibilities and ways of obtaining certain types of raw materials in this field. The more detailed is the geological study, the lower the risk of mining companies in the development of the field.

Right to exercise reserves
Right to use land
The right to use water from open water bodies and water from underground sources
Environmental expertise for the construction and operation of the GOK
Permission to use or build roads, power lines and other communications
Documents for the justification of the technology of extraction and processing of minerals
Contracts for the supply of products, permission for the supply of products
Examination of the project for construction of the GOK

↓

The development of the project for construction of the GOK and, if necessary, of the project of construction of infrastructure	The construction period (the volume of construction works, the composition of objects depend on geological information, its reliability in the degree of exploration and the quality of exploration)	Period of processing. Prospective and current plans of the company, which are formed on the basis of geological information
Construction project	The creation of productive assets	Plans of marketing, production, financial and other activities of the enterprise

Fig. 3.4. Geological information and obtaining permits at the stage of field operation

One of the key issues to be solved in the process of geological exploration is the study of the qualitative characteristics of explored reserves, the definition of a list of minerals and types of commercial products that can be obtained during the development of the field. The information obtained is also the basis for the development of extraction technology.

Mineral resources of each Deposit have mineral composition inherent only to this object. Mineralogical features of minerals require special technological research, both in laboratory conditions and in industrial volumes (the latter, as a rule, range from 50 tons to 200 tons). The study of the mineralogical composition of minerals is necessary to solve the following main issues of the future development of the field:

1. Justification of the list of commercial products from minerals of the field.
2. Definition of quality of the received commodity production.
3. The output of commercial products from the extracted minerals.
4. Technology of commodity production.

The technology of production of commodity products is associated with the justification of varieties and composition of equipment, type of material costs and their number, etc.

As a rule, the choice of the most cost-effective and environmentally efficient process is carried out from several alternatives. The example of one of the gold and silver deposits in Siberia shows how the choice of the technological cycle depends on the main indicators of the mining enterprise (table. 3.3). To select the technological scheme at this field, semi - industrial laboratory tests were carried out- a total of 20 samples with a total weight of 293.5 tons. The tests were carried out according to the gravitational-flotation scheme, the gravitational-flotation scheme with cyanidation and the gravitational-cyanide scheme. As can be seen from the table. 3.3, indicators of extraction of a useful component, cost of commodity production and costs of production considerably change. It should be noted that the ores of the object under consideration are easily rich, but even for them it is necessary to develop an alternative approach to the choice of technology. The availability of technological research, the search for new, more modern methods of extraction of all minerals from ores mined at a particular field, requires significant funds.

In the given particular example, the results obtained (the choice of extraction technology) can act as scientific and technical developments or as «know-how». And this is already the basis for their accounting as intangible assets, and, consequently, for the statement on the balance sheet of the enterprise.

Table 3.3. Influence of technological parameters on the TPE of the enterprise

Indicators		Ed.	Value of indicator**)		
			I	II	III
1.	Gold recovery	%	54,3	77,2	94,0-97,0
2.	Silver extraction	%	63,2	52,8	18,9
3.	Cost of commercial products*) Au/Ag	млн. rub.	1746,5/71,2	2481,8/58,9	3064,0/20,3
4.	Enrichment costs of 1 t of ore*)	rub./т	310,85	530,40	678,65
5.	Specific capital investments in the construction of the enrichment complex	rub./1 т	935	1190	1880

*) – in 2007 prices

**) I-III – extraction technology options based on the quality of proven reserves

Thus, geological information containing information about the geological structure, minerals, conditions of field development, etc., obtained in the process of exploration, is the main factor in the success of the future mining enterprise.

However, in our country, the issue of ownership of geological information obtained as a result of geological studies, and most importantly – how and in what quality to take into account this industrial property in the property complex of the enterprise, has not yet been resolved.

It is known that in subsoil use four types of the basic Institute of the property right are allocated (Fig.1.1.5): ownership of subsoil; extracted minerals; geological information and property created during the use of subsoil.[89,99].

Companies conducting exploration work, invest heavily in their conduct. The main result of investment for a long term (from 2 to 5 years) is geological information obtained as a result of exploration.

Fig. 3.5. The scheme of transfer of ownership of minerals

Geological information, as noted by B. V. Khakimov [21,p. 9-41], is not just a set of data, but a set of scientific models created on the basis of available knowledge about the deposits-analogues and the obtained data of geophysical and geological testing. In the form of scientific models in Geology can be text, graphic, physical (three-dimensional models), real (storage of minerals, core, liquids, gases), mathematical, computer. According to the content, these models reflect the spatial structure of subsoil plots, including the placement of minerals and their natural quality, as well as projects for the development of mineral deposits, or other use of subsoil plots (underground storage of oil and gas, other reserves, placement of buildings and structures, highways, waste disposal, etc.).

Prior to the transition to market relations, geological studies were carried out at the expense of public funds, and all geological information was owned by the state, forming the basis for the creation of a reliable mineral resource base in the country. Due to the fact that only the owner of the subsoil - the state carried out geological exploration, the issues of ownership of geological information and evaluation of its value were not relevant.

Everything changed during the transition of the country's economy to market conditions. The question of the right of ownership to geological information, legal and economic conditions of realization of production geological exploration of mineral resources acquired currently of particular relevance. The availability of geological information becomes a key condition for making not only technical, but also economic decisions of the subsoil user - attracting investments in the development of the object, determining the value of the future enterprise, its competitiveness, etc.

In accordance with the Law of the Russian Federation «On subsoil» [1], geological information contained in geological reports, maps and other materials may be owned by the state or by the subsoil user. The ownership of geological information is determined by the sources of financing of the works providing its receipt.

All geological information obtained before 1991 and stored in geological funds is the state property (including information about the subsoil in the territory of the former Soviet republics). Since 1991, geological information obtained by subsoil users at their own expense is their property. The legal entity that has received the right to conduct geological exploration and provided geological works on the methodological provisions and instructions of the subsoil owner, transmits in the prescribed form to the Federal Fund (rosgeolfond) and the relevant territorial geological Fund geological information with the definition of the conditions of its use, including for commercial purposes. A unified approach to the geological study of the subsoil makes the geological information on each object comparable both in terms of the degree of study and the complex of the studied issues.

The subsoil user has the right to use the obtained information about the subsoil (regardless of the form of investment) for scientific or teaching activities, if it is provided for in the contract.

All primary geological, geophysical, geochemical and other information, data on its interpretation and derived data, as well as samples of rocks, including core, formation fluids obtained by the investor as a result of works on PSA, in accordance with the Law of the Russian Federation «On production sharing agreements», belongs to the state. Subject to the confidentiality conditions provided for in the agreement, the investor has the right to freely and free of charge use of information, data and samples in order to perform work under the agreement. The order of use and export of geological information outside the Russian Federation are defined in the PSA agreement.

Ownership of geological information in our country is protected by the state.

Payment for geological information. The procedure and conditions for the use of geological and other information on the subsoil, which is state property, are approved by the MPR of Russia. The use of geological information is possible with a positive decision of the Federal Agency for subsoil use or its territorial authority on the submitted application. Applicants may be public authorities or local governments, organizations (research organizations, educational institutions, etc.) and public associations. Refusal to provide geological information may follow if the application is submitted in violation of the rules of its registration or in the absence of the applicant's access to information of limited access. Denial of access to open geological information can be appealed in court.

Payment for geological information is considered in our country as reimbursement of the state's costs for its receipt as a result of the state geological study of the subsoil. The amount of payment for the use of geological information and the procedure for its collection are determined by the Government of the Russian Federation. The specific size of the payment for geological information for the consumer is defined by Federal Agency for subsoil use by the technique approved by MPR of Russia (the Order of MPR of Russia of 15.12.2005 No. 344). Revenues from fees for geological information since 2005 fully credited to the Federal budget (Law of the Russian Federation of 23.12.2004 № 173-FZ «On the Federal budget for 2005»).

The minimum fee for geological information in the Russian Federation is 10 000 rubles. the Provision of geological information at the minimum rate is provided if necessary: 1) scientific research by students, graduate students, doctoral students, applicants for degrees, as well as educational institutions or research organizations where they are trained or enrolled in graduate school (doctorate); 2) works under state contracts (contracts) with legal entities and individuals.

The maximum amount of payment for geological information may not exceed the amount of public funds spent on geological exploration, as a result of which this information was obtained. Costs are accepted in the amount of actual exploration (in value terms) calculated on the date of calculation of payment for the geological information with the use of deflators (resolution of the Government of the Russian Federation of 29.12.2004, No. 873). The specific amount of payment for geological information is determined taking into account the amount of information provided, its type, consumer properties, depending on the stage of study of the subsoil plot. A type of geological information is characterized either as a result of geological observations (primary information), or as a result of geological generalizations (secondary information), etc.

Data of information and reference systems of geological information search (catalogues, registers, databases and data banks, etc.) are not recognized as geological information and are not charged for them.

As follows from the analysis of foreign experience, the approach to geological information, its collection and dissemination, the relationship in this area of government agencies and private companies, in particular, to the issue of charging for geological information in a number of leading countries with developed mining industry (Canada, USA, Australia, South Africa, etc.), is fundamentally different from the Russian reality. [21. C. 9-41].

Geological maps and reports, for example, in Canada (as well as in the US and Australia) are classified as a «public good» and are sold at a symbolic price. In General, the level of prices for products of the Canadian Federal service and geological survey provinces (interim and final reports, geological and geological and economic surveys, maps) is from 5 to 75 canadian dollars. The most expensive publications are reports on geological and economic assessment of deposits, their cost can reach $ 300. Geological funds of the country resemble a public library, with the only difference that here is not intensively distributed books and copies of geological maps, reports, databases, etc.

According to the legislation, any geological work performed on the territory of Canada by private companies should be open after some time: the results of drilling - in two years for any part of Canada, seismic data for the territories and the shelf - in 5 years. The availability of geological information is a fundamental condition for the development of the mining industry in Canada: the risks of planned exploration work are reduced, the investment attractiveness of projects is increased, which is especially important for «Junior» companies in Geology.

Exploration companies of South Africa at the end of the work (the term of the search license is five years) are required to transfer all reports on the results of exploration, as well as primary data (drilling logs, documentation of mining, core, etc.) to the state funds of the geological service of the country. South Africa geological survey provides maps, reports and other materials on the exploration work performed to any interested person for a nominal fee. The exception is the data on the results of works on hydrocarbon raw materials, which within four years after delivery are confidential.

Unfortunately, currently in the Russian Federation the concept of geological information is used without taking into account its differences in volume, content and form, and the same legal norms are applied to it. This leads to unreasonable restrictions on the use of information and, as a result, to an artificial decrease in the investment attractiveness of subsoil use in the country.

We can agree with B. V. Khakimov's proposal [21. p. 9-41] on the allocation of the totality of data, their volume, content and form of the four types of geological information:

1. Primary information - field records and samples, data of geophysical and geochemical surveys, well testing and mining.
2. Reporting information - processed data in full and scientific models with the most accurate detail corresponding to the technical capabilities of the applied research methods.
3. Generalized information - scientific models with averaged parameters without reference to the exact spatial coordinates.
4. Background - General information about the presence of the subsoil area (mineral Deposit), the area of location, its main parameters and possibilities of use.

The use of its proposed types of geological and economic information should be subject to the following conditions:

– the reference and generalized information which does not contain the state and (or) commercial secret shall be provided without restrictions and without payment, or for the payment in the amount of costs of copying and delivery;

– information describing the scientific models of the structure of the subsoil area (field) is the result of intellectual work of persons or organizations that should receive copyright and intellectual property rights;

– reporting information should be provided to the user of this subsoil area along with the right to use, other persons may have only limited access to certain parts of it (sections);

– primary information shall be the property of persons at the expense of which geological exploration works are performed.

All geological and economic information on subsoil plots, except for the primary, should be deposited in the state funds of geological information and used in the national interest without prejudice to the rights of its owners.

The right to conduct various activities in subsoil use. The presence of the rights to conduct economic activity is mandatory for any industry. However, in mining the value of the rights for exploration and development of deposits and concomitant process rights is fundamental.

For example, to start the process of exploration or development of a Deposit, a geological and mining enterprise needs to «stock up» a large number of licenses, the receipt of which costs a lot. So, for the Russian mining enterprises it is necessary to have the following licenses: on the right of conducting geological prospecting works with the subsequent production; on the right of extraction of minerals; on the right of drilling of prospecting, prospecting and estimated wells on solid minerals; on operation of mining productions and objects (the open method); on production of surveying works at use of subsoil; on works on carrying out measurements and analyses in the field of ecological control; on the right of use of the earth; on the right of use of water; on the right of deforestation; on works on utilization, warehousing, movement, placement, burial, destruction of industrial and other waste (except radioactive); on the intraeconomic works connected with violation of soil cover and removal of a fertile layer; on carrying out intraeconomic works in territories (water areas) of economic and natural objects; on development of standards of maximum permissible discharges of pollutants into the environment and many others.

To this should be added a set of documents, without which it is also impossible to start the development of the field: justification and approval of the conditions for the calculation of reserves; calculation and approval of reserves; technological studies of rocks and ores; the project of construction of the enterprise; the project of field development; approval of the values of losses and dilution; documents of Gosgortekhnadzor confirming the safety of mining operations, etc.

For fig. 3.6 presents the main permits required for mining for the implementation of enterprise production and business activities.

The right to conduct exploration. Acquiring the right to conduct geological exploration, the company has the opportunity to study the geological features of the subsoil object with the detail necessary for the development of conditions, calculation of reserves, determining the main parameters of the future enterprise. The right to conduct geological exploration in this area gives

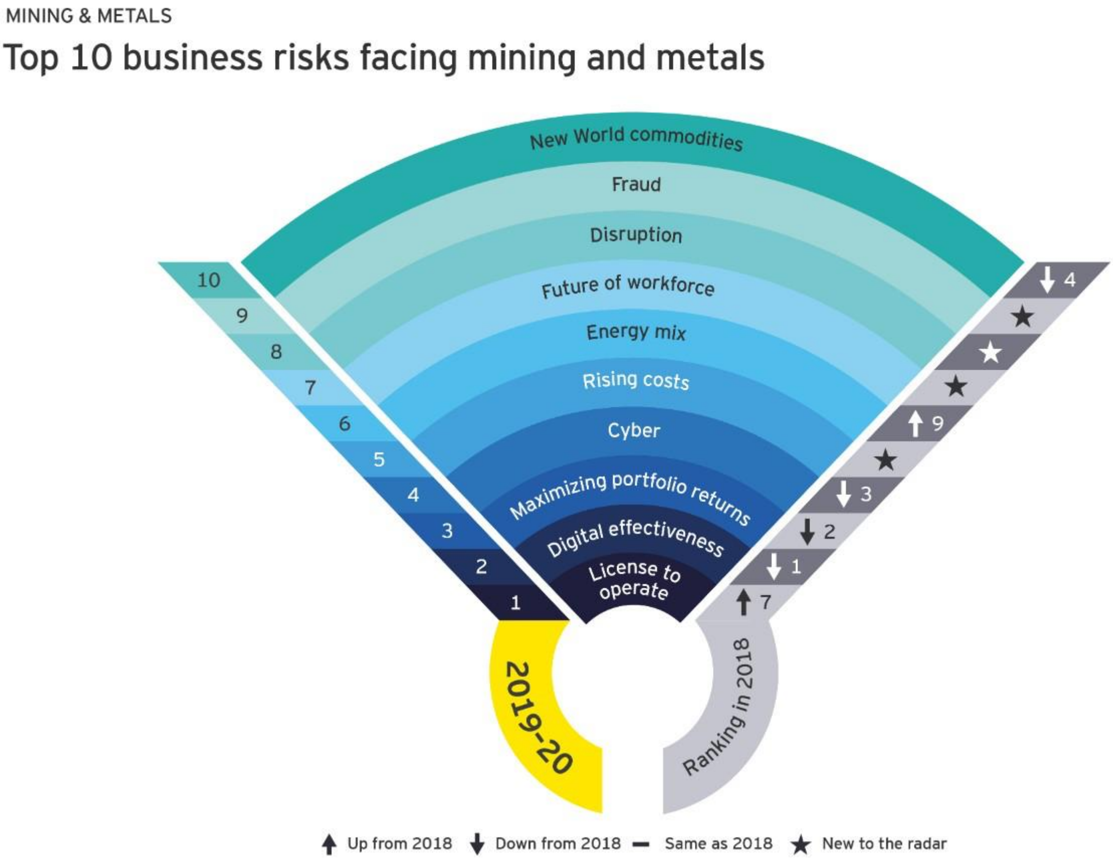


Fig. 3.6. Basic rights necessary for a mining company to conduct production and economic activities

the enterprise of obtaining and ownership of geological information (she becomes his property). Even obtaining geological information about the ease of the territory can be very popular, because this area can be used for construction or to create other important for the economy objects.

The right to extract mineral resources. Obtaining this right for at least 25 years enables the company to produce, process and supply consumers with products of the mineral complex. No one other than this company has the right to produce raw materials at this facility. Only an enterprise that has the right of extraction can transfer its rights to another person on a lease basis. Already this condition allows the company to have an advantage over other legal entities, which does not have the right.

The right to use the territory. Each mining enterprise requires a large area for its operation. Of particular importance is the area of land allotment. The size of the land seized in favor of the mining enterprise depends both on the method of mining (open or underground) and on the size of the future enterprise. Obtaining the right to use the land may be difficult, and in some cases impossible, if the location of the future mining enterprise is planned on the territory of natural or cultural reserves, residential or industrial buildings, agricultural land and other protected areas.

In addition to the right to use the land, the mining enterprise should have the right to use the resources on the land. These may include forest, water bodies, green spaces, buildings. The right to felling, demolition, backfilling, moving these objects is always associated with great difficulties, because it affects the interests of a significant number of other owners.

An important component of property valuation in extractive industries may be rights or ownership of industrial water supply and water resources. The right to use water requires a range of geological and hydrogeological studies and approvals.

The right to dispose of industrial and domestic waste. In the process of exploitation of deposits there are industrial waste in the form of waste dumps, which must be stored somewhere, tailings enrichment, storage of which requires the construction of special facilities (tailings). If we take as an example the average annual production capacity of a mining enterprise (1.0 million tons of ore), with a Stripping ratio of 7.9 and the content of the useful component of 10 Gy. at 1 ton, the company will «produce» about 20 million tons of waste rock and more than 990 thousand tons of tails per year.

A mine or quarry works not for one year, but for decades, and, therefore, the rights to the conditions for storing the rock mass are required. Even in the case where dumps and tailings are not toxic, it is required to obtain the right to create dumps. In case of increased radioactivity and chemical hazard of the stored rock, obtaining a permit for the placement of dumps and tails requires a lot of preliminary work. Such rights are often subject to environmental barriers and prohibitions. It is particularly difficult to obtain such permits in areas located in developed areas with a significant population density, close to protected natural areas. An example is lake Baikal. Development of open-pit deposits located in the immediate vicinity of the lake is not feasible due to the impossibility of obtaining permission to create dumps in this protected, unique zone.

Problems with the disposal of household waste have become particularly acute in recent years. In new underdeveloped areas, environmental pollution and the lack of special recycling facilities for waste disposal are of increasing concern to environmentalists. And obtaining a permit for the disposal of waste during the period of mine development can have a significant effect on the rate of input of object in operation.

The right to practice the object. The availability of licenses, rights, approved reserves and conditions may not be sufficient for mining operations. In accordance with the mining legislation of the Russian Federation annually, the company must justify and obtain permission from the Central Commission for the development of the MPR of the Russian Federation on the maximum amount of losses and dilution for each specific subsoil use object. On the basis of geological documentation the enterprise proves what size there can be losses of mineral in a subsoil and what size of dilution even at use of the most modern and effective methods of working off can be. Only after obtaining these parameters, the enterprise has the right to operate the field.

According to the Federal law «On licensing of certain types of activity» [137], a license for the production of goods, provision of services or performance of works is required in cases where it is necessary to confirm the level of professional skill in interaction with the consumer. The absence of the necessary professional level of the licensee can cause irreparable harm to consumers of goods, works and services. The license confirms, for example, that the doctor has medical education, the teacher – pedagogical, the enterprise – is completed with professional shots. The license, thus, determines the reliability and quality of the enterprise team. After obtaining a license, the company can carry out activities in the field of production of goods, works or services.

The license for the right to conduct geological exploration and the right to extract minerals has a completely different legal and economic burden. In this type of license is the main establishment of legal relations of the subsoil owner (according to the Constitution of the Russian Federation are citizens of the country on whose behalf the Government of the Russian Federation allows the subsoil license holder). In a document of this type is established as the legal relationship of the owner of the subsoil, the subsoil user and their financial relationships. By its nature, such a document corresponds to a Treaty or the right to use the property of the state. Oh, the basic right of the license holder relates to the possibility to obtain information about the structure of the subsoil, or to violate the natural state of the subsoil in order to profit from mining. The acquisition of such right takes place at the auction (competition). An enterprise wishing to obtain a license for exploration or development of a field pays both for the right to participate in an auction (tender) and for obtaining the license itself. The amount of payment is hundreds, millions, and in some cases billions of rubles. The presence of such licenses has a huge impact on the assessment of the business of the mining enterprise, both in terms of the value of its assets and in determining future cash flows from production and economic activities.

We believe that for exploration and mining companies these documents (licenses for subsoil use) should be considered as part of their property complex, as intangible assets, also because they are the main condition for obtaining the necessary set of permits for the organization, design, construction and operation of the mining and processing complex. For example, the implementation of the «mining license» in the mining industry involves obtaining a significant amount of permits in order to start the development of the field. Only the owner of such a license can obtain the right to use the land, to carry out geological exploration, to determine the size of the conditions, to approve reserves, etc. For each field, a set of permits, the depth of their study will always be individual, which requires both time and considerable funds of the license holder. All subsequent permits for the organization, design, construction and operation of the mining and processing complex, in turn, must also be considered intangible assets of the mining enterprise.

The list of intangible assets in the enterprises of mineral resources is much wider and more diverse than in other sectors of the economy, and their role in financial and economic activity is incomparable. Thus, intangible assets in subsoil use, and in particular, their most important part – ownership of geological information and licenses for subsoil use, being a set of property rights of a particular enterprise, can and should bring their owners income, the capitalization of which will be further directed to the expansion and development of production. To do this, it is necessary to develop and provide geological exploration and mining enterprises with methodological materials: a methodology for determining their commercial value and a methodology for assessing the effectiveness of the introduction of IA into the economic turnover of enterprises.

4. Risks in the mineral complex

4.1. Type of risk

Risks have the following fundamental features that are important to consider when further considering risks.

1. Randomness of possibilities, i.e. connection with the practical manifestation of probability theory, when the expected possibilities are predicted with a certain degree of probability. However, the social components of a market economy must always be a necessary complement to a market economy, which does not always produce social results. Therefore, according to Aurelio Pechchei, the first requirement for any firm should be its social utility, around which the questions of profit should be concentrated, and not Vice versa. At the same time, some firms with an active assortment policy function better in a volatile uncertain environment, and specialized firms – in stable conditions. [32].

Here it is necessary to take into account the fact that the higher the density of firms producing the same type of product, the higher the risk of doing business in a particular market segment. Such a high density of firms with the same type of goods (services) is caused by:

– match the form of the firm this niche;
– greater legislative support;
– increasing the number of people with experience in creating such organizational forms.

In such firms, for example, from the point of view of storage and warehousing costs, the supply volume of 20 tons is rational, and the price elasticity of demand is 1.78.

2. The probability distribution of negative, neutral and positive results is that the risk event could have three different outcomes with different probability distribution, especially when pure risks, for example, real investment cumulativity with speculative risk financial investment in the stock of financing real investment projects (prospectus and offering of securities under investment project financing in the real sector).

3. The undesirability of expected losses is due to the fact that any expected losses are undesirable, so it is better to avoid them by applying

preventive measures, leading to their level to an acceptable level, taking into account their own financial capabilities.

At the same time, it is advisable to identify indicators and parameters that determine the company's own investment potential:

– relatively stable and acceptable for forecasting by calculation indicators: the value of fixed assets, gross profit, taxable profit, net profit, etc.;

– established normative and variable parameters that determine, in particular, the depreciation rates share of investments directed to urgent measures to replace worn-out equipment, etc.

The objectivity of risk manifestation in economic activity remains unchanged due to the forces of the external environment and market competition.

The external environment in business is understood as a set of strategies of subjects of the market of financial means – clients, competitors, the state. In addition, modern conditions are characterized by increasing differentiation of scientific knowledge and the complexity of human activities, which entails social, economic, technological and environmental changes. Thus, in order to create a safe road transport system, it is necessary first of all to change the understanding of responsibility.

These characteristic features of risk should be supplemented with the following.

The subjectivity of the risk choice is due to the different level of reliability of the information used, professional experience: the qualification of managers, other factors.

Lack of information has become a feature of risk because risk needs to be distinguished from uncertainty in the information approach. If the uncertainty is due to the fact that the outcome has not been determined, the probability distribution remained unknown (immeasurable uncertainty), then the risk is a measurable uncertainty or probabilistic (stochastic) certainty with a known distribution of the random variable of the simulated risk situation. Therefore, this characteristic is associated with incomplete risk identification. The latter is designed to transform uncertainty into risk.

The irreversibility of the consequences of action is caused by the fact that most of the socio-economic progressive changes are irreversible processes, the number of risks in society has a stable tendency to absolute positive growth. In reversible social processes, the scale of risks remains unchanged. In irreversible processes, risks increase. In addition, the consequences of the risk occur when the risk is already transformed into a specific type of loss or additional income, i.e. it is too late to carry out preventive minimization and localization of risk. Preventive measures are carried out before the risk is realized in concrete consequences, especially of a negative nature.

Methods to achieve a balance between income and risk include:

- evasion risks (insurance, hedging etc.);
- localization of risk (e.g., stage in the project);
- risk dissipation (proportional division of responsibility);
- approval or compensation of risks (strategic planning).

Impossibility of long-term avoidance of expected consequences. Only short-term effectiveness of risk avoidance is possible under temporary stable favorable external conditions. But over time, this leads to large losses of profits and capital due to the refusal to carry out high-yield and risky operations, especially those associated, for example, with the commercialization of innovations. Moreover, the risks from which the firm evaded, as a rule, return after a certain time, taking a more dangerous character and acting with even greater destructive force. The latter is particularly characteristic of risks of a mass and systematic nature.

Thus, the current trend of global business is not only the development of the global financial market, but also its increasing integration into the global information, computer and telecommunications system with the appropriate software. Under the conditions of this system, the global market of material, but primarily cognitive resources is intensively developing.

Information-computer-telecommunication systems are beginning to show the features of a nonlinear dynamic system with characteristic signs of chaos, as the basis of these systems are people who are in the warehouse of consciousness «chaotic» creatures.

The inconsistency of negative and positive consequences is manifested in the fact that, on the one hand, the risk has a positive impact on the socio-economic and scientific and technical development of society, and on the other hand, leads to adventurism, voluntarism, subjectivity, which hinders socio-economic and scientific and technological progress, generates various costs in the conditions of incomplete and inadequate consideration of objective laws of development.

Thus, it is advisable to apply the following rules of risk management:

– you cannot risk more than your own capital can afford;

– have to think about the consequences of the risk, it is impossible to risk much for small;

– a positive decision is taken only when there is no doubt;

– if in doubt, negative decisions are made;

– one cannot think that there is always only one solution, perhaps there are others.

Structurally, the risk can be identified by the characteristics shown in Fig. 4.1.

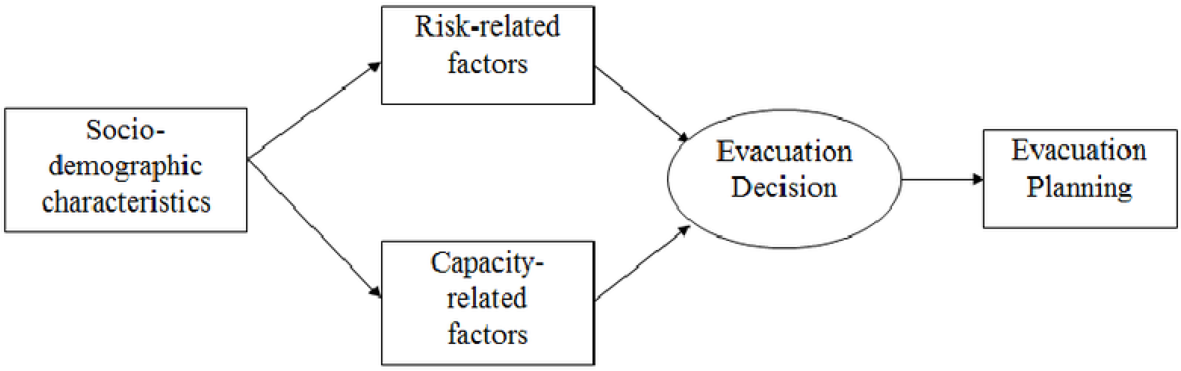


Fig. 4.1. Risk-related characteristics

Danger – a potential threat of damage or other form of risk realization, due to the specifics of the object, the characteristics of the risk situation and the nature of the damage. This characteristic reflects the interaction of two main elements: the risk carrier, i.e. the object or entity in relation to which this risk is assessed; the environment in which there is a risk carrier and which can provoke the realization of risk.

Exposure to risk is a characteristic of a situation that is fraught with damage or another form of risk realization.

Vulnerability expresses the degree or intensity with which damage of different sizes may occur with respect to the object in question, i.e. the corresponding danger may be realized. In practice, the vulnerability is often proportional to the time of observation of the object at risk.

Interaction with other risks has a significant impact on the individual risk. The relationship of risks is understood in the broad sense of the word, and not only in the sense of the presence or absence of a certain (mainly statistical) significance. Such analysis of the interaction of risks often has an impact on the understanding of the dangers to which the objects under study are exposed.

Consider the risks that are most common in the practice of economic activity of enterprises of the mineral complex.

1. Industrial and transport risks, i.e. the risk of damage to the company and third parties due to disruption of the production process. For industrial production, this is expressed in the form of an emergency situation as a result of natural and man-made events.

Let us consider technogenic risks in more detail, as in modern society, social, economic and environmental consequences of major man-made accidents and emergencies have an increasingly negative impact. This is especially true for potentially hazardous facilities.

Here it is important to ensure the adoption of engineering, organizational and managerial decisions that allow economically justified to minimize the consequences of negative impacts in the most rational (less costly) ways.

Economic methods of management and regulation of industrial safety in the direction of man-made risks are possible subject to the introduction of economic responsibility of state, joint-stock, private firms, as well as individual entrepreneurs for the damage they can cause as a result of an accident or catastrophe in their controlled industries.

In international practice, such responsibility is enshrined in the Directive on the prevention of severe accidents adopted by the EEC countries (sevezo III), in Russia, economic responsibility is enshrined in the Federal law of July 21, 1997 No. 116-FZ «On industrial safety of hazardous production facilities».

This means that the society begins to appear institutional capital associated with the quantitative assessment of man-made risks and processes that ensure their reduction. The adoption of engineering and organizational decisions that affect industrial safety should be beneficial to the manufacturer, but subject to compliance with all requirements of safety regulations.

The probabilistic structure of the environment in which transport enterprises are located, the stochastic nature and multivariance inherent in most phenomena of the surrounding reality, generate risk. Unpredictability of demand, saturation and differentiation of needs, changing customer preferences, individualization of consumption, increased competition - all this leads to increased risk in decision-making.

Thus, the risk of road transport companies can be divided into the following main groups:

– commercial risk, i.e. supply disruptions, cargo unavailability on time, violation of deadlines, non-fulfillment of financial obligations of the parties;

– risk of loss of property due to natural disasters, adverse transportation conditions;

– risk of loss of property due to strikes, riots, hostilities;

– risks due to safety and fire safety violations;

– risks of theft;

– environmental risks (accident with the goods or mismatch of their properties to the packaging, which can cause damage to the environment);

– technical risk, i.e. failure and vehicle breakdowns and as a result, may delay delivery and increase the likelihood of other risks;

– risks caused by low qualification of employees: negligence, loss of documents, their delay, etc.

2. Environmental risks, i.e. the probability of civil liability for damage to the environment, as well as the life and health of third parties. environmental Damage is expressed in the form of pollution or destruction of forest, water, air and land resources, damage to the biosphere and agricultural land. The most likely cases in which civil liability may be incurred are accidents, excess emissions and leakage of harmful substances at production facilities, the impact of which has affected the surrounding area.

Transport environmental risks are associated with air pollution by exhaust gases of vehicles, strong noise exposure, loss of life and animals in traffic accidents.

An important environmental problem is the reduction of the human environment as a result of the growth of the fleet of vehicles. This problem becomes especially urgent in large cities, where a qualitatively new environment is formed that does not fully meet the conditions of normal life of the population. The influence of this environment is manifested in the material, information, psychological and socio-economic spheres.

Thus, the world car Park exceeds 800 million cars to date, which leads primarily to a reduction in the natural environment in urban development.

In Moscow, the area of green spaces per inhabitant is less than 8-10 sq. m. with a standard of 11 sq. m. In Moscow from 2000 to 2014, the area of green spaces decreased by 636 hectares (about 2%), to 36.1 thousand hectares. Such data in the study of the amount of woody vegetation of the capital is given by the Russian branch of the environmental organization Greenpeace.

Such degradation of the natural landscape and the destruction of ecological systems lead to the disruption of the balance of environmental components (energy, gas, water, substrates, plant producers, animal consumers, and organisms-the decomposers). Such a change in the quantitative ratio of components leads to a violation of the balance of natural systems, which in turn adversely affects the state of nature and human health.

It is necessary to create a single complex of environmental control, including the regulation of the maximum permissible values of the controlled or measured parameters that determine the quality of the components of the environment or the characteristics of the effects on these components of the environment.

In this regard, the so-called ecological passport of the enterprise is introduced, which justifies the rate of emissions of pollutants into the environment, as well as the right to receive a certificate of environmental safety and to classify the technologies of this production as environmentally friendly or dirty. This document is interlinked with subsystems of monitoring of anthropogenic impacts, rationing, analytical control.

Growing demands on the quality of the environment make enterprises more strict about the possible consequences of their activities. Enterprises should identify these consequences and create an appropriate basis for decision-making on environmental safety.

In accordance with the above, the organization of works to reduce environmental risks by enterprises should include the following activities:

– familiarization of employees with the requirements of environmental legislation;

– providing all employees of the enterprise with instructions on environmental protection and requirements of the environmental legislation;

– formation of an effective system of environmental information at the enterprise;

– development of the company's regular detection of risks to the environment;

– the annual report on the status of environmental activities;

– organization of the system of environmental monitoring and environmental information, etc.

3. Investment risks are associated with the possibility of shortfalls or loss of profit during the implementation of investment projects.

These risks can be divided into the following features:

– by type. At the stage of the project vary; the risk of insolvency of the enterprise; the risk of reducing financial stability; the risk of design; construction risk; marketing risk; the risk of financing the project; inflation; interest rate risk; tax risk;

– stages of implementation of the investment project: project risks of the pre-investment stage; project risks of the investment stage; project risks of the operational stage;

– sources of occurrence are the following types of project risks: external, systematic or market risk; internal, non-systemic, or specific risk;

– financial implications: risks, involving only economic losses; risks involving loss of profit; risks, resulting in economic loss, and additional income;

– the level of financial losses project risks are divided into allowable project risk; critical project risk; catastrophic project risk;

– foreseeability project risks are divided into predictable risk; unpredictable project risk.

4. Credit risks associated with the possible non-repayment of the loan amount (and interest on it) issued for a specific investment project. As a rule, the condition for granting a loan is its intended purpose, i.e. it can be used only for the needs of a particular investment project.

Credit risk is not the very property of credit, not so much the probability, the possibility of an undesirable move or the inevitability of the result in the lending process, as the activity that can lead to a negative result.

The degree of credit risk of banks is influenced by the following factors:

– the degree of concentration of the Bank's credit activities in any area sensitive to changes in the economy, i.e. having an elastic demand for its products, which is expressed by the degree of concentration of the

Bank's customers in certain industries or geographical areas, especially exposed to market changes;

– specific weight of loans and other banking contracts attributable to clients experiencing some specific difficulties;

– concentration of the Bank's activities in poorly studied, new, non-traditional areas;

– introduction of private or significant changes in the Bank's lending policy, formation of the securities portfolio;

– share of new and recently attracted customers;

– introduction of too many new services in a short period of time (in this case the Bank is more likely to be affected by negative or zero potential demand);

– acceptance as collateral values, illiquid market or subject to rapid depreciation.

It is necessary to take into account the fact that the credit risk in lending can be quantified as the ratio of the volume of outstanding obligations for the return of loans provided on certain conditions to the total volume of customer obligations and is calculated on the basis of the credit history of the lending institution.

5. Technical risks are divided into construction,installation and operational.

Construction and installation risks include:

– risk of loss or damage to building materials and equipment due to adverse events – natural disasters, explosion, fire, malicious acts, etc.;

– risk with the operation of the facility as a result of errors in the design and installation of;

– risk of physical damage to personnel involved in the construction of the facility.

6. Business risks are caused by external and internal factors. External factors are associated with the loss and loss of the entrepreneur's expected profit due to the violation of its obligations by contractors or other circumstances beyond its control.

Internal factors depend on the ability of the entrepreneur to organize the production and marketing of products. They are influenced by: the level of management, cost, quality and reliability of products, sales conditions, advertising, organization of after-sales service, availability of working capital, clientele, etc.

Insurance companies and financial institutions do not usually provide entrepreneurs with guarantees of compensation for losses from internal risks, as they are associated with the impact of many subjective factors.

Damage from business risks can be direct and indirect. Direct damage is the loss of fixed and current assets, physical damage to personnel, physical and property damage to third parties (population and enterprises). Indirect damage is the loss of income (loss of profit) due to a business interruption for various reasons.

A significant place in the assessment of business risk is occupied by indicators of the effectiveness of processes in various fields of activity, as cost optimization plays an important role in the efficiency of the entire enterprise.

It is obvious that the system of indicators should first of all identify the shortcomings of the organization of existing processes in order to further reduce their costs. Such indicators should have the following properties: specificity (specific), measurability (measurable), achievability (achievable), relevance (relevant), attachment to a certain period of time (time-certain), as well as meet the main criteria, which include: clarity (clarity), completeness (completeness), complexity (complexity) and consistency (consistency).

It is now becoming increasingly clear that only those companies that have clear business strategies for using their limited resources can run a successful business (and thus reduce business risks).

For any economic structure, the main goal is to achieve positive financial indicators through the conduct of its economic activities, provided the optimal use of resources. At the same time, the business strategy of the enterprise means long-term objectives for the development and improvement of its work. The business strategy of the enterprise can be implemented in the course of one or a number of business areas that directly reflect the activities of the enterprise.

For the enterprise, as a rule, one business strategy is developed, which contains sections – separate business directions of its activity, which are dynamic and require constant attention and control.

Ready business strategy should answer the questions:

- what to produce;
- how much to produce;
- how and on what to produce;
- what technologies to use;

– to whom to sell and at what price;
– from whom to buy raw materials and components;
– where and under what to take working capital;
– how to get money for products sold.

The business strategy is aimed at the implementation of business goals.

Under favorable circumstances, such a goal may be to ensure the systematic development of the enterprise, taking into account the existing positive aspects in the financial and economic activities, with unfavorable – the concentration of resources to solve problems in accordance with the adopted strategy.

As a rule, a business goal is understood as a set of goals set by the enterprise. Such entrepreneurial business objectives can, for example, be:

– enter the market with new products (services);
– to gain a foothold in the market of certain products (services);
– create «your customer»;
– take a leading position in the production of products (services) in the region;
– take a leading position in the industry or business direction.

Business goals should not conflict with each other. Business goals should be focused on the real capabilities of the enterprise and take into account external and internal conditions.

The external conditions affecting the activity of the enterprise include:

– legal framework;
– regulatory framework;
– the presence of an for a release or planned release of goods;
– the presence of competition;
– the presence of customers;
– consumer needs.

The internal conditions affecting the activity of the enterprise include:

– compliance with the interests of the owners and managers of the company, as well as its employees;
– existing material-technical base and its condition, its possibilities for production and expected production;
– financial condition of the company;
– the presence of financial possibilities for development of the company;

– organization of marketing work;
– the organization's accounting policy;
– organization of accounting and control;
– the state of the system of enterprise management;
– management organizational structure, allocation of responsibilities, availability and compliance with regulations organizational purposes, the presence of elements of automation;
– the state of resources;
– the R & d expenses and cost of products;
– psychological climate in the team and compliance of this climate with the tasks or tasks under the new conditions of development of the company;
– the skills and ways of staffing;
– the presence of leaders of middle and senior divisions.

Such an assessment (diagnosis) of internal and external conditions of sleep because it allows: to clearly define problems in the organization and to identify well-established problems that in everyday activities, no one is straining; to develop some vocabulary of basic concepts and terms that allow the company employees alike understand this process; to examine in more detail the problem.

During the development of the business strategy, a number of fixed positions and boundaries are determined, which include:
– place and role of the company in the industry and region;
– activities of the company;
– achievement of certain economic and financial indicators adopted in a certain range, the violation of which requires adjustment;
– the level of influence on the market of this type of products and services;
– the choice of the direction and stages of promotion of goods to the market, the stages of expansion, the planned results at each stage; here the question is solved: what products the company will produce, to whom, where, in what quantity and at what price to sell.

However, during the implementation of business strategies, the interests of the company's employees may be violated. For example, the intensity of the development of the company can reduce the level of distributed profits; increase the load on the staff; require increased productivity of employees; require advanced training of employees.

Expanding the scope of services may require additional capital investments; to change the priority of certain officials; to a certain extent to reduce the concentration of efforts I coordination and monitoring of previously implemented activities; to create new objects of special attention; change the level of influence on the market of the manufactured products.

The main stages of business strategy development include:

– assessment of external factors;
– assessment of internal factors;
– development of concepts development of the company;
– select the product with which the company enters the market.

The most difficult and important problem for each company is the choice of the list of products with which the company can enter the market for a certain time with confidence that these products will be sold, as well as the definition of the characteristics of the product and its selling price.

The solution to these problems depends on the technical, technological and resource capabilities of the enterprise, as well as the existing system of sales of the selected products, which provides:

– assessment of external experience in the development of products of the same class and own experience in the development of new products;
– evaluation of competitors that produce similar or substitute products;
– determining the market place of similar or substitute products;
– defining temporal and spatial boundaries expansion;
– calculation of the necessary resources and time to achieve the selected goals and milestones;
– making business strategy as a basic document for the development of enterprises for the future;
– approval of business strategy as a program document of the company. Such documents may be two: one for internal use, the other for use in advertising to create the image of the company;
– development of detailed long-term and short-term plans for the structural units of the enterprise to implement the business strategy;
– appointment of those responsible for the implementation of the business strategy and its individual components;
– development of forms of control over the implementation of the business strategy and the procedure for making adjustments.

The methods used to develop a business strategy include: the first person initiative method; the brainstorming method: the method of planned work.

To develop a business strategy involved:

– management Board (Directorate) and company management;
– staff unit;
– working group;
– external consultant.

It is also necessary to detail the individual fragments of the business strategy by: activities; level of profitability; degree of risk; perspective of development; types and degree of required control; availability of resources; timing of implementation; availability of specialists, etc.

Information support for the implementation of the business strategy should include:

– requirements to information support of business;
– the settlement and analytical information base considering influence of conditions on results of implementation of planned actions of financial and economic activity of the enterprise;
– information database of the external environment;
– information base of internal conditions;
– technological and regulatory solutions for the processing of internal and external information;
– software and technical support system of information flows in the IT system;
– software and hardware base processing.

Business directions in the company's business strategy are characterized by a number of indicators, the most important of which are the following:

– the name of the product;
– market demand;
– time and cost characteristics for production of products;
– the cost of production;
– market value of the goods;
– product cost of sales;
– the labor costs of production;
– the methodology and technology of realization of production;
– possibility and price of purchase of raw materials and components;

– technology of purchase of raw materials and components and associated labor costs.

Business directions in the business strategy of the company are implemented through business processes, which are understood as separate poisons of work, the implementation of which is necessary in the implementation of business directions. During the implementation of one business direction requires the execution of several business processes. At the same time, the same business process can be carried out in a number of business areas, which in practice is overwhelming.

Business processes are characterized by:

– description of business process procedures;

– appropriate technology; technological equipment and tooling;

– labor costs; qualification of business process participants; time costs; relevant components and raw materials; cost indicators.

The latter suggests that all elements of business processes have their own cost indicators, which are the basis for the organization of economic and accounting work.

When developing business processes, the following problems are solved:

– develop technologies for the implementation of business processes;

– the equipment and technical means;

– define the required raw materials and components, as well as resources;

– determined qualification requirements to perform;

– defines the time parameters for execution (desirable and acceptable);

– the interrelation of business processes in one business direction is established.

Marketing is of great importance for the implementation of the company's business strategy. The main purpose of marketing when choosing a product for production is to determine those products that are in high demand and have a stable certain category of consumers.

As a rule, marketing in each company must have a direction associated with the provision of the production process, i.e. with the supply.

Within this direction the following issues are solved:

– who, at what price and in what time frame can supply the relevant components or raw materials;

– schedule of possible deliveries; assessment of quality of supplied components and raw materials; organization of storage of received components and raw materials;

– possible storage; modes of delivery and minimum amounts of parties; methods of payment components and raw materials;

– availability of other suppliers of similar components and raw materials, as well as conditions of their supply;

– the technical sales of the products of the company, i.e. sales, marketing needs to answer the following questions: what products are currently in high demand; what products demand is exceeding supply and trends in demand; what category of consumers designed product and evaluation of the solvency of the consumers; the market price of the goods; the method and form of implementation of the product; the required number of products to implement and maintain the demand and prices; the presence of competitors and quality of competition; the availability of substitute products and the pace of their introduction to the market trends.

Material and technical support of the company is connected with providing with accessories and raw materials for production processes, providing with machine Park and processing equipment, the tool, energy carriers, water, heat, etc.

Significant costs affecting the cost of goods are associated with the transportation of funds and resources. One of the ways to reduce transportation costs is to reduce the ways of transportation, consolidation of transported consignments, use of cheaper mode of transport.

Currently, a detailed calculation of the cost of production of goods, including the cost of storage, is given special importance, since later it will allow to objectively set its price for the products taking into account the prices of competitors.

The organization of sales of products should ensure the sale of products with the highest incomes, subject to the condition that these incomes exceed the costs incurred.

The primary task is to create a network of consumers of the produced goods. The main directions of creation of «own» consumer are: advertising of goods; creation of an image of the consumer; determination of interests of the consumer before production; determination of volume of the consumer market; identification of competitors -and the market; participation in long-term projects of partners, etc.

Further work is aimed at determining the conditions that surround the sale of goods. These conditions include the following:

- quality of goods;
- packing;
- organization of storage before shipment to the consumer;
- organization of loading operations;
- holiday warehouse;
- organization of transportation of products;
- organization and payment terms.

At the stage of storage of finished products require a clear organization:

- the work of warehouse employees with the definition of liability;
- accounting of products stored in the warehouse;
- access to shipped products;
- mechanization of loading operations.

The most common forms of delivery of products to the consumer are supplier delivery and pickup.

The most common forms of payment for the sale of goods include prepayment of products, payment upon shipment, as well as shipment (transfer) for sale.

Financial and commercial risks are a special group of risks within business risks.

Figure 3.2 shows the structure of financial risks.

Currency risks are understood as the probability of losses from changes in exchange rates in the process of foreign economic activity, investment activity in other countries, as well as in obtaining export credits. Operational, translational and economic risks are distinguished among them.

Operational currency risk can be defined as the possibility of loss or loss of profit as a result of changes in the exchange rate and its impact on expected revenues from the sale of products.

Translation currency risk (also called balance sheet risk) occurs in the following cases: the need to assess the overall performance of the company, including branches in other countries; the need to compile a consolidated balance sheet; recalculation of taxes in the currency of the country of location of the parent company.

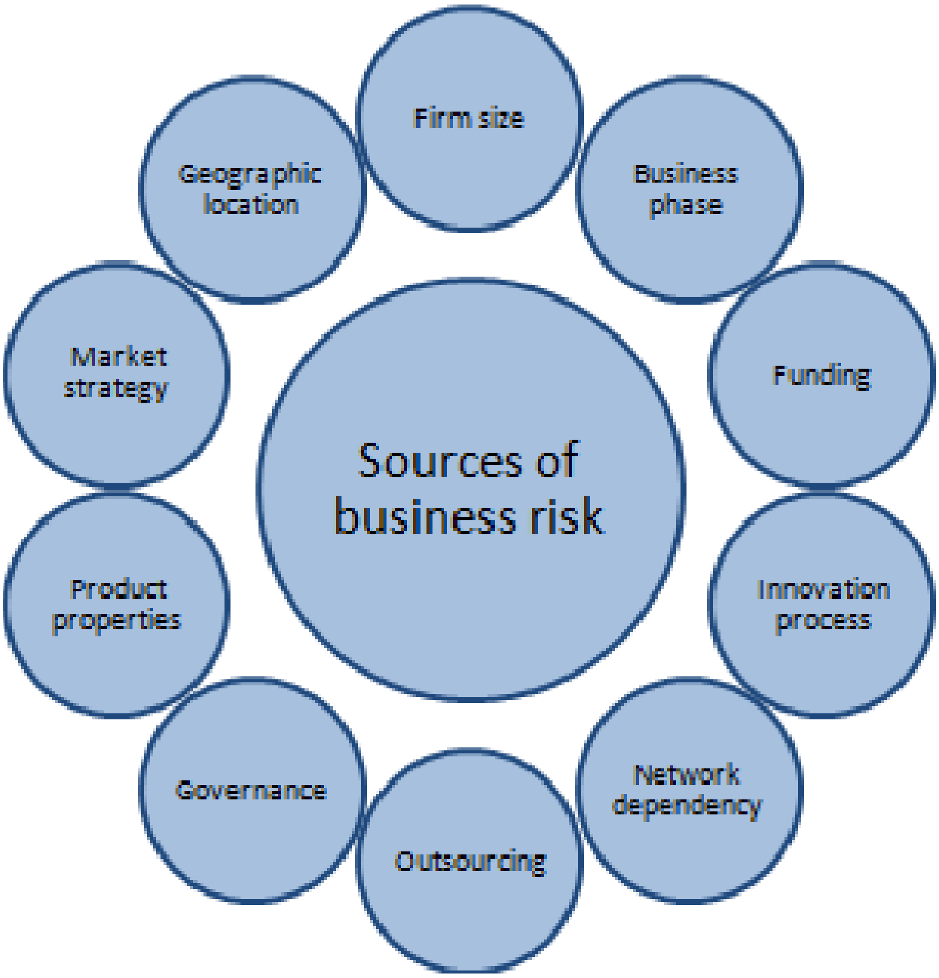


Fig. 4.2. The structure of the financial risks

Economic currency risk is defined as the probability of adverse impact on the economic situation of the company of exchange rate changes, such as artificial containment of wage growth, restrictions on the circulation of foreign currencies, exchange of money, etc. Economic currency risk is most pronounced in countries dependent on imports of goods.

Interest rate risk refers to the probability of losses in the event of changes in interest rates on financial resources. They include position, portfolio and economic factors.

Positional risk arises if interest on the use of credit resources is paid at a «floating» rate.

Portfolio risk reflects the impact of changes in interest rates on the value of financial assets such as stocks and bonds. An increase in interest rates on major credit resources tends to reduce the value of the portfolio and Vice versa.

Economic (structural) interest rate risk is associated with the impact of changes in interest rates on the economic situation of the company as a whole.

Portfolio risks show the impact of various macro-and microeconomic factors on the assets of an entrepreneur or investor. The portfolio of assets may consist of shares and bonds of enterprises, government securities, term liabilities, cash, insurance policies, real estate, etc. By compiling a portfolio of different assets on a certain balance technology can significantly reduce its riskiness and increase profitability. The so-called balanced (market) portfolio is least affected by risk factors, among which there are systematic and unsystematic.

Specialized risks include the following.

Commercial risks associated with the possibility of loss of profit or losses in the course of trading operations may be manifested in the following events:

- insolvency of the buyer at the time of payment of the goods;
- the customer refuses payment for the product;
- change in product prices after contract conclusion;
- decline in demand for products.

Country risks arise when entrepreneurs and investors carry out their activities on the territory of foreign countries. Loss or reduction of income from the business occur for various reasons, among which are:

- the change in the political system of the country;
- expropriation or nationalization of foreign property;
- destruction or damage to property as a result of hostilities and civil unrest;
- change of ordinary and special legislation – the customs, tax, etc.

For the investor, country-specific risks generally determine the likelihood that investment objects will be destroyed or expropriated as a result of political and social upheaval or that investment or economic conditions will deteriorate dramatically as a result of changes in the legal framework.

For an entrepreneur, country risks mean the possibility of non-performance of international contracts, damage or loss of property, money as a result of certain socio-political or economic events.

There is an international investment strategy based on the concept of the so-called «global portfolio», according to which the shares of investments in the assets of different States should be distributed inversely in proportion to their country risk. The latter can be of three types:

- socio-political;

– macroeconomic;
– microeconomic.

Political risks that may occur in the form of the following events:

– changes in currency legislation that prevent the execution of international contracts or the repatriation of foreign currency earnings;
– changes in the legal framework that make it difficult to conduct business;
– nationalization or expropriation of enterprises established with the participation of foreign investors;
– amendments to arbitration law;
– military actions, civil unrest, riots that caused damage to the property interests of entrepreneurs.

4.2. Classification of risks

In practice, the following principles of risk classification apply:

– risk classification should be tailored to specific objectives;
– classification should be carried out from the standpoint of a systematic approach;
– risk situations of one group should have the same order of detail and meet the classification objectives;
– the same risk situation may contain different risks;
– when considering the issue of risk taxonomy, it is advisable to identify such characteristic features of this phenomenon as the source of risk, the object bearing the risk, the subject perceiving the risk.

There is also a General classification of risks identified by the content of the following structural characteristics of risk: danger; risk exposure; sensitivity to risk (vulnerability); interaction with other risks; available information about the risk; the magnitude of the risk; costs (costs) associated with the risk; specificity of risks.

According to the hazard characteristics risks are classified:

– on the type of object associated with property (property); income; personnel; liability;
– cause (nature) of damage - natural; technical risks; associated with the human factor; risks associated with economic activity; political risks; social risks;
– typicalities of negative consequences - fundamental risk; sporadic risk.

According to the characteristics of exposure risks are divided:

– specific outcomes - net risk; speculative risk;

– place of occurrence - internal and external risks;

– the degree of dependence of losses from the original event - primary and secondary risks;

– the nature of the distribution of the burden of risk - unilateral, bilateral, multilateral risks;

– level of occurrence - risks arising at the level of the national economy; at the level of administrative and regional entities; at the level of individual economic entities (companies); at the level of structural units; on the level of the individual workplace;

– the level of negative consequences - project risks or unit risks; enterprise risks; industry risks; General economic risks (inflation, crisis of overproduction or financial markets, etc.); global risks, i.e. risks of the world economy as a whole.

According to the characteristics of the vulnerability, the risk is spread:

– according to the degree of influence of the natural and social environment, i.e. the risk from their manifestation can be either direct (losses from hurricanes, tornadoes or storms) or indirect (for example, long-term impact on the share price of a certain company);

– the degree of consideration of the time factor - indefinite risks and urgent, which in turn are divided into long-term and short-term;

– time-dependent - static, i.e. time-independent (earthquakes) and dynamic (increased risk of accidents due to wear and tear of equipment, etc.));

– duration of identification and elimination of negative consequences - risks with short-term, medium-term or long-term identification of negative consequences.

According to the characteristics of interaction with other risks, the risks are divided:

– by the degree of prevalence of this risk - mass (risks of automobile accidents) and unique (nuclear risks);

– the nature of the impact on various objects - General (natural disasters), private. The total risk is characterized by its accumulation, i.e. a situation where one event can cause damage at different sites, but the responsibility for covering this damage in whole or in part lies with one organization or one entrepreneur, so that the total damage as it accumulates;

– degree of diversification: if the aggregate vulnerability of risks by volume, time and space (e.g. portfolio as a whole) is less than the vulnerability of the respective risks individually, the risk is considered to be diversified, otherwise not diversified.

According to the characteristics of the available information on risks, the latter are divided:

– the degree of predictability of risks - predictable (predicted) based on economic theory or economic practice; unpredictable (unpredictable);

– type of information risks can be either quantified or qualitatively (verbally) described;

– degree of reliability of information risks can be assessed only qualitatively (I believe – I do not believe).

According to the characteristics of the magnitude of the risks, the latter are divided:

– the frequency of occurrence of the damage - a rare risks, i.e. low probability of damage; risks that the average frequency; frequent risks;

– size (severity) of harm - low risk; medium risk; high risk; catastrophic risks.

The distribution of damage in analytical or graphical form shows that losses of a certain value are characterized by a certain frequency (probability) of their occurrence. This dependence is shown in Fig. 4.3.

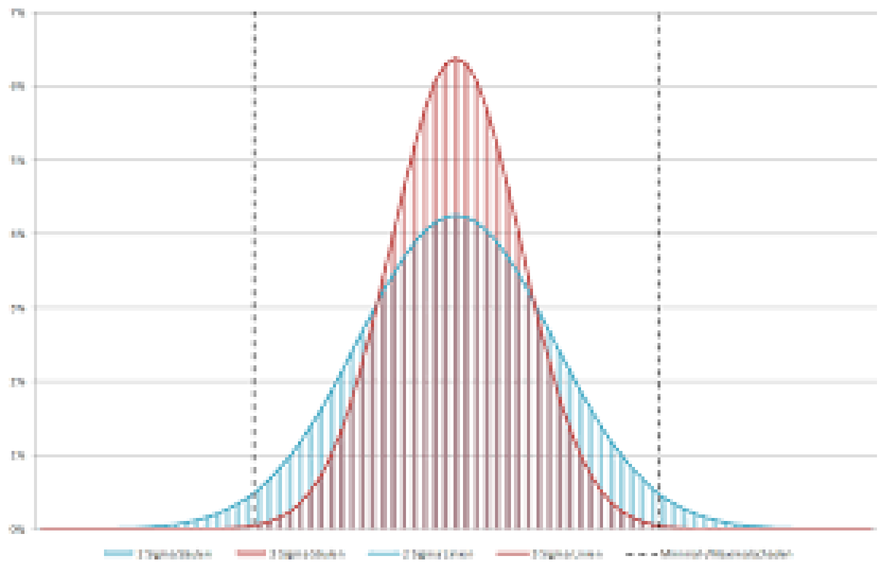


Fig. 4.3. Distribution of damage

This relationship is characteristic of situations where the magnitude of the damage can change continuously. As you can see, catastrophic losses are characterized by very low probability of their implementation.

The distribution of damage is used in the framework of probability theory to describe random variables on the basis of which are calculated: position characteristics (expectation, median, mode, etc.); scattering characteristics (variance, standard deviation, coefficient of variation, etc.).

Taking into account the nature of the costs (costs) associated with the risk, the risks themselves are divided:

– on possible financial consequences – resulting in direct damage and indirect losses (loss of income, increase operating expenses and (or) long-term effects of adverse events);

– the method of decision-making under conditions of uncertainty and risk; costs associated with risk reduction; costs associated with covering the negative consequences of realized events;

– the distribution allocate costs: private costs, social costs.

In accordance with the specificity of the risks can be divided:

– bank risks - market risk; credit risk; liquidity risk; operational risk; legal risk;

– insurance risks - risks coming to the insurer from the policyholders, as well as own risks (technical (current and special); investment; non-technical).

4.3. Risks in the gold mining industry

As shown above, risks are obstacles that need to be overcome in order to move from gold mining costs to profits. The study of economic literature showed that the process of gold mining is characterized by six main categories of risks: market, currency, exploration, geological and political.

Market risk

In the gold mining industry, short-term fluctuations and long-term trends in mineral prices are called market risks. The price of gold has been rising for more than fifteen years (Fig. 4.4).

The price of gold is influenced by many factors, ranging from such fundamental as physical demand and supply, and ending with the development of events in the geopolitical sphere, the macroeconomic situation and changes in the policy of Central banks, the situation in the foreign exchange markets and investment demand for gold. Today's demand for gold primarily reflects the growing investment demand, which was formed as a result of geopolitical instability, the global financial crisis and the subsequent period of volatility in capital markets, as well as currency fluctuations. Liberal monetary policy and a decline in confidence in non-gold-backed currencies also stimulate investment demand for gold. No less important result of this development at the macroeconomic level was the change in the mutual value of currencies and exchange rates.

A significant event that influenced the demand for gold was the decision of the UK to withdraw from the Eurozone. Almost all markets have undergone major changes, and there is high volatility in the markets. Thus, the us indices fell, almost all sectors today are in the «red zone». Currencies are falling while gold is growing. June 27 to 03:59 Moscow time prices reached $1332 (Fig. 4.4.), but earlier in the course of trading they exceeded $1350, reaching a maximum since 2014.

Source:HanOcci Advisorc Inc., World Gold Council

Fig. 4.4. Gold prices from 1997 to January 2011

At the same time, according to experts and analysts of the commodity market, the price of gold began to grow even before the first results of the referendum, which is explained by the fears of investors. High volatility and panic were virtually guaranteed in financial markets around the world, regardless of the voting results.

Thus, macroeconomic and political factors, such as the UK's withdrawal from the EU, tensions in the middle East, uncertainty in the oil market, the slowdown in China's economy and the weakness of the labor market in the US, point to possible shocks in the near future.

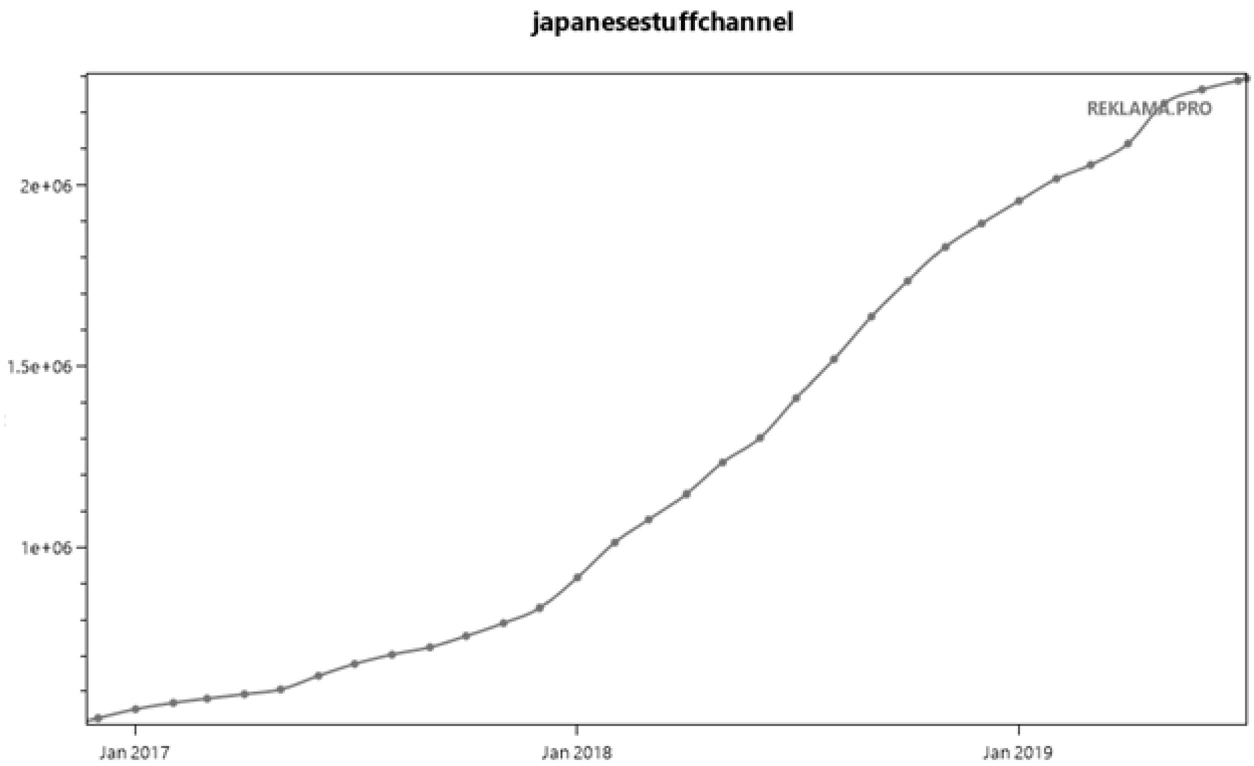
Source: FOREX Club group. http://www.vestifinance.ru/markets/commodities

Fig. 4.5. Gold price change in June 2016, USD/oz

The analysis showed that gold has recently become increasingly popular as a safe asset. This status of precious metals gradually lost, and in recent years, few people had the idea to use them as a means of preserving their money, given the dynamics of prices. But after the last global crisis, the situation began to change, albeit slowly.

Risk hedging saves money, but many retail small investors simply do not have the capacity to hedge with complex schemes and a large number of derivative financial instruments. For many years such people kept money in banks, bought shares, currencies and precious metals.

Despite the fact that the banking system as a whole feels relatively stable, but no one feels safe. Speculative games in the foreign exchange market have almost destroyed the value of currencies for those investors who are not ready to constantly monitor this market, and the stock market, especially in China and the US, is inflating a huge bubble. All this means that volatility and chaos in the markets will continue. In such a situation, gold and silver should become increasingly popular assets.



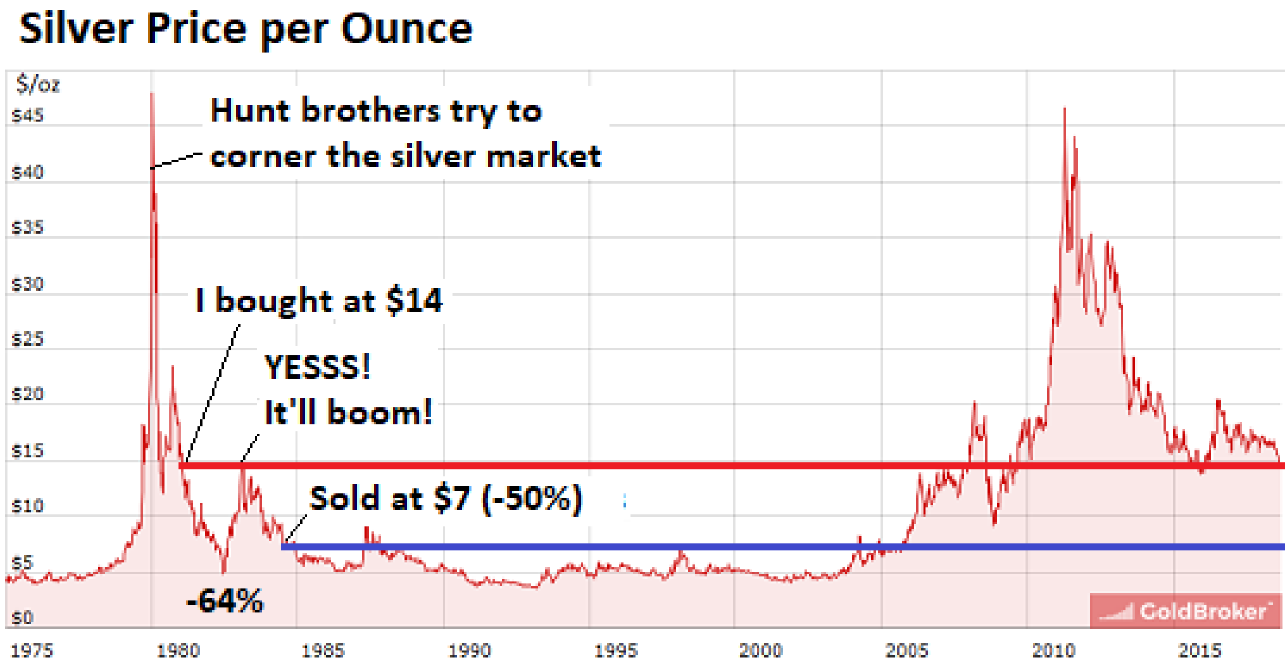
Compiled according to the Bank of Russia [33]:
Fig. 4.6. Accounting prices for refined precious metals for the period from 15.06.2013 to 25.06.2016

As can be seen from the figure. 7 these linear trends, the most rapid growth in gold prices over the past three years than the prices of platinum and palladium.

Currency risk

Currency risks, defined as changes in the value of currencies relative to each other, can have a significant impact on the competitive position of both individual projects in the mining industry and entire countries. Typically, the price of a commodity is inversely correlated with the value of the us dollar (Fig. 4.7).

A weak dollar implies that, all other things being equal, the costs expressed in the currencies of other States not tied to the dollar will grow. This is partly offset by increases in local currency commodity prices. The relationship between changes in costs within a particular country, offset by changes in the cost of raw materials, expressed in local currency, as a result of exchange rate fluctuations, ultimately determines the economic component of gold mining projects and the competitive position of States.



Source: Blomberg; Statistical data of the Federal reserve system of the United States; HanOcci Vining Advisorc Inc

Fig. 4.7. Weighted trade index of the us dollar against the price of gold (USD) US per ounce) (monthly from 1990 to n/a)

Survey risks

Prospecting risks are associated with the probability of opening a cost-effective gold Deposit of minerals and the time frame of this process. Geological study can be represented in the form of a conveyor, where the first stage of the set of potential targets selected several with economic potential [1]. Then begins further study of the selected fields, to eventually identify a small number of the most promising, able not only to cover the cost of exploration, but also to make a profit at a competitive level. The process of moving from initial targets to cost-effective mines varies depending on the type of field, infrastructure and depth of exploration process. On average, to find one cost-effective gold mine, we have to work a few hundred targets bowels. This statistical reality means that companies need to have access to large areas and many subsurface sites in order to overcome survey risks. Overcoming survey risks also requires significant time and money costs.

Geological risk

The study showed that geological risks are associated with differences in the size and quality of deposits in specific geographical and geological conditions. Most mineral deposits, including gold, are small; a few exceptionally large deposits account for a large portion of the profits generated by the mining industry. A relatively small number of giant deposits account for the lion's share of the total volume of minerals in value terms [2].

Another confirmation of this is the distribution of the size of gold deposits in terms of proven and projected reserves. On a few very large fields have a lot of small. Reserves of almost three-quarters (73%) of gold deposits are four million ounces or less. Ten percent of gold deposits contain more than 50 % of the total reserves of precious metal (687.5 million ounces) [32].

From the point of view of practical planning of geological study and formulation of the state policy in relation to mining, the above statistics show that, although companies hope to come across giant deposits, most likely they are waiting for only relatively small discoveries. The result is a significant increase in risks if the company determines the minimum allowable size of the mine, which excludes from the scope of its interests most of the fields.

3.4. Political risk

Political risks affect the geopolitical aspects of exploration, including the right to develop gold deposits, the right to profit, security issues, etc. [31,32]. By definition, gold mining companies are ready to take on certain levels of risk. However, the adoption of additional country risks should usually be offset by lower levels of exploration and geological risks. In other words, geologically attractive areas where the investor can hope to open a promising gold Deposit faster and at a lower cost, as well as a higher probability of opening a large and high-quality gold Deposit, can to some extent be a compensation for the need to work in conditions of increased political risks.

The canadian Fraser Institute (Fraser Institute), an independent research and education organization, conducts an annual survey of exploration companies. According to the results of the survey on the basis of indices of political and geological conditions, the rating of the countries most attractive for conducting survey work is compiled. Methodologically, the Fraser Institute focuses on the exploration phase. The country risk rating for the year 2010 are presented in table. 4.1.

According to table.3.1 Russia should be regarded as a country with a moderate level of risk. This is the opinion of experts participating in the survey of the Fraser Institute. One of the reasons for the optimistic perception of companies focused on long-term investments in the industry, the prospects of reform of the regulatory and financial spheres in Russia.

Table 4.1. Risk rating by state

№ PP	Country	Fraser Institute assessment		№ PP	Country	Fraser Institute assessment
1	Canada	1		14	Colombia	14
2	Australia	2		15	Kazakhstan	15
3	Chile	3		16	Zambia	16
4	Mexico	4		17	papua new guinea	17
5	USA	5		18	Argentina	18
6	Botswana	6		19	India	19
7	Brazil	7		20	Indonesia	20
8	Ghana	8		21	Bolivia	21
9	Namibia	9		22	Mongolia	22
10	Peru	10		23	SA	23
11	China	11		24	South Korea	24
12	Tanzania	12		25	Philippines	25
13	Russia	13				

*Source: Fraser Institute; Behre Dobear; Metals Economics Group

This, in turn, points to the fact that when the state pursues a policy aimed at stimulating business activity at the early stages of the gold mining process (for example, in terms of securing rights to develop deposits and the validity of licenses), investments in gold mining in the territory of the Russian Federation could significantly increase.

The analysis allows us to draw the following conclusions.

1. The key market risk factor for the period from 2000 to June 2016 was the long-term trend in the price of gold. If the price of gold in ruble terms on June 15, 2013 was RUB 1410,78/g, by 15 June 2016, it has increased almost two times (192,52%) and reached RUB 2716,08/g.

2. The Fraser Institute survey of exploration companies on political and geological conditions showed that Russia can be considered as a country with a moderate level of risk.

3. Russia needs a further increase in the state reserves of gold, as it is a strategic reserve, the safest in terms of protection from economic sanctions asset in the international reserves. It seems appropriate that the Central Bank of the Russian Federation should issue rubles not for foreign currency, but for gold mined in Russia, which would contribute to the investment in the real domestic economy, and as a result - support for the development of the domestic gold mining industry.

4.4. Manmade risks

Risks are obstacles that need to be overcome in order to move from exploration costs to profits. According To Kinross gold Corporation, the largest canadian investor in the development of gold deposits in the Russian Federation, the exploration process is characterized by four main categories of risks: market, exploration, geological and political. [31].

At the same time, due to the increase of crisis and catastrophic factors destabilizing any production activity in various fields of scientific knowledge, the assessment of so-called «technogenic risks» becomes extremely relevant for more intensive use.

It can be noted that the production activities of the largest gold mining companies, such as Polyus Gold, Petropavlovsk, Polymetal, Chukotka GGC, Yuzhuralzoloto, Sovrudnik, Susumanzoloto and others are subject to a number of natural and man-made factors, such as: flooding; collapse of sides and ledges of quarries; breakdowns of tailings dams; incidents in the use of mining equipment and blasting; interruptions in production caused by the cessation of electricity supply and equipment failure.

The risks of man-made impacts are common to many other sectors of the mining industry. Further development of mineral resources in some regions of Russia is associated with increasing seismic risks. Frequent earthquakes are a natural reaction of the host geological environment to the large-scale natural and man-made changes occurring in its depths.

Thus, in the production structures of mining enterprises there are significant changes that urgently require their theoretical and applied understanding, without this it is impossible to implement a coordinated strategy to confront the stochastic destructive factors expected in the near future, and accordingly take responsible and effective decisions.

Before proceeding to the analysis of the study of the problem of assessing technogenic risks in the mining industry in the works of Russian scientists, we consider the concept of risk in the field of research of technogenic safety as an economic category, its nature and content.

The Explorer J. Philip [31,32] defines risk as «uncertain outcomes». This author is known to the scientific world by introducing a parameter he called the risk price (VaR), by which it is possible to measure the worst expected damage in excess of the usual level under normal market conditions at a given level of confidence.

The risk in terms of the American scientist Frank knight is a measurable uncertainty, contrasting with immeasurable uncertainty, i.e. the risk is treated as a quantifiable or measurable (quantitiable), the uncertainty reduction of uncertainty of the external environment of the business. F. knight believed that the measurable uncertainty, i.e. the risk itself, is very different from the immeasurable uncertainty. We can say that the risk is not uncertainty [31,32].

John. Altern defines risk as follows: «risk can be defined either as the expected probability of damage (loss), or as the possibility of an adverse deviation from the expected value, since any deviation in an unfavorable direction from the expected means losses» [32].

Researcher S. A. Smolyak, dealing with the problem of investment risks, under the risk he understands «the possibility of conditions that lead to negative consequences of the project for its participants» [31,32].

Leading Russian experts, members of the joint Committee on risk management of the state scientific and technical programs (SCNTP of Russia), believed that the risk should be represented by a vector value, the components of which are the probability of an event, the damage caused by it and the uncertainty of both .

Thus, to date, there is no single agreement among scientists and specialists on the interpretation of the concept of «risk», including «man-made risk». At the same time, the study showed that the term «risk» is most often interpreted as the possibility of damage and its size, while the problem of risk itself is understood as finding a way to avoid mistakes in the decision-making process that can lead to this damage.

This interpretation of the concept of «risk», which researchers characterize the statistical approach that treats risk as the possibility of an adverse event and a quantitative measure of the consequences of such damage, is dominant in world science. This approach is followed by the majority of Russian analysts and experts in the field of technogenic risk analysis.

Also noteworthy is the definition of risk given by GOST R 51901.1-2002: «risk is a combination of the probability of an event and its consequences». This definition contains the main components that suit, in our opinion, most of the researchers. In this regard, it is advisable in this context to identify two key components of man-made risk - the component associated with the probability of occurrence of an undesirable event, as well as the component of risk associated with damage caused by an undesirable event.

The theory of technogenic safety studies dangerous factors and their negative consequences associated with the use of technology, the functioning of technical facilities and systems. On the one hand, they consist in systematic pollution of the human environment (chemical, physical and biological), as well as its modification. On the other hand, man-made hazards can be represented by an emergency risk associated with abnormal release of energy and/or hazardous substances as a result of various accidents at technical facilities [10].

In this regard, man-made risk, in our opinion, can be considered as a risk of damage from a particular technical system or process to people, the environment, tangible and intangible values.

As for the research on the assessment of technogenic risk in the mining and other industrial sectors of Russia, it should be noted that this issue, judging by the published works in Russian, Russian researchers have not yet shown proper interest. The vast majority of the published work deals with the analysis and assessment of market and financial risks (currency, interest rate risks, liquidity risk), as well as tax, regulatory, legal and other risks.

Approaches to the assessment of technological risk

According to the study, in Russia the management of technogenic safety is traditionally divided into areas carried out by the name of the state Supervisory agencies (environmental, fire, industrial, labor protection). This approach, the so-called traditional approach, is based on the detailed regulation of the set of design parameters and technology of functioning of technical objects, as well as on the all-encompassing state supervision of their implementation.

In the course of the study, the problems associated with the assessment of technological risks contained in domestic regulatory and technical documents were considered. The analysis showed that the approaches to solving this problem in the documents of the Supervisory authorities are practically not disclosed, it is possible to identify only certain points related to the category of the problem statement.

In particular, in the guidance document RD 03-418-01 approved by Gosgortechnadzor of the Russian Federation in 2001, section 4.4.4 draws attention to the fact that summarizing the risk assessment, it is advisable to analyze the uncertainty and accuracy of the results. It is emphasized that there are a large number of uncertainties directly related to the risk assessment. The correct interpretation of the risk assessment results requires an understanding of the nature of the uncertainties and their causes. However, the tools themselves, approaches to risk assessment in the working paper is missing.

In a series of standards of GOST R 51901 group, harmonized with relevant international standards, in particular GOST R 51901 the sources of uncertainty of the results of the analysis of technogenic risk and that it would be necessary to quantify this uncertainty are briefly shown. Approaches to assessment, not to mention the methods of risk assessment, are not disclosed.

And only in GOST R 51901.5-2005, although fragmentary, the risk assessment tools are considered. In particular, the question of estimation of parametric uncertainty set by intervals is touched upon.

It should be noted that in the early 90-ies of the last century for the first time in our country the state standard in the field of fire safety was introduced probabilistic criterion of compliance with the requirements of man-made safety. In the future, at the level of the Federal law, technogenic (fire) safety of the object of protection was proposed to evaluate, comparing the metrics of fire risk with their limit values. However, in July 2012 the Russian legislator acknowledged that the four-year experience of the new approach was negative and decided to abandon it in terms of replacing state supervision [32].

Summing up we will note that the normative and methodical documents on fire safety issued in our country operate exclusively point values of all parameters, questions of uncertainty of any sizes in them aren't paid that is, from the modern point of view serious methodological miscalculation. Against this background, international standards and guidelines on fire safety are winning, which clearly indicate the problem of quantifying uncertainty, and suggest ways to implement it.

Next, we consider alternative to the traditional Supervisory approach, methodological approaches based on the quantitative assessment of man-made risk. To date, several alternative approaches have been developed to Express both the uncertainty of the parameter and to establish rules to Express the uncertainty of the result of calculations on the model through the uncertainty of its parameters.

E. V. Kolesnikov identified four approaches [32]:

– probabilistic, which consists in postulating the belonging of the parameter value to a particular type of probability distribution;

– fuzzy (based on the use of fuzzy sets), according to which the parameter membership function is set based on expert judgment;

– synthetic, using Demster - Schafer formalism, allowing to combine probabilistic and expert intervals;

– interval, or a method of the borders of Scott Fearson.

In the field of security management and risk management, the most popular is the probabilistic approach. With regard to complex socio-economic systems, where there are a certain number of hierarchical levels of organization, there are elements of both randomness and determination. The probabilistic interpretation of the uncertainty interval is not always adequate. In a number of situations and under certain conditions of systems, accidental impacts do not lead to crisis phenomena, while in others they can cause a number of risk events. In the rare cases where the situation is statistically stable (e.g. meteorological observations), the probabilistic description is adequate. When performing a quantitative assessment under conditions of uncertainty of technogenic risk parameters, the probabilistic approach is made unsuitable.

The same objection could be made against the use for quantifying the uncertainty of fuzzy numbers (fuzzy set), because it assumes the existence of a stable membership functions.

From the works that could be read in the domestic scientific literature in relation to the method of quantifying the uncertainty of man-made risk, we can call the study of Om Kovalevich [32], who proposed the classical sampling method of Monte Carlo, which essentially represents statistical modeling, and its modification - the method of the Latin supercube (LHS, Latin Hypercube Sampling). Similarly, this method of assessing technogenic risk is studied in the monograph of V. A. Akimov, V. V. Lesnykh and N. N. Radaev [31].

Technogenic risks associated with the operation of production facilities in the mining industry are characterized by high values of possible economic damage. The occurrence of emergency situations in the mining industry is fraught with unplanned costs, the size of which reduces the profitability of the operating activities of enterprises. As it seems to us, first of all it concerns technological equipment (occurrence of emergency situations at the stage of development and operation, its insufficient loading, etc.).

It is possible to take into account the potential possibility of losses from an accident on the operated equipment by introducing at the enterprises of the gold mining industry an additional tool for assessing man-made risk based on the model of mathematical expectation of losses from damage in the event of a possible accident, which can be presented in the following form:

$$DR = \sum_{i=1}^{m} p_t^i \times D_t^i ,$$

where: $p_t^i \times D_t^i$ – mathematical expectation of losses and damage from an emergency in the t - year;

p_t^i – the probability of an emergency in the t-year at the i-th facility;

D_t^i – the expected damage from the accident in the t-th year on the i-th object;

m – number of potentially hazardous objects.

The occurrence of accidents in frequency, duration of elimination and cost of damage are simulated randomly. The risk of insufficient loading of equipment is associated with the possibility of reducing the production of mineral raw materials for various reasons, for example, in case of aggravation of the economic crisis, etc.

Summarizing this analysis, first of all, it should be noted that the domestic risk methodology of technogenic safety is currently going through a difficult period. Admittedly some lag domestic theory analysis and evaluation of technological risk in comparison with foreign scientific and applied developments, as the problems associated with the assessment of the technological risk still is actually outside.

Familiar approaches require rethinking, new methods need to be developed. One of the key problems in the theory of technogenic risk is the problem of quantitative estimation of uncertainty. It seems appropriate to adopt in addition to the existing tool for assessing man-made risk, based on the model of mathematical expectation of losses from damage from a probable accident, to take into account the applicability of the probabilistic description of the properties of technical systems operated in the gold mining industry.

4.5. Environmental risk

A number of industrial accidents 70-80-ies. XX century. showed the need to expand the content of the concept of risk from purely engineering to ensure the reliability of production to a set of measures to maintain the safety of the population and the environment during the construction and operation of industrial facilities. The immediate expression of this approach has been risk management systems in both normal industrial activities and accidents. Since 1986 The IAEA (International atomic energy Agency) and who are compiling regional experience in risk management under the UNEP/who/IAEA/UNIDO (UNEP/WHO/IAEA/UNIDO) programme for the assessment and management of risks to human health and the environment from energy and other complex industrial systems.[32].

A similar situation has developed in Russia, where in recent years the increase in the number and scale of the consequences of accidents and catastrophes in the technosphere is of particular concern.

The factors that pose a threat to human health and the environment include: environmentally hazardous, socio-economic, man-made and military.

Therefore, now and in the future, the main goal of security activities is to ensure the protection of human beings and the environment from excessive danger. At the same time, the assessment and management of various types of risk becomes important.

Risk - a measure of the quantitative measurement of danger, which is a vector (i.e. multicomponent) value measured using statistical data or calculated using simulation models, including quantitative indicators:

– damage from exposure to a dangerous factor,
– probability of occurrence (frequency) of the considered dangerous factor,
– uncertainty in the values of impact and probability.

Who recommendations (1978) define risk as «the expected frequency of adverse effects arising from a given exposure to a pollutant».

According to the Glossary of the U.S. environmental protection Agency (US EPA), risk is «the likelihood of damage, disease, or death under certain circumstances. Quantitatively, risk is expressed in values from zero (reflecting the confidence that harm would not occur) to one (reflecting the confidence that the damage will be inflicted)».

The concept of risk includes both categories of consequences and the likelihood of undesirable outcomes of hazardous events. It is the risk assessment along with the system of integrated environmental monitoring that is the main content of the problem of environmental safety. They are included as a mandatory element in the environmental justification of the project of any industrial activity, but are completely insufficient for the prevention and, especially, management of the emergency scenario and its consequences.

Most of the calculation systems of environmental impact assessment are based on the data of background monitoring of slow processes reflected in a series of multi-temporal maps. However, this approach can not be applied to large high-risk engineering facilities (gas pipeline, oilfield area, nuclear power plants, etc.), which require operational monitoring data, usually conducted by departmental control services.

Environmental impact assessments of such facilities are focused on making quick management decisions in large areas during a significant period of operation, during which the impact of the facility on the environment becomes significant.

Environmental risk - the risk associated with changes in the environment. This type of risk is used to assess the environmental consequences of accidents, natural and man-made disasters, etc.

Risk assessments are usually cyclical. The main elements of the cycle are the collection of information, information processing, assessment of the need for the formation of storm warnings, development of recommendations for changing the structure of the system. The work in an emergency situation should be analyzed.

An environmental risk assessment is an analysis of the origin (occurrence) and extent of the risk in a given situation. In a simplified form, the environmental risk assessment should include:

– identification of potentially dangerous events possible at the facility and its components;

– assessment of the likelihood of these events;
– assessment of consequences (damage) in the implementation of such events.

More detailed environmental risk assessment includes the following procedures:

– primary hazard identification;
– description of the source of danger and related damage;
– risk assessment in normal working conditions;
– risk assessment of hypothetical (probability moment) accidents at production, storage and transportation of hazardous substances;
– the range of possible scenarios of the accident;
– statistical estimates and probabilistic risk analysis.

The value of environmental risk is defined as the product of the value of damage I by the probability W of the event i causing this damage:

$$R = I \cdot Wi,$$

Possible causes of emergency (emergency) situations in General can be:

– random technical failure (damage) of the elements;
– man-made accidents, natural disasters and natural disasters in the area of deployment of the object;
– unintentional erroneous actions of maintenance personnel;
– deliberate malicious acts and the effects of the means of destruction on the elements of the object in time of peace and war.

The environmental risk assessment procedure consists of four main phases: preventive, crisis, post-crisis and liquidation (elimination of consequences).

The preventive phase includes industrial control and environmental monitoring, prediction of natural and man-made disasters, identification of vulnerable and unprotected areas, development of emergency regulations, creation of GIS, training of forces and means, training of personnel for response in case of emergency situations.

The crisis phase includes a warning system, operational control, first aid, evacuation.

Post-crisis phase - restoration of life-supporting infrastructure, prevention of relapse.

The liquidation phase is the restoration of biocenoses.

We list the economic, social and environmental indicators of environmental risk assessment.

Economic indicators of damage (economic risk) are the loss of wealth, the need for financial, sometimes significant, the cost of restoring the lost, etc.

Among the social indicators (social risk) are: morbidity, deterioration of human health, mortality, forced migration of the population associated with the need to resettle groups of people, etc.

Environmental indicators (environmental risk) include: destruction of biota, harmful, sometimes irreversible, impact on ecosystems, environmental degradation associated with its pollution, increased likelihood of specific diseases, land alienation, death of forests, lakes, rivers, seas (e.g., Aral sea), etc.

Environmental risk is associated not only with the deterioration of the state and quality of the environment and human health, but also with the impact of man-made activities on ecological,economic and natural-economic systems, changes in their properties, violation of the links and processes taking place in these systems. The concept of «environmental risk» may have different meanings:

– the probability of an accident with environmental consequences;

– the amount of possible damage to the environment, public health or some combination of effects.

In applied ecology (Geoecology), the concept of risk is associated with sources of danger to ecological systems and processes occurring in them. It serves as a basis for making decisions on the purposeful management of the magnitude of this risk.

For the justified application of measures to protect the population and the environment both in the conditions of normal operation of economic facilities and in emergency cases, identification, analysis and assessment of environmental risk is required. This information is also needed in decision-making systems, i.e. in the field of to administrative bodies, to minimize the harmful effects of industrial enterprises on the environment, to prevent man-made accidents, to reduce or neutralize the effects of sources of environmental danger, to prepare for the protection of the population and the environment and to ensure environmental safety, to adequately respond to the occurrence of environmental emergencies.

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Chapter 2. Mechanisms of intensification management at the enterprises of mineral resources complex

5. Program and target management at the enterprise.

5.1. Theoretical bases of program-target management.

Experience of application of separate target programs in practice of management of the enterprises showed their insufficient efficiency as implementation of each target program provides the decision only of some legal program, but does not give the chance essentially to improve basic technical, economic and social indicators of activity of the enterprise. Require the development of complex target programs local programs into a single coherent system, which include includes whatever aspects of the enterprise and ways of their promising solutions. Moreover, for industrial enterprises, it is most advisable to develop a set of targeted programs for a sufficiently long period (for example, five years), which is associated with the solution of complex problems of ensuring high quality and the required range of products, the achievement of an appropriate level of technical development of production and simultaneous solution of the problems of social development of the team.

The importance of program-target management has significantly increased with the transition of enterprises to new economic conditions, in which the level of income of the teams was put in direct dependence on the final results of their work, and the freedom of action to achieve these results has increased significantly.

A systematic approach to the formation and implementation of a set of targeted programs requires:

– first, the harmonization of the goals of these programs to obtain the maximum effect of their implementation;

– second, the coherence of all activities of each programme (both among themselves and with those of other programmes);

– third, the continuity of planning, accounting, control and regulation, i.e. ensuring direct and feedback management process. This allows to manage both each of the programs and the whole complex of target programs.

The following principles should form the basis for managing the development and implementation of programs:

– combination of the sole authority of the head and the collegial powers of the bodies for joint decision-making;

– empowering managers with the authority and responsibility to make management decisions;

– organization of a single management at all stages of development and implementation of programs;

– compliance with deadlines and balance of resources used;

– General centralized control over the development and implementation of programs and effective operational management of the program activities, timely adjustment of their activities at all stages of the development and implementation of the program;

– effective management of each of the programs and the enterprise as a whole.

The General structure of management of a complex of target programs, the most acceptable for industrial enterprises, is shown in the diagram. In each case, of course, it has its own specifics.

Work on the structure and content of each of the target programs begins after the publication of the order of the Director of the enterprise on the establishment of the coordination Council. At the same time, a working group is being formed to develop the target program.

The project of each of the target programs is prepared taking into account the proposals of all structural divisions of the enterprise. It must meet the basic requirements:

– specificity and feasibility at each stage;

– clear justification of expected social, economic and other effects;

– consideration of the principle of optimality;

– ensuring a comprehensive solution to the issues under consideration.

The functions of the coordination Council of the enterprise include clarification of the necessary composition of measures of the sequence of their implementation, according to the degree of importance based on the specific conditions of the enterprise. According to each program, the Council determines the composition of the performers and appoints the head. The coordinating Council assesses the completeness of the set of activities that need to be performed to achieve the ultimate goal of this program, sets the timing of these activities, the sources of their resource support. In addition, the Board is in the process of linking programmes.

After completion of the work on the formation of targeted programs for each of them, appropriate documentation is prepared, which includes:

– explanatory note (this identifies the main objective of the programme, its structure and brief content);
– table of targets;
– the list of activities ensuring the implementation of the programme (indicating the responsible persons and implementers, the deadlines and the expected result);
– network plans-schedules of activities.

In accordance with the overall management structure, the programme Manager is empowered to manage the implementation of the programme in a timely manner.

Fig. 5.1. The General structure of management of a complex of target programs at the industrial enterprise

The Manager is fully responsible for the achievement of the final result, the required level of quality and the deadline for implementation. The Director of the enterprise transfers to the program Manager certain rights in the field of resource allocation, planning and organization of the work, representation in higher bodies and third-party organizations, encouragement of individual departments and employees for active participation in the implementation of the program. Thus, the Director of the enterprise, on the essence, is exempted from the solution of tasks of operational management of a complex of target tasks.

The management structure of the enterprise involves responsible executors. This status is given to the heads of units and groups that carry out individual activities of the programme. Responsible executives are subordinate. For maintenance, the timing of the compliance with and assess the results on specific events they are subject to the program Manager. For all other matters, they are subject to their direct supervisors, according to the existing job descriptions.

The main tasks of managing the implementation of a set of target programs is to draw up plans for the implementation of activities provided for by each of the programs, monitor the actual implementation of planned activities, identify and analyze the resulting deviations between the planned and actual progress of their implementation, create conditions that ensure the elimination of deviations.

Calculations and adjustment of schedules of implementation of target programs should be made in the computer center of the enterprise on the basis of information coming from Department of management of complex and target programs (UKTSP), and also from responsible executors and executors. The new plan of implementation of the event, prepared by the programs, is agreed with the program managers and approved by the Director of the enterprise from the moment of approval and until the end of the period of implementation of its set of activities, which are provided by the plan, ensures the operational management of the entire complex of programs.

Operational management is carried out in three successive stages, each of which is repeated at regular intervals:

– collection of information on the actual implementation of the planned activities;
– processing of the received information;
– adjustment of plans for implementation of target programs and bringing them to the executors.

To implement the function of operational management, the collection and transfer to the Department of UCCP and to the computer center of operational information is carried out; its processing and preparation of management decisions; adjustment of calendar plans for the implementation of activities; preparation and communication to the responsible executors of the updated plans of individual activities.

Each Manager receives only the information that he needs to analyze and make appropriate management decisions. Various codes and documents on the actual state of implementation of the programs are being formed new plans for their implementation for the next periods of time.

On the basis of information on the actual progress in the implementation of the target programs, the necessary measures are taken to eliminate the deviations that have arisen, as well as material incentives for collective and individual work for the successful implementation of the set of target programs.

5.2. Methodological basis of development and implementation target complex program.

Target comprehensive program (TCP) of the organization's directives-tion and targeted instrument, which is linked on the resources, performers and terms of implementation of the full range of socio-economic, production, scientific research, organizational, economic and other tasks and activities aimed at implementation of the most effective ways to the problems and objectives of production associations (enterprises).

The CCP is developed to solve the most important problems and goals facing the organization, to perform the tasks assigned to the production Association (enterprise) within the framework of the industry or national economic CCP.

The organization's PSC is an integral part of economic and social development plans. CCP has a number of important features:

– has a clearly expressed target character, which is manifested in the strict orientation of all its activities and tasks, as well as the use of resources, to the complete solution of a certain problem, goal; and in the order of drawing up goals, which begins with the formulation of the final goal (goals) of the program, followed by their gradual disaggregation to the level of;

– characterized by clearly expressed final (target) results (indicators), which are usually determined on the basis of a system of progressive norms and standards;

– includes a full set of tasks, activities and related resources designed for the entire period of implementation of the goal set by the problem;

– combines the functions of planning and management, as along with the system of planning tasks and activities includes activities to manage the implementation of the CCP;

– has a planned implementation period, which does not have to coincide with the adopted planning period. The period of implementation of the CCP is determined by the time from the beginning of work on the implementation of the program to the moment of full achievement of its final goals.

Targeted integrated programmes are divided into types by content and by time length.

According to the content of the PSC are divided into types (types):

1. Socio-economic, aimed at solving the problems of development and improvement of living conditions, improving the material and cultural standard of living of employees (PP), improving working conditions and transformation of its nature.

2. Production and economic, aimed at solving major problems in the field of production, to improve its efficiency and quality characteristics, rational use of labor, material and financial resources.

3. Scientific and technical, aimed at solving the most important scientific and technical problems and the introduction of science and technology.

4. Territorial (regional), operating within the framework of target programs for the formation and development of territorial production complexes (TPC).

In determining the type of PSC, which has several of these features, it is necessary to identify the leading (priority) feature, arising from the content of the main purpose of the program.

In terms of time, the CCP is divided into long-term programs (lasting more than 5 years) and medium-term (lasting 5 years and months).

CCP may consist of sub-programmes at different levels. The division of the CCP into subprograms is based on the need to ensure the rational organization of the management of their development and implementation by dividing the responsibility between the participants in the development and implementation of the CCP.

The subprogramme is a relatively independent part of the programme, comprising tasks and activities aimed at the implementation of one or more of the objectives of the programme. The formation of sub-programs is carried out by separating from the final goal of the program

Pro-daily goals (sub-goals) and a set of tasks, activities, the definition of each group of tasks, activities, performers.

Each subprogramme can in turn be broken down into sub-programmes at a lower level. The number of subroutine levels should not exceed 4-5.

The system of indicators of achievement of the main goal, sub-goals of the PSC should be an integral part of the system of indicators and standards in force in the SOFTWARE (PP).

The CCP to be implemented in this planning period are included in the five-year plans for economic and social development (PP) with the distribution of tasks and activities by year. The annual plans to improve the efficiency of production (engineering support plans) reflect the relevant program tasks and activities. If the tasks and activities on terms and performers are reflected in the CCP, these tasks and activities may not be specified in the annual plans of measures to improve production efficiency (plans of engineering support).

Development of targeted integrated programs is carried out in two stages:

– rationale for the structure and content of the programme;
– formation of the program.

Justification of the structure and content of the program includes:

– statistical analysis of the dependence of the production efficiency indicators on the factors characterizing the object under study and the ranking of these factors by the degree of influence on the production efficiency indicators;
– identification of reserves to improve the indicators of the studied system (technical, technological, economic, social) in these production conditions on the basis of the long-term forecast of the development of this system;
– development of the main directions increasing efficiency of development of the investigated system and specification of the contents of the program (choice of the list of the first and second levels).

As a mathematical apparatus of statistical analysis are used: correlation and regression analysis, expert survey, sociological research, etc.

Identification of reserves to improve the performance of the system is based on the study of trends in the development of this system in the modeling of production and social processes. To simulate production and social processes and to obtain long-term forecasts of the values of the system under study, it is advisable to use objective system analysis, which makes it possible to take into account all the diversity of specific production conditions.

In cases when the received forecast is better than actually reached level of the indicator, the enterprise has reserves on improvement of this indicator. The obtained forecast value should be compared with the planned indicator in order to determine the need to attract additional reserves for the implementation of the plan.

If the forecast is equal to or worse than the actually achieved level of a specific indicator, then the enterprise in these production conditions has no reserves for improvement of the considered indicator and, therefore, it is necessary to develop measures aimed at improving this indicator.

Identification of reserves of improvement of indicators will allow to develop the basic directions of increase of efficiency of production and social processes which implementation promotes successful implementation of TPFP of the plan and the five-year plan of economic and social development of the enterprise.

The target integrated programme may include sub-programmes at the first and second levels. In this case, the detection of reserve improvement of indicators makes it possible, in addition, to determine the content of sub-grams of the first and second levels.

The structure of target complex programs is formed from several interrelated blocks: target, software, evaluation of the effectiveness of program implementation. For development of separate target programs it is expedient to provide allocation of the information block.

As a tool for the development of targeted integrated programs at the stage of identification and structuring of the leading problems used «de-Revo goals.» Based on the decomposition of the main goal of basic and private goals is provided by the requirements of their hierarchy, gender note, comparability, connectivity consistency, the definition of certainty, of reality.

The formation of the catalogue of goals, need the implementation of which the authors identify Lena on the stage of justification of the content of the programme; selecting indicators, ha racterized the achievement of the objectives and the apex body of management responsible for the successful attainment of goals;

Development of a draft action plan to ensure the implementation of the program.

Ensuring the balance and consistency of the developed program with the activities and resources of the five-year plan of economic and social development of the enterprise and the formation of the final version of the action plan.

As the activities of the programme are implemented, it is necessary to adjust the structure and content of the targeted integrated programme.

The organization of the PSC management provides:

– establishment of the structure of the CCP management system;
– establishment of duties, rights and responsibilities of management bodies implementing the PSC;
– distribution of tasks, events by artist, timeline;
– development of information support, providing for the definition of links, volumes and ways of passing information, the order of documentation;
– development of program management technology;
– selection and organization of the use of technical means;
– selection and training of managers and management personnel;
– organization of coordination and control in the CCP management system.

To organize the management of the CCP, it is recommended to form a matrix management structure.

To organize the matrix structure of the management system, it is necessary:

– to determine the horizontal links in the control system and appoint the head of the CCP;
– to appoint the Deputy head of the center for individual management subsystems in accordance with the structural program;
– identify the responsible persons in each functional division involved in the formation and implementation of the PSC;
– organize communication and information flows to ensure the work of program managers and line managers;
– organize a special program management service, if necessary.

The distribution of tasks, activities by performers and deadlines is carried out in form I.

Form I. Distribution of tasks, activities by performers and deadlines.

№	Work, event	Responsible Executive	Sospol of nitely	Term of work		Who accepts work	To whom the results of the work are transferred
				beginning	end		
1	2	3	4	5	6	7	8

To coordinate and monitor the implementation of activities, it is advisable to develop a network schedule for the implementation of the CCP, or a calendar (tape) schedule for the implementation of the CCP.

5.3. The management team is the organizer and coordinator of the target management

Success in the activities of business units is determined by many factors, the mere listing of which can take a long time. Therefore, without doing this, we note the well-known truth that effective management occupies a significant place among these factors. It is essentially a matter of ensuring full cooperation among the staff in order to achieve the goals.

The managerial activity of the Manager includes only those tasks that he performs with someone else's hands, i.e. organizing the activities of his subordinates. Therefore, sometimes they say: «the Head works with someone else's hands» or «you can Not work with someone else's hands, do not become a leader.»

Managerial and psychological knowledge, skills and abilities allow to increase the efficiency of collective activity. The following figures obtained in the course of research and relating to the importance of the implementation of managerial knowledge and skills for the effective operation of the unit performing production tasks have become classics [48] :

1. The Manager provides 15% of the effectiveness of its division through their professional knowledge and skills, and 85% - through the ability to work with people.

2. Manager, work directly with the executing production tasks, only 5% are improving their personal qualities, manifested in the work of subordinates, recent increases their productivity on average by 50%.

3. Official (formal) authority of the chief (authority) provides the work of subordinates only 60-65% of their capacity, while the presence of his actual authority (power authority) allows to get the employees work with full dedication. Such a leader is perceived by them as «one of us» and at the same time as «the best of us» (informal leader).

You can, of course, doubt the accuracy of the above figures. But this is not the case. All these figures, obtained by different authors, show only one thing: the perfection and implementation in practice of managerial knowledge, skills and abilities of the Manager directly working with the executors of production tasks, lead to a significant increase in the efficiency of professional activity of the latter. Currently, despite the abundance of relevant literature, each head of the Department develops managerial and psychological knowledge, skills, as a rule, on their own mistakes. But at the same time, the acquired knowledge, skills and abilities may not be scientific, but domestic in nature, and the way of their assimilation may not be optimal.

The leader clearly sees the nearest distant goals of his division, but he needs like-minded people who will help him to turn these goals into reality.

Often say, that «king plays his retinue.» But in order for this to happen, the leader («king») must create a worthy retinue in the form of his management team.

So historically in our country, in different areas of arts production activities because of certain ideological views largely used concepts such as «collective» and «asset»: the work team; the party, the Komsomol of the division's assets; collective management; management (management) with the OPO-Roy on asset division, etc.

The concept of «team» is adjacent, in our opinion, to these well-established and understandable for us expressions, but reflects the reality with a slightly different subtext, or rather, has a different basis. We say: «number of Department» and «Team leader». In the first case, the basis for the consideration of the concept of «team» is the unit, which in the course of its socio-psychological development through the achievement of unity of understanding by employees of the goals and objectives of joint activities becomes a team. In the second case, the basis for the consideration of the concept of «team» is the head. The team here is most likely co-put by his inner circle and other employees who support the head, share his ideas, views on joint activities and conduct them in life, i.e. the team is grouped around the head, understanding him, as they say, at a glance. Naturally, the team not only perceives the ideas and views of the head, but also can have a clear and implicit influence on him, «polishing» these ideas and views.

It is interesting in this respect to look at the «team», if I may say so, the marshals of Napoleon, who preferred to have as his assistants generals, strong in the execution of his plans. Napoleon with his mind and preferred to think of himself for free-their subordinates, the reverse relationship, we're talking about, not tolerance-Las. Therefore, the «team» as such, Napoleon did not succeed, which may be, and led to his mistakes in choosing strategic goals at the end of his military career and to its collapse. Another example is The state defense Committee of the USSR during the great Patriotic war of 1941-1945[73].

The historical phenomenon of GKO is so unique that it can hardly be found analogues in the pre-war history of the Soviet state. Although there was some continuity of ideas of development, the State defense Committee was formed and functioned as an emergency body with unlimited power, becoming also the main structure in the system of bodies of strategic leadership of the country and its armed forces are the product of a specific historical situation that developed during the great Patriotic war.

It should be noted that at the beginning of the war, on the second day, the Headquarters of the Main command was established as the highest collective body of strategic leadership of the army. In the complex military-political and strategic situation, which changed daily, and it is difficult to predict, the Rate had all the powers in the strategic leadership of the troops and Navy, but was not able to carry out power and administrative functions in the field of civil administration. Thus, the Headquarters of the General command could not act as a coordinating beginning in the activities of civil power and management structures in the interests of the army, which, of course, hampered the strategic leadership of the troops and Navy forces.

Meanwhile, the situation at the front deteriorated sharply, and this pushed the higher party-state leadership of the USSR to the formation of a power structure, which could become higher in status not only the Rate of the Main command, but also all the leading party instances, or-Gans of state power and management. Such a center of emergency power and management, endowed with special powers, and became

The state defense Committee is the main structure, including in the system of bodies of strategic leadership of the country and its armed forces, whose resolutions and orders have been given the status of wartime laws binding on all.

Initially, it was adopted by the decision of the Politburo of the CPSU(b)3, and then a joint resolution of the Presidium of the Supreme Soviet of the USSR, the Council of people's Commissars of the USSR and the CPSU(b) on the formation of an emergency state body — the State defense Committee. All officials of the newly formed body were members and candidates for members of the Politburo of the CPSU(b). Two days after the formation of the GKO, on July 3, 1941, its meeting was held, at which seven resolutions of the State defense Committee on responsibility for the assigned area of each member of the GKO were approved.

Chairman of the GKO I. V. Stalin and his Deputy V. M. Molotov carried out not only the management of the activities of this extraordinary body, but also the strategic leadership of the country, armed struggle and war in General. All resolutions and orders of the State defense Committee were signed by them. At the same Time, V. M. Molotov also as the people's Commissar of foreign Affairs led the foreign policy of the country.

If you go down from the heights of management activities and move away from historical analogies, then for the head of the unit we can say the following: it is good when he and his unit is a collection. Then this team is in fact his team. Therefore, in terms of the socio-psychological development of the unit, we adhere to the following scheme of this process: the head - the management team of the head - the team of the unit, ie. the head on the first pores as it makes the division goals and objectives of activities, on the basis of awareness of which is formed his management team. In the post following this command can cover all members in the unit, thus in the staff of this unit. But in the initial period, the quantitative composition of the management team can be significantly less than the total number of employees of the unit and correspond to the size of the so-called sociocritical mass.

The term «sociocritical mass» is derived from the concept of «critical mass» in physics, which characterizes the minimum mass of the dividing substance, providing the emergence of a chain reaction of division: as soon as the mass reaches a critical threshold - immediately there is a nuclear reaction.

The expression «sociocritical mass» is often used in sociology and psychology to determine the minimum composition of like-minded managers among the employees of the division, so that it is more likely that the employees of the division in solving production problems will follow the head. In other words, this is the minimum number of employees that is necessary for the unit to manifest the action initiated by these employees of the socio-psychological laws of infection and education, which reflect the essence of group integration of people, leading to the transfer of emotional States, actions and behaviors from one individual to another. Thus, the unanimity of the co-workers is formed.

Depending on the quantitative composition of the unit, the size of the co-critical mass may be as follows:

– if the number of employees does not exceed 30 people, the size of the sociocritical mass is «5%, i.e. the head is enough to have one or two of his associates on the first pores in order to effectively lead the unit with a certain confidence;

– if the number of employees is in the range from 30 to 150 people, the composition of the sociocritical mass is in the range from 10% to 15% (from three to twenty people).

Thus, when we talk about the formation of the management team by the head of the Department, we are talking about its formation in the size of the sociocritical mass. Then, with the appropriate work of the Manager, the size of this team, like uranium decay, can be increased, reaching the quantitative size of the unit, which is formed by the team in the socio-psychological sense. Thus, the concepts of «management team» and «team» begins to characterize the same production community of employees.

Under the management team in the theory and practice of management is often understood to be a group of like-minded employees associated with each other by the system of interpersonal relations (MLO), with common social values and cohesive around their leader in the interests of effective management of joint activities.

Under the us team is a unit, reached in the course of the joint activities of high-level social and psychological development, in which the interpersonal relations of the staff of operad-stouts socially valuable and personally important activity.

This nature of production relations determines the unity of thought and unity of team members, manifested in highly efficient activities. But this level of development is observed, as already-mentioned before, not every unit of the enterprise. However, if its Manager adheres to the already known scheme: from the management team to the staff of the unit through collective formation in the course of joint activities, the success in the development of the unit is significantly ensured.

The concept of «management team» can be represented in the form of a diagram shown in Fig. 5.2.[48].

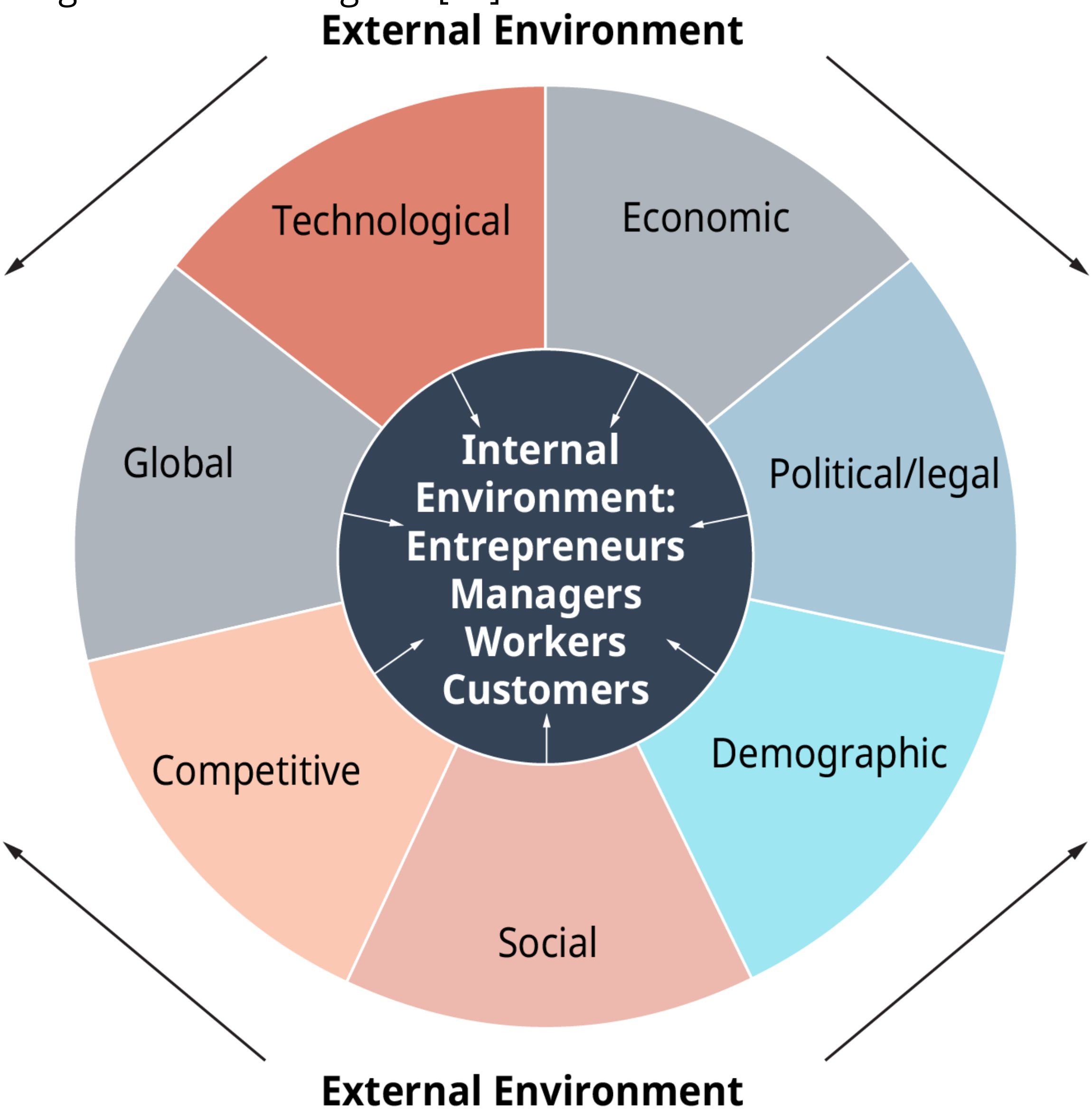


Fig. 5.2. Schematic representation of the interaction of the components of the concept «management team».

At the center of the scheme are such components as like-minded co-workers, the system of mlos and General social values. Interacting with them, influencing them, the head of the enterprise solves the problem of forming a management team in the interests of effective performance of activities. However, the considered components of the concept of «management team» are not equivalent in their dynamics of change. Thus, such components as «like-minded employees» and «common social values» are more stable.

The head of the enterprise is often unable to change his co-workers. As a rule, he is forced to work with those who have been hired by a superior Manager or even before his appointment to the position of chief. However, the higher position in the hierarchy of management activity is occupied by one or another Manager, the more opportunities he has to replace his immediate environment. He can even appear to jump with my management tion team with one senior position to another.

Of the components of the concept of «management team» the most movable and influenced by the head of the unit is a system of interpersonal relations between co-workers. In fact, the impact on this system predetermines the main directions of the head's work on the formation of his «management team». At the same time, the Manager can decide on the selection of employees, on their assimilation of the social values that characterize their activities, but he must clearly understand that the greatest impact of his efforts will be given only with the development of a system of interpersonal relations among employees. Moreover, other components of the concept of «management team»will be developed.

So, we can draw the following conclusions:

– managerial knowledge, skills and abilities directly enter into professional activity of the head of the enterprise, to a significant extent providing its efficiency;

– the most mobile component in the concept of «management team» is the system of interpersonal relations among employees, the establishment and development of which can play a major role in the formation of the head of the management team;

– theoretical and practical issues of formation and development of the system of interpersonal relations among employees deserve careful consideration.

The command organizational form, i.e. the form carried out by means of creation and functioning of teams as one of forms of collective management, is based on the process of delegation of authority. Almost all organizations give managers at various levels responsibility for a wider range of tasks than they could handle personally. In order for them to be able to bear this responsibility, some form of collective management based on the redistribution of responsibility is established. However, such a transfer is difficult for many managers. They are afraid that important aspects will be neglected or fulfilled in some way, and therefore are tempted to take on all important tasks. [48].

In successful teams, development and decision-making are carried out directly by the team, and the role of the administrator is to create the necessary conditions for this, to define the boundaries of the decision space and to give the necessary answer in a difficult case.

A team is a small number of people (usually 5-7, less often up to 15-20) who share goals, values and common approaches to the implementation of joint activities, have complementary skills; take responsibility for the final results, ways to change the functional-role correlation (intragroup roles); have a mutually determining affiliation of their and partners to this community (group). The team consists of a group of specialists belonging to different areas of organizational activity and working together to solve certain problems. The essence of the team is, in General for all its members, an obligation that requires the presence of a certain appointment, which is believed by all members of the team – its mission.

The mission of the team should include an element related to winning, championship, moving forward. There is a difference between the goals of the team and its mission: the goals of the team allow you to monitor your progress on the path to success, and the mission as a more global in its essence gives all specific goals meaning and energy.

None of the groups becomes a team until they know they are accountable as a team. Team accountability is a defined form of communication that underpins two aspects of effective teams: commitment and trust. Mutual accountability cannot be enforced. But when team members share a common purpose, goals, and approach, mutual responsibility arises as a natural component.

Teams are distinguished on several grounds. The following types of commands are distinguished by the type of action:

1. project teams, audit, quality or safety teams. In the activities of teams of this kind, there should always be a quick and qualitative start and the development of the final formulation, so that their recommendations could be implemented;
2. responsible for the physical production of anything. The activities of such a group, as a rule, have no time limits. To effectively manage it, it is important to focus on team performance;

3. process control. For such teams, it is important that they identify clearly the specific goals set by the front-line teams, which differ from the goals of the organization as a whole.

The process of formation team – the formation of its internal cultural context, in other words, its subculture.

The team processes are greatly influenced by the peculiarities of the personal style of interaction of its leader or leader with other team members.

Consider a number of characteristics that can be described as the type of leader. The modern concept of leadership emphasizes such its value as increasing the ability of subordinates to self-leadership. The most active leader is the one who can lead others in such a way that they lead themselves. A person capable of this kind of leadership is called a superlider.

People can also lead:

1. a strong leader who acts through the application of sanctions, the power of a strong authority;
2. a transactor that creates special ways of interaction between the subordinates, information networks and communication rules and thereby organizes effective work and maintains its own status;
3. the hero is a visionary who influences people with the power of his belief;
4. passionate personality, able to invite other high goals and lead participants of the group behind him.

There are four main forms of subculture management groups: «combine», «clique», «circle», «team».

«Combine.» The main psychological characteristic of this sub-tour is the unquestioning subordination of its members to their strong leader. Reasons for submission – fear of losing a place in the group and the opportunity to remain without work in the parent organization. The group is based on the traditional hierarchy. This is a very stable group culture, in which the actions of the members are clearly defined, decisions are made quickly – the leader has all the power and determines the policy of group interaction. The outer boundaries and the inner structure of the group are quite rigid. Group values are placed above individual values. Control is exercised directly by the leader. Participation in the decision-making process in a group is determined by the place of the subject in the intragroup hierarchy. Decisions are made as a result of the balance of influence of different forces on the leader, so the last word always comes to him.

«Clique.» Such a group consists of people who absolutely trust their leader. The leader of the «clique» in the business environment, at the initial stage of development of the organization is such a person who is simply believed and internally ready to follow him. It affects its followers the visions-eat future.

The group does not have a rigid internal structure. If the leader considers it necessary to create a leadership link in it, it will mainly serve to strengthen its authority. This leadership can assist its members and regulate the allocation of common resources, and the principles and rules of allocation are also consistent with the vision of the leader.

The group, as a rule, is unstable, has blurred boundaries: in crisis situations it has its own interests, based on its own goals; there is significant internal competition. The values in such an organization are individual creativity, energy in setting new goals and developing projects consistent with the leader's vision, readiness for innovation. Individual interests are higher than group interests. Information is seen as a shared knowledge that does not need to be brought out. The lack of strict regulation group of activities – it is like-wife fluctuations in the aspirations of the leader.

«Circle.» This subculture is characterized by a strict distribution of gender and spheres of activity within the team, a high degree of formalization and standardization. Functional areas and their interactions are governed by rules and procedures that rarely change. Source of influence – status. Leading values – synchronicity, parallelism, foresight. Everyone should know what to do and do what is prescribed. Everyone's going the same way. Everyone should feel involved and identify with the organization. Functions and responsibilities are implemented with almost automatic accuracy. Characteristics of typical a feeling of security among employees, diligence, interest in deepening of specialization and developing skills to automaticity. The leadership of such a culture sets the context and purpose, minimizing the rest of the intervention, the daily work is done by itself. The main task of the leader is to organize communication between specialists. Its effectiveness depends on the rational distribution of work and personal responsibility of the performers.

«Team», this type of group is characterized by open discussion of problems, good circulation of information. Activities are focused on solving problems, goals are changed as necessary. The main focus is on achieving concrete results: the appropriate staff and resources are pooled for the fastest and highest quality implementation of the task, and the timing and stages of its solution are constantly monitored.

Relations between employees are based on the principles of interdependence. Leadership is based on facilitating contacts and collaboration. Management acts as a catalyst for group interaction and collaboration.

The effectiveness of the group is determined by individual success combined with the ability to combine the personal goals of employees with the strategic goals of the organization. Commands are easily adapted due to the matrix principle of the internal structure: separate subgroups are created for the task and can be easily re-formed.

Management of a group with such a subculture is associated with the need to create a rational structure, to ensure a high degree of professionalism of employees, the complexity of achieving an optimal ratio of external control and independence of the working subgroup. The Manager must be flexible and confident in himself and his employees. Influence in a team is not based on status or position, but on professionalism and competence.

6. Methodical bases of complex assessment of intensity of use of resources of the enterprise and complex assessment of intensity of work of the enterprise as a whole

6.1. The concept of efficiency and intensity of use of resources enterprises

Problems of efficiency and intensification have always been and are at the head of production activity regardless of the forms of management [15 c.8-37]. Intensification of production and its efficiency are mutually correlated regularities. Consider their mathematical relationship through a system of economic indicators.

The efficiency of production management is defined as its efficiency, characterized by the degree of use of resources intended to achieve the goals of production. Or the effectiveness of production management is assessed by the degree of achievement of production goals in proportion to the resources spent. For example, the indicator of capital productivity characterizes the output of production (commodity production) per unit of fixed assets, the productivity of labor characterizes the efficiency of the use of live labor(labor, profitability of products, as the degree of use of the entire set of resources (fixed assets, material costs, labor, etc.).Therefore, the resource utilization performance indicator can be evaluated as a ratio

$$E_{ij} = \frac{K_{pi_i}}{P_{cj}} \tag{6.1}$$

where K_{pi} – the final result of production (volume of commodity products, total profit, net profit, etc.), P_{CJ} – the amount spent, j-th type of resource. Thus, many indicators of resource efficiency can be obtained. And if the activity of production in the current period of time is estimated, in comparison with the base period, it can be estimated with the help of data of separate indicators determined by the formula (1). If, when comparing the activities of the basic and reporting periods of production activity, the indicator of a specific quantitative result from the use of a particular resource increases, this indicates an increase in the intensity of use of this type of resource, since the output of the final result from the resource unit in the reporting period is higher (more). It follows from this that the intensity of the use of this type of resource to obtain a specific result can be estimated by the ratio of performance indicators of the use of this resource in the reporting year compared to the base year. In accordance with the formula (1), the intensity index of resource use PCJ to obtain the final result of the CRI Is determined by the formula

$$I_{ij} = E_{ij}^{from} / E_{ij}^{base} = I_{kr}^{i} / I_{res}^{j} \tag{6.2}$$

Where $I_{kpi} = \frac{K_{pi}^{from}}{K_{pi}^{base}}$ – index of the i-th final result;

$I_j^{res} = \frac{P_{cj}^{from}}{P_{cj}^{base}}$ - index of j-th type of resource.

If intensity indicator I_{ij} >1, we can talk about better use of the j-th type of resource to obtain the i-th final result (i.e. the output of the final i - th result from the unit of the j-th type of resource increases in the reporting period compared to the base) .

If intensity indicator I_{ij} < 1, it is possible to speak about decrease in efficiency of use of a resource in the reporting period in comparison with basic.

In practice, you can hear that the productivity of labor decreases from year to year, or the profitability of products increases from year to year, etc.

The ratio of the index of a particular end result to the index of a given resource is called an indicator of the intensity of use of this resource to obtain a specific end result.

The relationship and difference between the indicators of efficiency and intensity of use of the resource is presented in table 6.1.

Table 6.1. The difference between the concepts of «resource efficiency indicator» and «resource intensity indicator»

№ p/p	Indicator	Assessed period	Economic interpretation	Definition	Calculation formula
1.	Efficiency of resource use	one	Shows how much the final result is obtained from the resource unit	The ratio of the end result to the resource	E = Kp : Pc
2.	The intensity of use of resource	Two: reporting and basic	Shows the percentage change in the output of the final result from the resource unit	Ratio of the final result index to the resource index	I =Iкр : Ipc

The performance indicator is the ratio of the end result to the cost (resources).

The indicator of intensity is the ratio of the index of the result to the index of consumption of the resource.

6.2. Comprehensive assessment of the intensity of use of enterprise resources

We will set the task of determining a complex indicator that takes into account the efficiency of the use of the entire set of resources, i.e. determining the complex indicator of the intensity of use of the entire set of resources. To this end, we propose a matrix form of formation of production efficiency indicators. The outcome indicators (Ki) are horizontal and the resource indicators (Pj) are vertical, as shown in table 6.2. [4,5,6,7].

Table 6.2. Matrix of resource efficiency indicators for the period

Resources	End result						
	Kp_1	Kp_2	Kp_3	…	Kp_i	…	Kp_n
Pc_1 Pc_2:	E_{11} E_{12}	E_{21} E_{22}			E_{i1} E_{i2}		E_{n1} E_{n2}
Pc_j					$I_{ij} = \frac{K_{pi}}{P_{cj}}$		
Pc_m	E_{1m}	E_{2m}			I_{im}		I_{nm}

According to formula (1) and table 6.2. it is possible to obtain the matrices M1 and M2 of indicators of resource use (output of the final result per unit of resource), respectively, of the base and reporting periods of time. On the basis of M1 and M2 matrices it is possible to construct a matrix of indices of economic indicators:

$$I_{ij} = \frac{E_{ij}^{(from)}}{E_{ij}^{b}} \qquad (6.3)$$

where $E_{ij}^{(from)}$ - indicator of use of the J-th resource for the i -th final result of an even period of time, E_{ij}^{b} - according to the base time period. The economic sentiment index I_{ij} characterizes the changes in the final result from the unit of resources. For example, if I_{ij} =1,04 this means that the receipt (output) of the i-th final result per unit of the j-th type of resource increased in the reporting period compared to the base by 4%, and I_{ij}=0,95, It means, respectively, a decrease in output (assuming a specific result) per unit type of resource 5%.

As noted above the intensity indicator I_{ij} you can also evaluate the formula (6.3).

Then the complex index of intensity of use and conducti all resources in the reporting period, compared with baseline, peri-Odom can be estimated by the formula:

$$I_{com} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} I_{ij}}{mn} \qquad (6.4)$$

If you enter the weighting factors of resources, the formula (4) takes the form:

$$I_d E_f = \frac{1}{m}\sum_{j=1}^{j=m}\sum_{i=1}^{i-n}\alpha_{ij} l_{ij} \qquad (6.5)$$

If the resource has RS its components Pc_{jk}, it is possible to create similar matrices of end results and elements of the resource. Pc_{jk} . For example, a resource Pc_j (non-current assets) can be characterized by its constituent elements:

- intangible asset;
- fixed assets;
- unfinished construction;
- income investments in tangible assets;
- long-term financial investments;
- other non-current assets,
- which in turn can be characterized by its constituent elements.

For example: intangible assets are characterized by such constituent elements:

- patents, licenses, trademarks, other similar rights and assets;
- organizational expenses;
- business reputation of the organization.

Raw materials can be detailed into groups of raw materials or into specific types of raw materials.

The element-by-element analysis of the use of the j-th type of resource is presented in Fig.1.

Resource efficiency matrices are matryoshka dolls. Based on the indicators of the matrix M1 of the base period and the current indicators of the final results and resources of the reporting period, estimates of the extensive and intensive components of resource use in assessing the change in the final result can be obtained

$$\Delta\text{Kp}_i = \text{Kp}_i^{(from)} - \text{Kp}_i^{(b)} = \Delta\text{K}_i^{(ext)} + \Delta\text{K}_i^{(\text{int})} \quad (6.6)$$

Where $\Delta\text{K}_i^{(ext)}$ – extensive component of the change in the i-th result in the reporting period compared to the baseline,

$\Delta\text{K}_i^{(\text{int})}$ - accordingly, the intensive component. end result.

$$\Delta\text{K}_i^{(ext)} = E_{ij}^{(b)} \cdot \text{Pc}_j^{(from)} - \text{Kp}_i^{(b)} \quad (6.7)$$

$$\Delta\text{K}_i^{(\text{int})} = \text{Kp}_i^{(from)} - E_{ij}^{(b)} \cdot \text{Pc}_j^{(from)} \quad (6.8)$$

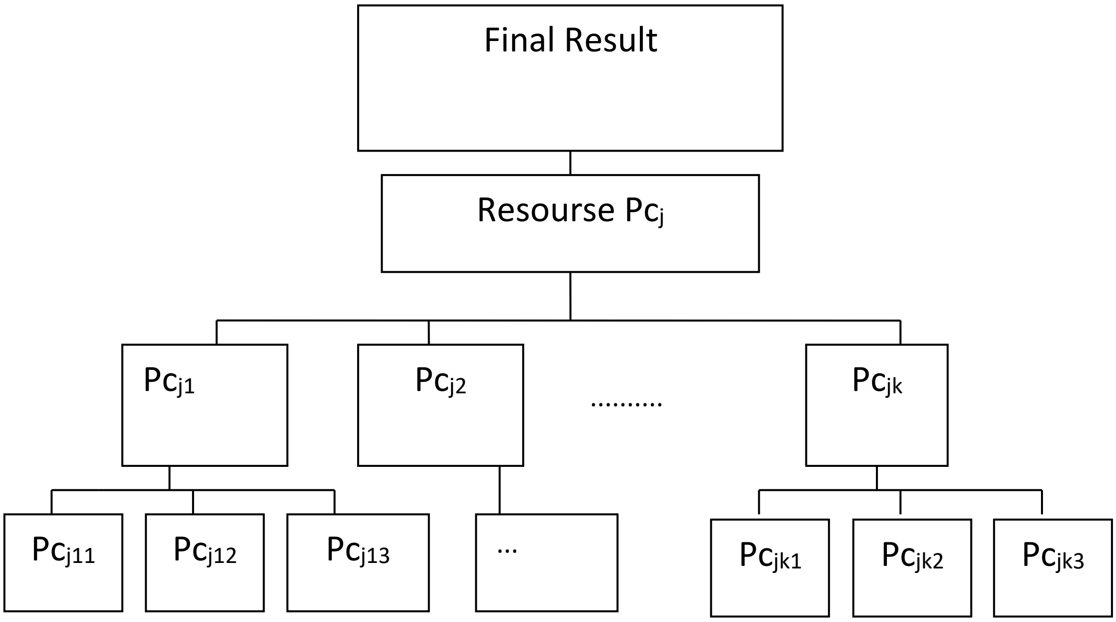


Fig. 6.1. The scheme of analysis of the final result KI on the levels of change of detail of the j-th type of resource.

The percentage components of the factors of extensive and intensive change of the final result are determined by the formula:

$$\Delta Kp\% = (I_{pc} - 1)\times 100 + (I_{\kappa p} - I_{pc})\times 100 \qquad (6.9)$$

where the first term is the extensive component, showing the share in the change in the final result due to the extensive factor, the second term is due to the intensive factor.

See table 6.3. the list of some matrices of indicators of efficiency of use of resources and obtaining final results is given.

Table 6.3. Matrix of estimated economic indicators of resource use and obtaining final results.

Matrix designation	The name of the matrix
1	2
M1	Matrix of basic economic indicators (actual indicators of the base period, planned indicators of the base and reporting periods) Fig.2.2.
M2	Matrix of comparable economic indicators (actual indicators of the reporting period, planned indicators of the reporting period). Rice.2.2.
M3	Matrix of indices of economic indicators of the reporting and base periods (or indices of actual and planned indicators of the reporting period).
M4	Matrix of indices of the initial indicators of the reporting and base periods.

M5	Matrix of absolute changes in the initial indicators of the reporting and base periods.
M6	The matrix values extensive component changes the end result
M7	Matrix of values of the intensive component of the final result change
M8	Matrix of absolute changes in the calculated indicators of the reporting and base periods.
M9	Matrix of indicators of obtaining the final result per unit of elements of non-current assets of the base period of time.
M10	Matrix of indicators of obtaining the final result per unit of non-current assets of the reporting period
M11	Matrix of indices of output (obtaining) of the final result per unit of non-current assets.
M12	Matrix of indicators of obtaining the final result per unit of working capital of the base period of time.
M13	Matrix of obtaining the final result per unit of current assets of the reporting period.
M14	Matrix of indices of output (receipt) of the final result per unit of elements of current assets.
M15	Matrix of indicators of consumption of non-current assets elements per unit of final result in the base period of time.
M16	Matrix of indicators of consumption of non-current assets elements per unit of final result in the reporting period.
M17	Matrix of consumption indices of non-current assets elements per unit of final result.
M18	Matrix of indicators of consumption of current assets per unit of final result in the base period of time.
M19	Matrix of indicators of consumption of current assets per unit of final result in the reporting period.
M20	Matrix of indices of current assets consumption per unit of final result.
M21	Matrix of indicators of the final result per unit cost element in the base time period.
M22	Matrix of indicators for the output (receipt) of the final result per unit cost element in the reporting period.
M23	A matrix of indices of indicators of the final result of the PA unit of item cost.
M24 I т.д.	Similar matrices can be obtained for the elements of material costs, the expenditure of wages of industrial and production personnel.

This matrix form of economic analysis can be performed not only when comparing the reporting and base periods of time of one enterprise, but also when comparing different enterprises, where the indicators of one enterprise are taken as the basis. Also, instead of the basic indicators, the planned indicators can be taken (see table.3.3.) and Fig. 3.2.

Table 6.4. Planned and actual indicators in matrix analysis.

Reporting period	Fact	Plan	Fact Plan	Plan	-
Base period	Fact	Plan	-	Fact	Fact Plan

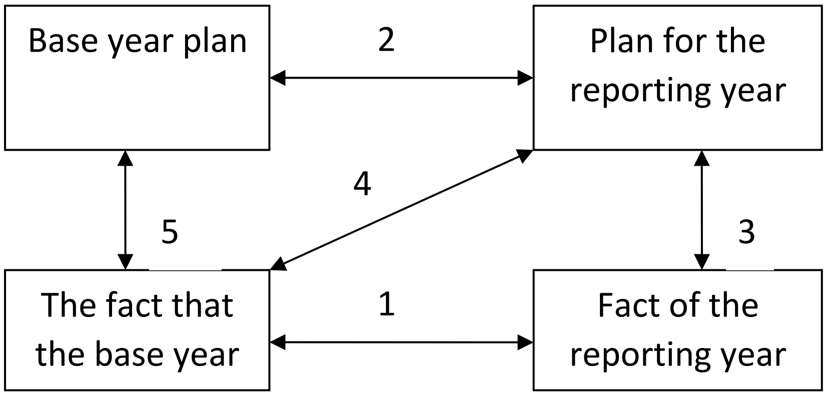


Fig. 6.2. The ratio of indicators of the base and reporting year in the matrix analysis

Analysis of indicators in relation to the fact of the reporting year - the fact of the base year characterizes changes in actual performance enterprises in the reporting period compared to the base;

1. plan of the reporting period – the plan of the base period characterizes the tension of the plan of the reporting period compared to the base
2. fact of the reporting period – the plan of the reporting period characterizes the level of implementation of the planned indicators of the reporting period;
3. the fact base year plan start year - characterizes tensions of the reporting year compared with the fact the base year.
4. the plan of the base year - the fact of the base year characterizes the level of performance of indicators of the base year (time period).

A detailed analysis of the elements of each type of resource allows you to determine the so-called «bottlenecks» in the production system and management system. The relationship of economic analysis in the development of measures to improve the efficiency of the enterprise is shown in Fig.6.3.

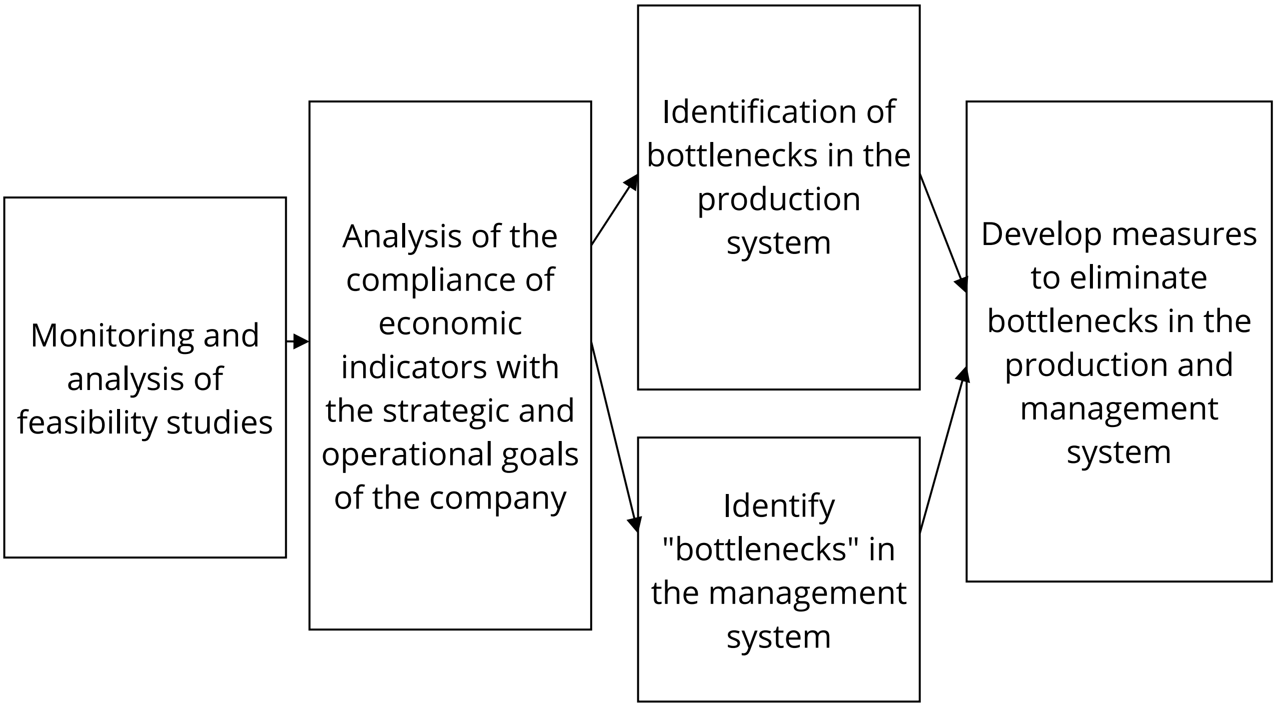


Fig. 6.3. Economic analysis in the development of measures to improve production efficiency

Detail (graph) of non-current assets of the 1st level.

The process of detailed analysis of the efficiency of use (return) of non-current assets is presented in figure 6.4.

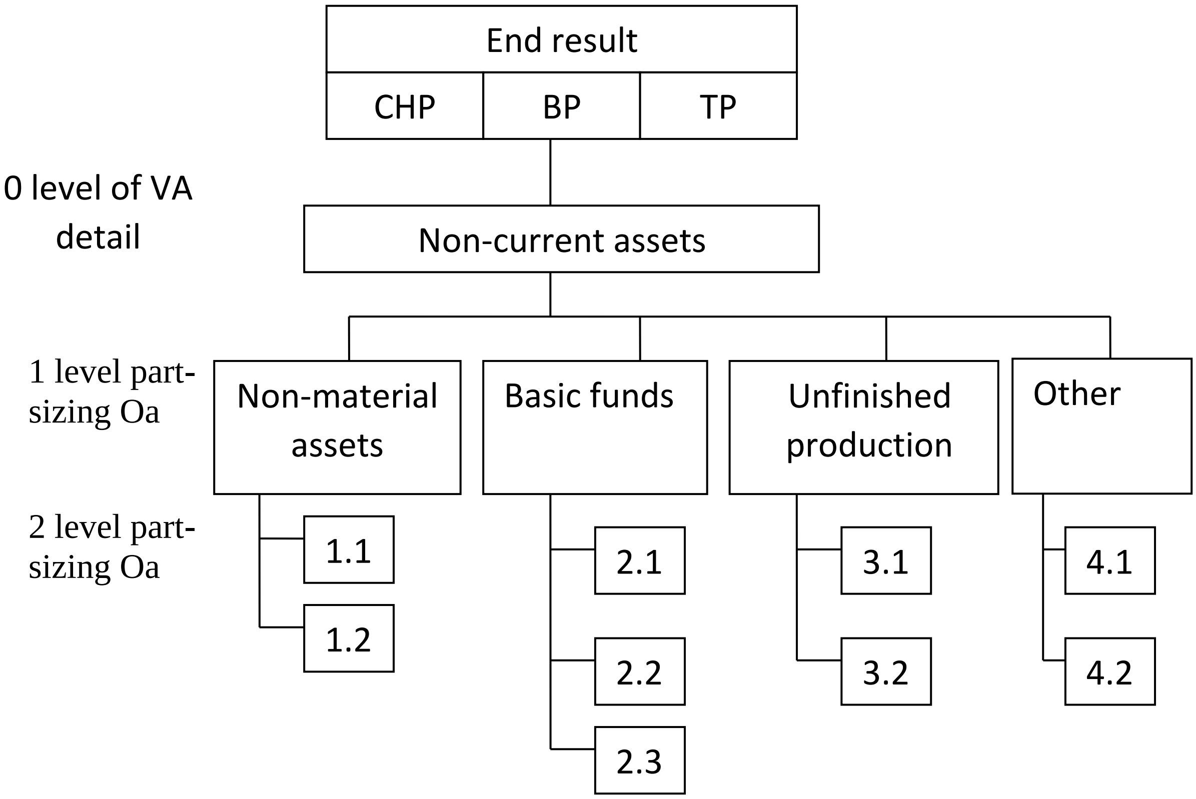


Fig. 6.4. Detailed analysis of elements of non-current assets.

1.1 Intellectual property.
1.2.Business reputation of the organization.
2.1.Buildings and structures.
2.2.Machinery and equipment.
2.3.Etc.

Level 1 current assets detail (graph).

Multilevel process of analysis of use (return) of current assets the principle («matryoshka») is presented in Fig. 6.5.

1.1. raw materials, materials and other similar values;
1.2. costs in work in progress;
1.3. finished products and goods for resale;

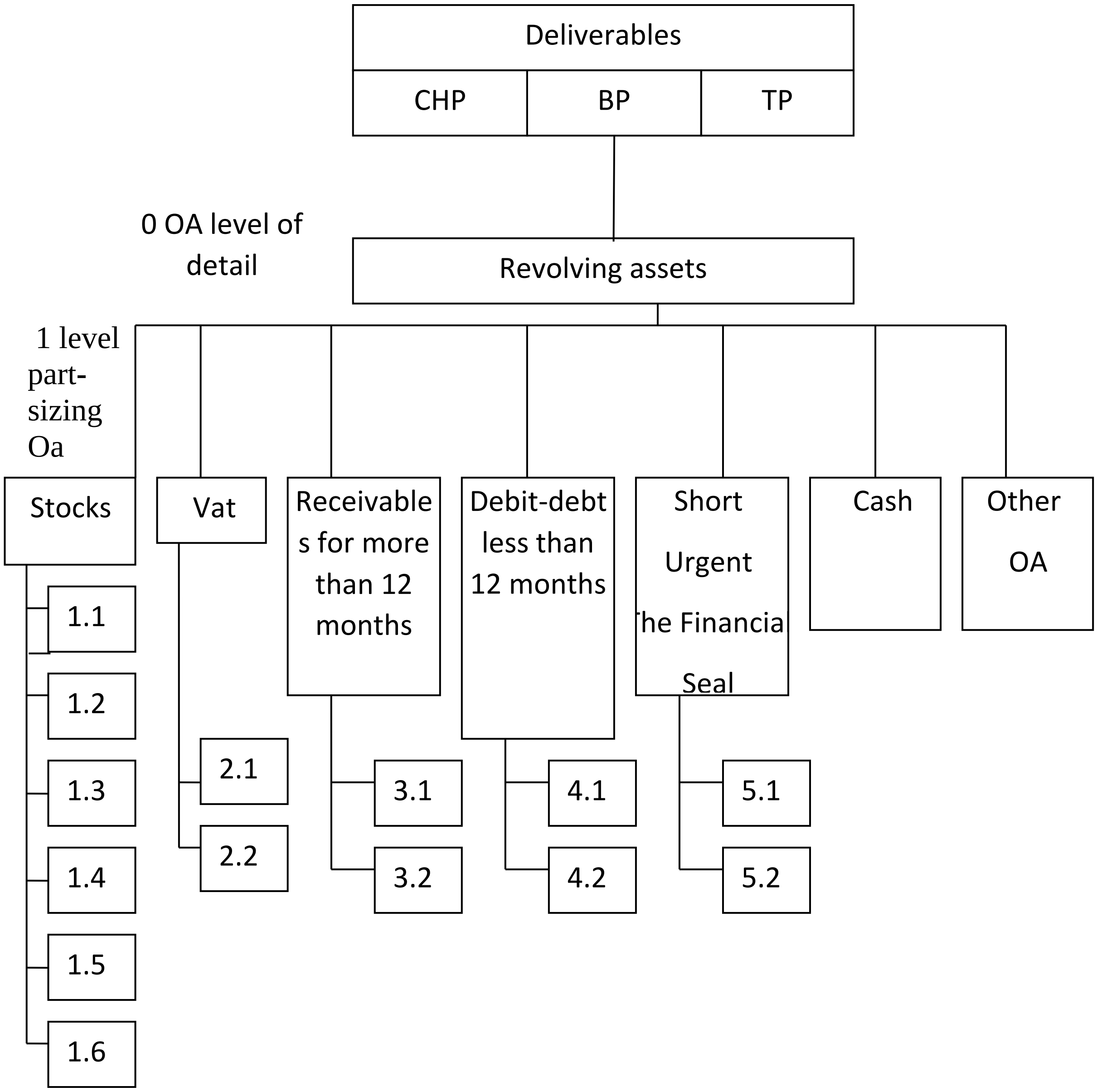


Fig. 6.5. Multilevel model of usage analysis (impact)

current asset

1.4. goods shipped;

1.5. deferred expenses;

1.6. other inventory and costs

2.1. VAT on acquired values;

3.1. accounts receivable of buyers and customers for products (more than 12 months);

3.2. VAT receivables;

4.1. accounts receivable of buyers and customers for products (less than 12 months);

4.2. VAT receivables;

5.1. areas of short-term financial investments.

Product cost detail

A multi-level process of matrix analysis of the cost of production in two versions is shown in Fig. 6.6 and 6.7.

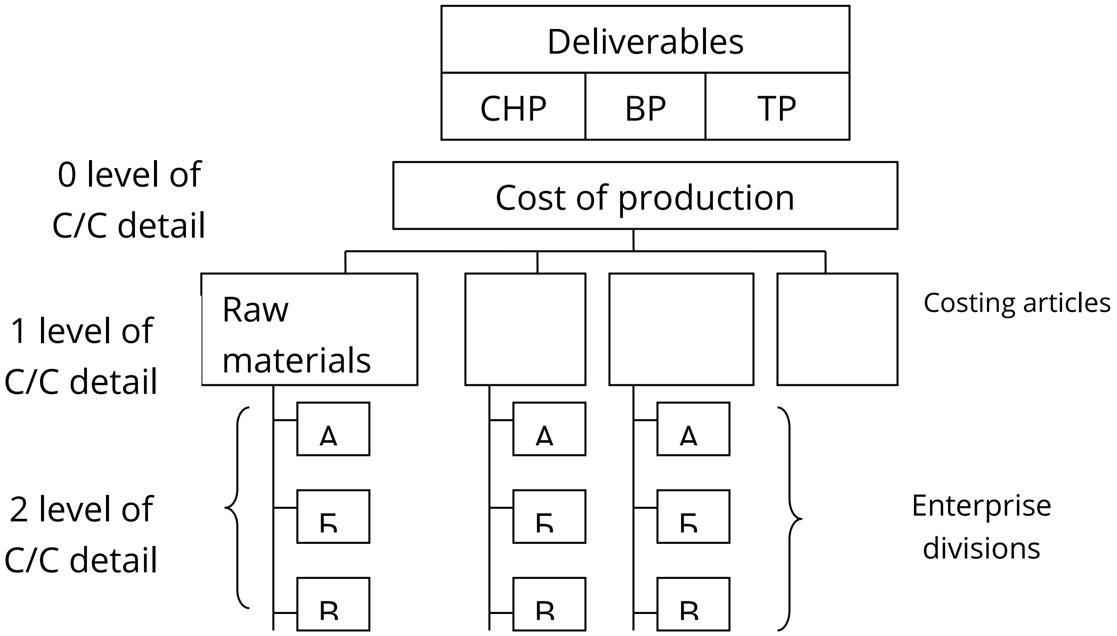


Fig. 6.6. Multi-level matrix analysis model production costs.

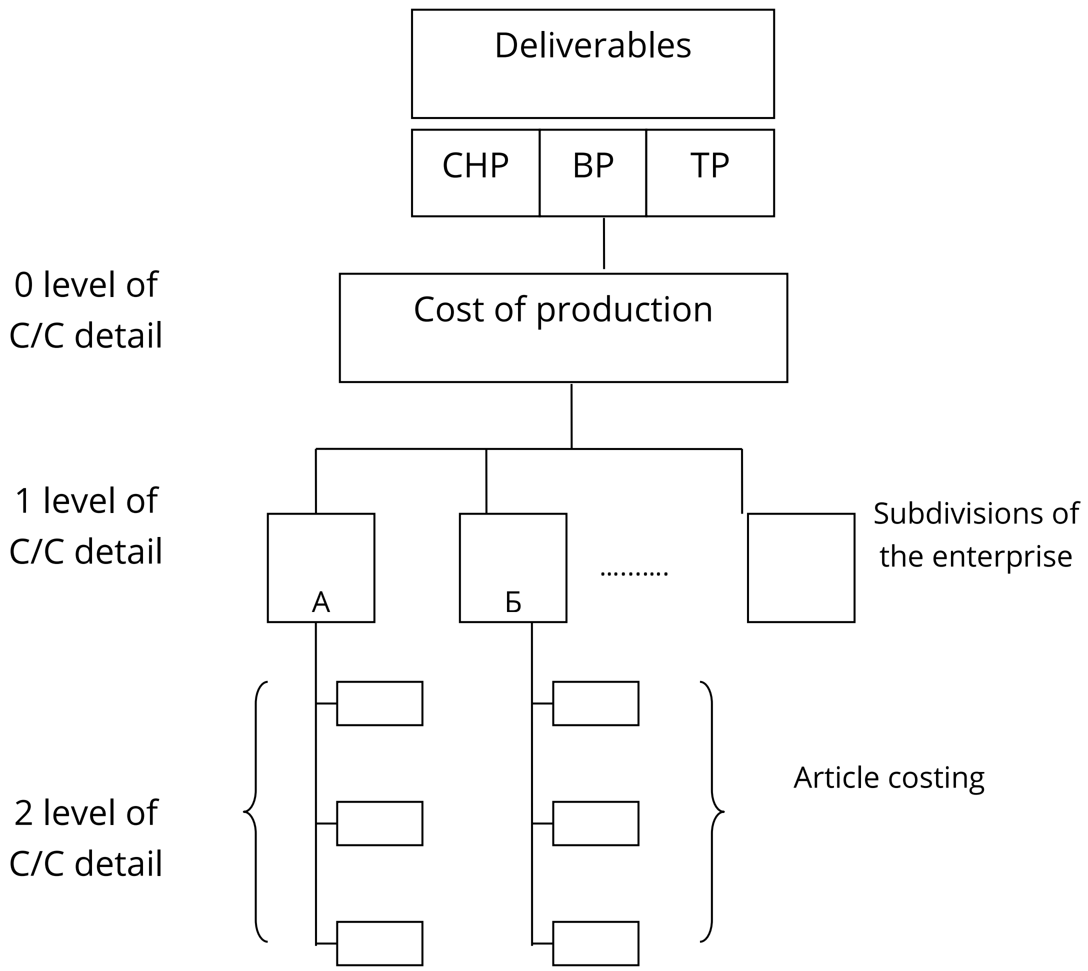


Fig. 6.7. Multilevel matrix model of analysis cost of production (1 option)

6.3. An example of a comprehensive assessment of the intensity and efficiency of the enterprise

Assessment of intensity and efficiency of use of resources of the enterprise will be carried out on the basis of available information of data of balance sheet of the enterprise and the income statement. These data are presented in table 6.5. [5].

Based on the data in table 6.5. performance indicators of the enterprise for the base and reporting periods for the 1st level of final results and resources are calculated.

Table 6.5. The source data for the analysis of dynamics of efficiency of industrial-economic activities of enterprises.

No. p/n	**The name of the indicator of this type of Resource (P).**		**Food. ISM rhenium's display's teley.**	**Values Indicators'**		**No. p/n**	**Name of bottom view indicators The final result (K. R.).**		**Food. ISM-rhenium's display's-teley.**	**The values show-teley.**	
				Base period	**Reporting period**					**Base period**	**Report-NY period**
P1	Material costs	MZ	T. R.	206225,40	289449,30	**K1**	Net profit	CHP	т.р.	40352,20	93772,70
P2	Production cost	WITH\S	T. R.	355561,70	490592,20	**K2**	The proceeds of the sale of products	B	т.р.	429548,60	643829,20
P3	Number working	H	people.	2208,00	2410,00	**K3**	Gross profit	BP	т.р.	73986,90	153237,00
P4	Current asset	OA	T. R.	237401,00	266711,20	**K4**	Non-replacement income	ВД	т.р.	7629,90	2398,10
P5	Non-current assets	V	T. R.	516550,00	517233,00						
P6	Wage fund	PHOT	T. R.	125824,00	156820,00						
P7	Commercial expenses	CU	T. R.	2071,20	3723,10						
P8	Administrative expenses	UR	T. R.	14825,60	26785,00						
P9	Non-operating expenses	BP	T. R.	1662,30	5475,10						

Table 6.6. M1. Matrix of economic indicators of the base period

№ PP.	Names and values of indicators		K1 CHP 403352,20	K2 B 429548,60	K3 BP 73986,90	K4 VD 7629,90
P1	MZ	206225,40	0,1957	2,0829	0,3588	0,0370
P2	C/C	355561,70	0,1135	1,2081	0,2081	0,0215
P3	CH	2208,00	18,2755	194,5419	33,5086	3,4556
P4	OA	237401,00	0,1700	1,8094	0,3117	0,0321
P5	BA	516550,00	0,0781	0,8316	0,1432	0,0148
P6	PHOT	125824,00	0,3207	3,4139	0,5880	0,0606
P7	KP	2071,20	19,4825	207,3912	35,7218	3,6838
P8	UP	14825,60	2,7218	28,9734	4,9905	0,5146
P9	BP	1662,30	24,2749	258,4062	445088	4,5900

Table 6.7. M2. Matrix of economic indicators of the reporting period.

№ PP.	Names and values of indicators		K1 CHP 93772,70	K2 B 643829,20	K3 BP 153237,00	K4 BD 2398,10
P1	MZ	289449,30	0,3240	2,2243	0,5294	0,0083
P2	C/C	490592,20	0,1911	1,3124	0,3124	0,0049
P3	CH	2410,00	38,9098	267,1490	63,5838	0,9951
P4	OA	266711,20	0,3516	2,4140	0,5745	0,0090
P5	BA	517233,00	0,1813	1,2448	0,2963	0,0046
P6	PHOT	156820,00	0,5980	4,1055	0,9772	0,0153
P7	KP	3723,10	25,1867	172,9283	41,1584	0,6441
P8	UP	26785,00	3,5009	24,0369	5,7210	0,0895
P9	BP	5475,10	17,1271	117,5922	27,9880	0,4380

Based on table 6.6. (matrix M1, it is seen that in the base period the return on non-current assets is — 0.83 rubles/RUB, the profitability of production — 20,8%, labor productivity 199,54 min/person / year, profitability of non-current assets in gross profit of 14.3%, net profit margin of 7.8%; return on current assets in gross profit -31,2%, net profit — 17,0 %, revenue per one ruble of managed resources is 28,97 roubles/rubles; the net profit for one ruble of the administrative expenses of 2.72 RUB/RUB

The corresponding performance indicators in the reporting period are as follows (table 6.7., matrix M2):

– return on non-current assets -1.24 RUB/RUB;
– product profitability — 31,2%;
– labor productivity -267.15 min. p/person year;
– return on non-current assets -29.6%;
– net profit margin of non-current assets -18.1%;
– return on current assets on net profit — 35.1%;
– revenue per ruble of management expenses — 24.03 RUB/RUB;
– net profit per one ruble of management expenses — 3.5 RUB/RUB.

Profitability of current assets in gross profit 57.4 per cent; On the basis of the matrices M1 and M2 of the economic performance indicators (table 6.5 and 6.6) the matrix of M3 — indices of performance indicators was obtained (table 6.7).

From the m3 matrix (table 6.8) you can see how the indicators have changed

– the impact of non-current assets (capital productivity) increased by 49.7 per cent; the efficiency of enterprises. In particular:
– product profitability increased by 50.1%;
– labor productivity increased by 37.3%;
– return on non-current assets increased 106.8%;
– return on current assets by gross profit increased by 84.4%;
– the profitability of current assets net profit rose to 106.8%;
– net profit margin of non-current assets increased by 132%;
– revenue per ruble of management expenses decreased by 17%;
– gross profit per ruble of management expenses increased by 14.6%;

Based on the m3 matrix (table 6.8) according to the formula (6.4) obtained a comprehensive indicator of the intensity of the use of resources of the enterprise in the reporting year compared to the base, it was 1,1137 (111,37%).

The efficiency of the Association in the reporting period compared to the base period increased by 11.4%, i.e. the intensity increased by 11.4%. as noted above, the dynamics of resource efficiency characterizes the intensity of its use.

Table 6.8. M3. Matrix of indices of economic performance indicators of the reporting and base periods.

№	№ P/P		K1	K2	K3	K4
	Name and values of the index of indicators		**CHP 2,3239**	**B 1,4989**	**BP 2,0711**	**BD 0,3143**
P1	MZ	1, 4036	1,6557	1,0679	1,4756	0,2239
P2	C/C	1,3798	1,6842	1,0863	1,5011	0,2278
P3	CH	1,0915	2,1291	1,3732	1,8975	0,2880
P4	OA	1,1235	2,0685	1,3341	1,8435	0,2798
P5	BA	1,0013	2,3208	1,4969	2,0684	0,3139
P6	ФОТ	1,2463	1,8645	1,2026	1,6618	0,2522
P7	KP	1,7976	1,2928	0,8338	1,1522	0,1749
P8	UP	1,8067	1,2863	0,8296	1,1464	0,1740
P9	BP	3,2937	0,7055	0,4551	0,6288	0,0954

Overall, for the total of all resources, they increased by 57.1% (the average index of expenditure of all resources 1,5715), and the final results increased by 55.2% (the average index 1,552). In General, the ratio of the growth index of final results to the growth index of resources was JEF=1,552/1,5715=0,9876(98,76%).

The decrease in the performance index of the Association calculated on the ratio of average indices of final results and resources is due to a decrease in non-operating income per unit of resources. This will be taken into account when establishing a balanced scorecard (see para.). Based on table 6.8. (matrix M3) table 6.9., characterizing the average change in the final results for each type of resource of the 1st level.

6.9. The average percentage of change in the final result to the resource of the 1st level of detail (1st level of the resource graph).

№	Resource	**Average % change in deliverables per resource unit**
1	MZ	10,6
2	S / S	12,7
3	H	42,2
4	OA	38,1
5	V	55,0
6	PHOT	24,5
7	CU	-13,7
8	UR	-14,1
9	BP	-52,9

In accordance with the formulas (6.6-6.9), the matrices of extensive and intensive components of the final result changes were calculated (tables 6.10. and 6.11.)

Table 6.10. Extensive components of the final result change

№ P.P.	Level 1 resources	The final results of the 1st level			
		CHP	B	BP	BD
1	MZ	16284,45	173347,75	29858,00	3079,11
2	S/S	15324,42	163128,26	28097,76	2897,58
3	H	3691,64	39297,47	6768,73	698,02
4	OA	4982,00	53033,29	9134,63	942,01
5	V	53,36	567,96	97,83	10,09
6	PHOT	9940,53	105816,76	18226,24	1879,58
7	CU	32183,18	342589,48	59008,77	6085,28
8	UR	32551,00	346504,93	59683,18	6154,83
9	BP	92555,42	985251,10	169702,77	17500,62

Table 6.11. Matrix of intensive components of the final result change

№ P.P.	Level 1 resources	The final results of the 1st level			
		CHP	CHP	CHP	CHP
1	MZ	37136,05	40932,85	49392,10	-8310,91
2	S/S	38096,08	51152,34	51152,34	-8129,38
3	H	49728,86	174983,13	72481,37	-5929,82
4	OA	48438,50	161247,31	70115,47	-6173,81
5	V	53367,14	213712,64	79152,27	-5241,89
6	PHOT	43479,97	108463,84	61023,86	-7111,38
7	CU	21237,32	-128308,88	20241,33	-11317,08
8	UR	20869,50	-132224,33	19566,92	-11386,63
9	BP	-39134,92	-770970,50	-90452,87	-22732,42

Let us explain the content of tables 6.10. and 6.11. From table 6.5. source what the net gain is changed (increased) at:

PPP=93772.70-40352.20=53420.50 Tr

Let's consider at the expense of what components and how much this increase is due to material costs. From table 6.10. it is seen that due to the extensive component of this increase is 16284.45 t. p, and from tables 6.11. it is seen that due to the intensive component of this increase is 37136,05 Tr. That is: PPP=534420.50=16284.45+37136.05

Table 6.12. the extensive and intensive components of changes in the final result and their share in this change are presented.

Table 6.12. Summary table of extensive and intensive components of changes in the final result and their share.

№ p/p	Level 1 resources	Changing the final result of Tr															
		ΔCHP=53420,50				ΔB=214286,60				ΔBP=79250,10				ΔBD=-5231,80			
		Extensive Component		**Intensive Component**		**Extensive Component**		**Intensive Component**		**Extensive Component**		**Intensive Component**		**Extensive Component**		**Intensive Component**	
		RUB	**%**	**RUB**	**%**	**RUB**	**%**	**RUB**	**%**	**RUB**	**%**	**RUB**	**%**	**RUB**	**%**	**RUB**	**%**
1	MZ	16284,45	30,5	37136,05	69,5	173347,75	80,9	40932,85	19,1	29858,00	37,7	49392,10	62,3	3079,11	-58,8	-8310,91	158,8
2	S / S	15324,42	28,7	380,08	71,3	163128,26	76,1	51152,34	23,9	28097,76	35,5	51152,34	64,5	2897,58	-55,4	-8129,38	155,4
3	H	3691,64	6,9	497,86	93,1	39297,47	18,3	174983,13	81,7	6768,73	8,5	724,37	91,5	698,02	-13,3	-59,29,82	113,3
4	OA	4982,00	9,3	48438,50	90,7	53033,29	24,8	161247,31	75,2	9134,63	11,5	70115,47	88,5	942,01	18,0	-6173,81	118,0
5	V	53,36	0,1	53367,14	99,9	567,96	0,3	213712,64	99,7	97,83	0,1	79152,27	99,9	10,09	-0,2	-5241,89	100,
6	PHOT	9940,53	18,6	43479,97	81,4	105816,76	49,4	108463,84	50,6	18226,24	23,0	61023,86	77,0	1879,58	-35,9	-7111,38	135,9
7	CU	32183,18	60,2	21257,32	39,8	342589,48	159,9	-128308,88	-59,9	59008,77	74,5	20241,33	25,5	6085,28	-116,3	-11317,08	216,
8	UR	32551,00	60,9	20869,50	39,1	346504,93	161,7	-132224,33	-61,7	59683,18	75,3	19566,92	24,7	6154,83	-117,6	-11386,63	217,6
9	BP	925,42	173,2	-39134,92	-73,2	985251,10	459,8	-770970,50	-359,8	169702,97	214,1	-90452,87	-114,1	17500,62	-334,5	-22733,42	434,

Consider the performance of the second level of resources and their dynamics. The initial data are presented in tables 6.13.

In tables 6.14. and 6.15. the indicators of efficiency of use of non-current and current assets for the base and reporting periods, respectively, and in table 6.16 indicators characterizing the intensity of their use are presented.

Table 6.13. Initial data for the analysis of dynamics of efficiency of components of non-current and current assets of the enterprise

No. p/n	The name of the indicator of this type of resource (P)	Measurement of indicators	Value of indicator	
			Value of indicator ($P_{(Б)}$) – «F»	Reporting period ($P_{(O)}$) – «G»
1.	**Reporting period**	Mln.RUR	516.55	517.23
1.1.	Intangible assets AT	Mln.RUR	12.30	13.28
1.2.	Fixed assets	Mln.RUR	445.69	449.36
1.3.	Unfinished construction of the national Assembly	Mln.RUR	28.42	30.28
1.4.	Long-term fin. Attachments TPP	Mln.RUR	17.82	15.97
1.5.	Other non-current assets of PVA	Mln.RUR	12.32	8.34
2.	**Current asset**	Mln.RUR	237.40	266.71
2.1	Stocks including S	Mln.RUR	165.30	187.93
	See raw materials	Mln.RUR	94.90	119.33
	Work in progress NP	Mln.RUR	28.83	21.38
	Finished products for resale GP	Mln.RUR	40.62	45.34
	Deferral expenses	Mln.RUR	2.38	1.87
2.2.	Receivables DZ	Mln.RUR	42.85	45.32
2.3.	VAT	Mln.RUR	14.22	15.34
2.4.	Short-term financial investments of KPH	Mln.RUR	5.92	6.82
2.5.	Money	Mln.RUR	1.18	2.32
2.6.	Other current assets of POA	Mln.RUR	7.93	8.98

Table 6.14. Performance indicators of constituent elements of non-current and current assets of the base period

№ p/p	Name and value of indicators	CH	B	BP	BD
		40.3520	429.5480	73.9870	7.6290
1.	VA - 516.5500	0.0781	0.8316	0.1432	0.0148
1.1.	AT – 12.3000	3.2807	34.9226	6.0152	0.6202
1.2.	OS - 445.6900	0.0905	0.9638	0.1660	0.0171
1.3.	NS - 28.4200	1.4198	15.1143	2.6033	0.2684

1.4.	DFV - 17.8200	2.2644	24.1048	4.1519	0.4281
1.5.	PVA - 12.3200	3.2753	34.8659	6.0054	0.6192
2.	OA - 237.4000	0.1700	1.8094	0.3117	0.0321
2.1.	Z - 165.3000	0.2441	2.5986	0.4476	0.0462
	SM – 94.9000	0.4252	4.5263	0.7796	0.0804
	NP – 28.8300	1.3997	14.8993	2.5663	0.2646
	GP - 40.6200	0.9934	10.5748	1.8214	0.1878
	RPB - 2.3800	16.9546	180.4824	31.0870	3.2055
2.2.	DZ - 42.8500	0.9417	10.0245	1.7267	0.1780
2.3.	VAT - 14.2200	2.8377	30.2073	5.2030	0.5365
2.4.	KFW – 5.9200	6.8162	72.5588	12.4978	1.2887
2.5.	DS - 1.1800	34.1966	364.0237	62.7008	6.4653
2.6.	POA – 7.9300	5.0885	54.1675	9.3300	0.9620

Table 6.15. Performance indicators of the constituent elements of non-current and current assets of the base period

№ p/p	Name and value of indicators	CH	B	BP	BD
		93.7720	643.8290	153.2370	2.3980
1.	VA – 517.2300	0.1813	1.2448	0.2963	0.0046
1.1.	AT – 13.2800	7.0611	48.4811	11.5389	0.1806
1.2.	OS – 449.3600	0.2087	1.4328	0.3410	0.0053
1.3.	NS – 30.2800	3.0968	21.2625	5.0607	0.0792
1.4.	DFV – 15.9700	5.8718	40.3149	9.5953	0.1502
1.5.	PVA – 8.3400	11.2436	77.1977	18.3737	0.2875
2.	OA – 266.7100	0.3516	2.4140	0.5745	0.0090
2.1.	Z – 187.9300	0.4990	3.4259	0.8154	0.0128
	CM – 119.3300	0.7858	5.3954	1.2841	0.0201
	NP – 21.3800	4.3860	30.1136	7.1673	0.1122
	GP – 45.3400	2.0682	14.2000	3.3797	0.0529
	RPB – 1.8700	50.1455	344.2936	81.9449	1.2824
2.2.	DZ - 45.3200	2.0691	14.2063	3.3812	0.0529
2.3.	VAT – 15.3400	6.1129	41.9706	9.9894	0.1563
2.4.	KFW – 6.8200	13.7496	94.4031	22.4688	0.3516
2.5.	DS – 2.3200	40.4190	277.5125	66.0504	1.0336
2.6.	POA – 8.9800	10.4423	71.6959	17.0643	0.2670

Table 6.16. Matrix of indicators of intensity of components of non-current and current assets

№ p/p	Name and value of indicators	CH	B	BP	BD
		2.3239	1.4989	2.0711	0.3143
1.	VA – 1.0013	2.3208	1.4969	2.0684	0.3139
1.1.	ON – 1.0797	2.1524	1.3882	1.9183	0.2911

1.2.	OS – 1.0082	2.3049	1.4866	2.0542	0.3118
1.3.	HC – 1.0654	2.1811	1.4068	1.9439	0.2950
1.4.	DF-0.8962	2.5931	1.6725	2.3111	0.3507
1.5.	DITCH – 0.6769	3.4328	2.2141	3.0595	0.4643
2.	OA – 1.1235	2.0685	1.3341	1.8435	0.2798
2.1.	Z-1.1369	2.0440	1.3184	1.8217	0.2765
	CM-1.2574	1.8481	1.1920	1.6471	0.2500
	HP – 0.7416	3.1336	2.0211	2.7928	0.4239
	GR – 1.1162	2.0819	1.3428	1.8555	0.2816
	RRB – 0.7857	2.9576	1.9076	2.6360	0.4001
2.2.	DZ - 1.0576	2.1972	1.4172	1.9583	0.2972
2.3.	VAT 1.0788	2.1542	1.3894	1.9199	0.2914
2.4.	KFW-1.1520	2.0172	1.3011	1.7978	0.2728
2.5.	DS – 1.9661	1.1820	0.7623	1.0534	0.1599
2.6.	ROA – 1.1324	2.0521	1.3236	1.8290	0.2776

Table 6.17. Matrix of extensive components of changes in the final result of the elements of non-current and current assets

№ p/p	Name and value of indicators	CH	B	BP	BD
1.	V	0.0531	0.5655	0.0974	0.0100
1.1.	UPON	3.2150	34.2241	5.8949	0.6078
1.2.	OS	0.3323	3.5371	0.6092	0.0628
1.3.	NS	2.6409	28.1126	4.8422	0.4933
1.4.	TPP	4.1892	-44.5939	-7.6810	-0.7920
1.5.	ANTIAIRCRAFT DEFENSE	-13.0358	-138.7663	-23.9016	-2.4646
2.	OA	4.9820	53.0331	9.1346	0.9419
2.1.	After	5.5243	58.8062	10.1290	1.0444
	CM	10.3878	110.5781	19.0464	1.9639
	STATE OF EMERGENCY	-10.4274	-111.0001	-19.1191	-1.9714
	GP	4.6889	49.9130	8.5972	0.8865
	BPM	-8.6469	-92.0460	-15.8544	-1.6348
2.2.	DZ	2.3260	24.7604	4.2648	0.4398
2.3.	VAT	3.1782	33.8322	5.8274	0.6009
2.4.	KFW	6.1346	65.3029	11.2480	1.1598
2.5.	JS	38.9841	414.9871	71.4790	7.3704
2.6.	POA	5.3430	56.8758	9.7965	1.0101

Table 6.18. Matrix of intensive components of the final result change by elements of non-current and current assets

№ p/p	Name and value of indicators	CH	B	BP	BD
1.	V	53.3669	213.7155	79.1526	-5.2410
1.1.	UPON	50.2050	180.0569	73.3551	-5.8388

1.2.	OS	53.0877	210.7439	78.6408	-5.2938
1.3.	NS	50.7791	186.1684	74.4078	-5.7303
1.4.	TPP	57.6092	258.8749	86.9310	-4.4390
1.5.	ANTIAIRCRAFT DEFENSE	66.4558	353.0473	103.1516	-2.7664
2.	OA	48.4380	161.2479	70.1154	-6.1729
2.1.	After	47.8957	155.4748	69.1210	-6.2754
	CM	43.0322	103.7029	60.2036	-7.1949
	STATE OF EMERGENCY	63.8474	325.2811	98.3691	-3.2596
	GP	48.7311	164.3680	70.6528	-6.1175
	BPM	62.0669	306.3270	95.1044	-3.5962
2.2.	DZ	51.0940	189.5206	74.9852	-5.6708
2.3.	VAT	50.2418	180.4488	73.4226	-5.8319
2.4.	KFW	47.2854	148.9781	68.0020	-6.3908
2.5.	JS	14.4359	-200.7061	7.7710	-12.6014
2.6.	POA	48.0770	157.4052	69.4335	-6.2411

6.4 Comprehensive assessment of the intensity of the enterprise

A comprehensive assessment of the intensity of the enterprise will not be complete without taking into account the quantitative growth of the final results (revenue, gross profit, net profit).

To do this, determine the average index of change in the final results by the formula (6.10)

$$J_{kp} = \sqrt[3]{\mathrm{Iv} \times I\mathrm{vp} \times Ichp} \qquad (6.10)$$

where : J_{kp} – average index of change of values of volume indicators of final results;

Iv - the index of revenue;

Ivp – gross profit index;

Ichp – the index of net profit.

Then the complex assessment of intensity of work of the enterprise taking into account change of values of volume indicators of final results will be defined by the formula (6.11)

$$J_{kp} = \sqrt{E_{fp} J_{kp}} \qquad (6.11)$$

For our data (table 6.5) we have:

$J_{kp} = \sqrt[3]{1{,}50 \times 2{,}07 \times 2{,}32} = 1{,}93$

According to table 6.8 and formula 6.4, the complex indicator of the intensity of use of resources amounted to 6.4, then a comprehensive assessment of the intensity of the enterprise as a whole will be:

$$J_{kp} = \sqrt[3]{1{,}93 \times 1{,}14} = 1{,}483$$

Thus a comprehensive assessment of the intensity of work of the enterprise as a whole amounted to 1,48 i.e., the intensity of work of the enterprise in analitucs compared to the baseline increased by 48.3%.

6.5. The formation of a balanced scorecard

The block diagram of building a balanced scorecard is shown in Fig. 6.8.

The strategic map of the balanced scorecard (BSC) is shown in figure 6.9.

The values of the strategic objectives indicators and their modules are shown in table 6.11.

The composition of tasks and activities to achieve the strategic goals is given in table 6.12.

In paragraph 6.3 on the basis of the methodology of integrated assessment of the intensity of work of the enterprise ,the matrices of indices of economic indicators of resource use, the matrix of extensive and intensive components of changes in the final results given in tables 6.8 - 6.18 were calculated, on the basis of which a strategic map of a balanced scorecard, standards and indicators of changes in the final results and indicators of efficiency of resource use were compiled. Detailed resources were carried out in tables 6.13-6.18 to the second level, which allows to determine the standards and indicators of resource efficiency to the structural units of the enterprise and specific performers.

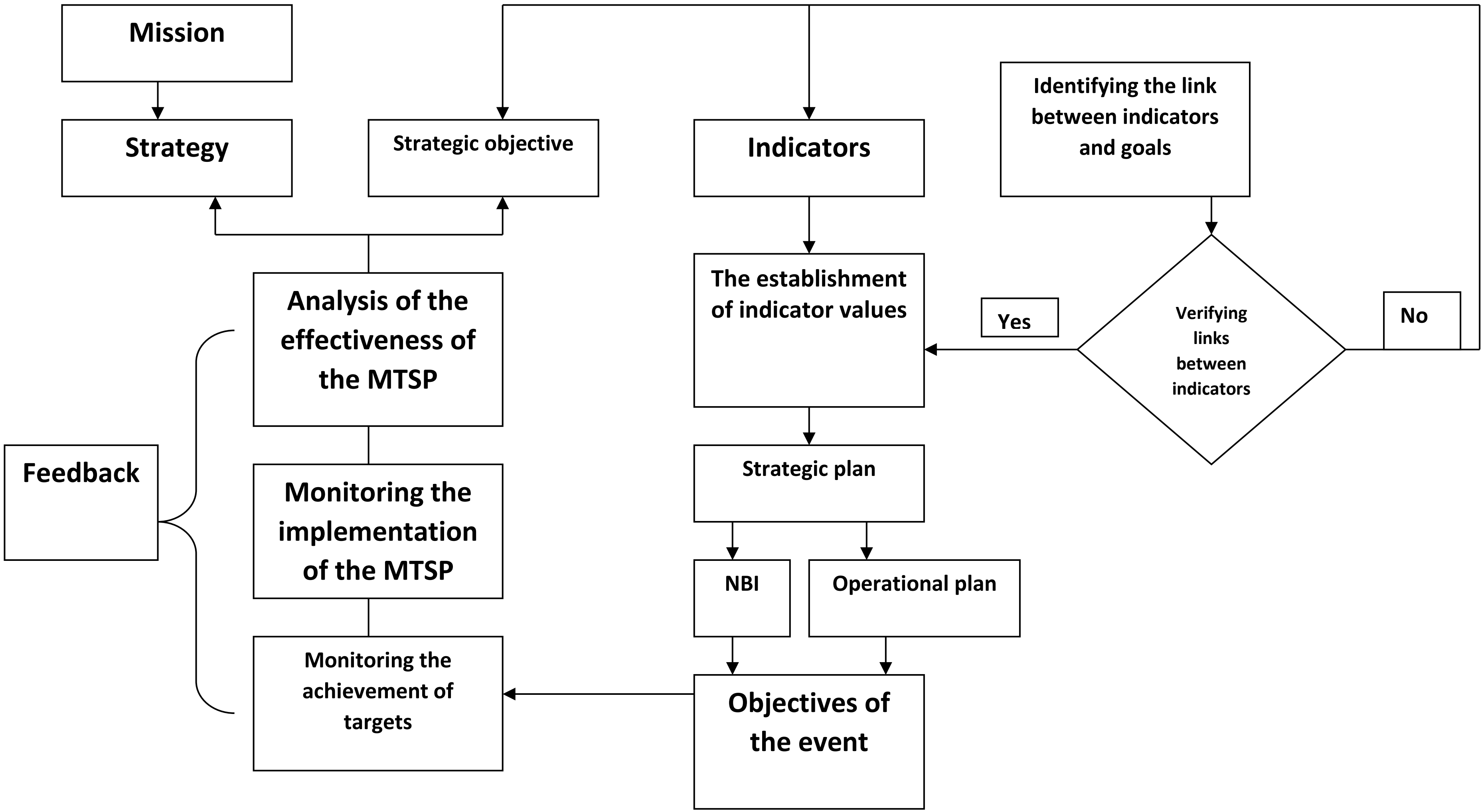


Fig. 6.8. Block diagram of a balanced scorecard.

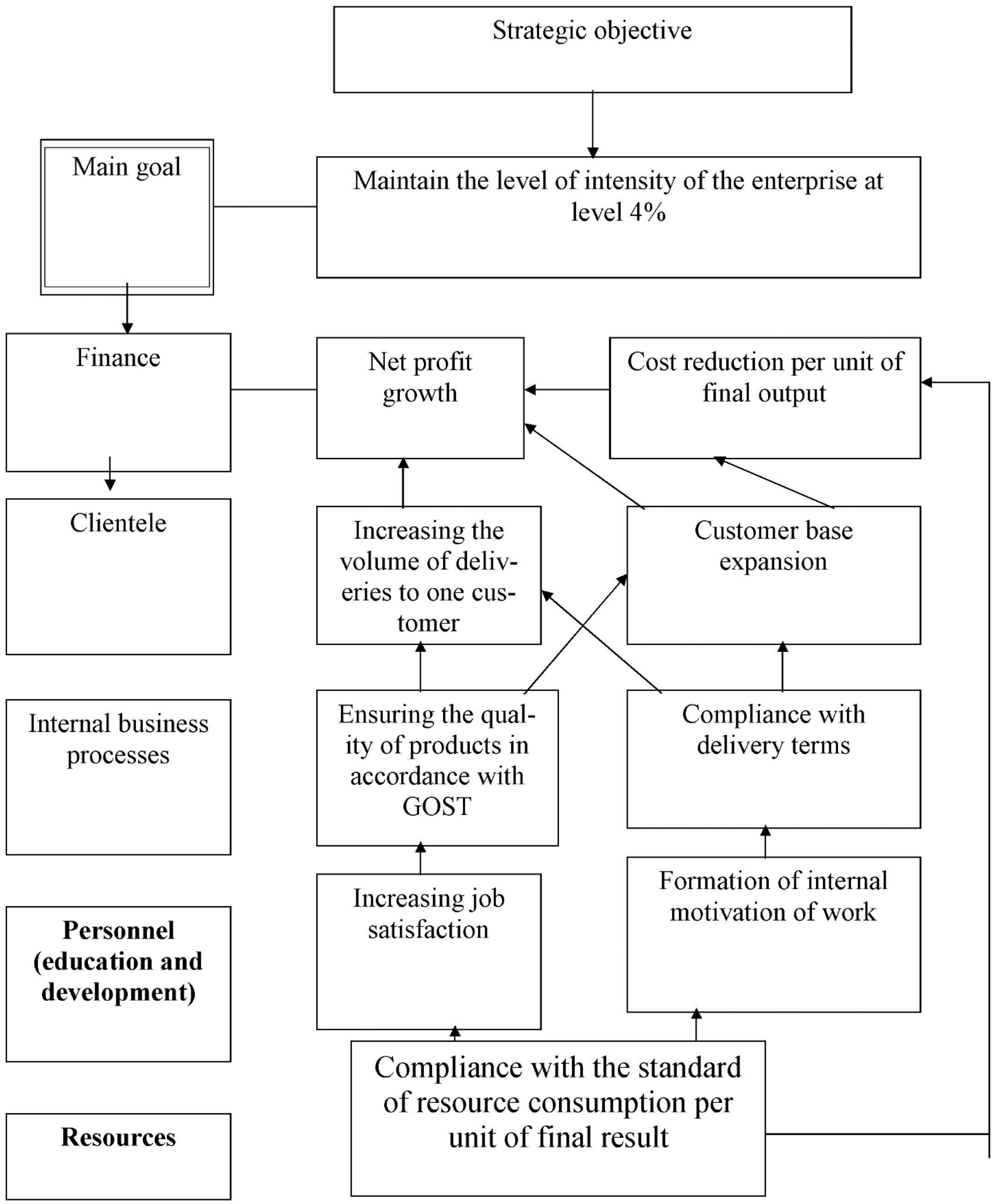


Fig. 6.9. The scheme of the strategic map of the enterprise.

Table 6.19. The structure of the balanced scorecard.

The components of the MTSP	Strategic objective	Value of indicator	Head on management
1	2	3	4

Main goal	Maintain the level of performance dynamics of JSC «ISKOZH» at a given value	3%	Deputy Gen. Directors of Economics and Finance
Finance	Net profit growth	3%	—
	Cost reduction per unit of end result	3%	Deputy Gen. Director for production
Clientele	Increasing the volume of deliveries to one client	Nevertheless 3 %	Marketing and sales Department
	Customer base expansion	At least one per year	—
Internal business processes	Quality assurance in accordance with GOST	No complaints	Head of quality management
	Compliance with delivery dates	Compliance with supply contracts	Deputy sales Director
Staff (training and development)	Increasing job satisfaction	Percentage of employees satisfied with working conditions not less than 65 %	OOM and S
	Formation of internal motivation	Percentage of employees aware of the importance of their work at least 65 %	OOM and S

Resources	Compliance with the specified standard of resource consumption per one ruble of sold products:		
	Fixed assets	0,70 RUB. / RUB.	Chief engineer
	Intangible asset	0,02 RUB. / RUB.	BNTI and R
	Unfinished construction	0,04 RUB. / RUB.	GL. mechanic
	Long-term financial investments	0,025 RUB. / RUB.	FO
	Stocks of raw materials	0,2 RUB. / RUB.	DITC

	Work in process	0,03 RUB. / RUB.	Deputy production Director
	Stocks of finished products	0,07 RUB. / RUB.	OM and
	Deferrals	0,03 RUB. / RUB.	Chief engineer
	Receivables	0,07 RUB. / RUB.	FO
	Short-term financial investments	0,01 RUB. / RUB.	FO
	Costs per 1 ruble of production	0,75 RUB. / RUB.	UAE and the P

Table 6.20. Composition of tasks and activities to achieve strategic goals:

The components of the MTSP	Objectives and activities to achieve the goals
1	2
Main goal	To introduce a method of comprehensive assessment of the dynamics of the effectiveness of the work of JSC «Iskozh»
Finance	Increase in production. Increased productivity. Compliance with the standards of costs per unit of production. Optimization of the production program based on EMM.
Clientele	Maintaining long-term contractual relationships. Development of new sales customers. Sociological studies of consumer satisfaction ISKOZH, Stock. Organization of meetings, seminars with consumers. Development of advertising activities.
Internal business processes	Introduction of statistical methods of regulation and control of product quality and technological processes. Organization of production of goods from waste. Stimulation of implementation of the production program and product quality. Clear regulation and organization of work.
Staff	Professional development of personnel and the development of related professions. Improve working conditions. Increasing the importance of their work. Implementation of sociological studies to assess job satisfaction.

Resources	1.Material and moral stimulation of resource consumption standards. Organization of efficiency and quality circles. Organization of schools for the transfer of experience in the effective use of resources and organization of labor.
	2.Organization of collection and analysis of proposals for the economical use of resources and organization of labor through special bins. Provide regulation of timely consideration of applications and proposals for the economical use of resources and labor organization submitted by employees of the enterprise.

6.6. Monitoring of indicators of dynamics of efficiency of use of resources

Monitoring of the General indicator of dynamics of efficiency of work of the enterprise can be carried out graphically (see Fig. 6.10).

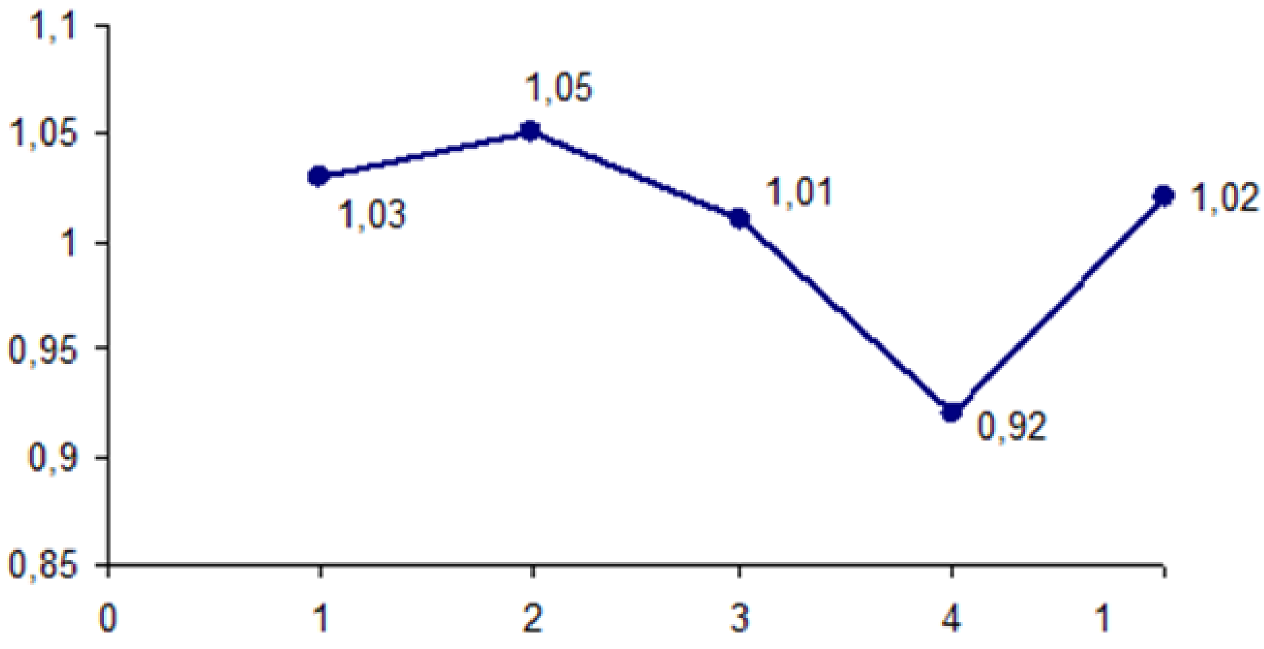


Fig. 6.10. The schedule of dynamics of complex assessment of efficiency of work of the enterprise

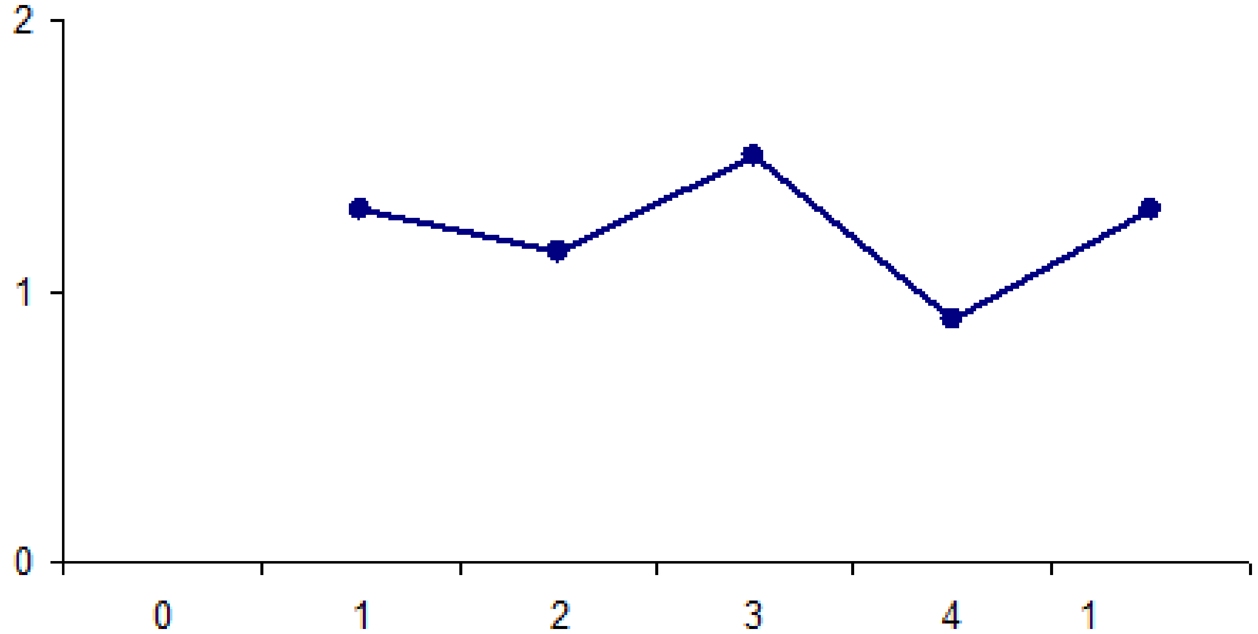


Fig. 6.11. Schedule of dynamics of efficiency of use of non-current assets

Monitoring the dynamics of integrated assessment of the dynamics of resource efficiency can also be graphically interpreted. For rice. 6.11. a graph of the dynamics of a particular type of resource (for example, non-current assets) is presented.

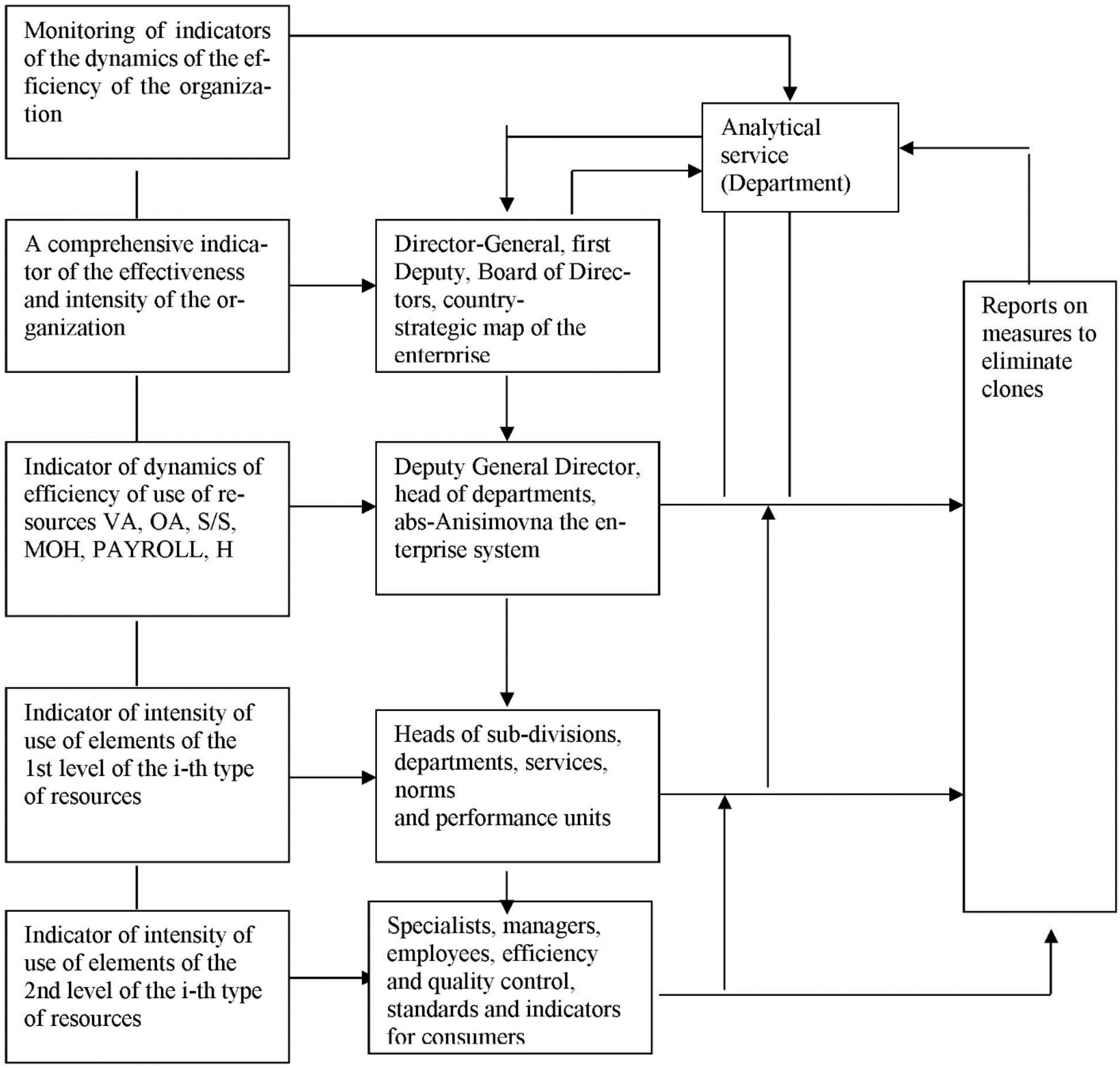


Fig. 6.12. Block diagram of the formation of a balanced scorecard based on graphs of outcomes and resources and evaluation of the dynamics of their effectiveness and evaluation of extensive and intensive components of changes in the final result.

Monitoring of complex assessment of efficiency and intensity of work of the enterprise shall be carried out by analytical division, which transmits the results of monitoring to the relevant management bodies of the enterprise in accordance with the flowchart shown in Fig. 6.12.

7. Organization of analytical work at the enterprise

7.1. Controlling as a system of organization of analytical work at the enterprise

Controlling is a new phenomenon in the theory and practice of modern management, which arose at the junction of economic analysis, planning, management accounting and management.

In recent years, more and more often among scientists and practitioners in the field of Economics and management there is an interpretation of the term «Controlling» depending on the subjective opinion of experts in a particular field of Economics and management. Some believe that controlling is internal control, while others believe that controlling is akin to auditing. Specialists in the field of automated enterprise management systems (ASUP) believe that controlling is almost the same as the ASUP, but only taking into account the new economic conditions. Often controlling is associated with a system of program-target management. Often controlling is identified with management accounting, or the latter is considered the dominant component of controlling [34,35,36, 37, 41]

Let's carry out some definitions of controlling. According to the definition of Aniskin Yu. P., Pavlova a.m. controlling is the subject of the activity of the corresponding Manager, regardless of his position or hierarchical level in the management of the enterprise. Controller – a specialist performing the functions and tasks of controlling. Depending on the size of the enterprise and the accepted version of the organization of the controlling service as a controller can be the head of the enterprise, and the head of the Department (group), and a separate Manager. [32. c.143]. Karminsky a.m., Olenev N. I., etc. controlling is defined as the concept of system management of the organization, which is based on the desire to ensure its long-term effective existence [37,p. 237]. Falmouth HY. defines controlling as a holistic concept of economic management, aimed at identifying all the chances and risks associated with profit in the market [5.].

Mann R., Mayer E. define controlling as a system of managing the process of achieving the final goals and results of the company's activities, i.e. in economic terms as a system of managing the profit of the enterprise [5.].

Controlling is a concept aimed at eliminating «Bottlenecks», focused on the future in accordance with the goals and objectives of obtaining certain results [51. p. 10].

Utkin E. A., Martynyuk I. V. define controlling as the concept of effective management of firm for the purpose of ensuring its stable existence in the market [5.].

In the work of Anankin E. A., Danilochkin S. V., Danilochkina N. G. and others, controlling is understood as a functionally separate direction of economic work at the enterprise associated with the implementation of the financial and economic commenting function in management for making operational and strategic management decisions [34. p.6]. According to the founder and ideologist of the famous German school of controlling albert dyle, controlling is a process understood as the mastery of the economic situation in the enterprise. Each Manager is responsible for the implementation of controlling. The controller itself must be a Manager in the field of controlling. The controller organizes controlling, using certain methodological approaches and techniques of documentation, acting as a moderator, carrying out management, structuring the forms of documents and questionnaires to be filled in, as well as speaking the usual language of terms for managers [5.].

As studies have shown controlling – a system of organization of analytical work in the enterprise at all levels of management. [5, 89].

Xvv. – the introduction of the post «countrllour» (UK) – the first attempt to solve the problems of public administration with the help of controlling ideas.

1778. – statutory office of «Comptroller, Auditor, Treasure and six Commissioners of Arccounts» (USA). Its tasks are management of the state economy and control over the use of funds.

1892. company «General Electric Company» (USA) – introduces the position of the controller.

In 1931. founded the Institute «s Controller' Institute of America» as the professional organization of controllers in 1962. he renamed the «Financial Executives Institute» (FEI).

Increasing demand for controlling services has led to the emergence of a number of scientific and educational institutions in Germany in this area [37. p. 18].

Initially, the controllers dealt with financial and economic issues and audits. This was due to the peculiarities of American corporate law, which is known only to two governing bodies – the General meeting of shareholders and the Board of Directors. The absence of a special governing body, along with other reasons, which are listed below, was the most important reason for the introduction of the post of controller (analyst). However, despite this, until the 30s of the twentieth century in American enterprises controllers (analysts) were almost not known.

The need for the emergence of modern enterprises such a phenomenon as controlling, can be explained by the following reasons :

– increased environmental instability puts additional demands on the enterprise management system:
– shift from the control of the past to the analysis of the future;
– increase the speed of reaction to changes in the external environment, increase the flexibility of activities and enterprise management;
– the need for continuous monitoring of changes occurring in the external and internal environments of the enterprise;
– the need for a sound system of actions to ensure the survival of enterprises and to avoid crisis situations;
– increased impact on the environment and livelihoods;
– the complexity of enterprise management systems requires a mechanism within the management system;
– information boom with a lack of relevant (significant, significant) information requires the construction of a special system of information support of enterprise management;
– General cultural aspiration to synthesis, integration of various fields of knowledge and human activity.

The above provides an opportunity to summarize and form the concept of controlling taking into account the Russian market economy (see table 7.1.)

Table 7.1. The basic concepts of controlling (analytical activity) as the core of the system of management of the intensification of the enterprise

№ p/p	Aspects (components) of the concept	Essence and main tasks within the framework of this concept
1	2	3
1.	Focus on the future	Regulation in normative-methodical documents of the company (enterprise) (the Charter, the standard of the company, the user)

		mission, strategic goals, culture firms, forms of motivation of its employees
2.	Relationship between strategic and operational management	Subordination of operational management goals to strategic goals, analysis of deviations in indicators of achievement of strategic and operational goals, coordination of the company's management system for the implementation of its goals.
3.	Organization of analytical work	Regulation in regulations on divisions (services), job descriptions of workers of the skills of conducting analytical work corresponding to their competence (analyses of indicators of activity of identification of the reasons of «bottlenecks», preparation of administrative decisions).
4.	Organization of system of support of managerial decision-making	The creation of a common management information system based on modern information technology, management accounting (direct costing, stator costing, etc.), the creation of organizational-economic conditions of involving employees in the process of preparation and adoption of managerial decisions.

See table 7.2. the generalized characteristic of the «controlling» system is given.

Table 7.2. Controlling feature

Definition	Controlling – the concept of system management and the way of thinking of managers to ensure long-term effective existence in the market.
Purpose	Orientation of management accounting to achieve the goals of the organization
Controlling object	Enterprise management processes, including: goal setting, strategy development, development and alignment of strategic and operational plans and budgets, monitoring of current events, monitoring and analysis of deviations of actual results from intended goals.
Functions: Planning	Coordination of strategic and operational plans of the enterprise development of the concept and methodology of planning.
Organization of work	Assessment of ongoing processes, identification of deviations, identification of the causes of «bottlenecks». Preparation of management decisions for management, service (providing the necessary information for management). Conducting special studies.
Stimulation, motivation	Development scenarios, the modeling methods of increase of creative activity of workers.

Control and regulation	Internal control and audit at the enterprise
Information and analytical support	Coordination and integration of information flows at the enterprise on the basis of modern information technologies. Development of information system architecture.
Analysis	The development of techniques for the analysis of strategic development. Coordination of work of divisions on the analysis of results of activity.
Controller (analyst)	Always future-oriented and responsible for ensuring that the organization is on the right economic course (in accordance with the objectives of the organization).

If the Manager is responsible for the result of the activity, the controller (analyst) for the correct interpretation of the results and their transparency.

As can be seen from table 7.2. controlling functions are the specification of the Manager's functions. The tasks of controlling are formed as part of these functions, depending on the specific circumstances. An example of such tasks on controlling functions is given in [5.].

7.2. The analytical unit of enterprise management systems

For effective work and clear definition of responsibility of controllers (analysts) at the enterprise it is necessary to create special structural division (service) of controlling (analytical division, service). The organization of the controlling service (analytical service) depends on the size of the enterprise, its production and technological structure and other factors. In small enterprises, the functions of controlling can be performed by the head of the company, or his assistant for analytical work (controlling), or his Deputy. Many tasks are integrated and simplified.

Controlling service (Analytics) is included along with accounting, financial Department, planning and economic Department in the financial and economic services of the enterprise. When creating a controlling service (analytical service) in the enterprise, the following requirements should be taken into account: [5. p. 133]

1. The controlling service should be able to obtain the necessary information from the accounting Department, the Finance Department,

the planning and economic Department, the sales (marketing) service, the logistics service, etc.

2. The controlling service (analytical service) should be able and authorized to organize with the help of other services and departments of the enterprise the collection of additional information required for its analysis and conclusions, but does not contain in the existing documents of these services and departments.

3. The controlling service should be able to implement new procedures for the collection, processing and systematization of analytical information on an ongoing basis. The question of entering these duties into the job descriptions of employees or compensation to employees of these services for the increase in production should be decided by the managers for whom the information of the controlling service is intended or directly by the head of the organization to whom the controlling service (analytical service) reports.

4. Controlling service should be able to quickly bring information to the attention of senior management.

5. The controlling service (analytical service) shall be independent from this or that financial and economic service and other services and divisions.

Since the information prepared by the controlling service (analytical service) is intended to solve mainly strategic tasks related to the improvement of the enterprise management system, it is advisable to subordinate this service directly to the General Director or his Deputy for the economy, to whom the planning and economic, financial departments, marketing (sales) Department, etc.

Currently, some analytical work is carried out at the enterprise. It is engaged in planning and economic Department, marketing Department (on the functions). Therefore, these services will consider the activities of the controlling service (analytical service) as an «invasion» into its legitimate territory and can secretly or openly boycott the activities of the controlling service «clamp information», conduct «positional battles of local importance». A common argument of these services is «Give people, teach them methods of controlling, and we will do everything ourselves.»

The fundamental mistake of this position is underestimation of the role of analytical and even to some extent research work at the enterprise, that analysis can be done «by the way». On the duties financial and economic services are loaded with the current (routine) work and their efforts are directed not to improvement of financial and economic activity (from-for insufficiency of time, and not regulation of these tasks in job descriptions). The management of the enterprise will be able to issue an order that all began to work on new schemes, to make new reports and summaries of information, but to develop these schemes, methods of processing and use of information, to check their activities in practice, managers usually can not due to lack of time, workload current work. To overcome this situation, the company creates a controlling service (analytical service). The principal difference between the controlling service and other financial and economic services is that it solves the problem of improving the activity and management of the enterprise as a whole, taking into account the strategic development of the enterprise.

Organizational form of controlling service is selected based on the specifics of a particular enterprise. Comparison of three variants of the organisation of controlling activities (1. controlling Department, 2. group of PEO, 3. temporary group) according to several criteria is given in work [5. p. 136-140].

As already mentioned, the controller is a specialist who implements the functions and tasks of controlling, capable of analytical work. According to a number of foreign and domestic specialists in controlling, this is the one who learns more than others, knows how, thinks systematically and acts in harmony with the environment, focusing on the goals and the future to successfully manage the enterprise. [5. p. 157].

The requirements for the controller specialist (analyst specialist) are presented in table 7.3.

Table 7.3. Requirements for professional and personal qualities of the controller (Analytics)

Requirement category	Content
1	2
Expert knowledge	Fundamentals of Economics and enterprise organization; accounting (financial) ; calculation of the cost of the enterprise, and manage; ability to read and analyze the balance of the enterprise; investment planning, reporting and analysis; knowledge of planning methods and tools; knowledge of the method of analysis of deviations; knowledge of PC, allowing to set the task to the programmer.

	know the basics of psychology of communication; knowledge of methods and techniques of controlling (risk analysis of the enterprise in the market, analysis of weaknesses and strengths of the enterprise, analysis of the life cycle of products, existing and future structure of products and services of the enterprise, forecasting methods, methods of problem solving, technical and economic analysis).
Methodical abilities	ability to think analytically; ability to think abstractly; ability to explain and prove; ability to learn and master new things; good communication skills, knowledge of the basics of communication in organizations; analytical curiosity; ability to use technical means of communication and presentation; the ability of systematic thinking.
Behavior requirements	do not behave very «important» when communicating with others; tolerance, i.e. tolerance of other opinions and judgments; the ability to present unpleasant facts so that the recipient could easily tolerate them (ideally laugh at their failures); not to disclose the facts testifying to failure of divisions or employees of the enterprise.
Additional requirements to the head of controlling service (analytical service)	to see and put problems under uncertainty; think about the factors influencing the success of the enterprise in the future; to abstract from routine activities; to evaluate the innovation and to contribute to its promotion; own moderation methods of manifestation of hidden creative abilities of employees.

Within the centralized controlling service (analytical service) there can be specialization of controllers (analysts) by types: marketing, logistics, foreign economic relations, resources, information systems, management accounting, business units (spinning, weaving, finishing production). Part of the tasks of controlling (analytical work) can be extended to functional departments (services): PEO, FO, ACS, marketing, etc.

- analysis of deviations and identification of their causes;
- decision-making on deviations.

7.3. Possible variants of implementation of controlling (analytic work)

The implementation process begins with the adoption of the development of a controlling system in the enterprise. A favorable moment to start building a controlling system is the emergence of new weak signals (indicators) about the possible risks for the long-term successful operation of the enterprise. It is a question both of internal, and external in relation to the enterprise signals, manifestations, as a rule, in hardly noticeable tendencies and signs. [43,44].

It is necessary to take into account the availability of the enterprise of sufficient financial and human resources. The development and implementation of the controlling system cost a lot of money, especially if this process is implemented with the assistance of external consultants. Considerable funds are required for the preparation of controllers (analysts).

Controlling as any new phenomenon in the organization can cause resistance. The phenomenon of resistance to the new at first glance is paradoxical, but still well known.

The main factors determining the pace of any innovation, as well as contributing to and hindering the rapid implementation of controlling are given in table 7.4.

The introduction of controlling system can go in two ways: revolutionary; routine - gradual implantation of controlling elements in the existing enterprise management system.

In the first method bought a project controlling related businesses (i.e., the packet with suppliers of analytical tasks, forms of cost accounting, providing problem solving and managerial decision-making, etc.), hired consultants to teach the staff to use the techniques of controlling. This method is very expensive. The second method is cheaper and can be implemented by its staff with the involvement of external consultants as necessary. As a rule, the second method of implementation takes a long time from 2 to 5 years. For rice. 1.7. the sequence of work on implementation of the controlling technique and creation of the corresponding information system is provided. In accordance with the plan «creating a controlling service in the organizational structure of the enterprise», it is advisable to create a group of 3 people, which acts as an analytical service and provides managers with operational information about the state of costs in the enterprise, periodically prepares detailed analytical reports, predicts the position of the enterprise, makes a catalog of analytical tasks.

Table 7.4. Factors contributing to and hindering the implementation of controlling (analytical service)

Group (category) of factors	Contributing factors and ways of perceiving them	Obstacles and ways to overcome them
Socio-psychological	Opacity, the lack of a real picture of the state of Affairs with the efficiency of individual units of the enterprise; the presence of the company «friction» between the individual units with respect to the functions performed and the lack of agreed goals; the emergence of new or change of existing targets of the enterprise in the changed operating conditions; the need for creativity; the advanced experience of the controlling or other related enterprises.	Inertia of structures and group inertia, threat to the status of the group (in particular, the status of accounting or planning Department may suffer); threat to the existing relations of power within the enterprise; threat to the existing order of distribution of resources; on the consistency of controlling methods with the knowledge and ideas of employees of the planning Department, accounting, etc. habits and fear of the unknown; feeling of security.
	Ways to achieve perception: carrying out explanatory work with leading specialists of the enterprise; involving them in the formation of a controlling system with their focus on the future of professional growth; meetings and seminars on best practices in controlling.	Ways to overcome: Organization of employee training; gradual introduction of new methods; material and moral incentives; prospects for growth of employees working in accordance with the concept of controlling. Search for innovators.
Economic	The deterioration of the basic indicators of efficiency of activity of the enterprise. Reduction of the company's image in comparison with related enterprises.	Stable position of the company in the market, stable financial condition (opinion, we are so good, why introduce a new one). Ways to overcome: Carrying out a special analysis and holding a special meeting on

	Ways to achieve perception: holding a special meeting of employees and shareholders of the company with an illustration of the dynamics of indicators and market conditions.	the results of the analysis in order to disclose the insolvency of thinking «we are doing well, why introduce a new one».
Financial	The possibility of improving the financial condition of the enterprise. Ways of perception: presentation of calculations and best practices to improve the financial condition of enterprises on the basis of controlling.	Significant financial costs are required. Ways to overcome: finding sources of financing and providing justification for their economic efficiency (payback).
Organizational	Existing base of enterprise management system; Existing information management system; Ability to adapt to the requirements of controlling the timing and level of knowledge. Ways of reproduction: Propaganda agitation capabilities of the existing management system to adapt to the requirements of controlling.	The duration of the period of implementation; Additional burden on employees; Clarification of departmental regulations and job descriptions of staff. Ways to overcome: Outreach on the appropriateness of the timing of implementation, taking into account peculiarities of adaptation of the existing management system to the requirements and methods of controlling.

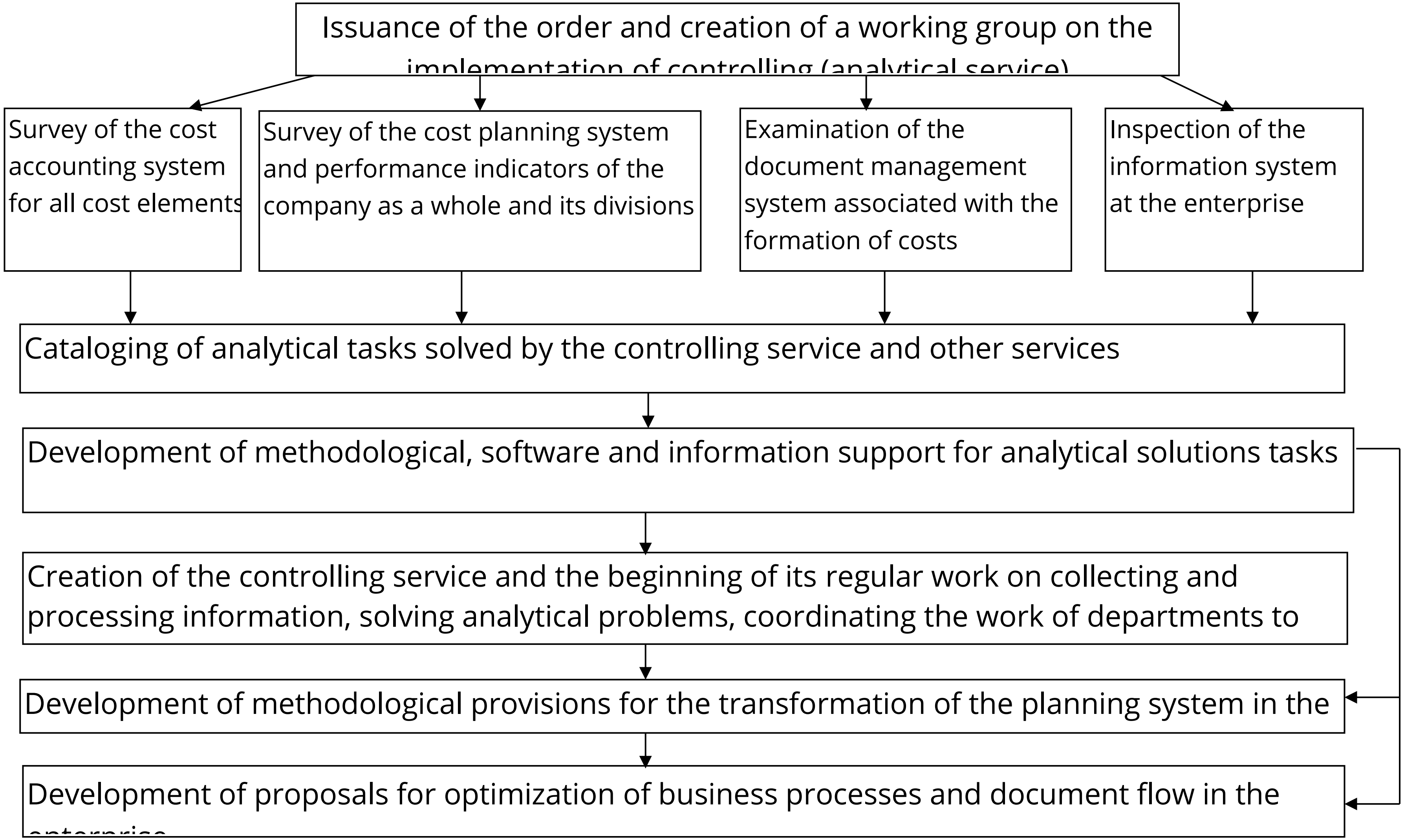


Fig. 7.3. Sequence of works on implementation of controlling system at the enterprise

At the initial stage of the controlling service (analytical service), there is no need to involve additional employees to collect information at the level of shops (departments) of the enterprise, since the filling of analytical forms for the controlling service can be assigned to economists of shops (productions). Thus, the controlling service at the enterprise during this period of activity is a small group of highly qualified specialists with sufficiently large powers and access to the entire volume of economic information.

7.4. Attracting shareholders to invest in the development of the enterprise

Problem statement.

The company from net profit directs a certain share of it to pay dividends to shareholders, the rest of it is sent to the funds of scientific, technical and social development of production. Diagnostic analysis of the dynamics of production efficiency and forecast of market conditions shows that the company from the time period T will not have a profit. Therefore, the Board of Directors wants to make the following proposal to the General meeting of shareholders. Within T years, shareholders do not pay dividends, but from the time period T+1 to pay dividends in a larger volume (100β%) for τ years, so that by the time period T+τ the amount of dividends paid for the time period τ years exceeds the amount of dividends paid for the time period T years, taking into account the time factor, inflation q (100q%) and guaranteed yield p (100p%). (see Fig. 7.4 and 7.5).[55].

Problem solution:

The accumulated value of dividends, taking into account the time factor, guaranteed yield p (for example, Bank Deposit (100P%) and inflation q in each case will be as follows:

$$HC_1(p_i,q_i) = [\sum_{i=1}^{T} D_i^{(1)}(1+p_i)^{T-i}]\cdot P_{j=1}^{\tau} (1+p_{T+j})/P_1^{T+\tau-1}(1+q_i) \qquad (7.1)$$

$$HC_2(p_i,q_i) = [\sum_{i=1}^{\tau} D^{(2)}_{T+i}(1+p_{T+i})^{\tau-i}]/ P_1^{T+\tau-1}(1+q_i) \qquad (7.2)$$

The Directors ' proposal will be economically justified if:

$$HC_2(p_i,q_i) \geq HC_1(p_i,q_i) \qquad (7.3)$$

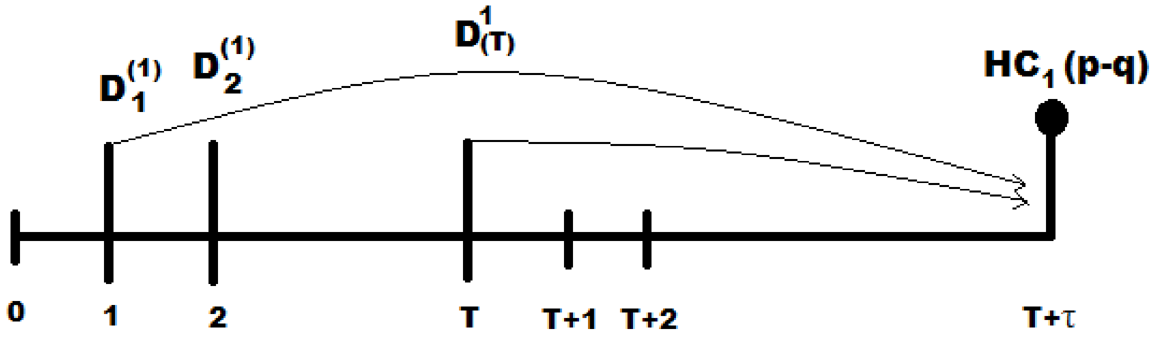


Fig. 7.4. The flow of dividends for the time T years and their accumulated value by the time T+ τ, taking into account inflation q and guaranteed yield p.

That is

$[\sum_{i=1}^{\tau} D^{(2)}_{T+i}(1+p_{T+i})^{\tau-i}]/ P_1^{T+\tau-1}(1+q_i) \geq$

$\geq [\sum_{i=1}^{T} D_i^{(1)}(1+p_i)^{T-i}] \cdot P_{j=1}^{\tau} \ (1+p_{T+j})^{\tau}/P_1^{T+\tau-1}(1+q_i)$ (7.4.4)

After reducing identical multipliers get:

$$\sum_{i=1}^{\tau} D^{(2)}_{T+i}(1+p_{T+i})^{\tau-i} \geq [\sum_{i=1}^{T} D_i^{(1)}(1+p_i)^{T-i}] \cdot P_{j=1}^{\tau} \ (1+p_{T+j}) \quad (7.4.5)$$

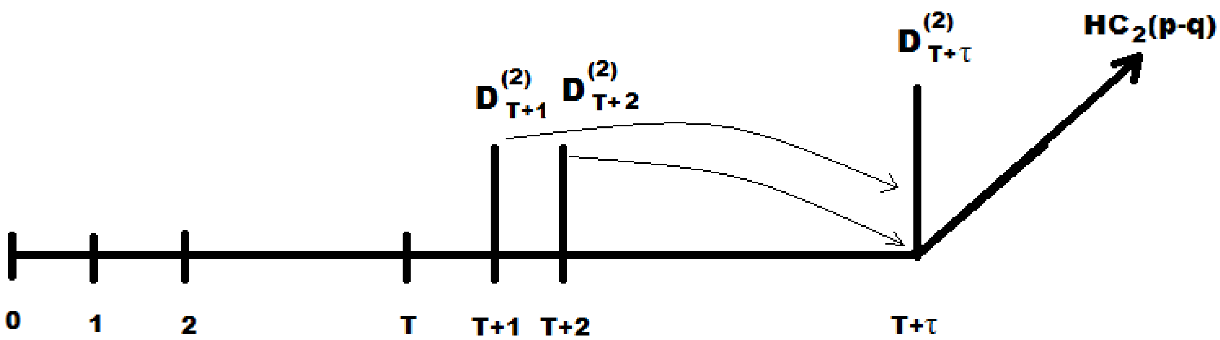


Fig. 7.5. Dividend stream with the time period (T+1) до (T+τ) and their accumulated value by the period of time T+τ adjusted for inflation q and guaranteed profitability p.

The algorithm for solving the problem is shown in Fig. 7.6.

Consider some special cases:

$D_i^1 = const = D$

$D_i^2 = const = (1+\beta)D$

$P_i = P_{T+j}$ = Const

Then the ratio (7.3) takes the form:

$$(1+\beta)D \sum_{j=1}^{\tau}(1+P)^j \quad \geq \quad D[\sum_{i=1}^{T}(1+p)^{T-i}]\times(1+p)^{\tau} \quad (7.6)$$

After summation and reductions we obtain:

$$(1+\beta)[(1+p)^{\tau}-1] \geq [(1+p)^{T}-1]\times(1+p)^{\tau} \qquad (7.7)$$

Consider special cases:

$$1.\ T=\tau,\ \text{then get } 1+\beta \geq (1+p)^{T}-1 \qquad (7.)$$

Based on the formula (7.4.8), the lower values are calculated β (in percentage terms.) which are given in table 7.5.

Table 7.5. Lower percent β increase of dividends to shareholders during the period from T+1 until T+ τ , if during the period from 1 to T payment of dividends has been suspended. (case T=τ)

P% T years	4	5	6	7	8	9	10
1	4,1	5,1	6,1	7,1	8,1	9,1	10,1
2	8,2	10,3	12,4	14,5	16,7	18,9	21,1
3	12,5	15,8	19,2	22,6	26,0	29,6	33,2
4	17,0	21,6	26,3	31,1	36,1	41,2	46,5
5	21,7	27,7	33,9	40,3	47,0	53,9	61,1

Table 7.5. shows how many percent dividend payout can be increased in the time period from T+1 до T+τ, if during the period from 1 to T payment of dividends has been suspended. For example, for three years the shareholders expected payment of dividends in the amount of 8%. The average Bank interest on the Deposit is 6%. Then if shareholders refuse to receive 8% of dividends in the first three years, in the period from 4 to 6 years they will receive 9.6% of dividends {8×(1+0.192)}.The value 0.192 (19.25%) is taken from table 7.14 at the intersection of row T=3 and column p= 6%.

2. τ=T+1, then get:

$$(1+\beta)[(1+p)^{T+1}-1] \geq [(1+p)^{T}-1]\times(1+p)^{T+1} \qquad (7.9)$$

Based on the formula (7.9), the lower values are calculated β (in percentage terms) which are given in table 7.6.

Table 7.6. The lower percentage of increase dividends in β% in the period from T+1 до T+τ, if during the period from 1 to T payment of dividends was suspended. (case τ=T+1)

P% Smoldering	4	5	6	7	8	9	10
3	-14,0	-11,0	-8,1	-5,0	-1,9	1,2	4,5
4	-4,6	-0,4	3,9	8,3	12,9	17,6	22,5
5	3,4	8,3	14,7	20,7	26,3.	33,5	40,2

Negative value β (in percentage terms) show that the payment of dividends over a period of time T+1÷T+τ can be reduced by β% compared with the dividend planned to be paid in the period of time1÷T. At the same time, the shareholder by the period of time T+τ will have savings in the case of dividends in the period from T+1 to 2T+1 (T+T+1) not less than if he received dividends in the period from 1 to T years.

For example, the shareholder planned to receive dividends of 8% in the period from 1 to 3 years. Average Bank Deposit 6%. If he refuses to receive dividends during the first 3 years, when receiving from 4 to 7 years (τ=T+1=3+1=4) dividends in the amount of 7,3% {8×(1-0,081)} the accumulated value by the time period T+τ (T+T+1=3+4=7) will not be less than if he received a dividend of 8% in the period from 1 to 3 years.

The value - 0.081(-8.1%) is obtained from table 2 at the intersection of row T=3 and column p = 6%.

3. τ =T+2, then we obtain:

$$(1+\beta)[(1+p)^{T+2}-1] \geq [(1+p)^{T}-1] \times (1+p)^{T+2} \tag{7.10}$$

Based on formula 3.10, table 7.7 is compiled.

Table 7.7. The lower values of the percentage change of dividends by β% in the period from T+1 to T+τ, if in the period from 1 to T the payment of dividends was suspended. (case τ=T+2)

P% Smolders	4	5	6	7	8	9	10
4	-19,0	-15,0	-11,0	-6,8	2,5	2,0	6,6
5	-9,8	-4,5	1,0	6,8	12,7	18,9	25,5

The explanations for the negative and positive β values of table 3 are identical to those given in tables 7.14 and 7.15.

A brief conclusion can be drawn from this section. The proposed method of managing payment of dividends to shareholders during time period T years, allowing you to accumulate funds in the given period of time without affecting the interests of shareholders so that their accumulated value of the capital by the end of the period of time T has not decreased compared to declared the wound, while the accumulated funds of shareholders to direct on development of production.

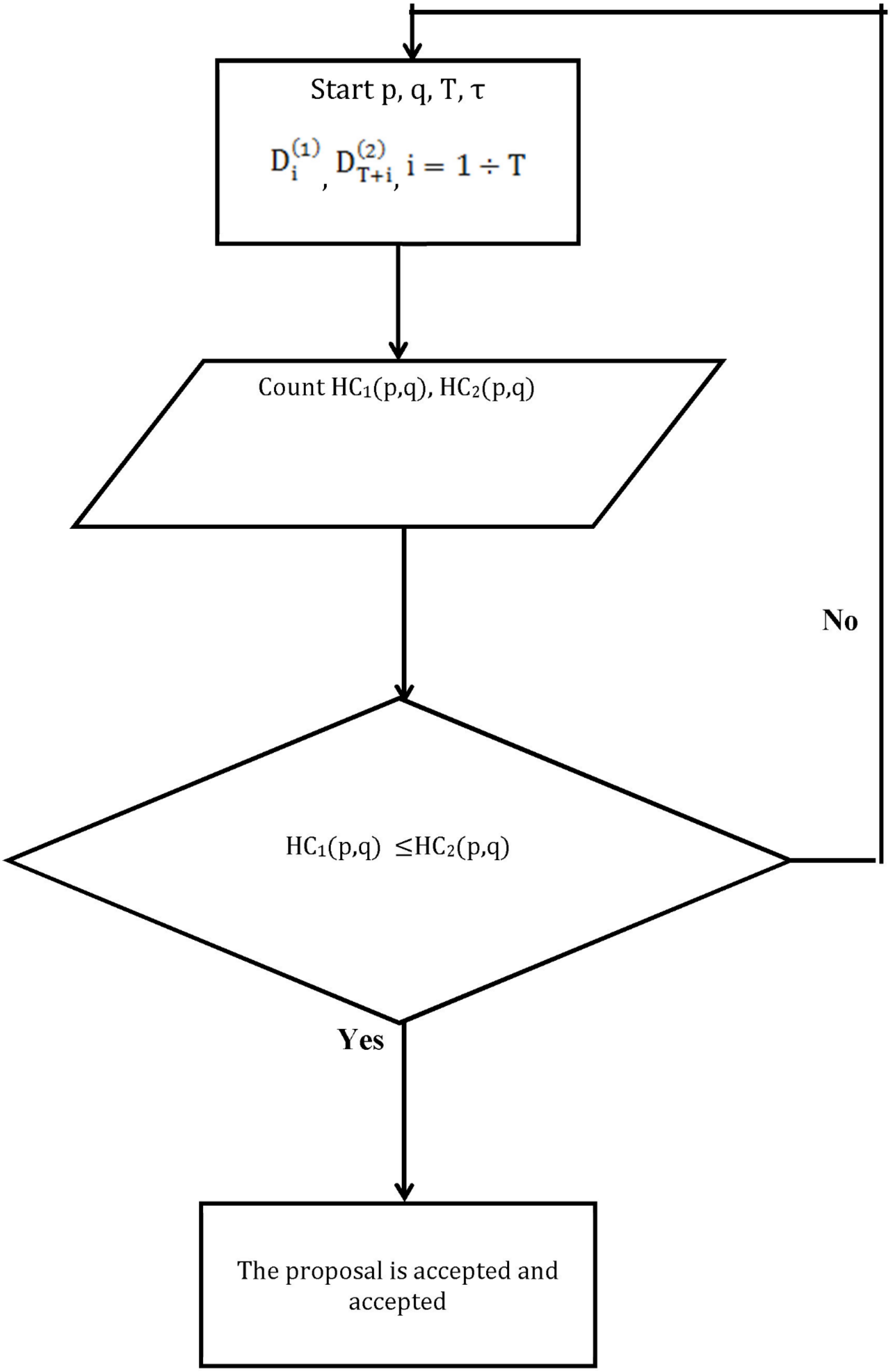


Fig.7.6. Algorithm of decision-making by the Board of Directors.

7.5. Investments in securities taking into account their risks

If the investor makes a real investment, i.e. creates an enterprise or acquires shares of a joint stock company (enterprise), its immediate task is to ensure the effective operation of the enterprise, as this will depend on its profits. The investor should be very careful in selecting such financial instruments, taking into account their profitability and the degree of risk. To achieve the goals of investor divers their investments, i.e. building up the investment portfolio.

By distributing their investments in various areas, the investor can achieve a higher level of return on their investments or reduce their risk. A characteristic feature of the portfolio is that the risk of the portfolio can be significantly less than the risk of individual investment instruments included in the portfolio. Investors create the factor that losses from investments in one direction can be compensated by gains in the other direction. In other words, the important issue is not the behavior of a single investment, but the movement of the crown of profit and risk of the entire portfolio. A single investment considered as part of a portfolio is less risky than when it is considered in isolation. The greatest contribution to the creation of the theory of investment portfolio was made by the American scientist G. Markowitz and W. Sharn, who received the Nobel prize for his achievement in this field in 1990.

The expected return of the portfolio is determined by the formula: (1):

$$Rp = R1\ L1 + R\ 2L2 + \ldots + Rn\ Ln \qquad (7.11)$$

where Rp is the portfolio return of the investment;

Ri - return on i-th investment;

Li – share of investments in i-th enterprise (share);

$$\sum_{i=1}^{n} Li = 1$$

where n is the number of investments.

However, the task of forming a portfolio of investments (shares) is to take into account not only the values of profitability , but also the degree of risk included in the portfolio of shares (investments).

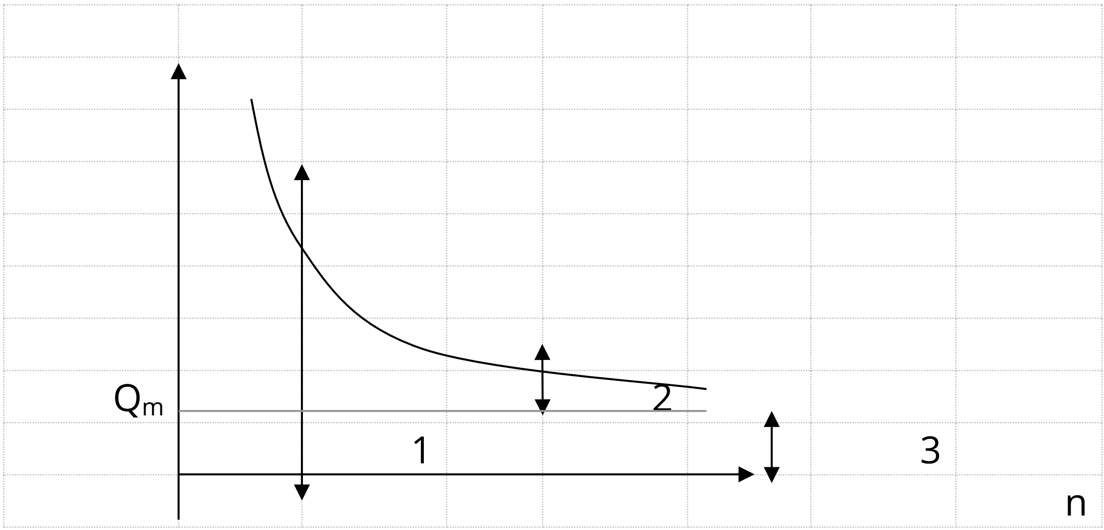
The degree of risk can be measured using a standard deviation. Consider the investment in the shares of enterprises. Then the degree of risk of investment in the shares of a particular enterprise will be assessed using the B-coefficient. Analyzing the behavior of shares in the market

Sharpe came to the conclusion that it is not necessary to determine the covariance of each share with each other (Markowitz model). It is enough to establish how each share interacts with the entire market. Stock indices can be used as a market indicator.

Most stocks tend to rise in price when the economy grows, and fall in price when the economy recedes.

Consider how portfolio risk is reduced if the number of shares listed on the new York stock exchange is approximately 28% . The average portfolio made up of two randomly selected stocks will have a smaller standard deviation of about 25%. If the number of shares in the portfolio is increased to 10, the risk of such a portfolio is reduced to about 18% [5].

The chart shows that the portfolio risk tends to decrease and approaches some margin as the size of the portfolio increases. A portfolio consisting of all shares, which is commonly called a market portfolio, should have a standard deviation of about 15.1%.



1 - General risk;
2 - specific risk;
3 - market risk;
n – number of shares (investments).

Fig. 7.8. Portfolio diversification and risk

Thus, half of the risk inherent in an average individual share can be eliminated if the shares are in a portfolio of 40 or more shares (investments). Nevertheless, some risk always remains, no matter how widely the portfolio is diversified.

Thus, the part of stock risk that can be eliminated by diversifying the shares in the portfolio is called diversified risk (synonyms: non-systematic, specific, individual); the part of risk that cannot be excluded is called non-diversified risk (synonyms: systematic, market). Specific corporate risk is associated with such phenomena as changes in legislation, strikes, successful or unsuccessful marketing program, conclusion or loss of important contracts and other events that have consequences for a particular company (enterprise). The impact of such events on the equity portfolio can be eliminated by diversifying the portfolio. In this case, adverse events in one firm will be overlapped by favorable developments in another firm.

It is essential that a significant part of the risk of any single stock can be eliminated through diversification.

Market risk is caused by the presence of factors that affect all enterprises (firms). Such factors include war, inflation, warehouse production, interest rate hikes, etc. Since such factors affect most firms in one direction, market or systematic risk cannot be eliminated through diversification.

The risk that remains after portfolio diversification is the risk inherent in the market as a whole, or market risk. Therefore, the risk of an individual stock can be measured by the extent to which the stock tends to move up or down with the market.

The tendency of shares to «move» together with the whole market is measured by the β-coefficient, which characterizes the shift of its variability in relation to the «average share», which is considered as a share seeking to move synchronously with the entire stock market. By definition, such action will have β-coefficient equal to 1 ($\beta = 1$). This means that if the profitability of the market as a whole increases by 15%, the yield of the average share increases to the same extent, and Vice versa when falling – falls. A portfolio of shares with β-coefficient equal to one will have the same degree of risk as the whole market. For shares with β-coefficient equal to 0.5 ($\beta = 0.5$), the yield will rise or fall half that of the entire market compared to the portfolio having $\beta = 1$. But at the same time, if the share has $\beta = 2$, then its mobility is twice that of the average share, but the risk of such a share will be twice as high (twice as risky) than the portfolio of the «average share» (with $\beta = 1$).

Suppose that there are three blocks of shares whose returns for three years are presented in table 7.7. [2, p. 383].

Table 7.7. Dynamics of return on shares A, B, C and market portfolio

Year	Yield (%)			
	A	B	C	Market portfolio
T	15	15	15	15
t+1	-20	0	-10	-10
t+2	30	21	26	26

The yield of all three stocks changes in one direction, but at different rates.

In (t+1)-m year, the yield of the market portfolio went down and became negative (- 10%), the yield of shares Fell to zero, and the yield of shares A and C decreased by 20% and 10%, respectively.

In (t+2)-m year, the yield on share C is in full accordance with the market portfolio, while on share B it increased to a lesser extent, and on share A to a greater extent.

In the US, such well-known companies as Merrill Lynch and Value Line calculate β-coefficients for at least hundreds of companies. For most shares there is $0.5 < \beta < 1.5$.

If the β-coefficient of a share is higher than its market average ($\beta = 1$), and this share is added to the portfolio with $\beta = 1$, then the β-coefficient of the portfolio will increase, and the risk of the portfolio will increase accordingly. On the contrary, if a share with $\beta < 1$ is added to the portfolio in $\beta = 1$, the beta and the risk of the portfolio will decrease. Thus, since the beta of the stock shows the contribution of the stock to the portfolio risk, this ratio can be considered a measure of the stock risk.

The value of β-coefficient can be estimated by the least squares method. If the yield of the stock is presented in the form of dependence:

$$R_i = \gamma_i + \beta_i * R_m \tag{7.12}$$

where:

R_i = yield of the i – th share;

β = β-coefficient of the i – th share;

R_m = profitability of the market portfolio of shares (average share).

The values of ßi and γi can be estimated by the formula (3), (4) [53, c. 87;].

$$\beta_i = \frac{\sum_{i=1}^{K} R_{ij} \sum_{i=1}^{K} R_{mj} - K \sum_{j=1}^{K} R_{ij} R_{mj}}{(\sum_{j=1}^{K} R_{mj})^2 - K \sum_{j=1}^{K} R_{mj}^2} \qquad (7.13)$$

$$\gamma_i = \frac{\sum_{j=1}^{K} R_{mj} \sum_{j=1}^{K} R_{ij} R_{mj} - \sum_{j=1}^{K} R_{ij} \sum_{j=1}^{K} R_{mj}^2}{(\sum_{j=1}^{K} R_{mj})^2 - K \sum_{j=1}^{K} R_{mj}^2} \qquad (7.14)$$

where R_{mj} - return on market portfolio (average share) in year j;

K – number of periods (years) of observations.

Example. Let there be data for five years on shares A and B presented in the table (7.8)

Table 7.8. Statistics of the dynamics of the stock and

Year	**Yield (%)**		
	A	**B**	**R_m**
T	35	25	20
t+1	-25	-15	-7
t+2	14	7	8
t+3	7	4	10
t+4	38	20	27
Average	13,8	8,2	11,6

Solasno formulas (3) and (4) have

for action A:

$$\beta_A = \frac{69 * 58 - 5 * 2083}{58^2 - 5 * 1342} = 1{,}92$$

$$\gamma_A = \frac{58 * 2083 - 69 * 1342}{58^2 - 5 * 1342} = - 8{,}43$$

$R_A = - 8{,}43 + 1{,}92 * R_m$

<u>for action In:</u>

$$\beta_B = \frac{58 * 41 - 5 * 1241}{58^2 - 5 * 1342} = 1{,}14$$

$$\gamma_B = \frac{58 * 1241 - 41 * 1342}{58^2 - 5 * 1342} = - 5{,}07$$

$R_B = - 5{,}07 + 1{,}14 * R_m$

The regression lines of stocks A and B are shown in figures 7.9 and 7.10.

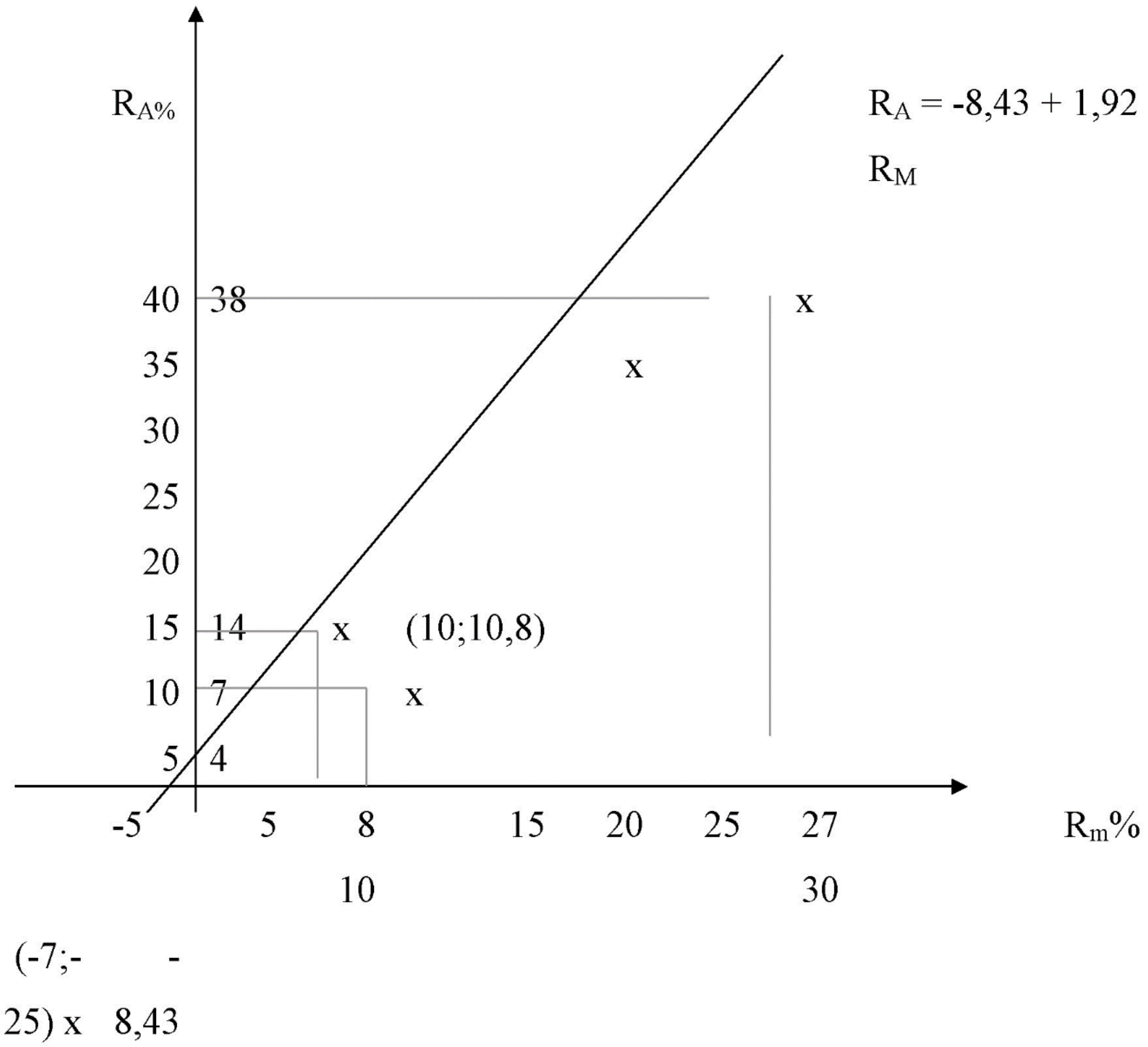


Fig. 7.9. Chart of return on equity stake A.

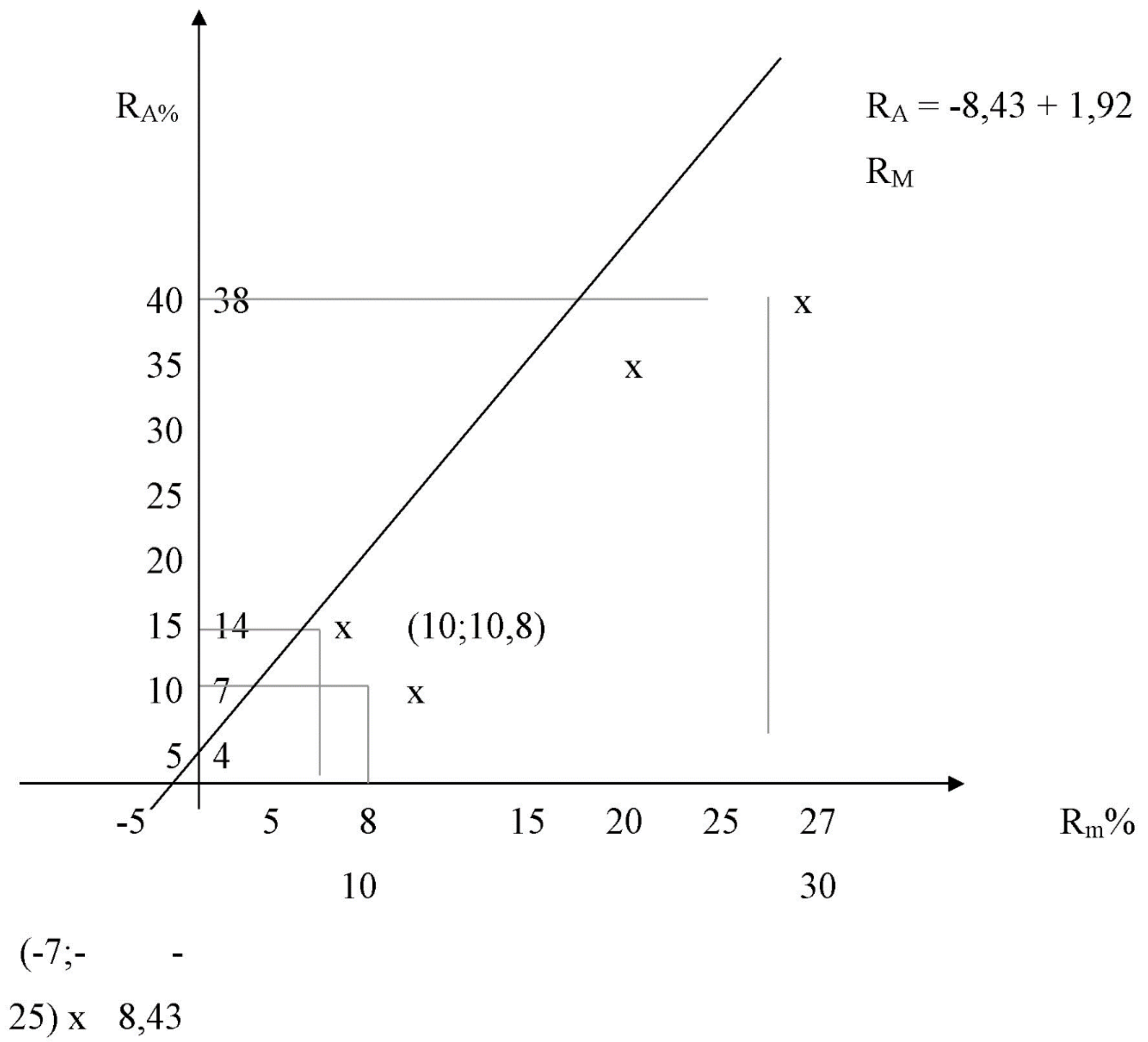


Fig. 7.10. Chart of the return on the block of shares B.

For a block of shares β-coefficient is calculated by the formula:

$$\beta_p = \Sigma \alpha_i * \beta_i \qquad (7.15)$$

where:

β_i = β- the factor of i th stock;

α_i = share of investments in i – th block of shares.

β_p = β- the ratio of the portfolio.

n – number of investments (types of shares).

For example, a company invests 50 mil. RUB four stakes in equal shares (12,2 mil. RUB per share package, α_i = 0,25). If each share has a β = 0.9, then β-coefficient of the portfolio will be equal to 0.9.β_p = 0,9 * 0,25 + 0,9 * 0,25 + 0,9 * 0,25 + 0,9 * 0,25 = 0,9

Such a portfolio will be less risky than the entire stock market and will experience less fluctuation in the yield and value of the portfolio compared to the market.

Let's imagine that one of the blocks of shares is replaced by a block of shares with β-coefficient equal to 2 ($\beta = 2$), then the portfolio risk will increase and its β-coefficient will increase.

$\beta_p = 0,9 * 0,25 + 0,9 * 0,25 + 0,9 * 0,25 + 2 * 0,25 = 1,175$

Thus, portfolio risk can be reduced by including shares with a low β-coefficient in the portfolio.

The investor, assuming market risk, even if he invests in a peacefully diversified portfolio, expects a certain premium, which can be determined as follows:

$$PP = R_m - R_o \tag{7.16}$$

where:

PR – market risk premium;

R_m – profitability of the market portfolio, that is, the portfolio consisting of all shares (the yield of the «average share» with $\beta = 1.0$);

R_o – profitability of risk-free investments (usually for the purposes of economic analysis. To include a risk-free investment in government bonds).

The risk premium on the i – th share is determined by the formula:

$$PP_i = (R_m - R_o) * \beta_i \tag{7.17}$$

If in the estimated period of time the yield on government bonds (risk-free rate) is Ro = 6% per annum, and the average yield on the entire market R_m = 9%, then the market risk premium will be:

$PP_i = (9-6) * 1 = 3\%$

If we know that for the i – th share $\beta = 2$, the risk premium for this share will be:

$PP_i = (9-6) * 2 = 6\%$

If you know the values of R_m, R_o and β, then to find the required yield of the i – th share, you can use the line of the securities market, the equation of which has the form [1 p. 389]:

$$R_i = PP_i + R_o = R_o + (R_m - R_o) * \beta_i \tag{7.18}$$

The share referred to above should have the following yield:

$R_o = 6 + (9 - 6) * 2 = 12\%$

The above share should have the following yield:

$R_j = 6 + (9 - 6) * 0,6 = 7,8\%$

The average share with $\beta = 1$ should have the same required yield as the entire market portfolio:

$R_a = 6 + (9 - 6) * 1 = 9\%$

Figure 7.11 shows the chart of the securities market line.

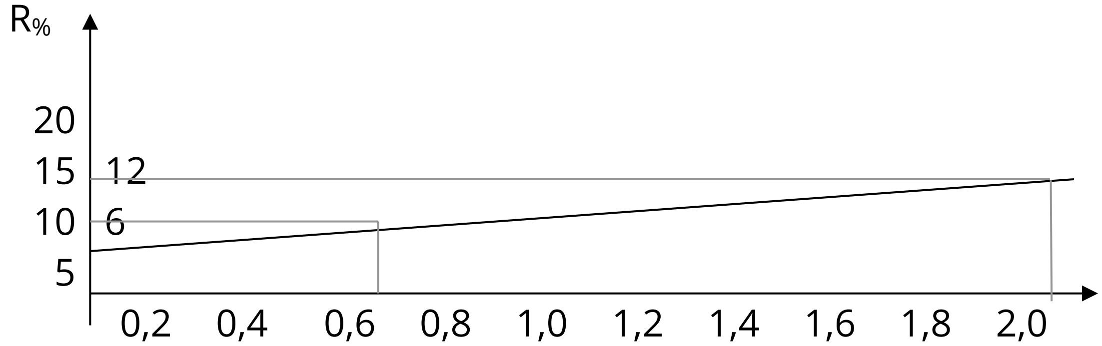


Fig. 7.11. Securities market line

The slope of the securities market line reflects the degree of investment risk avoidance or risk aversion. The higher the degree (level) of risk avoidance, the steeper the slope of the line relative to the horizontal axis, the higher the risk premium and the higher the required return on the stock.

If there were no risk avoidance, there would be no risk premium and the line of the securities market would be horizontal. Over time, the position of the securities market may change due to changes in interest rates, the degree (level) of risk avoidance by investors and changes in β-coefficients of individual shares.

Model for determining the optimal diversified portfolio of investments of the insurer taking into account risk.

The company has free reserves that it wants to invest in securities. There are n blocks of shares on the securities market. Yield of the i – th share package R_i, β- coefficient β_i.

We formulate the optimization criterion of the investment portfolio in the form of minimizing the risk of the entire investment portfolio [54, 57]:

$$\beta_p = \Sigma\, \beta_i * \alpha_i \rightarrow \min \tag{7.19}$$

With restrictions: the Yield of the entire investment portfolio must be at least a specified value (you can take the value of the yield of the real portfolio of shares R_m).

$$\Sigma\, R_i * \alpha_i >= R_m \tag{7.20}$$

The condition must be met:

$$\sum_{i=1}^{n} \alpha_i = 1 \tag{7.21}$$

Table 7.9 shows data on the three investments in the shares of A, b, C. the Volume of investments in absolute value 13728,2 thousand RUB is Required to determine the amount of investment in each of the stakes.

Table 7.9. Data on blocks of shares A, B, C

№ p/p	Investment object	β- coefficient	Yield (%)
1	A	0,4	10
2	B	0,9	15
3	C	1,5	20

According to formulas (9) – (11) we have:

$0{,}4\ \alpha_1 + 0{,}9\ \alpha_2 + 1{,}5\ \alpha_3 \rightarrow \min$

$10\ \alpha_1 + 15\ \alpha_2 + 20\ \alpha_3 \geq 17$

$\alpha_1 + \alpha_2 + \alpha_3 = 1$

The solution of this problem of linear programming has the form:

$\alpha_1 = 0;\ \alpha_2 = 0{,}6;\ \alpha_3 = 0{,}4$

If the volume of investments is equal to 13728,2 thousand RUB, the amount of investments the following:

In object A UA = 137 28,2 * 0, = 0 thousand rubles.

The object UA = 137 28,2 * 0,6 = 8236,92 thousand RUB

The object UA = 137 28,2 * 0,4 = 5491,28 thousand RUB

8. Analytical service as a «think tank» of the organization of advanced management of intensification of activity of the enterprises

8.1. Methodical bases of advanced management

Advanced management (advanced management) - are methods, techniques to eliminate or prevent adverse events or uncertainties faced by managers, as well as the development of normative and methodological materials for the organization of management in the event of these adverse events. For example, in the management of nuclear power plants painted all the emergency situations that may arise and for each situation painted the actions of each employee to prevent it, or his actions in case of its occurrence. Within the framework of civil defense, and emergency situations (situations), the actions of management bodies on coordinated interaction in case of emergency situations and relevant exercises, trainings with simulation of these emergency circumstances are described [39].

Enterprises can also fall into emergency situations (for example, default 1998.) Emergency States can be both macroeconomic level (such as default, crisis of the banking system, etc.) and microeconomic level (such as a natural disaster, the refusal of the supplier of the contractual terms of delivery, loss of consumer, etc.). Therefore, the analytical service of the enterprise should develop a set of regulatory and methodological materials for the organization of management, in the event of these emergencies. Advanced management is an integral part of crisis management, which has been developing in Russia since 1998.

From our point of view, advanced management and crisis management are synonymous. The goals of advanced management and crisis management are identical, namely , the development of recommendations of methods, methods of measures to eliminate or prevent undesirable phenomena (emergency conditions) or uncertainties and (or) the organization of management in case of their occurrence while minimizing losses for the enterprise.

Tasks of advanced management:

– identification of uncertainties,

– emergencies, adverse events in the implementation of the objectives of the company;

– development of methods of analysis of possible situations in the event of adverse events or uncertainties;

– development of methods of decision-making under uncertainty or adverse events;

– development of control scenarios in case of adverse events or uncertainties;

– development of methods for assessing the economic efficiency of the implementation of advanced management procedures;

Advanced management differs from strategic management in that if strategic management determines the organization to achieve strategic goals, the advanced management determines the organization of the implementation of these goals in the event of unforeseen and undesirable events or uncertainties (see table 8.1.)

Table 8.1. Distinctive features of strategic and advanced management.

No. p/n	Sign of comparison	Strategic management	Anticipatory management
1	Goals and reliability of their achievement	Quite clearly defined with high reliability of their implementation, close to one	Fuzzy definition of goals, consequences with low reliability of their implementation
2	The degree of implementation of measures	As a rule, all activities are implemented to achieve the goals	Implemented in the event of adverse events or to prevent them in the event of trends in their occurrence
3	Factoring in	As a rule, factors are taken into account, the reliability of which is very high	All factors, both reliable and unlikely, are taken into account
4	Availability of scenarios	Not obligatory	Necessarily

Thus, advanced management, we can say, is an additional «tool» in achieving strategic goals. The same can be said about the difference between advanced and operational management. If the activities, functions, tasks of operational management take place to be implemented, the activities, tasks of advanced management can be implemented only in the event of adverse events or uncertainties. But these activities, management tasks in the event of an undesirable phenomenon or uncertainty should be designed in advance, regulated, justified and optimized. The process of advanced management is shown in Fig. 8.1.

Examples of diagnostic economic analysis of economic activity of the enterprise were considered in Chapter 6 on the example of matrix analysis of economic activity. Paragraph 8.2 will address the methodological foundations of cause-and-effect analysis.

Let us stop at the stage of the process of analysis of the management work plan presented in figure 5.1. This stage has three main objectives:

1. Рот8енСIальные to identify problems by answering the question: «what can go wrong during the implementation of the plan?», and on this basis to provide for actions to reduce the likelihood of undesirable consequences of the relevant problems;

2. Identify potential opportunities by answering the question: «in what aspects can things go better than expected in the implementation of

this plan (scenario)?», and on this basis to provide for actions to increase the likelihood and impact of opportunities on the whole situation;

3. To evaluate the economic effect and efficiency of the development of the procedure of advanced management based on a comparison of results and costs in the operation of advanced management and in its absence.

The plan analysis process consists of the following steps:

1. A summary of the plan (scenario), including a description of the desired outcomes;
2. The enumeration and consideration of the sections of the plan and identification of critical (unwanted) moments;
3. Identification of potential problems, uncertainties, opportunities;
4. Identify the most likely causes of major potential problems, uncertainties and opportunities;
5. Development of preventive or promotional activities;
6. Development of insurance measures;
7. Provision of conditions for the introduction of insurance measures;
8. Evaluation of the effectiveness of the development of preventive, facilitating, and hedging measures.

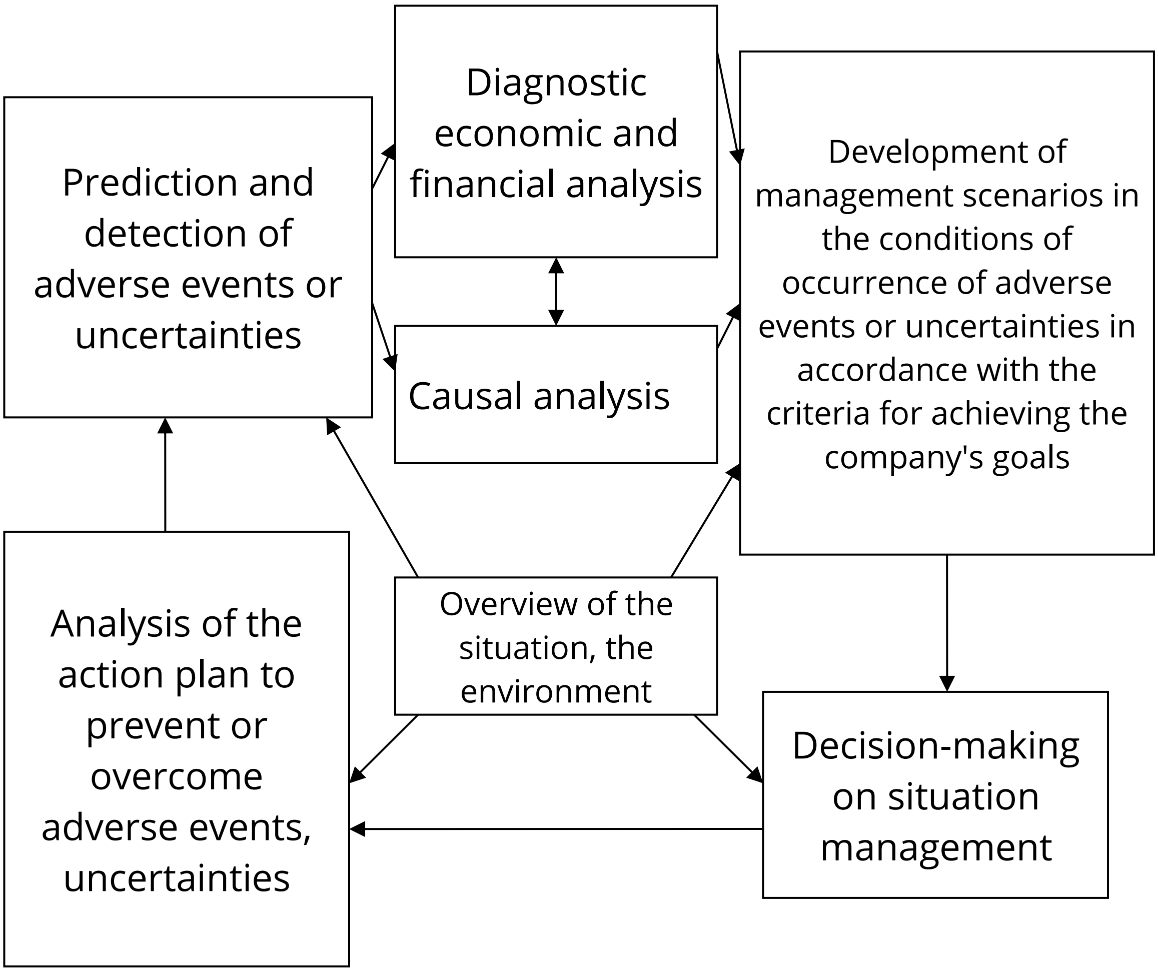


Fig. 8.1. The relationship of advanced management processes

Phase 1. Describe the plan you need 1-2 pages. In this case, it is necessary to include in the description of the desired end results.

Phase 2. At this stage, it is necessary to answer the question: «how to implement the plan?». The plan can be a preliminary list of activities, and a complex, multi-functional network schedule. But simple and complex plans are similar in one respect. They are a list of actions that must be carried out to achieve a specific end result.

Each plan should contain at least the following three elements: 1. A specific list of actions in chronological order – «What should happen?»; 2. Distribution of responsibility – «Who should do it?»; 3. The deadline is «When should it be done?».

The Manager considers the plan and selects those sections that require special attention.

Consider the example in table 8.2. []. From table 8.2. it can be seen that only two sections of the plan really require further analysis. In that time, the other stages require only regular monitoring, these two require special analysis.

Phase 2. Listing and reviewing sections of the plan and identifying critical points.

Table 8.2. The main stages of moving the office to a new room.

	Date	responsible executor	Critical moment
1	2	3	4
1.Organization of telephone installation	25.12.	А	
2.Notification of suppliers, consumers about new address and phone numbers	01.01.	Б	
3.The distribution of new working spaces between the divisions of the company	10.01.	**С**	It can be a delicate matter
4.Transfer of archives, documents and equipment to the new premises	15.01.	Д	Can have serious consequences if performed poorly

Phase 3. At this stage, potential consequences that may occur are identified. There can be three types of consequences:

1) Worse than expected (negative deviation);

2) Better than expected (positive deviation);

3) What was expected (norm or standard).

Step 4. The purpose of this phase is to lay the Foundation for pre-emptive action. If the Manager is able to identify some of the likely causes of potential consequences, it will be easier to plan actions to control these consequences.

When performing the fourth stage, you need to take each identified potential problem and opportunity and ask yourself: «What could cause this consequence?». Then it is necessary to make the list of the reasons for the subsequent use at development of necessary actions. It is important to make a complete list of possible causes, and not limited to the indication of only one reason.

Step 5. At this stage, managers need to be proactive, taking some action on potential consequences and thus influencing the future. Having predicted that «something» should happen and having also predicted its possible cause, it is now necessary to build actions on the basis of these indications. Two types of actions are possible here: those aimed at causes and those aimed at consequences.

If a certain cause can lead to a certain effect, then you need to think about what effect should be exerted on this cause and whether it is necessary at all. If the consequence is undesirable (potential problem), the action should be aimed at reducing the occurrence of this cause. We call it a «preventative measure.» If, on the contrary, the potential event is favorable, it is desirable to increase the probability of this consequence. The action taken in this case is called a «facilitating action». Preventive and promotional activities are included as part of the initial management plan.

Phase 6. By means of preventive actions try to influence reduction of probability of occurrence of a problem. However, it can occur; and it is impossible to guarantee its complete elimination. For this reason, experienced managers usually develop «safety measures» to neutralize or minimize the consequences of potential problems and in case these problems still arise. The development of these activities is the answer to the question: «If this problem arises, what will I do?».

Phase 7. The management plan should provide a mechanism by which the Manager (Manager) can put into effect the insurance measures. In his absence, any insurance may be ineffective – or a favorable opportunity is missed, or violations will go too far. An alarm signal is a pre-determined sign by which a safety measure is activated. Each planned safety action should be provided with an alarm. Without this, neither the end result nor the timeliness of such action can be guaranteed. An alarm is the occurrence or non-occurrence of certain events at a prescribed time. For example, when managing cash flow, the alarm is the achievement of cash for the level of the lower warning border, which means that you need to implement the event on the sale of securities of the company.

Phase 8. At this stage, we consider both qualitative and quantitative assessment of the development of preventive, facilitating, hedging measures. At the same time, the possible damage is estimated, if these measures are not, the costs of developing these measures and their implementation, the positive effect or reduction, prevention of damage in the event of the implementation of these measures. If, for example, one of the consequences may be the bankruptcy of the company in the absence of preventive, facilitating or hedging the management of the company will make every effort to develop an action plan to prevent the bankruptcy of the company.

The review of the situation of the environment assumes the purpose of choosing the right tasks, solving them in a certain order and by appropriate methods. The situation and environment review process consists of the following steps:

1) Identification and consideration of tasks (and those consequences that need to be controlled);

2) Separation and clarification of tasks (if necessary) taking into account changes in the elements of the situation and environmental factors;

3) Priority setting (relevance, urgency, trends));

4) Determination of the main point of analysis.

At the first stage, determine the scope of responsibility of managers for the consequences of the situation that require attention and action. A situation is an event, something that has happened, it always has a time frame.

The task is the formulation of the requirement for the Manager to pay attention or take action on a specific situation. Thus, managers transform the situation into a task by realizing the need for some action. They try to identify the actual or potential impact of the situation on their area of responsibility.

At the second stage there is a dismemberment of the identified problem into component parts so that you do not have to spend time searching for a single magical solution that would solve all the problems at once.

At the third stage, making a list of tasks and making sure that they are set in such a form and at such a level of specificity that allows the Manager to select the most important priority ones.

Typical criteria for the importance of tasks include: significance-seriousness, urgency-timing, trend, potential impact, assessment of time to solve.

The fourth step verifies that the type of analytical process that should be used for each task is correct.

Thus, the process of reviewing the situation is a filter, a means of expressing uncertainty. When reviewing the situation, the problems are not solved, but only a list of solvable problems in order of their importance, which are then classified according to the principle of the final result.

Let's consider examples of application of elements of advanced management at the solution of the problems arising at managers in the conditions of inflation. These examples are related to financial decision-making in conditions of inflationary depreciation of money, regulation of wages in conditions of inflation, pricing policy, cash flow management. In all cases, there is uncertainty in the form of future inflation trends, which may lead to undesirable phenomena. So, if you do not provide for proactive measures in the field of regulation of wages in conditions of inflation, it can lead to discontent of workers, to production stops, strikes, which in turn will lead to significant losses and losses.

8.2. Methodological basis of cause-and-effect analysis in the framework of advanced management

When diagnosing problems of entrepreneurship and management, analytical managers are faced with a whole chain of causes and consequences. The Manager must decide how deep to go in search of the root (or primary) cause. It is necessary to remember first of all about the purpose of diagnosis. Tracing the cause in reverse order to the original cause may not do much good. The task of the analyst is to identify the main reason for which the customer (enterprise, client) is able to do something. The analyst needs to propose solutions relating to fundamental reasons, not stating anything. The analyst and managers of the enterprise should have a single methodological basis of cause-and-effect analysis in order to avoid mutual misunderstanding and inconsistency of the analysis procedures.

Decision-making by analysts and managers is based on the fight against the laws of cause and effect. If the consequences are undesirable and cannot be easily explained, a causal analysis is necessary. But the implementation of cause-and-effect analysis should be done so as not to conflict with the objectives of the company's management.

In carrying out cause - and-effect analysis, it is useful to look at the problem as an iceberg, what can be seen is only a hint of the problem as a whole. It is only through rational analysis that the analyst can determine its true extent.

One of the mistakes of managers and analysts is confusion with symptoms, causes and consequences. Symptoms are the obvious aspects of the problem that draw attention to it. Symptoms never explain the problem, they are only its manifestations. The reasons are incentives, motivations, objective factors that make something happen and that can be tested. They are the bases of the observed consequences. Consequences - what are the consequences of the problem. The consequences give rise to the need to solve the problem. For example, the symptom is an increase in staff turnover in the division, the reason is unsatisfactory conditions and organization of production and labor, the consequence is a decrease in productivity, failure to fulfill the planned task.

Symptoms are useful because they show the first signs of a problem. For example, if the organization begins to happen absenteeism, conflicts, failure to comply with orders, the competent Manager will understand that all this can be symptoms of deeper problems. At the same time, the effect on the symptoms is effective only if the Manager or analyst does not deceive himself, believing that he solves the problem.

The analyst must establish a cause-and-effect chain, that is, a hierarchy of causes and effects that leads back (from effect to cause) to the point at which actions can be taken to eliminate the problem.

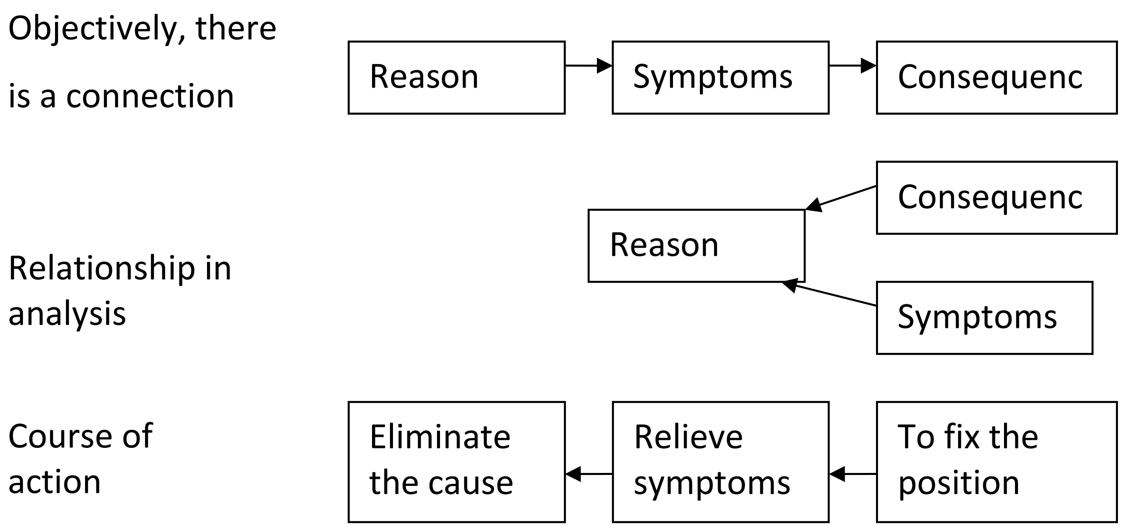


Fig. 8.2. Cause – symptoms - effect relationship

The causal analysis procedure is as follows for each step:

Step 1 Formulation of the problem. The object, division, the person creating difficulties and consequences which need to be eliminated are revealed.

Step 2 Description of the problem. Facts can be gathered by asking questions on four parameters: What? Where? When? How much? At this stage, both the observed object with deviations (defects) and the comparative object (similar to the observed) are characterized. Without comparison, the main causal factor cannot be identified. Therefore, in causal analysis, the description should include comparative data. Their function is more distinct separation of the “investigation” with the purpose of transition to the stage of identifying causes.

When collecting comparative facts it is necessary to answer the following questions:

What? What object one would expect the deviation (defect), but it hasn't been discovered? What kind of deviation could be expected, but it was not found?

Where? Where else geographically defect (deviation) could be observed, but not observed? Where on object it would be possible to expect emergence of defect (deviation), but it didn't appear?

When? When the first time you could notice a deviation (defect), but it was not noticed (life cycle, hour, calendar time)? What could be the sequence of events?

How much? To what extent could the object be defective, but it was not? How many objects could have a defect, but it is not received? What could be the trend?

Who? Who owns the problem, who is affected by the problem? What people (managers) are most interested in solving this problem?

Step 3 Identification of differences between observed and comparative objects.

The comparison should be made in order to highlight the unique characteristics and features, i.e. the distinctive features of the problem. For example, if one of six identical machines works poorly, the cause of the problem may be something specific only to this machine. If a poorly functioning machine does not have any distinctive features, then all the machines could deteriorate. The key to the solution lies in the ability to highlight some specific differences that cause the problem.

Step 4 Identification of changes. Using the concept of change, you can write the most important changes related to the observed facts. The challenge is to consider each previously identified difference individually and to highlight all the changes associated with this characteristic. It is necessary to answer the question: “What has changed in connection with these differences?”

Step 5 Identification and verification of causes. Change analysis can help to identify likely causes. When checking the reasons it is necessary to answer the question: “How does this reason explain the differences between the observed and comparative facts?”.

Step 6 Confirm the most likely cause. At this stage, there may be a discussion of the cause with the appropriate staff, obtaining the missing data.

The method of cause-and-effect analysis is applicable to solving the problems of human relations. The causal analysis procedure can also be described in stages.

Phase 1. Problem statement. The statement of deviations in the work provides the basis for the subsequent determination of the boundaries of the problem. To verify the problem statement, you should ask the following questions:

1. Are Your requirements specific and measurable. (On what basis will You judge their implementation? What performance indicators can be used?)

2. Are the requirements realistic? (Has anyone been able to do them? Does the person have the skills and resources to carry them out?)

3. Do all those concerned understand the requirements in the same way?

4. Are employees aware of the actual level of efficiency of their work? If they know about the presence of abnormalities?

Phase 2. Problem description. Only observable behavior (observable facts) should be used to describe the problem. The procedure for asking questions is shown in table 8.3. Particular attention is given to the importance of collecting comparative facts in order to specifically identify groups or individuals that can be compared.

Phase 3. Identification of differences. Individuals, groups of people are very different from each other. It is common knowledge that there are mental and physical differences. But the differences are primarily to be found in the working environment, as the Manager is acting on it.

Step 4. Change enumeration. Changing the external environment may not immediately affect people's behavior. They do not always react immediately. It is therefore necessary to extend the time frame covered by cause-and-effect analysis.

Step 5. Establishing probable causes. At this stage, it is necessary to pay attention to changes in the external environment, always consider the results of work and behavior of people. Often trying to “solve” human problems, managing in search of reasons (mistakes), often focus on relations, personalities.

Table 8.3. Procedure for raising questions

Phase 2	Observed fact	Comparative facts
1	2	3
Who? Who is the person or group that has the unwanted behavior?		Who could expect similar difficulties, but they are not?
What? What in behavior or work disturbs you?		What other deviations could be expected from this group, but they are not observed?
Where? Where is this behavior seen?		Where else can you expect the same deviation, but it is not?
When? When this behavior was noted for the first time? (specify time, not events) At what stage of the person's work was this behaviour first observed? In what form was this behavior observed?		In what other periods can we expect the same behavior, but it is not observed? When can we expect this difficulty, but it is not observed? What part of the job responsibilities are all right, and could be otherwise? In what form could this behavior manifest itself, but it did not manifest itself?
How much? How often does this behavior occur? What is the trend of the problem?		How often can you expect this behavior to occur, but it is not observed? What trend could be expected?

Phase 6. Verification of probable causes. If the solution of technical and economic problems managers check a lot of different solutions, methods, they risk only time, money. But if they take the same approach to people, they risk losing people. That is why it is so important to check the reasons, to check them against the definition of the problem.

Phase 7. Confirmation of the most probable cause. When determining the most likely cause, it is necessary to consider: “Who should be interviewed?”, “What information should be collected and verified?”, “Where should discussions be held?”, “When is the most appropriate time for this?”, “How many questions to put?”.

In dealing with human problems, it is necessary to be aware of all the consequences of solving these problems and not expect that the establishment of the cause will entail a simple correction of shortcomings.

Cause-and-effect analysis can help not only in correcting deficiencies in the work, but also in finding methods to stimulate higher performance. To do this, it is necessary to establish cases of “positive deviations”, i.e. those periods when the effectiveness of the person (group) exceeded the normative values.

As a result of the causal analysis, the analyst must answer the questions what? Where? When? how much? at all stages 2-6, causal analysis as presented in table 5.4.

Table 8.4 Matrix of responses by stages of cause-and-effect analysis.

Phase 2			Phase 3	Phase 4	Phase 5-6
1			2	3	4
problem description	observed fact	comparative facts	identifying differences	identification of deviations	identification and verification of causes
What? On what object the deviation (defect) is noticed. What exactly is it, etc.					
Where? Where the object with the observed deviations is located geographically. Where on object there was a deviation? Etc.					
When? When the deviation was first noticed. In what sequence was the deviation observed? Etc.					
How much? The scale of the deviation? What is the trend? Etc.					

The final document is a matrix of cause-and-effect dependencies (Fig.8.3.)

This matrix can be obtained through teamwork, under the guidance of an analyst (see 5.3.)

Consequences / Reasons		Simple machine	Long terms of work	High level of work in progress	Deterioration of quality as a result of TRANS-portability	Low output of finished products	Supply disruptions Materia crystals	Excess consumption of materials	
		1	2	3	4	5	6	7	Σ
1	Violations of labour discipline								4
2	Shortage of personnel								3
3	Violation of terms of performance of works								2
4	No material cutting programs								2
5	Violations of technological discipline								3
6	Irrational placement of machines								2
7	Inefficient serialization								3
8	The lack of TPP								3
9	poor quality technical requirements								2

10	Lack of measuring instruments								1
11	Disadvantages of incentive system								3
12	The shortcomings of the system demand planning								3
13	Deficiencies in the regulatory framework of inventories								2
14	No optimal production program								3
15	The shortcomings of the system of orders,								2
	Σ	4	6	4	3	8	5	8	38

Fig. 8.3. Matrix of cause-and-effect relationships.

8.3. Analytical service as a moderator of collective search and decision-making

The analytical service as the «headquarters» of organizational changes should be located, first of all, in order to overcome structural barriers in improving production efficiency, as close as possible to the highest level of enterprise management, to enter into the «horizontal structure» of this level. Thus, the following goals are achieved:

– perception, understanding of innovative ideas by the staff of the enterprise and their realization are carried out in the conditions well stimulating members of collective on their decision;

– the whole process of reorganization, from the moment of emergence of an innovative idea to its full implementation, is managed from a single center;

– the goals, concept and methods of solving problems to improve the efficiency of production are not subject to the deforming influence of a certain level (unit) of management, taking into account, first of all, its specific interests. Tasks to improve the efficiency of production can not be aimed only at solving the problems of a certain unit. Therefore, the analytical service (service consulting), as already mentioned, must be placed in the management hierarchy closer to the higher management level of enterprises to be flexible in their activities and capable of rapid receipt and processing of information in order to, innovation, innovative proposals for improving the efficiency of production coming from the «lower classes», were widely spread and implemented.

Analytical service should be a battery of» creative imagination of employees, to become its organizing link for the implementation of group methods of search and decision-making.

It should also be noted the following psychological phenomenon. The contradiction between the desire to manifest themselves and the «fear» of responsibility for wrong decisions or additional work «load» on the implementation of the proposed innovative ideas. No wonder they say «the initiative is punishable», «your idea, you implement it», «do not climb across the father in hell», etc.

In a market economy increases the responsibility for decision-making until the bankruptcy of the enterprise. Therefore, especially when making strategic decisions, their adoption is increasingly shifted from one person to a group of persons.

The decision becomes collective, collective. The redistribution of responsibility plays an important role in shifting the choice of a solution to the team: the more people involved in the development of solutions, the smaller the share falls on each.

Responsibility is not the only reason to resort to collective decisions. Group method of decision-making in some cases is less subjective.

In addition to these advantages, decision-making in the team also provides opportunities to identify more alternatives, comprehensively assess the numerous options, choose the best ones and eliminate the weak ones.

The methods of collective decision-making include:

– the method of «brainstorming»;
– meeting;
– business game;
– situation analysis;
– round table;
– expert methods (Delphi method, Pattern, etc.));
– analytical methods (retrospective method, method of comparative morphology, etc.));
– systematic methods (test method, loss map method, etc.));
– combination of methods (Lado model, situational combinations, monographic method, etc.)) []

The method of «brainstorming» appeared in the 30s as a way of collective production of new ideas.

History is rich with examples of sometimes quite complex issues that defy solution by conventional methods, unexpectedly found an original solution in terms of brainstorming.

The scope of this method is quite wide – from scientific, technical and economic problems to social, psychological, pedagogical and even ethnic situations.

In General, the brainstorming procedure consists of the following steps:

1. Informing about the topic of the research to be done; justification of the task to find a solution; definition of the rules and conditions of collective work. Formation of decision-making criteria, formation of an expert group that will select and evaluate the proposed solutions (see Fig. 5.4.).

2. «Brainstorming» - problem solving, ideas, solutions.

3. Selection and evaluation of the best solutions and ideas.

4. Evaluation of results and report on the results of «brainstorming»

The effectiveness of «brainstorming» depends on compliance with the following rules:

During the session («brainstorming») there are no bosses, no subordinates, no newcomers, no veterans – there is a leader and participants: no one can claim a special role or privileges; advantages are not even the authorship of brilliant ideas.

The participants in the session should not seek to demonstrate their knowledge and skills, but rather to address the problem raised.

«Brain attack» requires complete emancipation of thought and freedom of imagination, the more unexpected and unusual the idea, the more reason to expect success.

No matter how fantastic and incredible the idea put forward by any of the participants of the session, it should be met with approval.

Mutual criticisms and interim assessments are strictly prohibited – they interfere with the construction and formation of new ideas.

It is necessary to avoid the idea that the problem under discussion can be solved only in known ways.

No judgment is allowed that this problem is not solvable at all.

It is allowed to ask questions to colleagues in order to clarify and develop their ideas; the question should not contain an assessment or Your attitude to the idea.

Do not contact the head of «brainstorming» for support before the end of the session, he has no right to a public assessment.

If the problem as a whole can not be solved, try to divide it into its constituent elements and think about each of them separately.

Try to remember interesting and unexpected solutions to similar problems in other areas.

Try to remember interesting and unexpected solutions to similar problems in other areas.

Do not hesitate to change the parameters in the problem – to reduce or increase the cost, time, size, etc.

Five minutes before brainstorming, try to answer the following questions for yourself:

- whether this problem deserves attention;
- what gives its solution;
- who needs it and why;
- what happens if nothing changes;
- what happens if I don't come up with any ideas?

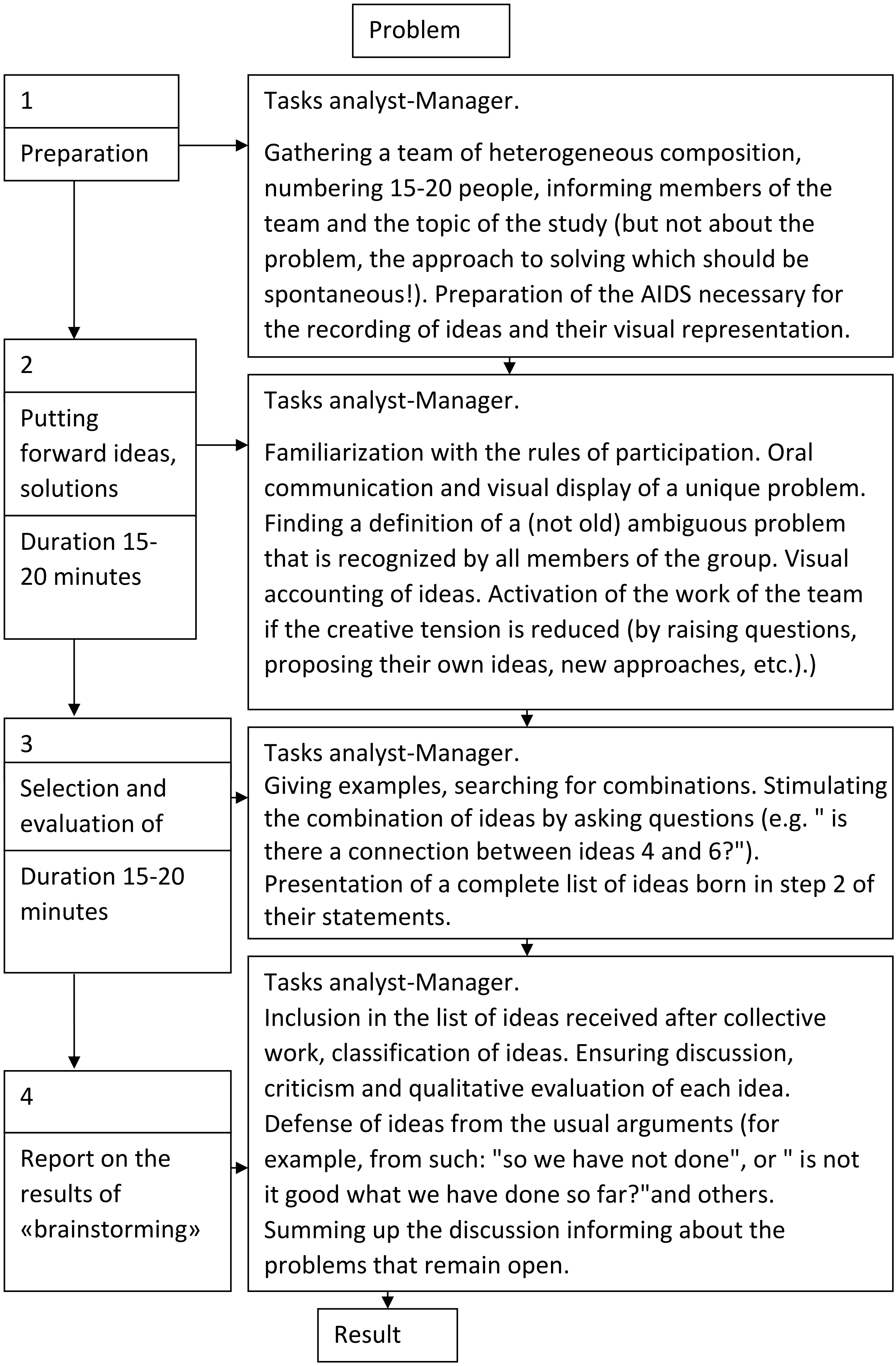


Fig. 8.4. Scheme of implementation of the method of @brain attack»

8.4. Advanced management in the framework of technical re-equipment and automation of production

Modernization and automation of production, introduction of new machines or in General improvement of the material and technical base of production are not yet a guarantee of the expected positive economic results.

Any production system, technology and technique of production has its organizational prerequisites, as well as its implementation can not affect the organizational structure of production and management structure.

An important task of advanced management is to create the prerequisites for technical and economic changes to painlessly «fit» into this economic unit, such material, technical and labor conditions that would contribute to the introduction of technical innovations and increase the efficiency of their impact. Therefore, along with plans for partial reconstruction of the enterprise, plans should be drawn up and rationalization of the organizational structure of production and management structure. Otherwise, the low level of organization of production and management may be «frozen» for a long time, and in the worst case, i.e. when the technical and organizational conditions are «incompatible», the introduction of new equipment and technologies may not give the desired economic results or even lead to a deterioration of economic indicators.

The integration of new technical and technological solutions into the «old» organizational structure of production and management system can create a situation where the technical and technological prerequisites will be poorly adapted to the established organizational conditions of production and management, and the change of the latter «retroactively» will be possible only partially, half-reducing in the end the effectiveness of the introduction of new equipment and technology.

Preventive management in the implementation of mechanization and automation of production, provides for coordinated changes in the organizational structure of production and management system by making optimal use of the potential of technology, production technology and management system and ensure on this basis the implementation of performance indicators, productivity and product quality, inherent in the technical update and reconstruction. This is somewhat more than production planning, production operations, movements, etc. according to the «cost principle», which in the recent past satisfied our needs. This essentially means striving for a systematic approach in solving problems related to the technical renewal of production.

Adaptation of the modern workplace equipped with means of mechanization and automation to the system of this organizational unit is a complex and multifaceted task, the solution of which should also cover the study of whether a new approach requires new solutions:

a) the content and form of links (on the technological chain, on the hierarchical ladder, on information support, etc.);

b) service;

c)environmental protection;

d) labour protection;

e) personnel background;

f) remuneration system;

g) market conditions, etc.

The leading management on modernization, automation and reconstruction of production was carried out by such heterogeneous groups on the structure which are capable to realize thus all professional points of view and requirements. The exchange of information within such a collective will be targeted if the «distorting primacy» of the individual professions «i.e. the preferred attitude towards them) and the hierarchy in the organizational structure are eliminated. This is equivalent to the fact that individual points of view are considered and evaluated exclusively from the position of a single (whole) solved problem.

The implementation of the system principle in advanced management means taking into account all direct, indirect and even secondary links, impacts, influences in the entire area covered by the optimization of production on the one hand, and the selection of such optimization methods that meet the nature of the tasks to be solved and through which it is possible to identify and solve the problems in the future – on the other.

9. The human factor of increase of efficiency of intensity of work of the enterprise

9.1. Organizational factors of efficiency and intensification of labor

Organizational factors effective and labor intensive formulated Harington Emerson [80]. Harrington Emerson (1853-1931) was trained as an engineer in Germany, then worked in the United States. In the book «Twelve principles of productivity» he formulated the principles of the correct organization of both the work of an individual performer and the production process of the enterprise, considered the feasibility of human activity in terms of productivity, proposed a method for achieving maximum management efficiency.

Emerson's main idea is that true productivity always yields maximum results with minimum effort.

Hard work produces great results with the efforts of the abnormal. Stress and performance are not only not the same thing, but things are just the opposite. To work hard is to exert maximum effort. To work productively means to make minimal efforts. The desire known to many of us to execute the plan at any cost is also an attempt to solve an economic problem not at the expense of the rational organization of work, and by avral, command methods of management, coercion of workers. Not, the production should adapt to the controls, says Emerson, and the management should maintain production.

Here are all twelve principles of performance, as they are formulated by the author.

1. Clearly defined production goals and clearly defined personnel tasks. Any goal should contain an indicator of achievement of the goal, resources to achieve the goal and time, time to achieve the goal. For an employee, this is a clearly defined amount of work, the time of execution of this amount of work and the necessary resources to perform this amount of work.

2. Common sense. This does not mean just everyday sharpness, but courage to face the truth: if there are difficulties in the organization of production - it does not bring profit, the produced goods are not sold out on the market - then there are specific reasons that depend primarily on

the organizers and managers. Need to find these reasons and boldly and decisively to eliminate them.

3. Competent advice. It is expedient and profitable to involve specialists in this field - sociologists, psychologists, conflictologists, etc. - in the continuous improvement of the management system.

4. Discipline. Real discipline requires, above all, a clear division of labour: each Manager and executor must be clearly aware of his or her responsibilities; each must be aware of what he or she is responsible for, how and by whom he or she can be encouraged or punished.

5. Fair treatment of staff, expressed in the idea of «better work — better live.» The arbitrariness in respect of the employees shall be excluded.

6. Feedback. It allows you to quickly, reliably and fully take into account and control the actions taken and the products produced. A violation in the feedback leads to failures in the control system.

7. Order and planning of work.

8. Norms and schedules. Good results in work are not associated with an increase, but with a reduction in effort. The reduction of efforts is achieved by knowing and taking into account all the reserves of productivity, the ability to implement them in practice and avoid unnecessary labor costs, loss of time, materials, energy.

9. Normalization of conditions. It is not necessary to adapt a person to a machine, but to create such machines and technologies that would enable a person to produce more and better.

10. Rationing operations. Work must be normalized so that the worker was able to perform the task and earn good money.

11. The written standard of the user. They serve to free the brain of the worker for initiative, invention, creativity.

12. Pay for performance. It is advisable to introduce a system of remuneration, which takes into account both the time spent by the employee and his skills, manifested as his work.

Vanadzite principles of the organization of work proposed by Emerson, served as the basis for the rational organization of labor in industry, and is currently used effectively in management practice.

9.2. Social and psychological working conditions

The socio-psychological group of factors is determined by the composition and characteristics of the enterprise (socio-demographic composition of the staff, the interests of employees, management style in the divisions of the enterprise, etc.). Under the influence of these factors is formed moral and psychological climate in the enterprise, expressed in the level of stability of staff, its cohesion, the nature of the relationship between groups of workers, attitudes, discipline, work activity and creative initiative. Socio-psychological factors do not yet have units of measurement, norms and standards. But sociological research in the form of an oral survey, questionnaires create an objective basis for the creation of their measurement and evaluation.

Interestingly, for members of the surveyed teams reducing the number of brigade coincides with the increasing thrust towards communication among themselves, and informal interpersonal contacts. In this case, business clear contact, contributing to the improvement of the moral health of the team, is replaced by an active non-business. We can assume that in each case the reduction of a certain number of teams, in the team possibly worsening psychosomat.

Consider the typical problems that arose and were resolved in the studied specific situations and recommendations for their solution.

The first problem is to improve the moral health of the collective. This problem can occur in two scenarios.

First, the team members come into various conflicts with each other than harm the working atmosphere, the achievement of a common goal of the team, in the end - work at a given level of productivity. Indicators of psychosomat in this case will be intra-group expansiveness of the levels below medium, the presence of several informal leaders and the isolation of individual members of the team. In the process and as a result of communication there are couples or groups of individuals with objectively incompatible attitudes, views, goals, needs and methods of action in specific situations.

Secondly, the need to improve the moral health of the team is not associated with low rates of expansion and cohesion. In such groups, there is no guarantee that people will always relate their actions and actions to the requirements of morality and the rule of law. Unlike psychosomat in this team is that intra-group expansiveness is manifested only in the orientation on specific criteria that do not coincide with the group-wide goal.

The solution to the problem of improving the moral health of the team in the first case is, first of all, to correctly, in accordance with the characteristics of the team, to choose means of easing tension and to correctly determine the factors of team cohesion.

In the second case, it is necessary to create conditions for the correct orientation of the collective activity for the subordination of individual goals to the General group goal and to increase the strength of intra-collective moral and psychological ties. This can be achieved, inter alia, by restructuring the process chain to reallocate the process between workers. Thus, the interdependencies between individual workplaces are brought into line with the peculiarities of the team.

The second problem is to improve the overall comfort of the social work environment. This task is the next level of improving psychosomat in the workplace. It is very common in the workforce in industrial enterprises. The specific means to address it are diverse. Their effectiveness depends on how well understood the various causes of discomfort. Consider some of them.

The first reason is the irrational nature of the material (economic) connection between team members for a given case. First of all, this applies to the system of material incentives for team members for performance and the system of sanctions for marriage in work, violation of labor discipline or public order. Collective financial responsibility for marriage does not always contribute to team building. More often this negative material connection becomes a reason for the separation of the team.

The second reason is the high turnover under the influence of any reasons not directly related to psychosomatik. For example, there is an outflow of workers «noiseless» professions from noisy shops. In this case, the team as such is unstable in composition.

The third reason is the unfavorable layout of jobs depending on the type of work, on the personality of each member of the team, on the possible and necessary communication of workers in the process of work during the shift. For example, if communication is possible and desirable members of the team, and the layout of jobs prevents this, there is frustration, tension from dissatisfaction in the pursuit of communication and in the end - moral discomfort. Or Vice versa, frequent communication in the process of work interfere, reduce productivity, and the layout of jobs does not contribute to individual concentration, resulting in tension.

To solve this problem, when planning jobs, it is necessary to correctly assess and take into account the measure of the needs of team members in communicating with each other. All these activities are determined by the content of labor in each workplace and the sequence of jobs themselves, which is set by technology.

The third problem is the development of an organic instead of a mechanical system of collective management. It is associated with the correct choice of leadership style of this team in a particular situation.

Sometimes this can lead to the need to replace the head. Evaluation of psychosomat in this case, is complemented by the analysis of the features of the reaction of subordinates to the controlling influence of the ratio of popularity in the collective formal and informal leader.

When solving problems of this type, a certain role can be played by the regulation of the number of micro-teams in the workforce, predetermined by the production technology. The achievement of the goal in solving the problem under consideration is also accompanied by an increase in the level of team cohesion and an improvement in the emotional background in the relationship of group members. The practical implementation of this kind of research and development, as mentioned above, involves the formation of a comprehensive team, whose members - employees of the enterprise and scientific consultants from other institutions. They should be United under both formal and informal agreement on scientific cooperation. The experience of a formal contract with a clear work plan is more productive, especially for promising developments. For example, at the Novosibirsk metallurgical plant. A. M. Kuzmina the composition of the team, the current and future plan of its work were discussed at the technical Council of the plant, which supervised all the work. Current and future work plans were approved by the order of the Director for each specified period.[75].

9.3. Job satisfaction

Although a large number of studies have been accumulated, there are still major shortcomings in the study of job satisfaction. One is the weak connection between the few theories in this field and its dimension. The paradox of this situation is that job satisfaction, being one of the most frequently studied concepts in industrial and organizational psychology, remains one of the most poorly supported in theoretical terms concepts in this area. That is «a pleasant or positive emotional state resulting from evaluating the work or job experience» (Locke, 1976), or «achieving anyone work values in the employment situation as a result of a pleasant emotional state known as job satisfaction» (LockeandHenne, 1986), understood as the essence of job satisfaction. Most definitions of job satisfaction are very similar to those given, although they may differ in conceptualizing what they mean by «achieving someone's work values (work-related values).»[23].

There are three most important parameters of job satisfaction. First, job satisfaction is an emotional response to a work situation.

Second, job satisfaction is often determined by the extent to which work results meet expectations.

Third, some other attitudes are manifested through job satisfaction. Some researchers suggest that there are five parameters of work that most accurately characterize it in terms of the affective reactions that it causes in people. These options are listed below.

Actually work. The degree to which the work provides a person with interesting tasks, opportunities to learn new things, to feel a sense of responsibility for the task.

1. Payment. The amount of remuneration paid for work and how that amount relates to the remuneration received by other members of the organization.
2. Career opportunities. The opportunity to advance through the ranks.
3. Guide. The ability of the Manager to provide both technical and moral support.
4. Colleagues. Degree of technical literacy of colleagues and level of their social support.

We note several factors that affect job satisfaction.

Actually work. The main source of satisfaction is, of course, the work itself. The content of the work and autonomy in its implementation are the two most important motivational factors associated with labor. Studies have shown that other important components of job satisfaction are interesting and challenging work, work that leaves no room for boredom, and work that gives a person a certain status.

Payment. The system of monetary rewards is seen as a significant but complex and multifaceted factor of job satisfaction. Money not only gives people the opportunity to meet their basic needs, but also helps to meet the needs of higher levels. Employees often perceive their wages as a reflection of how management assesses their contribution to the organization. Additional benefits are also important, but their role is less important. One of the reasons for this is that employees often do not even know how much they receive in the form of benefits. Moreover, many tend to underestimate these benefits because they do not see their practical value. However, a recent study has shown that if employees are able to choose to some extent their own benefits from the overall package provided by the company, called the flexible benefits system (or «cafeteria system»), they are more satisfied with the benefits and work in General.

Promotion. Promotion opportunities have a diverse impact on job satisfaction. This is because promotions can take many forms and are accompanied by a variety of rewards. For example, people who are promoted for years of service, although they are satisfied with the work, but not to the extent that workers who are promoted for the results achieved.

Guide. Management is also a moderately important factor in the analysis of job satisfaction. There are two main management parameters that affect job satisfaction. The first is the orientation of the Manager to the employee, which is measured by the degree of management's interest in the welfare of their subordinates. As a rule, this interest is manifested in whether the management checks the activities of its subordinate, whether it gives advice on his work, whether it provides assistance, and whether it communicates with him not only at the official but also at the personal level. In the US, workers are often dissatisfied with their leaders precisely for these parameters. For example, a recent survey showed that only less than half of the respondents received regular feedback and help from managers to solve their problems. In Russia, the results of such studies are not known, but according to the author's observations, they would not be better, but most likely worse.

Another parameter is involvement or influence; it illustrates the activities of those managers who allow their employees to participate in decisions that are directly related to their work. In most cases, this approach leads to an increased sense of job satisfaction. In particular, the deep meta-analysis led to the conclusion that the involvement of workers in the decision - making process really has a positive impact on job satisfaction. The overall climate of engagement created by the Manager has a greater impact on job satisfaction than participation in a limited range of decisions.

Working group. The very nature of the working groups has a direct impact on job satisfaction. Friendly, ready to help colleagues in themselves are a certain source of satisfaction with work for the individual. The working group serves as a source of support, comfort, advice and assistance for the individual employee. When the situation is reversed, i.e. when people are difficult to get along with, this factor has a negative impact on job satisfaction.

Operation condition. Another factor that has a moderate impact on job satisfaction is working conditions. If the conditions are good (for example, working spaces are clean and attractive), the staff will be easier to cope with their work. If the working conditions are poor (for example, the room is hot or noisy), it will be more difficult for employees to do their job. If all goes well, there will be no problem with satisfaction; if things go wrong, problems will necessarily arise.

In a market economy dramatically increases the role of the individual in the team, its individual psychological potential, concluded in professional skills, abilities, abilities, skills, character, health and other features of the person.

It is known that members of the collective, as individuals, determine its social structure, the originality of which in the most General form is due to social and demographic characteristics (age, gender, profession, education, place of residence, party membership, etc.) Psychological characteristics of the individual contribute to or hinder the formation of a sense of community, thereby affecting the relationship in the team. Individual psychological characteristics of people are manifested in interpersonal relationships.

As a result of numerous studies of relationships in the team found that the positive development of interpersonal relationships, as a rule, increases productivity, reduced staff turnover, reduces the number of conflicts and their severity, increases the effectiveness of team management, improves the overall psychological well-being of team members.[48].

Job satisfaction has a major impact on productivity growth. In work [48] the method of estimation of satisfaction with work, an estimation of orientation on social usefulness of work, an estimation of quality of work and their interrelation with productivity of work is considered.

Job satisfaction was assessed by processing the results of the questionnaire.

Table 9.1. Job satisfaction assessment.

No. p/n	The questionnaire	Characteristics of answers and their evaluation in points Characteristics of answers and their evaluation in points>>				
		1	2	3	4	5
1	Do You think with pleasure or not about Your job?	With a very large newdoors the effects	With enough large autowalls the effects	With the campaigns. the effects, but with autowalls the effects	With a large enough box. the effects	With a very large box. the effects
2	Are there situations in which You are particularly satisfied with your work?	They are very few or almost none	Quite small	Not little, but not much	Quite a lot	Very many
3	Do You have difficulties and troubles at work?	Very often	Often enough	Not often, but not rarely	Rarely enough	ДостатоСHно редко
4	Do You have any cases when You are so carried away with work that you do not notice how time passes?	Very rarely or not at all	Rarely enough	Not rarely, but not often	Often enough	Very often

Evaluation of orientation to usefulness and quality of work was carried out on the basis of questionnaire processing.

With the help of correlation analysis, the impact of job satisfaction (X1), orientation on social usefulness and quality of work (x2), motivation (X3) on the implementation of the norms of production was assessed.

The correlation coefficient between the percentage of implementation of the standards (Y) and satisfaction of labour (X1)-0,78; between the percentage of implementation of the standards (Y) and evaluation orientation for public utility and quality of the labour (x2)-0,80; between the percentage of implementation of the standards (Y) and motivation (X3)-0,72. The significance of the correlation coefficient is confirmed on the basis of student's criterion.

Table 9.2. Evaluation of orientation to usefulness and quality of work.

No. p/n	The questionnaire	Characteristics of answers and their evaluation in points				
		1	2	3	4	5
1	How often do You think about the social usefulness of Your work, its usefulness to others?	Not at all or very rarely	Rarely enough	Not rarely, but not often	Often enough	Very often
2	How do You assess the social usefulness of your own work in comparison with the work of others?	Very insignificant	Quite minor	Not great, but not small	Sufficiently large	Very large
3	How often do You try to find an opportunity to improve the usefulness of Your work?	Very rarely Or not at all	Rarely enough	Not rare, but not often	Often enough	Very often
4	What is your productivity, Your team taking into account available technical conditions?	Very low	Relatively low	Not low, but also not high	With respect-but high	Very high
5	What is the quality of your team's work subject to available technical conditions?	Low	Quite low	Not low, but also not high	Very high	Very high

Management of multiple regression has the form:

$Y=61,4+4,8X1+2,6X2+4,2X3$

Thus, the increase in job satisfaction and the level of orientation to the social usefulness and quality of work, the right motivation has a positive effect on the growth of productivity.

The above factors that have a direct impact on productivity, efficiency of the enterprise can be subject to longer analysis. We show this by the example of the indicator «job satisfaction».

The indicator of the level of job satisfaction obtained as the arithmetic mean of the questionnaire responses can be entered in the following evaluation table.

Table 9.3. Job satisfaction assessment based on the answers to the questionnaire

Average response rate	Below 3.00	3,01-3,50	3,51-4,00	Higher 4,01
Feature satisfied-work hard	Dissatisfaction with work	Moderate job satisfaction	Relatively high job satisfaction	High job satisfaction

A detailed analysis of the causes of job satisfaction and dissatisfaction can be carried out on the basis of an assessment of job satisfaction indicators in the following areas:

1. General working conditions (transport to the enterprise, work schedule, social benefits, dining room, kindergarten, consumer services, medical care, the possibility of earnings, the possibility of promotion, the organization of the shower, changing rooms, pre-order shop).
2. Labor protection (noise, dust, lighting, temperature, aesthetics of the workplace).
3. The content of work (diversity, monotony of work, the complexity of work, the need to solve new interesting problems, the ability to participate in management, compliance with personal abilities and wishes of work).
4. Relations between people in the process of work (relations with the team, relations with the immediate supervisor).

5. Organization of work (level of organization of work at the enterprise, in the shop, the team, the state of public opinion, stimulating work atmosphere)

6. Non-production conditions (living conditions, use of free time, interests)

The assessment of job satisfaction on specific indicators in points can be carried out in accordance with table 9.4.

Table 9.4. Assessment of job satisfaction based on answers to questionnaire questions on specific indicators.

Score in points	1	2	3	4	5
Qualitative characteristics of satisfaction in terms of	To a very small extent	To a minor extent	Not great, but certainly not least	In large enough measure	In very large measure

As studies have shown, respondents ' assessment of indicators on a five-point system does not cause difficulties and is psychologically more accessible, since each Respondent receives the skill of assessment on a five-point system while studying at school.

9.4. How to increase the creative activity of staff

Russian people. in the work of Lossky N. O.[61]» Conditions of absolute good «in the section» Character of the Russian people « he notes the talent of the Russian people: «the Practical mind of the Russian man was manifested in the rapid and very successful development of industry and engineering in the second half of the NINETEENTH century. Sharpness of the Russian peasant and worker has long been noticed even by foreigners. Russian Russian people's practical mind is well expressed in Proverbs and sayings, which V. Dahl collected in his book «Proverbs and sayings of the Russian people» [60]. «Gol is wise, the need for inventions dexterity», «Gol – it will give the mind if there was no rye bread» [60]. Now the XX1 century and therefore the words of Lossky and Dahl's proverb about talent can be attributed to any nation living in great Russia.

What mechanisms should be used to fully reveal the talent of the staff. In Japan, this mechanism is implemented through quality circles. Quality circle (quality control circle) — a group of employees of the plant (factory), regularly meeting on a voluntary basis to identify problems affecting the efficiency of production and product quality, and prepare proposals to address them. Quality clubs originated in Japan in the early 1950s in industrial enterprises and were originally called «shop groups for the study of quality management methods.» In April 1962, the editorial Board of the magazine «quality Management for masters» renamed them «quality circles».

Quality clubs are a group of workers of one production site: the number of participants is usually from 4 to 8 people. A large number, as experience shows, does not give the opportunity to «Express» each participant. The circle gathers, as a rule, 1 — 2 times a week during working hours (and often in non-working hours) for 1-1.5 hours. The main difference of such circles from individual innovation is not only in collective work, but also in its purposefulness, and most importantly — in the existence of a single methodological base. All members of the circles are trained in methods of statistical quality control, analysis of problems and development of optimal solutions. As a result, it becomes possible to analyze production problems, to assess the impact of each of them on the quality and efficiency of work, to develop specific solutions and implement them with the help of the administration of the enterprise. However, the results of the quality control circles are not limited to the direct economic effect. Much more important is the indirect effect, expressed by the creation of a moral and psychological climate, contributing to the revitalization of workers to improve the organization of work on their own site. The use of the system of material and moral incentives by Japanese firms, and the obsessive propaganda of the formed stereotypes of behavior gradually accustom to the need for intensive work with high quality. The main conclusion from the quality circles is the reaction of the administration to the proposals of the members of the circle and the corresponding motivation. Under socialism, Soviet workers were not interested in creativity. One of the authors of this monograph talked with a pensioner of one of the Murom factories. He told me that the workers came up with a device that facilitates manual labor, but it was hidden when an engineer from the Department of labor. And all because then the introduction of this product will reduce prices and increase the amount of work. Prices for manual work were much higher than when working with a machine or device. In modern conditions, the creative activity of workers can be activated. Here is that writes Krasnova W. - Deputy. General Director of the agricultural holding «Kuban» Sense of ownership, by the way characterized by a democratic style in the relationship head-subordinate, which is why our workers appreciate when they seek advice, initiative. The same feeling demands that the initiative be rewarded» [59]. The conditions for the activation of creative activity can be grouped into the following table 9.5.

Table 9.5. Conditions of activation of creative activity

N PP.	Condition of activation of creative activity
1.	Interest and participation of all levels of management enterprises
2.	Organization of group and individual reviews of proposals and initiatives
3.	Development of a provision to encourage initiatives and implemented proposals
4.	The reports of the heads of the competent jurisdiction on creative activity of the personnel entrusted to them
5.	The organization of visual propaganda, results of operations and creative groups or individuals
6.	The development of distancesto

Each company sets its own bonus scale. To stimulate the activity of «circles» of efficiency and quality and individual inventors and innovators, a system of incentives is proposed, presented in table 9.6. Each company can set its own scale of bonuses.

Table 9.6. The scale of stimulation from the embedded event (recommended) [5]

№ p/p	The size of the economic effect, (thousand rubles)	The percentage of encouragement from the amount of economic effect
1.	less 100	15
2.	101-400	12
3.	401-800	8
4.	801-1200	3
5.	1201-1500	2
6.	1501 and more	1

The calculation of the economic effect (e) is carried out according to the formula:

$$E = \Delta CHP(\sum_{i=0}^{T} \frac{4P_i}{(1+E)^i} - \sum_{i=0}^{T} \frac{3i}{(1+E)^i}) \quad (9.1)$$

where$^{\Delta}$ CHPi – increase in net profit of the enterprise per year from the i - action of the implemented measure;

3i- capital costs associated with the implementation of the event in the year of i - operation;

E- discount rate determined by the formula (9.2.)

$$E = R+I/100 \quad (9.2)$$

where R- the percentage of profitability of products;

I - average annual inflation rate

Example: the offer of «circle» of intensity and quality of crew provided increase in net profit of the enterprise by years of implementation of action within 6 years provided in table 4. At the same time, there were capital investments in the first two years of the project. The discount rate was E=30% (E=CH+I=22+8=30%). The calculation results are also given in table 9.7.

Table 9.7. Assessment of the economic effect of the event «circle» efficiency and quality of the team

The year of implementation of the event	Net profit growth (thousand rubles) ΔCHP	Capital expenditure (thousand rubles) Zi	$\frac{1}{(1+E)^i}$	Discounted net profit	Discounted costs (thousand rubles)
0	-	120	1	-	120,060
1	-	40	0,7692	-	30,768
2	328	-	0,5917	194,078	-
3	350	-	0,4551	159,285	-
4	420	-	0,3501	147,042	-
5	450	-	0,2693	121,185	-
6	480	-	0,2072	99,456	-
TOTAL:				611,976	150,828

According to the formula (9.1.) the economic effect will be:

E=611,976-150,828=461,148 th. Rub.

According to table 9.6. the premium amount will be:

P=184,288*0,08=36,891 th. Rub.

If the effect is direct wage savings, it is recommended to direct 80-90% of these savings to bonuses.

Material incentives for employees and managers implementing the proposed measures are carried out in accordance with the regulations on awarding employees and management staff in accordance with the criteria for assessing the effectiveness and quality of work in force at the enterprise.

9.5. Shchekino experiment

In 1967, in the framework of «Kosygin» reforms aimed at increasing economic independence and material interest of enterprises, Shchekin chemical plant conducted an interesting economic experiment (lasted until 1970). Before the management of the chemical plant, as before, put certain plans for the production of products, but made it possible to change the number of employees at their discretion. If the enterprise carried out the delivered plans at smaller number of workers, the most part of money saved on dismissed, went on salary increase to the remained workers and other own needs of the enterprise. At the same time, the General wage Fund was not allowed to reduce. Naturally, such a system has created a powerful incentive for management and employees to increase productivity and optimize production. The appeared competition of workers was strengthened by the fact that each dismissed increased a salary and other benefits for the others. As a result, during the experiment it was possible to increase production by 80%, increase productivity more than twice and raise wages while reducing staff from 6 thousand people to 5 thousand people who were sent to new facilities. For these achievements Shchekinsky chemical plant was awarded the order of Lenin.[75,76].

Unfortunately, even after successfully using schekinskiy method for several companies, this initiative soon stalled. It was all about the discrepancy between its principles and the principles of the planned economy established in the USSR. The method could work only at individual enterprises under the watchful eyes of journalists and party leadership.

An ordinary enterprise was not interested in increasing labor productivity, because it reduced its financing (fewer workers — less money is allocated, because all enterprises, as Shchukin chemical plant, can not raise wages) and required a lot of effort. Besides, what was to do with the released workers? Besides, by this time «Kosygin reform» was curtailed.

Numerous studies of the problem of labor resources show how far we are from being able to fully master the methods of control over the use of labor resources available to society, how complex are the tasks of science and practice to bring society closer to the ideal - the full and rational use of labor resources.

9.6. Assessment of economic efficiency of target training of personnel of the organization (enterprise)

To date, many methods have been developed to assess the effectiveness of training the person of the organization, such as the method of Donald Kirpatrick, Jack Phillips method, etc., but the generally accepted methodology for assessing the economic efficiency of personnel training is not presented [63]. However, in practice, economists and managers have to solve this issue one way or another. It is possible to assess the effectiveness of staff training in accordance with the objectives of the training. This work will build on the approach to the assessment of the effectiveness of the task learning proposed in [63,64,65]. There are five learning objectives:

1. Training will lead to increased productivity through the development of new skills in the organization's management unit or service and support units.
2. Training will lead to increased productivity in the production unit (shop, site).
3. Training, after which the employee will take a higher or other position.
4. Training, which is determined by law and controlled by the bodies of Rostekhnadzor.
5. Training is necessary due to the installation and development of new equipment.

Consider the 1st case. In this case, the increase in labor productivity is carried out by reducing the number of employees. Then the economic effect will be estimated from the ratio of wage savings and training costs, taking into account the increase in wages by a certain percentage for the intensification of labor for employees performing the volume of work of reduced employees. In turn, the released salary gives q% of income.

Then, in General, the economic effect will be determined as follows [66]:

$$E_T = \sum_{i=1}^{T} E_i * \frac{(1+q)^{T-i}}{(i+E)^i} \quad (9.3),$$

$$E_i = Z_i \cdot \Delta Ch \cdot 12 - 12 \cdot (Ch_1 - \Delta Ch) \cdot Z_i \cdot \frac{\alpha}{100} =$$
$$= 12 \cdot \Delta Ch \cdot Z_i (1 + \frac{\alpha}{100} - Ch_1 \cdot 12 \cdot Z_i \cdot \frac{\alpha}{100} \quad (9.4),$$

Where

E_i – annual wage savings due to the growth of labor productivity and the release of employees in the unit;

T – period of validity of learning outcomes;

Ya_i – monthly salary of the employee in the i-th year of the period of validity of training results;

α – the percentage of growth of the employee's salary for the results after training;

12 – number of months per year;

ΔCH – the number of employees released from this division due to the growth of labor productivity;

CH_1 – initial number of employees in the unit before training;

q- income from released wages (e.g. Bank Deposit).

E – the discount rate determined by the Fisher formula:

$$E = \frac{P}{100} + \frac{I}{100} + \frac{PI}{100} \quad (9.5),$$

where P is the percentage of return on training costs that is pledged(P can be taken as the percentage of return on products, assets or wages);

And – the average annual percentage of inflation.

Example 1. The organization employs 20 people as a result of training can be conditionally released 2 people. Then the growth of labor productivity will be

$$\Delta PT = \frac{\Delta Ch}{Ch_1 - \Delta Ch} \cdot 100 \quad (9.6)$$

$$\Delta PT = \frac{2}{20-2} \cdot 100\% = 11,2\%$$

Then the percentage α of wage increase for the results of training and productivity growth will be no more than 11% (the percentage of wage growth should not exceed the growth of labor productivity). $\max \Delta ZP = \Delta PT (\Delta ZP \leq \Delta PT)$

In our case, put ΔZP=10%,

ZP= 30 th.rub/month

I=8%

T=5 years (duration of the learning effect)

Then the monthly salary by years of the operating results of training makes (see table 9.8):

Table 9.8. Monthly wage of an employee, adjusted for inflation and allowance dzp% for productivity growth.

Year	0	1	2	3	4	5
Average monthly salary (t.)	30	33,00	36,30	39,93	43,92	48,31
Including indexation due to inflation (t. R.)		2,40	2,64	2,90	3,19	3,51
Increase in labour productivity (T. R.)		0,60	0,66	0,73	0,80	0,88

The release of wages for the years of the estimated period according to the formula 2 will be (see Table 9.9).

Table 9.9. The savings in wages due to layoffs.

Year	0	1	2	3	4	5
The savings in wages	0	81,000	87,120	95,832	105,408	115,944

Taking into account the time factor, the economic effect for the period of 5 years will be (see table 9.10) in the calculations E=0.15, E = (0,08+0,07+0,08·0,07) · 100% ≈ 15%.

Table 9.10. Calculation of the economic effect of training, taking into account the time factor at a discount rate of E = 15% and yield q = 6%/

Year	Training costs, etc.	Saving wages, etc.	Value $(1+q)^{T-i}/(1+E)^i$	Given the savings in wages plus income from Deposit savings payroll
0	200	0	1	0
1		81,000	1,0983	88,962
2		87,120	0,9004	78,443
3		95,832	0,7393	70,848
4		105,408	0,6063	63,909
5		115,944	0,497	57,624
Subtotal:	200	395,304		359,786

The economic effect for T=5 years will be:

$$E_T = 359,786 - 200 = 159,786(th.rub)$$

Average payback period:

$$T_{ок} = \frac{200}{359,786/5} \approx 2,8(year)$$

The index of profitability (efficiency) J=359,786:200=1,8, ie one ruble spent on training the organization receives an income of 1,8 rubles.

Return on training costs Jp = 159,786:200 =0.80 (80%)

In the second case, the increase in productivity can be carried out without reducing employees, and by intensifying the work of personnel with a corresponding increase in wages.

In General, the economic effect will be determined as follows:ΔC=(UZP/ UPT -1) · UZP (9.7)

where: Δ C - percentage change in cost per ruble of revenue;

UZP, UPT - indices of change (growth) of wages and labor productivity;

UZP – the share of wages in the cost of production.

Example 2. The organization employs 22 people as a result of training can be conditionally released 2 people. Then the growth of labor productivity, determined by the formula (4) will be:ΔPT = {ΔCH/ (CH - ΔCH)}x100% = {2/(20-2)}= 11,1%.

Then the percentage α of wage increase for the results of training and productivity growth will be no more than 11% (the percentage of wage growth should not exceed the growth of labor productivity).

In our case:

ΔZP=8% - the projected rate of inflation -I=8%;

UZP = 1,08; UPT = 1,11; UZP = (6238/29741)x100% = 21,0%.

Then according to the formula (9.7) we obtain:

Δ With =(1,08/1,11-1) ·21,0= -0,568%, i.e. the result of the growth of labor productivity and wages, expenses for one rouble of production will decrease on 0,568%. If we assume that if costs and revenues grow at the same time as inflation, it is obvious that the profit from sales as the difference between revenue and cost will also increase by the level of inflation, and hence the net profit will increase by the level of inflation. The increase in profit from sales is determined by the formula.

ΔP = B·Δ C·Z

where Z = 0,6473 rub./rub.– costs per ruble of revenue, B – revenue (in our example B=49945 thousand rubles.)

Profit growth in the first year of the event will be:

ΔP =49945·0,00568·0,6473=183,631 thousand RUB

Taking into account income tax, net profit will be equal to

CHP =183,631x0,80=146,905 th. rub.

The profit growth by years of the learning effect is presented in table 4.

T=3 years (period of validity of increase of results from training).

Table 9.11. Calculation of the economic effect of training, taking into account the time factor at the discount factor E = 15%

YEAR	The cost of TRAINING, Tr	THE INCREASE IN NET PROFIT T. R.	YEAR I	GIVEN THE NET PROFIT T. R.
0	280	0	1	0
1		158,657	0,870	138,031
2		171,350	0,756	129,540
3		185,058	0,658	121,768
Subtotal:		515,065		389,339
Average annual increase in net profit				129,780

The economic effect for T=3 years will be:

389,339 – 280 = 109,339 thousand rubles.

Average payback period:

280/129,780= 2.2 years

3. Training, after which the employee will take a higher or other position.

This case can be calculated by the following formula:

$$E=S-Q \quad (9.8),$$

Where

S – costs for the selection of a new employee (RUB.)

Q – training costs.

Example 3. Assuming that S = 220t.R., Q = 80 Tr

E = 220-80= 140 (Tr.)

4. Training, which is determined by law and controlled by the state Supervision.

In this case, it is more correct to speak not about the economic effect, but about the economic assessment of the consequences of not conducting training:

$$E = SH + \Delta CHP - Q \quad (9.9),$$

where

W –possible penalties for violation (non-compliance) of the requirements of the state supervision bodies (t. R.);

PPP – shortfall in net profit for the period of prohibition of operation of equipment by untrained personnel (t. R.) by the state Supervision bodies.);

Q – training costs.

$$\Delta CHP = \Delta P - H \qquad (9.10),$$

where

DP – lost profit,

H – income tax.

Example 4. Consider the following conditions : W = 70 Tr.,

Q = 96 Tr.,

DP = 471 Tr,

H = 471 · 0.20 = 94.2 (income tax is 20 %)

E = 70 + (471 – 94,2) – 96 = 350,8 Tr

5. Training is necessary due to the installation of new equipment.

At first glance, in this case, as in the previous one, it is possible to do without evaluation. Put a new machine – so people have to learn to work on it, the other is not necessary. It happens, however, that management insists on the development of new equipment in the process, neglecting specialized training. The following approach will help to convince of its necessity:

Calculate the effect of this event.

$$E_T = \sum_{i=1}^{T} \Delta CHPi \frac{1}{(1+E)^i} - Q - S_0 \qquad (9.11),$$

where

Where T – useful (effective period of use of new equipment)

S_0 – cost of new equipment

$_\Delta$CHPi – additional net profit from the use of new equipment in year i.

E – discount rate determined by the formula (9.11)

Q – cost education.

$$_\Delta P_i = C_i \cdot {}_\Delta B_i - C_i \qquad (9.12)$$

Where C_i – the price of additional products produced on new equipment in the i-th year (RUB/unit prod.)

C_i – cost of additional output in the i-th year.

$$_\Delta B_i = (PT_{H.o.} - PT_{c.o.})\, t_{year} \qquad (9.13)$$

Where $PT_{H.o}$ – performance of new equipment (prod./hour)

$PT_{c.o.}$ – performance of old equipment (units prod./hour)

Example 5. If $PT_{H.o}$ = 50 units cont./hour

$PT_{c.o}$ = 40 units cont./hour, t_{year} = 2000 hour

$_{\Delta}B_i$ = (50 – 40)∗2000 = 20000 units cont. = 20 prod

C1 – 180 RUB/unit prod.

C_1 = 3000 T. R.$_{\Delta}P_1$ = 180 ∗ 20 – 3000 = 600 T. R.

$_{\Delta}CHP_1$ = 600 – 0,20 ·600 = 480 T. R.

Provided that the average annual inflation And = 8%, suppliers of raw materials and energy will increase the prices of their products, so that the cost of production of the manufacturer will grow. Assume that this increase will be at the inflation rate of 8%. Then, in order to maintain the same level of profitability and production, the manufacturer will have to increase the price of its products, also within the inflation rate of 8%. Under these assumptions in table 3.6. the values of prices, cost, profit for the years of the calculation period t = 5 years are presented.

Table 9.12. Values of prices, cost and profit, by years of the settlement period T = 5 years and E = 21%

year	$C_{i\ rub.}$	ΔBi·Ci T.P.	C_i т.р.	$_{\Delta}CHP_i$ T. T. R.	i 1/(1+E)	Discounted value CHP_i
1	180	3600,00	3000	480,00	0,826	396,48
2	194,4	3888,00	3240	518,40	0,683	354,07
3	210,0	4200,00	3499,2	560,64	0,564	316,20
4	226,8	4536,00	3779,16	605,47	0,466	282,15
5	244,9	4898,00	4081,46	653,23	0,385	251,49
total						1600,39

Let the cost of equipment 850 Tr, the cost of training 200 Tr, then according to the formula (10) have: e = 1600,39 – 850 – 200 = 550.39 Tr

Payback $T_{ок}$ = 1050/ (1600,39:5) = 3,3 years

The cost of training can be estimated by the formula: Q = ZP ∗ n + $S_к$

Where Q – cost of training; ZP – salary of the employee (RUB/hour); n - the amount of training (hour); $S_к$ – course price.

In Western countries, performance measurement options are based on the theory of human capital, whereby the knowledge and skills of employees are considered to be their own and income-generating capital, and the time spent on acquiring this knowledge and skills is an investment in it.

The cost of in-house training in the United States at the end of the twentieth century was: «IBM» - $ 750 million. (5% of labor costs); General electric - $ 260 million. (2%); Xerox - $ 257 million. (4%); Texas instruments

- $ 45 million. (3.5%); Motorola - $ 42 million. (2.6%). The amounts are given without taking into account the salaries of employees who were trained, if they are taken into account, the amounts will almost double.

On average, us firms spend $ 263 on training programs. Per employee. In General, the cost of intra-firm education is comparable to the cost of public and private schools (secondary and higher education) – about $ 350 billion. [1].

10. Innovation and best practices of efficiency and intensity of production

10.1. From information technology to the digital economy

In modern market conditions, no enterprise can do without information and information technology services. Every day new computer programs are developed, which facilitate receiving, processing and work with new information. One of the global information technologies is the Internet. Internet in enterprise management at the stages of information collection, its systematization and analysis, development of strategy and tactics, allows you to make the most rational decision. The Internet is a convenient means for rapid exchange of business correspondence, including internal exchange of internal documents of companies with branches, with a high degree of reliability and confidentiality. From the Harvard University information resources Policy program prospectus: «Without materials, nothing exists. Without energy, nothing happens. Without information, nothing makes sense.» Many countries have established programs of development of information technologies which are called digital economy.[67].

In 2017-2030, the Russian government is implementing a digital economy program approved by President Vladimir Putin. The main objective of the program is to create and develop a digital environment that will facilitate the solution of problems of competitiveness and national security of the Russian Federation. The term digital economy (digital economy) appeared in 1995, with the light hand of the American scientist from the University of Massachusetts Nicolas Negroponte. The digital economy of the Russian Federation − what is it? The digital economy is an economy of innovation, developing through the effective introduction of new technologies. The number of Internet users in this economy is growing exponentially, information and computer technologies are dissolving in our lives, there is a digital revolution. The beginnings of the digital economy appeared in the world at the end of the 20th century, and now we are in an active phase of its development. What changes? The age of new technologies dictates its own rules in the field of services and the market of information inventions. IT-sphere is developing very quickly, and the emergence of the Internet has really changed the course of our lives. Even today, no public relations do not develop without the Internet, communication and computer. These things simplify our lives and help us achieve our goals. In the 21st century it is very important to save your time and protect your life and money. The digital economy introduces virtual money into circulation. Of course, this does not eliminate the real economy, but removes unnecessary work, reduces time, increases productivity Today we see how much simpler monetary relations are: now it is not necessary to exchange physical money, they are «digitized». Thanks to this development of technology, trade is growing much faster. Almost any thing we can buy from the comfort of home. Entrepreneurs successfully conduct business on the Internet, the amount of production is growing, the costs of the enterprise are reduced. Automation simplifies the production process. Today, companies do not have to be huge to gain leadership in their niche.[77].

Digital systems increase the speed and accuracy of delivery. And violators can be easily found by IP-address, card number, or, in the end, a page in social networks. And this is just the beginning of the digital era! The program of development of the digital economy in Russia In the approved in Russia «Strategy of development of the information society of the Russian Federation for 2017-2030» provides the following definition of the digital economy: – it is an economic activity in which the key factor of production is data in digital form, processing of large volumes and the use of the analysis results of which in comparison with traditional forms of management can significantly improve the efficiency of various types of production, technologies, equipment, storage, sale, delivery of goods and services in Other words, the digital economy – this activity is directly related to the development of digital computer technology, which includes services for the provision of online services, and electronic payments, and Internet Commerce, and crowdfunding and so on. Usually the main elements of the digital economy are called e-Commerce, Internet banking, electronic payments, Internet advertising, as well as Internet games. As mentioned above, the digital economy has developed before, but the authorities intend to accelerate this process to reduce the gap with other States. An important role in the «digitalization» of the Russian economy is given to entrepreneurs: according to the strategy, they should actively participate in the implementation of this project.

It is planned to create «smart cities», increase the number of specialists in the field of information security, increase financial literacy of the population, the introduction of digital technologies in the health sector. It is assumed that all villages will have access to the Internet, and in the cities will be applied coverage of 5G or more. The government is confident that the development of the digital economy is necessary for the development and strengthening of economic relations between the subjects. This will simplify and speed up people's work, making processes simple and transparent. Humans will not be replaced by robots, as digitalization will increase the need for skilled labor. However, innovations may require retraining, with this the government also promises to help citizens. The Russian government plans to actively develop digital technologies and introduce them in all aspects of life: in the economy, and in medicine, and education, and in public administration, and in the economy. The program is planned to be implemented by 2024.

Advantages of the new economy: Implementation of remote work Simplification of payments Free market Availability for all sectors High level of productivity Electronic document management, reduction of paper «red tape» Reducing the cost of production the Russian Government plans to actively develop digital technologies and implement them in all aspects of life: in the economy, and in medicine, and education, and public administration, and agriculture. The program is planned to be implemented by 2024.

«But as for the digital economy, without the digital economy, we will not be able to move to the next technological mode, and without this transition to a new technological mode in the Russian economy, which means that the country has no future. Therefore, this is the number one task in the economic sphere, which we must solve,» Putin said. He stressed that the Russian Federation still has a very good mathematical school, actively developing programming. «We just need to provide a market for our programmers and a lot of good technological achievements. We can do it,» the President added. Russia can (and should) become the country that will offer all of humanity a future where there is a place for everyone.

Historically unique culture and thinking can allow us to formulate the laws of the new world, which will be combined real and virtual spheres of activity, which will effectively apply new models of management, successfully coexist network and hierarchical principles, and more. Such an integrated vision will form a coalition of like-minded countries and lead the process of transition to a common digital future.[79].

10.2. 14 principles of Deming to increase production efficiency

In 1950, William Edwards Deming at his management seminar in Tokyo, speaking to the leaders of the 45 largest companies in Japan, delivered a key speech — «Listen to me, and in five years you will compete with the West. Keep listening as long as the West will not ask for protection from you.» Thus was born «the 14 principles of Deming». [68].

His words proved prophetic and in the early 60's Japan took a leading position in a series of industries, and through some time the whole world became to speak about Japanese miracle, admiring them until now time.

His idea of transformation William Deming outlined in 14 postulates, which are widely known as the «14 principles of Deming.»

Principle 1. Continuous improvement of the quality of the products or services

Improving the quality of products and services should not be carried out sporadically, but continuously and systematically, become one of the most important tasks of the manufacturer. It is necessary to ensure:

- rational allocation of resources;
- meeting long-term needs;
- competitiveness of products;
- business growth;
- employment and job creation.

Principle 2. Adopt a new philosophy

We can no longer live with the current system of delays, delays, errors, defective materials and imperfection of the workforce. It is necessary to change the management style in order to stop the ongoing recession in the economy, constantly improve the quality of all systems, processes, activities within the company.

Principle 3. Stop dependence on inspection

To do this, mass inspections should be eliminated as a way to achieve quality. To achieve this goal, the manufacturer can only if the quality issues are for him in the first place and he has constant information about its level, using statistical methods of quality control in production and procurement.

Principle 4. Stop the practice of concluding contracts on the basis of low prices

It is necessary to measure the quality with the price (the price does not matter if it is not compared with the quality of the purchased products); to choose one supplier for the supply of one type of product; to establish long-term relations with the supplier on the basis of trust; to try together with the supplier to reduce total costs.

Of principle 5. Constantly improve the system

Continuous and continuous improvement of the planning, production and maintenance system provides for the prompt solution of emerging problems, continuous improvement of quality and productivity. The result of improving the system is a constant reduction in the cost of raw materials, design and improvement of the equipment used, retraining and training of personnel, quality control.

Improvement of the system involves progress in the organization of continuous monitoring of continuous production processes in order to improve the performance of each site.

Principle 6. Teach in the workplace

For on-the-job training, it is necessary to introduce modern methods of on-the-job training and retraining for all, including management personnel. Special attention should be paid to the use of the opportunities of each employee.

Principle 7. Establish mentoring (principle of leadership mentoring)

This implies the establishment of a leadership institution to assist staff in achieving their objectives. Today, the most important task of leadership at any level is to identify the required perfection for subordinates and to help them to become leaders. Facilitate two-way communication between management and subordinates to improve efficiency and productivity.

Of principle 8. To eradicate fear

The employee of the company should not be afraid of changes in his work, and strive for them.

Principle 9. Remove barriers

This means removing barriers between departments and groups of staff. Personnel working in the field of research, design and production should be perceived as a single team. Each employee should think and try to satisfy at the workplace not only requirements of the consumer of production of firm, but also the consumer of results of the work at this firm. Only in this case the requirement of continuous quality assurance of the process can be fulfilled.

Principle 10. Avoid empty slogans

Not to call for the improvement of quality, without considering the means for achieving it. Empty slogans, however attractive they may be, have a certain effect for a short time and then are forgotten. At the same time, the majority of defects and as a result — low quality take place not because the employee does not want to perform well work, but because the system existing at firm (interest, time of performance of work, responsibility I т.д.) It does not allow you to do your job efficiently.

Principle 11. Exclude digital standards for work management

Digital quota typical of piecework. At the same time, the rate for piecework is set as the average time of its execution. Therefore, half of the workers perform it quickly and then rest, while the other half will be late with its implementation and continue to work. This cannot create a normal climate in the team, and therefore piecework reduces productivity.

Furthermore, piece-rate work the most part of officials investigating the specific operations, the timing of their implementation, the establishment of norms (in figures) on piece work. It would be better to use this category of people in a particular job in the manufacturing process, and to transform the process so that the piecework system is replaced by a system that ensures the growth of quality and productivity in a team working as a team.

12. To give the opportunity to be proud of belonging to the company

Remove barriers to pride in work. It is very difficult to have a sense of pride in their work, if the products produced by the company does not have a good reputation or the employee can not influence the working situation.

13. Promote education and self-improvement

Promotion should be determined by the level of knowledge.

14. Involve everyone in the work but transformation of the company

One of the main conditions for success in the process of achieving quality is the conviction of the company's management of the need for this. It must participate daily in the process of improving quality and productivity. Top management must act, not be limited to support.

The reorganization of the business should begin with the development of each of the 14 points and the fight against «deadly diseases», which, according to Deming, is subject to most companies in the Western world:

– lack of consistency of purpose;
– the pursuit of short-term profits;
– personnel certification and ranking systems;
– senseless rotation of management staff;
– use only quantitative criteria to evaluate the company's performance.

The obstacles that may appear in addition to these «diseases» are different: motivational, educational, commitment to the technologies used, etc. the Whole implementation plan consists of seven steps.

Step 1

The company's management should identify and understand the factors hindering further growth and development. Based on each of the 14 principles described by yours, managers should develop a change implementation plan.

Step 2

Each head of the company should gather the spirit and internally tune in to move in a new direction. Progress cannot be started until there is at least one leader who is not ready for the changes to come.

Step 3

The management of the company should convey to the employees the need for change. Management should be open, not shy away from questions asked by employees or hide the reasons for the changes.

Step 4

The changes should be carried out in stages, the next stage can not be started until the previous one is completed. The goal of each stage is to improve the quality of the company's activities.

Step 5

The organizational structure is changed in such a way as to also work to improve the quality.

Step 6

Each employee should be involved in the process of quality improvement at any stage.

Step 7

The built quality system should be formalized and documented.

10.3. Lean manufacturing: 5s system (Kaizen system)

5S is one of the methods of lean production and the system of improving the production process, the main objectives of which are to reduce losses, organize the workplace and increase productivity. 5s system involves the organization of the workplace and the use of visual cues to achieve better results. As part of a culture of continuous improvement, 5S is typically the first lean method that organizations use to facilitate the adoption of other lean production methods that optimize workflow and process design.

The system includes 5 components: Sort (Seiri), Compliance order (Seiton), the Content is clean (of Seiso), Standardization (Seiketsu) and Improvement (of Shizuka). Together, they form a methodology for organizing, streamlining, developing and maintaining a productive production environment. Typical instructions, templates, the best experience of enterprises can be found in the practical guide to the implementation of 5S[80].

5s system components:

1. Sorting: getting rid of unnecessary things and cleaning the workplace.
2. Keeping order: organization of storage of necessary things, which allows you to quickly and easily find and use them.
3. Keeping clean: keeping the workplace clean and tidy.
4. Standardization: documented execution of technological operations, use of standard tools and implementation and promotion of best practices.
5. Improvement: maintaining the improvement process, monitoring technological operations and implementing 5S into the corporate culture.

In the daily work of the company, the 5S system allows you to maintain organization and transparency – the most important conditions for the continuous and effective flow of the production process. The successful implementation of this lean method also improves working conditions and encourages workers to increase productivity and reduce losses, unplanned downtime and work in progress.

The result of the successful implementation of 5S is a significant reduction in the materials and space required for production processes. The system involves storing tools and materials in special, color-coded storage locations, such as baskets and crates. Such conditions provide a basis for the successful implementation of other lean production methods: Universal care of equipment, Flexible automated production, production on Time. Also, the 5S system prepares the ground and optimizes the organization of processes for the introduction of methods of statistical regulation of technological processes.

The use of this system ensures the improvement of production indicators, namely::

- Transparent technology route
- Clean work place
- Reduced set-up time of the equipment
- Shorter cycle times
- Increased working space
- Reducing the number of accidents
- Reduction of working time losses
- Improved equipment reliability

Many enterprises face such problems as a non-permanent output and frequently changing settings of the equipment due to the changeable parameters of the manufactured products and the characteristics of the equipment. The result is spent a lot of time and effort to change and the configurations set up production lines, and also have difficulty refusing production lines, control of workflows, workplace organization, cleanness and transparency of the process. All this has negative consequences: it leads to damage to materials, loss of resources and the need for their disposal, as well as overloads the production process and increases the tension of workers. This means that there is a need to analyze the production processes and redesign the enterprise so that it meets the requirements of production with flexible parameters and the content of jobs in a clean and tidy, as well as to facilitate the control of the workflow. The introduction of lean manufacturing begins with the creation of an initiative group and the creation of a Kaizen project.

A simple but effective methodology is used to achieve the project objectives. The scale of the project is determined after a thorough study of the enterprise and the production process and a detailed discussion with the company's management, engineers, heads of departments and workers. All participants should take the project as a necessary and important step for the enterprise. The main difficulty was how to make the necessary changes in the workflow. In this regard, the project can choose a simple and at the same time practical approach to the implementation of changes in the main shop of the enterprise, simplification of the workflow and giving impetus to further continuous improvement. The main provisions of the methodology are as follows:

1. Observe the working process at the enterprise, evaluate it and identify the main problems in its organization.
2. Determine the structure of the current production process.
3. To assess the seriousness of the problems with the organization of the workplace on the basis of personal observations, as well as interviews with Department heads, masters of production sites and workers.
4. Use the 5S system to improve the production process and process configuration.
5. Discuss the measures taken with the management of the enterprise.
6. Evaluate the results and present them to the management of the company in the form of a report.

The main objective of the project is to improve the efficiency of the production process at the enterprise. In addition, it is planned to improve the organization of the workplace and the production process in order to modernize technological operations, simplify the management of the shop and improve communication in the team. Further increase of productivity and profitability of the enterprise is impossible without introduction of the program of motivation of workers.

In the initial phase of the project, it is necessary to determine the scheme of the production process, for which the enterprise should be divided into several sections. This is necessary to plan the placement of equipment, identify work areas and prepare for the implementation of the 5S system in all areas of the enterprise. After that, it is necessary to carry out activities to raise awareness of the company's staff regarding lean production and 5S system in particular, such as meetings and seminars for engineers, craftsmen and workers. Once everyone is familiar with the project objectives, principles of lean manufacturing, time frames and stages of the project, it is necessary to start a campaign to clean up the enterprise inside and outside. Cleaning of industrial premises and adjacent areas necessary for the release of passages, increasing the working space and convert the jobs to the workers and visitors. These three steps are the preparatory stage for the implementation of the 5S system in certain areas of the enterprise. A significant transformation of each site will take some time (an average of a week). It is necessary to hold several meetings with the management of the enterprise to discuss the success of the project and exchange ideas. To ensure the sustainability of the implementation of the 5S system, it is necessary to develop special questionnaires. All activities should be documented and reflected in the final report submitted to the management of the enterprise.

It is often easy to talk about how lean methods and 5S work. However, applying these methods in practice is not so easy because 5S is not just a methodology. It implies a change in the entire culture of the enterprise, as a result of which its entire team is aimed at moving forward, to success and improvement. Therefore, it is necessary at the beginning to explain to workers and management why the 5S system is being implemented. As a result of the diagnostic study conducted at the enterprise, as a rule, the following problems are identified, indicating the need for the implementation of the 5S system:

– space is cluttered with tools and components;
– unused materials and tools are stacked in stacks between workstations;
– unnecessary inventory is stored on the floor;
– unnecessary tools and machines make the working process difficult;
– the equipment is contaminated and is a storage place for a variety of equipment;
– the necessary equipment, such as tools, is difficult to find.

Based on the data of the diagnostic study, the main measures of the 5s system application at the enterprise were the following results of the production process improvement:

1. 5s system simplifies the production process as a result of cleaning, sorting, ordering;
2. 5s creates the infrastructure needed for enterprise-wide improvements;

3. the 5S system is needed for adjusting the process flow and redesign workspace;
4. 5S system is necessary to increase the motivation and dedication of workers;
5. the 5S system is the key to a clean production environment;
6. 5S system is necessary to implement safety measures and reduce the number of accidents at work;
7. the 5S system is a way to reduce waste by:
- minimizing the amount of waste and its reuse;
- minimize the time and effort spent searching for the necessary equipment or materials;
- disposal of surplus inventories.

It should be mentioned that the 5S system is not a list of activities to be carried out from time to time. This system needs to be practiced constantly. Therefore, for best results, it is rational to use a step-by-step approach to the implementation of the 5S system. Here is a brief description of the project stages.

1. Determination of the structure of the production process and space planning.
2. Explanation of the principles of 5S system to the staff of the enterprise.
3. General cleaning of industrial premises and adjacent areas.
4. Application of 5S system in all areas of the enterprise.
5. Use of the control check card for implementation of 5S system and check of its functioning.
6. Reduce waste (less waste and reuse of materials).
7. Freeing up space (freeing the main passage, clearing space for materials to be reused, freeing up shop floor space, providing storage space for materials).
8. Creating a cleaner and safer working environment.
9. Creation of a base for motivation of workers.
10. Improvement of working environment.

At the stage of determining the structure of the production process, the territory of the enterprise is divided into several zones/sections in accordance with the specialization and technological route. Each section is separated from the other by means of a special marking and has access to the main passage, which facilitates the production process and simplifies the transportation of materials.

For sustainable and effective implementation of the 5S system and verification of its functioning at all sites of the enterprise, it is necessary to develop a map of control checks, which would help to determine how the real situation corresponds to the plan of implementation of the system described above. Control results for each site are reflected in the summary table, as well as in the tables individually designed for each site. Such a table helps to see the achieved result − an improved technological route, a transparent production process and a cleaner and safer production environment. In the shops, it is also necessary to carry out measures to free up space, create and mark storage sites, marking passages, improve safety measures and ensure the smooth flow of the production process.

10.4. Experience of Toyota production system implementation in the United metallurgical company

In December 2017, the Vyksa metallurgical plant (VMP), which is part of the United metallurgical company (OMK), received a silver medal for success in the development of the production system following an audit conducted by the Japanese company Toyota Engineering Corporation (TES; part of the Toyota group).

«According to our assessment, the level of maturity of the production system of the Vyksa metallurgical plant exceeds the same indicator not only of Japanese metallurgical enterprises, but also of the entire world metallurgical industry. This is the first enterprise in the industry, which has achieved such impressive results,» — said the President of TES, and Toshihiro Yamada.

Earlier, in 2016, VMZ became the first metallurgical enterprise in the world to be awarded the TES bronze medal. At that time, it was the best indicator in the world for metallurgy and, in principle, proved the possibility of replicating the Toyota production system outside the engineering industry, in particular to the enterprises of the metallurgical sector.

And in January 2018, another enterprise of the OMK group — Almetyevsk pipe plant — according to the results of the TES audit, received an assessment of the level of maturity of the production system corresponding to the bronze medal. And thus became the second in the world metallurgical enterprise, awarded this award.

We are talking about the introduction of a universal production system Toyota —Total Toyota Production System (T-TPS). The production system has been developed by the Japanese engineering company Toyota since the late 1940s, when, after a heavy defeat in world war II, Japan lay in ruins, experiencing a severe deficit in everything — from Finance to raw materials and technologies.

Since 1948, the founder and head of Toyota Kiichiro Toyoda began to introduce the principle of «just in time». This is the most well-known principle, which is now most often associated with Toyota - in contrast to the previously dominant principle of Fordism, suggesting, on the contrary, the maximum reliance on their own strength. At the same time, the company constantly worked on improving the quality, mastered the rapid changeover of equipment (Single-Minute Exchange of Dies; SMED).

As a result, in 1949, Toyota declined from the intermediate warehouse, and in 1958 — from the insulators of marriage. What is the essence of these innovations? Previously, any mistake could be covered by stocks, although this meant overspending of materials and man-hours. Now to hide the mistakes become impossible. As a result, losses were reduced and product quality increased.

Since the 1980s, Toyota's production system has been transformed into a universal t-TPS production system. An important innovation in it was the principle of activation of personnel and production sites through the stimulation of the initiative from below.

«Toyota's manufacturing system is based on the optimal flow of materials and information, — says Tatsumi Kimura, senior consultant at Toyota Engineering Corporation. — Ideally, this is a flow of single products, which does not stop anywhere. But then we realize that there are other factors behind it — “M”. These are materials, equipment maintenance (machines), activation and involvement of personnel (men), improvement of ways of doing this work (methods). There is a former model of TPS — Toyota production system. Now we call our model T-TPS — the universal production system Toyota, which focuses on all four “M”. The organizational structure of the company — working, line Manager, middle-level managers and, accordingly, management, top management of the company. If the leadership is strong, it can give a certain result. But until you create opportunities for line personnel, for line managers to move from the bottom up — the opportunity to submit their proposals, initiatives for improvements - there will be no sustainable development of the company. This movement from the bottom up is very important.»

The Toyota production system gained worldwide fame thanks to the American researcher Jeffrey Liker, who devoted a number of books to the Japanese giant, of which the most famous is perhaps «Dao Toyota: 14 principles of management of the world's leading company» (2003), which sets out the main features that formed the basis for the management of the Toyota production system (see).

OMK began to build its production system in 2011. The pilot object was the main production site of the company — VMZ. Clear goals were set: to increase the growth rate and reduce losses. Prior to that, the plant already had experience in implementing advanced management technologies. In 2002-2003, a program of production optimization was implemented, in 2010 — a program to improve the safety culture. And in 2011, with the help of third-party consultants, OMK developed a concept for the development of the production system.

In 2011, OMK decided to start the production system at the Vyksa metallurgical plant. In the first phase, staff were selected to begin the transformation from within. Out of several thousand employees, ten of the most competent “navigators” of the changes were selected. The necessary training was conducted, the basic tools of lean production for implementation were identified, and transformations began. Consultants helped in this work.

At the next stage, in 2012, the implementation of the production system at the Chelyabinsk plant “Trubodetal” began. One year was enough to assemble a team of “navigators” and get the first positive results. In parallel, the development of Chusovsky metallurgical plant and Almetyevsk pipe plant began. After joining the OMK of the Blagoveshchensk rebar plant, work also began on the development of the production system.»

Japanese auditors first appeared at OMK plants in 2015. According to the company, this was done in order to check how the work done on their own corresponds to the Toyota system. It was believed that the best in the construction of the production system and the founder of the actual production systems, lean production tools is Toyota.

As a result of the audit, OMK decided to finalize its production system. The main directions of development were defined: daily management and control, visualization of processes, 5S-production and 5S-office (this was called a single tool), production culture, following the corporate course, which includes goals, objectives, business vision, business strategy; these are also workplace standards, technological standards, production safety standards, quality standards. If we consider some of these aspects in more detail, the 5S — a standard Japanese system of organization and rationalization of the workplace, one of the tools of lean production. The system includes such concepts as sorting (division of things into necessary and unnecessary), order (organization of storage of necessary things, which allows you to quickly and easily find and use them), the content of the workplace clean, standardization, improvement (education habits of accurate implementation of established rules, procedures and technological operations). In a sense, this system echoes the ideas of the Soviet theorist of the scientific organization of labor Alexei Gastev.

OMK recognizes that it is not possible to fully apply Toyota's achievements for metallurgy.

«We still have such a factor as production in batches, — the company says. — The enterprise of the metallurgical complex, which produces metal for us, can produce a certain minimum batch. And even if we only need half of that batch, we'll be forced to buy everything because they don't work any other way. And we plan our production taking into account two factors: the capabilities of the supplier and the needs of the consumer. Therefore, «just in time» does not work, a small stock will still be stored.»

On the other hand, Tatsumi Kimura does not believe that the introduction of Toyota's universal production system in metallurgy required some kind of adaptation: «it does Not matter which industry. In the overall Toyota production system, the main thing is to create a production of people who can independently engage in improvement. I was the head of the metallurgical plant, which works in the group of companies Toyota, he used to be called Toyota Steel. This is also a steel company, and I understand that this can and should be used in our work. We started with quality circles — line staff were going, chose the subject himself, found the problem, looking for root cause, developed measures, implement them. Then the implementation of the internal system of General quality management began. Then we were trained in the Toyota production system. This, of course, went hard. Especially in metallurgy, much can not be adjusted to the flow of single products. And then, the universal production system is based on the full development of personnel, line managers. This is all quite feasible, I was engaged in this in my company and saw success.»

Thus, the most important factors of the production system at today's level are the involvement of all personnel in the development of the company, personal interest and initiative from below.

The unifying factor of all work within the production system is the development and care of the company's people. Without employees who work in production and are the main value for OMK, nothing can be done. Here, one of the important factors was, is and remains constant training. The company has existing training programs for employees, including the development of the production system. We train people as tools for the development of the production system, and methods of their use with access to existing production. For this purpose, pilot projects are implemented, mini-transformation of processes is carried out.

A new person in the company must undergo an introductory training course. At OMK enterprises, new employees pass through the training center, where they are told about the tools of the production system at the Academy of the production system. When training the tools of the production system, employees are told about everything that is required from a person in terms of the use of lean production tools in his workplace. Next, a new employee takes tests in an automated training system and receives a mark, passed or not passed, and only after successful completion of the test is allowed to perform the work.

Another important point in the maintenance and development of OMK production system tools is the principle of continuous improvement. For this purpose, all OMK enterprises have created and operate quality circles of processes and are actively engaged in innovation activities, which are supported and encouraged by the company's management. There are competitions for the best workplace, for the best innovation proposal, for the best circle of quality processes. Winners and prize-winners receive valuable prizes and recognition from the top management.

In OMK there are several tools for the development of innovation movement.

An employee of any level has the opportunity to submit a proposal that has an economically justified effect, makes some change, some novelty in the work.

There is format A3. A3 format is aimed at improving the process that already exists. That is, a person working for a certain time on a machine sees that the process is imperfect, but knows how to change it. The company has a special form for this. The employee fills it, discusses with the master, with the head. A Commission is being created, and it passes it all on up.

And there is rapid improvement. Under them in OMK understand improvements that do not require any significant material costs and can be implemented almost automatically.

OMK is also developing two forms of employee self-organization. First, these are the so-called small initiative groups. They came from Japan and actually are similar to the Japanese «quality circles». As part of a small initiative group, several workers under the direction of a master or foreman gather at a certain time and solve some problems related to technology. They work out a solution. There are special forms that members of the group fill out. And then the decision comes to the attention of the supervisor. After that, if a positive conclusion is received, it is sent for execution. And then people get rewarded, like cash payments.

By the end of 2017, there were more than 310 small initiative groups at the WMZ, involving more than 1,900 employees. Just a small initiative groups implemented around 900 projects, over 300 is in the works.

Secondly, the so-called small working groups can be mentioned. The principle is based on the same, but here the head of the shop or the Director of the enterprise is already in charge. At this level, larger-scale problems associated with the reorganization of production, with a significant change in technology, are being solved.

The initiative from below is encouraged even at the level of production standards. At first, the development of standards involved «navigators» — employees of the Department for the development of the production system. Then, when a process is run-in, it is regulated and transferred to production. Further, in the production directly to the workers, technicians and supervisors workers, the foreman or Brigadier, create the standards, approve them with the technical services and placed in corporate information systems. In the UMC there are even charts the change of standards.

At the same time, the development of certain tools of the production system can lead to both an increase in employee productivity and its reduction — but at the expense of quality growth.

How, in such circumstances, to encourage employees to initiative and own participation in the production system?

Alexander Ivanov, Director of development of the OMK production system, says: «If you ask me what is the secret of success in the development of lean production, my answer will be short: man. The well-known American scientist William Edwards Deming formulated fourteen key principles of management, most of which are aimed at the person — employee of the company. Now I would like to single out four of them: establish leadership; cast out fears; eliminate arbitrary numerical norms and tasks; give workers the opportunity to be proud of their work.

At OMK, together with the underlying philosophy of Deming — we are developing a leadership Institute, to set up a system allowing each employee to freely Express their opinions and propose solutions to improve its working environment and business processes. For all employees, a system of goal-setting and performance evaluation has been developed and operates, reasonable norms and standards of productivity of units and productivity of workers are in place, the system of submitting proposals for improvements allows to identify the best workers, encourage their merits and give opportunities for further development. The specificity of our production at VMZ — processing line.

From the worker first of all strict observance of technological modes of operation of the equipment and performance of the established norms and rules is required. We also encourage suggestions for improvements, improvement of processes for which the employee is responsible. Therefore, for us, the most preferred time-bonus system of remuneration. This system allows you to set the level of remuneration adequate to the contribution of each employee.»

Relevant is the issue for the Russian economy now, when on hearing the talks about a critical gap in productivity and production system, they say, can only serve as a tool for fine tuning a well-oiled mechanism?

Lean production tools at the first stage allow you to get the biggest effects, remove the «low-hanging fruits», as well as to instill in the team a certain production culture aimed at continuous improvement.»

So, for two years, the duration of changeovers in the main shops of the VMZ decreased by 55%, which gave an economic effect of about 300 million rubles and allowed to increase the flexibility of production. In addition, the company has the opportunity to take on relatively small orders, the number of which has recently increased, while new major pipeline projects are not expected in the near future.

The average duration of loading of the machine at the VMZ was reduced from 17 hours to four, the time spent on the preparation of a set of accompanying documentation when sending pipes by rail decreased from 20.5 hours to 3.8 hours. Today, employees of the VMZ every month submit about two thousand proposals for improvements. In recent years, VMZ has achieved a significant improvement in product quality, which has helped OMK to strengthen its position in the Russian and global market of welded pipes, in particular in the oil and gas segment.

The development and application of lean production tools together with modernization allowed the VMZ to continuously improve most of the technical and economic indicators over the past two and a half to three years, each year obtaining an economic effect of billions of rubles [80].

11. Methodological provisions for the valuation of intangible assets of production and economic activity of exploration and mining enterprises and improve their efficiency

11.1. Methodological approaches to valuation and accounting of intangible assets in subsoil use

One of the most problematic issues related to intangible assets is the determination of their value. To date, even in advanced market economies, the problem of valuation of intangible assets has not been fully resolved. This is most relevant to the valuation of specific types of intangible assets in the mining and exploration industries.

Registration of intangible assets for the purpose of their use in the economic turnover of exploration or mining enterprise involves the solution of a number of issues. The most important of them, from our point of view, are:

- determination of the value of intangible assets;
- establishment of the period of their functioning;
- development of approaches to re-evaluation of IA;
- calculation of the residual value of assets;

If to determine the value of fixed assets all of the above issues have been studied in detail, have developed and legislated regulatory framework, which varies depending on the needs of the economy, for intangible assets these issues are in our country at the stage of research and development.

The topic related to the valuation of intangible assets and the establishment of the term of their operation is the most important, as the adopted methodological approaches to its solution depend on the basic principles of the solution and other issues raised.

One of the most difficult tasks in the field of valuation of intangible assets is to determine their value.

Determination of the value of intangible assets can be established at the stage of obtaining information, development of new technologies, geological study of the object at cost. At the stage of scientific and technical research (it can be an activity aimed at obtaining new knowledge, search for new technical solutions, technological developments), the costs of creating intangible assets are determined as they arise. In Geology and mining, these types of IA are very important.

In other words, the cost of IA created within a mining or exploration enterprise should include all types of costs for its creation, including overhead costs and even interest payments on borrowed funds. [28].

Intangible assets can also be measured at market value.

The market value of intangible assets can be determined only if the enterprise has the opportunity to assess the market value of intangible assets (for example, when selling or buying an object of intangible assets). As is known, the initial cost of intangible acts includes: the last price; import duties; non-reimbursed taxes included in the cost of acquisition; costs of legal services; costs associated with the preparation of the asset for its intended use, etc.

The most objective basis for assessing the market value of IA can be considered the costs of the enterprise incurred at the auction for the acquisition of rights to use subsoil objects. In accordance with the current legislation in the Russian Federation, the cost of the right to conduct geological exploration, extraction of mineral resources, construction of facilities at the facility is determined on the basis of an open auction and should be recognized as the market value of this type of intangible acts. Enterprises may have several objects for which there are similar rights. The market value of intangible acts can include the right to use land, water resources, environmental requirements. The latter is due to the fact that the payment for these rights tends to change over time and reflects modern value relations.

The solution of issues of valuation and accounting of IA is especially important for exploration and mining enterprises. For these organizations, the problems of establishing the value and accounting system of intangible acts in our country are not sufficiently investigated.

As already noted, the composition of intangible acts in the exploration and mining industries has a pronounced specificity. The latter can have a significant impact on approaches to determining the value of IA.

The use of the latest technologies by Russian companies, as well as the transition of exploration and mining enterprises to international standards of financial reporting, will certainly affect the principles of accounting for intangible assets.

In addition, to date, Russia has not yet accumulated the necessary information base for the accounting and efficiency of the use of IA in the financial and economic activities of enterprises. Only on the basis of practical experience in the accounting of IA can be created, both in the whole country and for each industry methodological principles and provisions of accounting of IA, methodological approaches to determining their value and evaluating the effectiveness of their use. Currently, the financial activities of Russian enterprises are faced, on the one hand, with the need to take into account IA, and on the other - with the lack of methodological and regulatory documents for their accounting, evaluation and use.

Table 11.1 shows the grouping of intangible acts depending on the methodological approach to determining their value.

Table 11.1. Methodological approaches to valuation of intangible assets exploration and mining assets

№№	Methods of determination value of the intangible assets	The main types of intangible assets'
1	The cost of IA is determined by the cost of acquisition	The right to conduct exploration works, right to production, approved conditions
2	The cost of IA is determined by the cost of their creation	Geological information obtained, results of technological research, new technical solution
3	Obtained geological information, the results of technological research, a new technical solution	Acquired geological information, previously received by others enterprises; use technological solution, previously developed

To the first group (table. 11.1) include the types of intangible assets, the cost of which is accurately recorded in the documents on acquisition. Such intangible assets include, first of all, the right to use subsoil (licenses) obtained at open auctions. Enterprises in this case have documents confirming the amount paid for obtaining this right. In the vast majority of cases, the right to use the subsoil, the company must also obtain a permit for the use of land for various production purposes, the right to deforestation, permission of fish and hunting, permission of environmental services. Even in cases where mining or exploration company carried out the annual payments for the damage to the environment, obtaining and holding rights to conduct works according to the agreed technology will be a cost.

According to the current regulation on accounting, the cost of IA includes costs «directly related to the preparation of the asset for use». This means that all costs incurred by agreement, legal registration of rights to use natural resources will form the value of intangible assets.

The second group of intangible assets (table. 11.1.) involves special work on their creation. This can be geological exploration, technological research, development of a feasibility study for the processing of the field. The cost of this type of intangible assets can be determined as the sum of the estimated cost of work for each type of work, taking into account all associated costs. The latter may include, for example, not only the cost of development of feasibility studies and calculation of reserves, but also the costs associated with the payment of expertise and approval of the main parameters of mining and conditions.

This group of intangible assets may also include rights acquired from owners in the field of new equipment and technology for processing deposits. An example is the purchase of the right to use the new technology of enrichment of polymetallic ores by the Gaysky mining plant. The acquired technology allows to abandon the I and II stages of enrichment, which significantly reduces the cost of the total enrichment of ores produced by the plant. In addition, the use of new technology of enrichment of polymetallic ores significantly increases the coefficient of extraction of useful components at the enrichment stage, improves the quality of the concentrate, which allows them to set higher prices for delivery to metallurgical plants. By purchasing documentation for the right to use the new technology, the company not only saves time to conduct the necessary research, but also reduces the cost of production using this technology.

In General, the value of intangible assets under The IA group can be determined fairly reliably and will reflect the market (today's) value of intangible assets.

Determination of the value of intangible assets of the third group (table. 11.1), highly difficult and not always objectively. This is mainly due to the fact that the costs incurred for their creation were carried out in other economic conditions. For example, geological information obtained before the 90s of the XX century, technical or technological solutions developed earlier may be of interest in modern conditions only for similar deposits or types of ores.

For example, an enterprise that has received a license for exploration and development of a new field has an analogue - an already developed object with a similar type of mineralization, a proven enrichment technology, similar mining and geological conditions of the useful stratum. Acquiring all the necessary information from the owner (most often such information from its owner is not evaluated and is not listed in the assets of the enterprise), the buyer company can have as a result of significant cost savings, and most importantly - saving time to obtain the necessary information base. But how to estimate the cost of such information? From our point of view, the cost of such information can be equal to 50% or higher of the current cost of similar types of research.

Determination of the cost in the current economic conditions is possible for exploration work performed earlier. This value is determined through the use of existing and used in economic practice deflator indices. An example of this kind of information is the data on the development of diamond tubes in the Arkhangelsk region. It is known that the tubes put into operation by it. Lomonosov and them. Mushroom, as well as a number of other objects that are at the stage of exploration, have a very complex hydrogeological and engineering-geological processing conditions. Pipe them. Lomonosov was the first to start diamond mining. A special system of mining operations has been developed for the safe conduct of works and achievement of minimum losses of mineral resources by a number of research and design institutes.

The developed principles of processing deposits of similar geological structure can be successfully used in the development of similar facilities. New enterprises through the use of existing scientific and technical developments save both resources and time. And those who conducted these studies can increase their income by selling the original data.

The question of the useful lives of intangible assets is important in the practice of their use. The amount of depreciation charged depends primarily on the terms of use of IA.

We propose a grouping of intangible assets of exploration and mining companies by their duration. The classification of IA is based on two main principles:

– the first - the validity, documentary evidence of the terms of use of IA (A, B, C);

– the second is the duration of the period of use of IA (1,2,3).

Groups A and B have a well-developed approach to determining the useful lives of IA. If the documents accurately indicate the time conditions – it is intangible assets attributable to group A. If the company has IA related to the time of use with the terms adopted in the regulatory or other legal documents, they should be attributed to group B.

For example, group A would include subsoil use rights acquired by the enterprise. The documents on the right to operate accurately set terms of 5, 10, 15, 20, 25 years.

So, with the approval of the temporary condition on one of the rare metal deposits, a decision was made about the need to report permanent conditions after 3 years. In this case, the feasibility study of temporary conditions, as the IA of the enterprise, will be referred to item B1.

The most difficult task is to establish useful lives for such types of IA as geological information. Depending on the detail of the research data on the geological structure of the territory can be a source of new types of information, the choice of directions in the search and exploration of objects that are not previously of interest.

The most striking example of this type of IA is geophysical survey data for oil and gas exploration. Materials of seismic, gravio - and magnetic exploration, made more than a dozen years ago, with modern methods of interpretation allow to determine with a high degree of probability new areas, and sometimes new deposits of hydrocarbon reserves. The useful lives associated with the availability of such geological information should be assigned to group C and, in our view, should not be less than 10 years.

Table 11.2. The grouping of intangible assets in terms of their existence

	Determination of the duration of IA	Main types of intangible assets
A	The term of validity of IA is precisely established (documented) 1. Up to 5 years 2. From 5 to 10 years 3. More than 10 years	Rights (licenses) for subsoil use, parameters of processing of deposits, principles and sizes of calculation of reserves, minerals, production volumes
B	The duration of IA is established on the basis of generally accepted norms 1. Up to 5 years 2. From 5 to 10 years 3. More than 10 years	Set condition of operation, technological solutions for mining and beneficiation
C	The term of validity of IA is unknown and can be established by the enterprise 1. Up to 5 years 2. From 5 to 10 years 3. More than 10 years	Geological information on the object, territory, region. Technical and technological developments

Summarizing the proposed classification of intangible assets, including the timing of their use, for accounting IA can offer their grouping in the form shown in Fig.11.1.

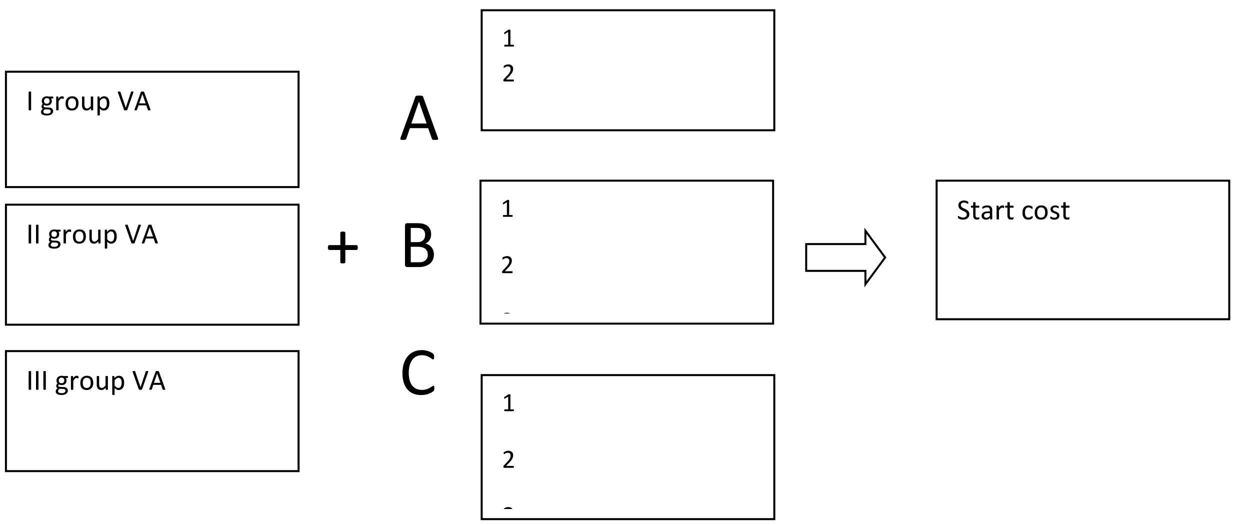


Fig. 11.1. The scheme of accounting and valuation intangible assets

For example, the right to develop a field obtained for 20 years will belong to group I-A-3; temporary conditions for the above-mentioned field – to II-B-1, etc.

The proposed classification, in our opinion, will make it possible to establish more objectively both the value of intangible assets and the depreciation rates.

For intangible assets, as well as for fixed assets, one of the topical issues is the determination of their replacement value. According to PBU 14/2007, the determination of the replacement value of intangible assets is the prerogative of the enterprise itself. The company decides when and how to carry out the revaluation value of the intangible assets and whether to hold it at all. Revaluation of intangible assets should be carried out on the same methodological approaches as revaluation of fixed assets. However, we believe that a number of specific industry-specific intangible assets are not appropriate for revaluation. The following groups should be attributed to such a genus of IA:

- intangible assets with a term of up to 5 years;
- intangible assets acquired at auction and having a fixed value;
- intangible assets related to group II on the formation of the value of IA.

Thus, revaluation and establishment of replacement cost may be subject only to the intangible assets related to the group III.

Fundamental differences in the definition of the residual value of intangible assets compared to the net book value of fixed assets, from our point of view, is not available. The residual value should be defined as the value of intangible assets on the balance sheet of the enterprise, less the amount of accrued depreciation for the entire period of use of this type of intangible assets.

11.2. The method of calculating the cost of geological information obtained at the expense of own funds of exploration and mining enterprises for accounting and its use as IA

In the transition of the country's economy to the market, the issue of the cost of geological information, as the most important type of IA in the assets of exploration and mining enterprises, is particularly acute. For nearly 20 years, the largest scientists and scientific schools have been solving this problem.

Thus, when obtaining a license for the right to conduct geological exploration or mining, the future owner of the right to use the subsoil must pay for the geological information provided to him. It is this value that should be included in the evaluation of the license and its registration as an intangible asset. The question is - how much to pay for each object in subsoil use, subject to licensing? The problem of justification of payment for geological information in obtaining a license are engaged as individual scientists (M. N. Denisov, M. A. Komarov, B. I. Benevolsky, F. F. Kireev, and many others.) [28] and research institutes (viems, TsNIGRI, VIMS). The Law «On subsoil» [28], in particular, States that the fee for geological information should be no more than 10% of the net discounted income (NPV) for this object.

Specialized geological enterprises, conducting at their own expense prospecting and exploration, acquire geological information about a particular type of minerals on the studied object. Even obtaining negative data on the availability of minerals may be of industrial interest to justify the construction sites of facilities, or the development of new methods or technologies for the development of the facility.

We propose the following method of determining the cost of geological information, which is obtained by exploration and mining enterprises at their own expense, for accounting and use it as IA.

Taking into account the specifics of this type of industry IA as geological information, it is necessary to specify possible options for its use in the activities of exploration and mining enterprises, as this affects the system and evaluation, and accounting, and its depreciation.

It is known that one of obligatory conditions of registration of property as intangible assets is their ability at application to bring to the enterprise the income. In connection with this requirement, geological information, as an IA enterprise, can be divided into 2 types.

1. The geological organization carries out the study of the subsoil on request and at the expense of third-party enterprises, which receive geological information is necessary for future mining operations. In this case, geological information acts as the intellectual property of the enterprise that ordered its receipt, is estimated and registered. The availability of such information will contribute to the stability and sustainability of the mining enterprise, the growth of capacity, the expansion of its raw material base with new facilities, etc.

In such a situation, the geological organization, which performed exploration work on request, can not claim as the owner of the geological information obtained.

It should be noted extremely rare to date cases where the geological organization performs prospecting and exploration work at its own expense. The obtained geological information can act as its intellectual property, be estimated and registered, for the purpose of realization (sale) to other enterprises or use for diversification of own activity. The latter is possible only when the geological organization has received important, promising information that allows in the future to open a new field or to work on it. The described phenomenon (to work out the field itself) is unique and has not yet been recorded in the practice of geological exploration organizations. But only under such conditions geological information as intellectual property can be put as IA on the balance sheet of exploration organizations.

2. The mining company itself, at its own expense, conducts geological study of the territory. In this case, the obtained geological information is the property of this enterprise and is registered as IA.

In connection with the above, the following options for the application of the developed by the author methodological approach to the valuation of geological information obtained by exploration and mining enterprises at their own expense, depending on the types of this information.

As you know, the effectiveness of exploration, the reliability of the information depends on the degree of exploration of the object. The more detailed the geological exploration, the more reliable it is possible to plan the technical and economic indicators of the future mining enterprise. To assess the impact of the degree of detail with which the geological structure of the subsoil is studied on the cost of geological information, we have developed the following methodological approaches.

1. Search work.

The interest of future investors in information on objects with reserves of category C2 and resources P1 will be determined by the coefficient K1.

The proposed coefficient represents the «success» of search operations. The coefficient K1 can be greater or less than one. Its value should be determined on the basis of both the efficiency of future processing of reserves and the means of ensuring the future of the enterprise reserves of minerals.

The coefficient K1 will depend on two main parameters: the amount of reserves, which is associated with the duration of the enterprise, and the economic efficiency of the future development of reserves:

$$K_1 = 1 + (\alpha + \beta), \tag{11.1}$$

where K_1-change in the cost of geological information at the stage of exploration; α -coefficient, taking into account the number of expected reserves, determining the life of the future enterprise; β - coefficient, taking into account the efficiency of mining reserves.Table 11.3 shows the proposed values of the coefficients α and β.

Table 11.3. Formation of coefficient K_1

Security of object with stocks		The efficient processing inventory	
Years	**α**	**IRR ≥15**	**β**
До15	-0,5	15-20	-0,20
15-20	0,0	20-25	0,0
20-25	+0,1	25-30	+0,3
25-30	+0,2	30-50	+0,8
More 30	+0,3	More 50	+1,0

Depending on the success of the search operations, the company, which carried out the work at its own expense, can take into account the cost of the obtained geological information in its assets, taking into account the success of these works. The transfer of assets from one owner to another (on the basis of the legislative framework adopted in the country) will be carried out not only at the cost of the costs incurred, but also with an assessment of the economic significance of the exploration work carried out. For example, take two objects, which were carried out search operations at the expense of the enterprise.

The first object is located in the Kemerovo region. Here were prospecting for coal. The territory with reserves and resources of drilling coal was revealed. The development of the object can be extremely profitable (IRR is estimated at 83%), because the area has a developed infrastructure, the released capacity of existing coal mining enterprises, the demand for drilling coal for the operation of CHP. Reserves and resources of coal will ensure the activity of the future enterprise for a period of more than 45 years.

The cost of exploration amounted to (for 2 years) 28.9 million rubles. In this case, the cost of geological information received by the enterprise and its statement on the balance sheet as an intangible asset, taking into account our proposed methodology (according to the formula 3.2 coefficient K_1 is 2.3) will be determined by the amount of:

28.9 million rubles.* [1+ (0,3+1,0)] = 28,9 * 2,3 = 66,47 million rubles

This means that the implementation of geological information with the obtained economic characteristics of the studied object can bring the company not only spent on the search for funds, but also a significant profit.

The second object is located in the Khabarovsk territory, is a gold mine, which according to the enlarged estimates can be worked for 8 years, and its IRR is estimated at 18.9%. Using the same calculation method (formula 11.1), we obtain K_1 equal to 0,3 + ([1+ (-0,5 – 0,2)]. When funding in the amount of 19.5 million rubles. the cost of geological information is only 5.85 million RUB

Geological exploration organizations, as well as mining companies can carry out prospecting not on one object and not on one type of minerals. In this case, the formula for determining the cost of geological information will be as follows:

$$NMAPE = \sum ZPo_i * [1 + (\alpha_i + \beta_i] = ZP_{Oi} * K_{1i}, \quad (11.2)$$

where NMAPE – the cost of geological information; SPO – the cost of prospecting-evaluation works on the first object; K1i - (see formula 10.2).

The costs of prospecting within the facilities with fading mining can be allocated to a separate group. This is due to the impact and consideration of the social factor. Extending the life of the mining company even for 5-10 years can be essential to solve the problems of employment, existing infrastructure, tax revenues to local budgets. When developing existing reserves at sites with fading production, the search for new deposits acquires great economic and social interest. For these cases, the assessment of the value of the obtained geological information to account for it as an intangible asset, it is advisable to have other values of the indicator «α» (table. 11.4).

2. Field exploration

Geological information on the results of exploration includes not only the exploration of the geological object, but also to justify the conditions, the choice of equipment and technology of mining, calculation and approval of reserves. Such work requires not only considerable money, but also time. This is due to the need for heavy field work, which include a dense network of wells, mine workings, semi-industrial or industrial tests, etc. The development of the project for the future development of deposits is associated with the study of a number of problems, such as demand and prices for minerals, environmental problems of the territory, the study of hydrogeological and engineering-geological conditions, etc. the Availability of all necessary material allows to justify the conditions for the field, to approve these conditions in the prescribed manner and only then calculate the reserves and put them on the balance sheet.

Table 11.4. The value of the indicator «α» for the calculation of the cost of geological information in order to account for it as IA for enterprises with decaying production

Duration of the enterprise	**α**
Until 5 years	+0,5
5-10 years	+0,8
10-15 years	+1,0
More 15 years	+1,1

The costs of conducting exploration work at the expense of the enterprise, from our point of view, should not lead to costs (with the exception of the cost of conducting operational intelligence). The value of intangible assets that are formed as a result of exploration and the statement of reserves on the balance sheet, is one of the most valuable and costly types of assets. This is due to the following factors:

– development of deposits can be carried out only after the reserves are put on the balance sheet;

– in the license received for working off of reserves of minerals, terms of input of object in operation are specified. Violation of the terms of development of the object may result in the loss of the license;

– the cost of exploration, development of conditions and approval of reserves is not less than 3 years, and often much more;

– the cost of the whole complex of works is 3-5 times higher than the costs at the search stage.

Already from these factors it is clear how important geological information for the development of mineral deposits. The company, which has such information, can develop, plan mining and capital works, have a reliable economic justification of production at the present time. The lack of geological information on the results of exploration does not provide such opportunities not only in practice, but also in terms of legal aspects.

All of the above allows to justify and determine the cost of geological information on the results of exploration (exploration stage):

$$Zrazy = [(Zгр + Zк + ZPZ) * K_1] * (1+E_н)^{t-1}, \quad (11.3)$$

where Zrazy - the cost of geological information on the results of the exploration and production of reserves on the balance sheet; SGR - cost exploration; LC - the cost of the substantiation and approval conditions; RUP - the cost of counting the inventory and placing them on the balance sheet; Yong – coefficient of bringing of past costs at the time of production of intangible assets on the balance sheet; t – the time of the whole complex of exploration operations; $(1+E_N)^{t-1}$ - time factor (f).

Taking into account the time factor in determining the cost of exploration is necessary. However, the discount should not be higher than 8-10 %. This is justified by the fact that the technique and technology of geological exploration is changing, which to some extent compensates for the discount rate adopted in the industry for capital investments in the construction of a mining enterprise.

Summarizing the above, we summarize all the options of the proposed methodological approach to the valuation of geological information obtained as a result of exploration by enterprises at their own expense, depending on the variety of this information in table 11.5.

Table 11.5. Methods of calculating the cost of geological information for accounting as IA geological and mining enterprises

Types of exploration works'	Composition of costs for obtaining informations	Purpose of obtaining geological information	Method calculation's
A. Exploration activities *-search*	the cost acquiring geological information, development of temporary conditions the cost exploration, approval of conditions,	-identification of new facilities, issuance of licenses, expansion of SMEs in the country	$ZP_o * K_1$

-intelligence	calculation of reserves, statement of reserves on the balance sheet	- issuance of licenses for field development, determination of TEP of the mine	$(Z_{paZ} + Z_{K}+ZP_{Z}) *K_1*f$
B. Testing fields':			
1. New object *- exploration works*	-exploration costs, approval of conditions, calculation of reserves, statement of reserves on the balance sheet	-preservation of the existing mining enterprise, expansion of its raw material base with new objects, development of TEP of working off of new object	
2.Operated facilities *-search*	the cost obtaining geological information, development of temporary conditions	- assessment of the prospects for the development of the raw material base of the existing mining enterprise at the operated facility	$(Z_{paZ} + Z_{K}+ZP_{Z}) *K_1*f$
-intelligence	the cost exploration, approval of conditions, calculation of reserves, statement of reserves on the balance sheet	-maintain capacity of existing mining enterprises, the increase in terms of availability of reserves to the operated object, the preservation of the TEP indicators, sustainability value indicators	$ZP_o * K_1$

<u>*3.A fading mining*</u> <u>*- search for promising objects near the existing mining enterprise*</u>	the cost replenishment of used stocks	-extension of the term of operation of the mining enterprise at the existing facility	$(Z_{paZ} + Z_{\kappa} + ZP_{Z}) * K_1 * f$ $ZP_o * K_1$

When determining the value of the available geological information, the enterprise that already has approved reserves will always benefit. In the event that these reserves were obtained at the expense of public funds, but the geological information provided to them free of charge cannot be the intellectual property of the mining enterprise.

Taking into account the specifics of this type of industry IA as geological information, the following options are proposed for its use in the activities of exploration and mining enterprises, as well as evaluation, accounting and depreciation:

And.) Geological information, for which the company's own funds were spent, remains unclaimed. In this case, geological information acts as the intellectual property of the enterprise, is estimated, but not recorded and amortization of such intangible asset is not carried out.

Bel.) Geological information, for which the company's own funds were spent, is used in the activities of the same enterprises for further development and diversification of activities. In this case, geological information acts as the intellectual property of the enterprise, is estimated, recorded and depreciated as IA. Features of depreciation of this type of IA will depend on the subsequent stage of exploration or its use in the development of the field.

V.) Geological information acquired when purchasing a license acts as the intellectual property of the buyer enterprise, is estimated, recorded and depreciated as an intangible asset. Features of depreciation of this type of IA will depend on the subsequent stage of exploration or its use in the development of the field.

Thus, if the company has invested its own funds in the search, exploration and subsequent work on the field – such geological information should be reflected in its property as intangible assets that can ensure stable, profitable activities, and most importantly - predictable results and ways of further development.

11.3. Theoretical and methodological provisions of compensation of costs associated with the acquisition of IA, based on their allocation to the value of mineral reserves

Having determined the cost of IA and put them on record, the mining company faces the question of how to compensate for the costs incurred for the acquisition of intangible assets. It is not important, at the expense of own means the mining enterprise received necessary geological information or got it at auction.

In this case, from our point of view, the following options are possible.

1. Amortize the value of the obtained (acquired) geological information, as the company's IA, according to the traditional methodology arising from PBU 14/2007.

2. More interesting in both theoretical and practical terms is the proposed mechanism of depreciation of the received (acquired) geological information about a particular field, built by the valuation of mineral reserves on the basis of the costs associated with the acquisition, exploration and preparation of the field for development.

The proposed mechanism of depreciation of the obtained (acquired) geological information (as IA of the enterprise) is based on the following theoretical considerations based on the essential features of the exploration and mining industries.

The production potential of any enterprise is the existing and potential production capabilities, the presence of factors of production, the provision of its determining types of resources. We can agree with the opinion of scientists [28] that when talking about business, including mining, it is more correct to use the concept of «economic potential of the enterprise». This term is «wider» than the concept of production potential, as it additionally includes the accounting of external relations, the system of existing relations and other aspects of the external environment in which the enterprise has to act in a dynamic market environment.

The economic potential is closely related to the concept of economic resources of the enterprise - a fundamental concept of economic theory, meaning the sources, means of production. Economic resources are classified into natural (raw materials, geophysical), labor (human capital), capital (physical capital), working capital (materials), information, financial (monetary capital). This classification is not strictly unambiguous, but gives some idea of the resources consumed in the course of production.

In the accounting policy of our country, the property complex of the enterprise has a valuation. However, when it comes to subsoil use enterprises, there are a number of problematic issues in the valuation of their property complex, which have not yet found a theoretical or regulatory final solution.

One of the distinguishing features of mining business is that the activity of any mining enterprise depends on the availability of mineral resources. After all, mineral deposits are the objects of entrepreneurial activity in the mining industry. In other words, the mining enterprise is a mining complex consisting of the field itself, i.e. mineral reserves in the subsoil, and the mining enterprise - on the other. This feature of the mining business should certainly be taken into account when assessing the efficiency of the mining enterprise, since deposits in market conditions can often belong to one owner and be developed by another person (or company).

In our country, in accordance with the legislation in the field of subsoil use, there is a ban on civil transactions in respect of subsoil plots, including purchase and sale, donation, inheritance, pledge, etc., involving their alienation. But at the same time, the process of selling mining enterprises, their merger, consolidation, etc. is carried out. And together with the change of the owner, it passes to him (albeit through the re-registration of licenses) and the right of disposal and operational management of the field on which the mining enterprise was created. After all, the mining enterprise itself is nothing without a Deposit, without proven reserves of minerals. In rich deposits, the cost of reserves is tens (and sometimes hundreds of times) higher than the cost of OPF mining enterprises. Thus, there are strong theoretical grounds to consider the mining enterprise as a single mining complex consisting of the field itself, i.e. mineral reserves in the subsoil, and the mining enterprise – on the other. This requires an appropriate reflection of the proven mineral reserves as the assets of the mining enterprise.

The lack of mineral reserves in the accounting assets of mining enterprises leads to a sharp underestimation of their production and property potential, including in the eyes of investors.

One of the most important factors of investment attractiveness of mining enterprises is the size of reserves. It is large enterprises in most cases and the most effective in terms of the effectiveness of their activities. Large capitalization (calculation of the value of the property on the income it brings) provides, undoubtedly, the best guarantees of return of funds to investors in extreme situations - large funds are more reliably preserved both in total and in the balances in adverse cases. The fact that the availability of mineral reserves, their quantity and quality directly affect the capitalization of the value of mining companies is confirmed, for example, by the accumulation of reserves by many Russian companies (oil, gas, etc.) in order to sell them to foreigners, mergers, appreciation of their shares, etc.

Domestic accounting practice has never taken into account the reserves of minerals and other objects of environmental management as part of the property of mining enterprises. Under the socialist mode of production, this was not necessary in practice, since the economy was dominated by state ownership, and the only owner of all newly created value was the state. The idea of crediting the explored balance reserves of mineral resources in the subsoil to the balance of the state, as part of the national wealth, was expressed in 1974 by M. I. Agoshkov, V. A. and First N. Khrushchov.[1]. According to their proposed formula for calculating the wholesale price of diluted reserves, the mining company would have to pay for each ton of repaid reserves in order to provide economic incentives for the rational use of reserves, the determination of the economic efficiency of exploration. However, the possible mechanism of payment for these prices of repaid reserves by mining enterprises remained undisclosed by the authors. In addition, due to the lack of commodity relations in the country, the question of direct self-financing relations between geological exploration organizations and mining industries was not even raised at that time.

Later, in the transition period (in the 1990s), the solution to the problem of improving economic relations between exploration and mining on the basis of economic assessment of proven reserves of mineral resources and the price of 1 ton of proven reserves was reflected in the works of M. I. Agoshkov and E. L. Goldman. [1].

The evaluation of proven reserves in the system of socialist economy was decided on the basis of such economic categories as average operating, closing, individual reduced costs, normative profit, current wholesale prices, etc., which are not used or are used in a limited way in the market system of management.

In a market economy, accounting for subsoil use objects and assessing the effectiveness of their use requires a different methodological approach.

For example, E. S. Melekhin in his research [28] proposed to take into account the value of reserves in the subsoil on the balance sheet of mining enterprises as an intangible asset. «The introduction of the value assessment of the developed field in the balance sheet of the mining enterprise in the form of an intangible asset» is considered by him as «a source of coverage of the state's costs (the drowned rate of compensation) for the preparation of reserves and the creation of its national wealth. In the transition to the calculation and exemption in the form of a tax of flood rates of payment for the extraction of minerals, the enterprise is exempt from payment of all currently existing payments for the use of subsoil.» For this purpose, he proposes to determine the value of reserves as the difference between the cost of mineral raw materials at world prices and investment needs for the preparation of the development of mineral reserves. In other words, the mechanism proposed by E. S. Melekhin For valuation of reserves and their reflection on the balance sheet of a mining enterprise as an intangible asset is primarily aimed at withdrawing payments, i.e. rents, and indirectly at improving the efficiency of field operation.

We have developed a methodological approach to the accounting of reserves in the assets of a mining enterprise has completely different goals and objectives, which determined the specifics of calculating the value of reserves, their reflection in the balance sheet of enterprises. This made it possible to theoretically substantiate the possibility of using the mechanism of subsoil depreciation and determine its impact on the efficiency of production and economic activity of mining enterprises.

One of the reasons for the lack of attractiveness of Russian enterprises for foreign investment, including the mining industry, is the dissimilarity of a number of principles of Russian and foreign accounting, although in Russia the task of their maximum convergence has been set and has been successfully solved for several years. In particular, the issue of accounting for the value of mineral reserves in the assets of mining companies has not yet been resolved in domestic accounting standards.

In the transition of domestic accounting to international standards in the first section of the balance sheet of domestic enterprises there were two articles: one related to the acquisition of land (account 8-1); the other - with the acquisition of natural resources (account 8-2). This is a special type of property that is included in the non-current assets of the enterprise, and is not included in the balance sheet neither to fixed assets nor to intangible assets. No detailed explanation of the use of these articles in the regulatory accounting documents to date is not provided. It is specified only that the land plots, objects of environmental management are not subject to depreciation, although they are included in the first section of the balance sheet of the enterprise – «non-Current assets». Accounting of objects of nature management, as the analysis shows, is practically not carried out at the enterprises.

Thus, today in the national accounting practices of the extractive industries minerals included neither in balance sheet nor in off-balance accounts. This is a significant shortcoming in the methodology of accounting for resources and leads to an underestimation of the property potential of mining enterprises.

As follows from our analysis , the features of foreign accounting of minerals are as follows. Minerals in the subsoil according to international accounting standards belong to the category of irreplaceable and «intangible» natural resources, which determines some specifics of their cost accounting. In GAAP standards, for example, irreplaceable minerals are included in the property of mining enterprises as intangible assets, and their value is estimated on the basis of cost capitalization.

Initially, this amount can be debited to a cost account or a mineral inventory account and credited to the corresponding non-renewable resource account. When using the inventory account when these reserves are introduced into production, their costs, including the cost of depletion of minerals, are attributed to the cost of sales. At the end of the accounting period, part of the cost of depletion of minerals can be returned and included in the account of inventories in proportion to the number of minerals produced but not sold before the end of the accounting period.

In GAAP standards, the valuation of mineral reserves is based on the capitalization of five types of costs: 1. costs of acquisition of the right of economic disposal of subsoil (costs of purchase, lease or any other method of acquisition of the right of economic disposal of property for the purpose of exploration and production of minerals); 2. exploration costs to determine their level of capitalization; 3. development costs - extraction, primary processing and storage of minerals; 4. production costs – extraction of natural resources (they are capitalized as the cost of the extracted resource as they arise and the stage of processing); 5. costs of auxiliary production - capitalized and recorded, as well as other types of equipment and working capital.

These types of costs are subject to depreciation. Depreciation of these types of costs is based on a decrease in the cost of non-renewable resource or its depletion (depletion), and their amount is the basis of depletion (depletion base). The base of depletion is the sum of all capitalized costs minus the residual value plus the cost of bringing the mineral Deposit to a condition suitable for its subsequent sale (for example, landscape restoration, etc.). If the cost of these works exceeds the residual value of the developed field, the depletion base will be greater than the amount of capitalized costs.

The most common method of calculating mineral depletion is to determine the so-called depletion rate, which is calculated per unit of extracted (produced) mineral (ton of ore, barrel of oil, cubic meter of gas, etc.). At the same time, the unit of the extracted fossil is correlated with its total estimated volume and the base of depletion - the cost of all capitalized costs associated with the production of this mineral:

where N East. - the rate of depletion; B ist. – base depletion; On the West. – estimated mineral reserves.

If the minerals are reduced, there is a depreciation of natural resources. The term «depreciation» is used to define the process of writing off the value of depleted assets. Depreciation of natural resources is similar to depreciation of fixed assets of the enterprise. However, when accounting for depreciation of natural resources produce a direct reduction in the account «Funds». Therefore, in this case, the accounting account to account for accumulated depreciation is not usually used.

Depreciation of natural resources is calculated by multiplying the amount of resources used for a given period by the cost of a unit of resources. For example, if a company purchased a $3000000 coal Deposit and the expected output of the coal is 1,000,000 tons, the cost of one ton of resources will be $3. Suppose that in 2003 the company produced 100,000 tons of coal. Knowing the cost of one ton of coal (as a resource), equal to$3, you can determine the amount of depreciation of reserves for this year. It is $300000 = $3x100000.

In the company balance compiled on December 31, 2002, will be shown the cost of the coal field - $3000000. In the balance sheet as of December 31, 2003, it is necessary to take into account the depreciation of reserves in the amount of $300,000, and the cost of the coal Deposit will be $2700000.

In each accounting period, the amount of resource depletion is equal to the amount of mineral mined multiplied by the rate of depletion per unit. Initially, this amount can be debited to a cost account or a mineral inventory account and credited to the corresponding non-renewable resource account. When using the inventory account for the sale of mineral reserves, their costs, including the cost of depletion of mineral reserves, are related to the cost of sales. At the end of the accounting period, part of the cost of depletion of mineral resources will be included in the inventory in proportion to the number of extracted, but not sold before the end of the accounting period of minerals.

It should be noted that under GAAR, the base of depletion is considered an intangible (intangible) asset, which is largely a Convention. Because the cost of not having a physical embodiment, such as the acquisition of rights of ownership, exploration costs, in base of depletion include and quite materialize into concrete physical form costs (e.g. extraction of fossil surface).

The GAAR standards (financial accounting Standards regulation No. 19, «Financial accounting and reporting of oil and gas producing companies») describe this procedure for the oil and gas industry, but consider that it can be used in all extractive industries dealing with minerals.

We propose to introduce mineral reserves in the property of mining enterprises as intangible assets, and their valuation is carried out on the basis of capitalization of costs associated with obtaining (acquisition) of geological information about a particular field.

The term «capitalization» has a diverse meaning (transformation of surplus value into capital; calculation of the value of property on the income it brings; transformation of income into capital, that is, the use of income to expand the business). In this case, we refer to capitalization as the allocation of costs to the increase in capital assets, and not to the expenses of the reporting period. To capitalize means to record expenses that may yield returns in the future as assets rather than as the costs of the period in which they are incurred. The principal accounting scheme is that the amount of capitalized costs is determined, and then the procedure is carried out to correlate them with the income of future periods received by means of such costs.

This approach, based on the use of international experience, to reflect the value of mineral reserves on the basis of capitalization of costs in the assets of mining enterprises, as IA, allows them to compensate for the costs associated with the acquisition, exploration and preparation of the field for development.

To account for the value of mineral reserves as intangible assets of a mining enterprise, capitalize, from our point of view, should be the following costs:

and.) costs of acquisition of the right of economic management of subsoil (costs of purchase, lease or any other method of acquisition of the right of economic management of property for the purpose of exploration and production of minerals). For example, in order to start the process of mining, a mining company needs to «stock up» a large number of licenses, the receipt of which costs a lot. So, for the Russian mining enterprises it is necessary to have the following licenses: for the right of conducting prospecting works with the subsequent production; for the right of production; the right to drill prospecting, exploration and evaluation wells for solid minerals; for the operation of mining industries and facilities (open method); for the production of surveying work in the use of subsoil; for work on measurements and analyses in the field of environmental control; for work on utilization, storage, movement, placement, disposal, destruction of industrial and other waste (except radioactive), on-farm work related to the violation of the soil cover and removal of the fertile layer; on carrying out of on-farm works in territories (water areas) of economic and natural objects; on development of standards of maximum permissible discharges of pollutants into the environment and others;

bel.) exploration costs in order to determine their capitalized level and their compensation. They can be defined in two ways: 1). capitalized costs only for successful exploration, ie, led to the discovery of industrial minerals; the costs of unsuccessful exploration are written off as expenses of the current period as they arise; 2). if it is expected that the estimated value of the recoverable minerals exceed capitalized costs, it kapitaliserede costs for exploration, both successful and gave a negative result. Both methods are acceptable, and the choice of a particular one is left to the discretion of the mining companies;

V.) other costs of preparation and development of production

To compensate for these costs incurred by the mining enterprise, they should be written off (depreciated) as the field is developed.

In accordance with the economic criteria defined in PBU 14/2000 «Accounting for intangible assets», which include: the use of the asset in the economic activities of the organization; the long-term nature of the use of the asset, namely for a period exceeding 12 months; and the ability to generate income of the organization; - the value of reserves of mineral resources can be attributed to intangible assets of the mining enterprise subject to depreciation.

Of the three possible methods of depreciation of intangible assets permitted by PBU 14/2000, for the depreciation of inventories, we propose a method of writing off their value in proportion to the volume of production. The depreciation rate will be defined as the ratio of the initial cost of mineral reserves, determined on the basis of capitalization of these types of costs, (NW) to the amount of reserves defined in the license for the right to develop this field, (Zl) :

$$НаZ = CZ / Zл, \text{ rub./т}, m^3 \text{ I other.}, \quad (11.5)$$

In this method, in each accounting period, the amount of depreciation of the resource (reserves) will be equal to the amount of extracted mineral (Zvi) multiplied by the depreciation rate per one unit (Naz) in t, m^3 and other natural units of measurement:

$$AZ = НаZ * Zл_i, \quad (11.6)$$

The methodical approach based on the accounting of stocks of MPI in the property complex of the mining enterprise as intangible assets is already tested in the world, and partly in the domestic accounting activities of enterprises. This approach can be seen as an option for convergence of international and domestic accounting standards in the mining industry.

As you know, depreciation in the classical form is the distribution of the value of assets, i.e. the transfer of their value in parts, the value of the products. The peculiarity of this situation lies in the fact that, unlike the classical version, mineral reserves of the mineral resources of the mineral resources of the MPI will act in two «hypostases»: as IA and as products.

To implement the mechanism of depreciation of reserves, we propose to evaluate reserves in two States: a) in the source (in the array, in the natural state); b) in use (in operation). Being in a subsoil (in an array, in a natural state), stocks act as part of a property complex of the mining enterprise. In this case, their valuation will be carried out in order to account for reserves as part of the assets of the mining enterprise. When developing a field (during operation), the extracted reserves should be considered as «worn-out IA», subject to write-off («redemption»). They are transformed into another category - the category of «finished products», the valuation of which will correspond to the process of pricing for finished products.

In the scientific literature, one can find a number of theoretical objections to the legality of the application of the depreciation mechanism to the subsoil. The main one is the argument that in order to apply the depreciation mechanism, there must be both production assets and products produced. So, N. P. Uvarin [28] suggests to estimate working off of reserves of mineral deposits not through the mechanism of depreciation, and through the account of exhaustion of resources, emphasizing by it specific features of such asset of the enterprise as reserves. In his view, the essential difference between depreciation and exhaustion (or depreciation due to exhaustion) is, first, that depreciation is the distribution of the value of production assets (i.e., the transfer of the value of assets to the value of production) and exhaustion is the use of minerals. Secondly, from his point of view, exhaustion depends entirely on the volume of production, and depreciation in the classical version is made regardless of the volume of production.

However, these «contradictions» (or rather features of subsoil depreciation) are quite solvable, if we bear in mind, first of all, the positive consequences of the practical use of the mechanism of subsoil depreciation, and not the struggle for the «purity» of economic terms and concepts.

For subsoil, the amortization process would mean transferring the cost of inventory in the bowels of the earth (in natural state), acting as the

NMA on the cost of production, i.e. the cost of produced and sold a mining company minerals (the cost of commercial products).

The peculiarity of this situation (the stocks are at the same time and as IA, and the quality of the manufactured product) is not essential, render impossible the application of damping to the bowels. The noted features of reserves, as part of the property complex of the mining enterprise and as a finished product, do not change, from our point of view, the main thing – the possibility of using the depreciation mechanism in relation to such a category as subsoil.

In the case of mineral resources, their «wear» depends entirely on the volume of production (the amount of mineral extracted). But in the practical use of the mechanism of depreciation of other types of OPF, there are a number of examples that have an analogy with the depreciation of subsoil as IA.

The situation is similar to the depreciation of mineral resources, took place in a number of sectors of the mining industry. We are talking about fixed assets directly related to the opening, preparation and development of minerals in the field or in part (mining,as well as specialized buildings, structures and transfer devices), which are intended only for the needs of the mining enterprise and after mining its reserves, as a rule, can not be used without capital conversion for any other purposes. For this category of fixed assets of mining enterprises depreciation was carried out at flood rates [28].

The flood rate is an established standard that allows you to determine the amount of depreciation for the restoration of specialized funds during the development of reserves that they serve. The unit of production rate was determined per ton of repaid reserves of the mineral in rubles. Repayable reserves were the amount of recoverable reserves (approved balance reserves taken out for a certain period and accounted for in production that meet the requirements for the quality of minerals) and operating losses. The tonnage rate was calculated for each production unit of the mining enterprise for the year on the basis of the residual value of specialized fixed assets, the volume of recoverable reserves and projected operating losses of minerals. The monthly depreciation amount is determined by multiplying patonay rates on the volume of repaid reserves. For mining enterprises with a service life of more than 25 years, the depreciation rate was set at 4% of the cost of the relevant mining and capital workings.

As you know, the depreciation of the rolling stock of road transport was carried out according to the norms as a percentage of the cost of vehicles, while depreciation was determined by 1000 km of actual mileage.

It should also be noted that the Regulation on accounting «Accounting of fixed assets» (PBU 6/01) provides (but not for tax accounting) and a method of accrual of depreciation, as the write-off of the cost of OPF in proportion to the volume of production (work).

Subject to the foregoing, to the mineral resources (reserves of mineral deposits) can reasonably apply the basic category and the mechanism of depreciation. And so, in practice, to carry out depreciation of subsoil for their restoration.

It is known that not all objects of environmental management are subject to depreciation. For example, land, as one of the most important objects of nature, is not depreciated. This is due to such a distinctive feature of this object of nature management as the lack of land useful life. «Indestructible forces of the earth» have an unlimited life, and by virtue of these properties the earth is called the eternal source of wealth. Although this in itself does not guarantee a reduction in the economic value of land. Such losses are not offset by depreciation but are identified and liquidated as they arise. Objects of the same nature, having a useful life, depreciated (eg, forest, perennial plantations, mining and capital development in the form of Stripping when posting boards, etc.). These issues are discussed in detail in a number of papers. [28].

Under the depreciation of reserves of mineral resources we mean the reduction of the cost of non-renewable (irreplaceable) natural resource for the purpose of their recovery. This does not mean the restoration of a specific field. This is impossible, unlike, say, green spaces or forests in a particular area where it was cut down. We are talking about obtaining the necessary funds for the development of the existing mining enterprise, the introduction of new technologies and advanced equipment, the return of funds to the state spent on the exploration of a particular field, the reserves of which are «depreciated», for the search and exploration of new fields for the purpose of business development and preservation of the workforce of the mining enterprise, etc.

Currently, mining companies for successful operation in the development of market relations in the country should use a different method of management – commercial calculation, inheriting part of the principles on which the economic calculation was based. The essence of the commercial calculation is to measure the cost (monetary) form of costs and results of economic activity [28]. Expressing economic and industrial relations, it fully meets the requirements of emerging market relations, in particular, and the enterprises of Moscow time. The basic principles of commercial calculation include: self-sufficiency; the measurement of the size of the invested funds with the financial results of their investments; profit; improving the competitiveness of the enterprise and products; efficiency of resource use; self-financing; independence of the enterprise associated with decision-making or action in the face of market uncertainty, but within the law; risk accounting; responsibility to the state for taxation; material interest; distribution of labor, etc.

Thus, the assignment of mineral reserves to intangible assets of mining enterprises allows for their accounting and the procedure of depreciation of reserves as the field is developed, which opens up fundamentally different opportunities for the effective use of subsoil and the construction of an effective economic model based on the principles of commercial calculation in the relationship between the owner of subsoil (state) and subsoil users in order to synchronize their interests.

Accounting for mineral reserves as intangible (intangible) assets, the value of which is determined on the basis of capitalization of the relevant types of costs, and then the implementation of the procedure for their depreciation as the field is developed, and, accordingly, the reduction in the value of the remaining and on the balance sheet of the mining enterprise explored mineral reserves will also contribute to the growth of investment attractiveness of the mining industry, convergence of international and Russian accounting standards.

12. Clusters in the mineral complex as a reserve for intensification of production

12.1. Cluster approach to the development of Russian regions, aimed at Russia, aimed at the integrated development of mineral resources of these territories

One of the priorities of the state economic policy in the country is to increase the competitiveness of various industrial entities of the country. This is primarily due to the process of globalization of the world economy and Russia's accession to the WTO.

To determine the priorities of socio-economic development of a particular region in the economic space of Russia in comparison with other areas there is a need to identify the competitive advantages of the studied regions. The implementation of comparative advantages and their transformation into competitive advantages of the regional economy can be carried out primarily through structural and territorial policy, which is based on the principle: the advantages of the structure of economic resources in the regions should meet the corresponding structure of production.

In the modern economy to obtain a new impulse of development at the regional level and increase the competitive advantages of the economy of a particular region and industry, to solve the practical problems of organizational design of territorial and industrial integration, the cluster approach (cluster theory) is used. The essence of the cluster approach is a systematic understanding and regulation of the economy of a particular region and industry, taking into account the indirect and direct participants of this economic model in order to obtain additional growth impulses.

The concept of a cluster was introduced into economic theory by Michael porter: «a cluster is a geographically concentrated group of interrelated companies, specialized suppliers, service providers, firms in the relevant industries, as well as organizations related to their activities (for example, universities, standardization agencies, as well as trade unions) in certain areas that compete, but at the same time lead joint work» [28].

In other words, it is not enough for one organization to take its problems into account in order to improve its competitiveness. In order to effectively address the problems, it is necessary not only to go beyond the organization and consider the factors of its competitiveness in the framework of all participants in the process, regardless of their industry, but also to take into account their contribution to the common cause within the region under consideration. Thus, in order to be a cluster, a group of geographically adjacent interconnected companies and related organizations must operate in a certain area, be characterized by common activities and complement each other.

Systematization of cluster definitions by foreign economists from 1986 to the present time is presented in the work of L. S. Markov [12]. According to the research of Markov L. S., the participants of the cluster at the same time can be: companies; government; research associations;

financial institutions. Also, according to Markova L. S., in the activities of the cluster so called institutions of cooperation, such as chamber of Commerce, industrial and professional associations, unions, organizations, technology transfer etc.

Currently, the system of creating clusters, their classification and grouping scientists pay great attention. Different types of classifications of cluster formations are proposed. There are classifications of clusters by size, by the principles of integration, by the conditions of interconnection, etc. Thus, N. A. Larionova proposes to distinguish three definitions of clusters, each of which establishes the main feature of their functioning [28]:

– regionally limited forms of economic activity within related sectors, usually linked to scientific institutions (research institutes, universities, etc.));

– vertical industrial chain, narrowly-defined sectors in which adjacent stages of the production process form the core of the cluster (e.g., chain «supplier–producer–marketer–client»). In the same category fall and networks formed around the parent companies;

– industries defined at a high level of aggregation or a set of sectors at an even higher level of aggregation (such as the «mining cluster»).

However, the theoretical question of the conceptual nature of the cluster has not yet been resolved. Scientists give different characteristics and definitions of such type of cooperation as clusters. There is no single point of view on the structure, characteristics and varieties of existing clusters. To date, there is no consensus on the list of necessary and sufficient features for the creation of a cluster (i.e., on the prerequisites and favorable conditions for the creation of clusters). A methodology for evaluating the effectiveness of the cluster has not been fully developed.

The starting conditions for the formation of clusters include the following conditions for the formation of clusters, the choice of which in each case will depend on the type and characteristics of the cluster and the circumstances of its creation [28]:

– availability of competitive enterprises in the cluster. As indicators of competitiveness, different characteristics can be used: specialization that increases production productivity; low costs of doing business; high economic performance of companies (such as profitability, shareholder value); innovative potential of enterprises; high level of exports of products and services of enterprises belonging to the cluster, etc.;

– territorial proximity of organizations. This condition is necessary, first of all, to minimize transport operating costs. Depending on the type and characteristics of the cluster, it may cover one or more regions of the country. Different characteristics may serve as indicators of geographical concentration. In particular, for the mining and metallurgical cluster, it is the distance of ore and concentrates transportation between mining, processing and metallurgical capacities;

– ability to implement innovative development models for the cluster;

– the presence of direct domestic and foreign investments in the creation and development of the cluster. The possibility of state participation in investing in the creation of the cluster is also of great importance;

– availability of competitive advantages of the region for the development of the cluster. For example, the existence of an appropriate mineral resource base (mineral deposits), the necessary infrastructure, access to raw materials, the existence of suppliers, qualified personnel and specialized educational institutions, research organizations, etc.;

– -availability of the required number and appropriate set of organizations for the formation of a full cluster. Types of created clusters have different composition from the point of view of the enterprises included in it, depending on the scope of activity and the differences in the technological process in obtaining the «final product». «End products» means the end result that a cluster is created. The composition of the enterprises included in the cluster, their relationship and the importance of each individual link can be different. But the cluster is not only organizations that produce final products, but also suppliers serving enterprises (electricity, gas, water supply, etc.), small businesses, as well as professional educational institutions, research institutes and other supporting organizations;

– cooperative relations and interrelations between organizations - participants of clusters. The peculiarity of technological schemes, the characteristics of the products and their specific features can fundamentally change not only the composition of the objects included in the cluster, but also to determine the interaction between the organizations participating in the clusters, their interdependence. The cooperative relations and interrelations between the organizations - participants of clusters can have different nature, but at the same time should provide long-term, stable and predictable relations between the participants of clusters;

– a high level of added value in the formation of the final product or service specific cluster. Value added is used to measure the value created in the production process. The more stages of processing and refinement of the product passes, the more value is attached to it, the higher the added value. So, if we are talking about the creation of clusters in the mineral sector, it is not so much mining as the development of processing industries in the area;

– the presence of a synergistic effect in the development strategy of the companies included in the cluster, and the possibility of innovation in the production process. Synergetic effect (from the Greek συνεργός- together acting) - the increase in the efficiency of activities as a result of integration, the merger of individual parts into a single system due to the so-called systemic effect (emergence);

– the possibility of development in the region of small and medium-sized businesses as the basis for the successful functioning of the cluster. These enterprises act as supporting organizations, without which the effective functioning of the cluster enterprises is sometimes impossible;

– availability of a region-wide development strategy. Successful implementation of programs for the formation and special stimulation of cluster structures is possible only in the presence of a regional development strategy;

– interaction with regional and municipal authorities, the ability to support cluster enterprises at the regional and Federal level. This makes it possible to find methods and means of solving emerging problems, choosing ways to overcome them that part of them that lie within the competence of the region. For example, the participation of the state in the creation of the necessary infrastructure for the development of the cluster, simplification of customs procedures, support for education, event life (marketing activities, exhibition activities), the presence of representatives of state structures in the cluster management bodies, targeted state orders to cluster enterprises from Federal and regional state structures, etc.

The creation of clusters based on the development of mineral deposits has very significant distinctive features. For the conditions of development of an area, the structure of clusters in the mineral resource complex will also have additional specifics related to regional characteristics.

Let us consider the method of cluster approach on the example of creating a mining and metallurgical cluster in southern Yakutia.

12.2. Substantiation of the prerequisites and conditions for the creation of clusters, their composition on the example of mining and metallurgical clusters

In the context of globalization and increasing competition, the development of the Russian economy largely depends on the sustainable and effective development of each industry. The metallurgical industry is the basis for the development of the economy of the country and its Eastern regions.

The unstable situation in the Russian steel industry as a whole, in the Urals and Siberia, in particular, due to the depletion of the local iron ore base, creates problems in the industry and requires a new strategy for its development, taking into account the current state of the mineral resource base of the country.

The strategic task of the Russian steel industry in the realities of today is the involvement in the national economic turnover of proven iron ore resources of the far East region, which has the appropriate resources and an excess of fuel and energy capacities, and the creation of new capacities in its undeveloped territories, which will implement the concept of dispersed development of the industry in the country.

In accordance with the Concept of long-term socio-economic development of Russia until 2020 [52], clusters should be the main object of the state policy to stimulate innovation. Application of the cluster approach is considered as an effective form of functioning of complex economic systems and as one of the most effective ways of development of territories.

At the same time, many methodological and methodical aspects of the formation of clusters, and, in particular, mining and metallurgical, have not yet been sufficiently investigated. Such, for example, questions as: justification of strategy of creation and development of the concrete mining and metallurgical cluster; development of the mechanism of formation of the mining and metallurgical cluster considering branch features and allowing to create the most perspective directions of development of the region; the organization of interaction between participants in the mining and metallurgical cluster; development of measures and mechanism of state support for the cluster development of the mining and metallurgical industry of the country and other Scientific and practical significance of the above issues determines the need to continue relevant research.

From our point of view, the strategy for the development of ferrous metallurgy in Eastern Siberia and the far East should be determined through a cluster approach, both in the sectoral and territorial aspects.

In Russia, as follows from research Grigoriev VP [25,31], has already begun the formation of a number of mega-metallurgical clusters of global scale, the core of which are large vertically integrated holdings, geographically located in 4 regions: North-West, Center,

In table. 11.1 the distribution of reserves, production of commercial iron ore, steel smelting in the metallurgical clusters of Russia in 2011. and the projected values of these indicators for the period 2015-2020. [25,28,31].

The formation of a metallurgical mega-cluster in the far East is possible only at the expense of the South Yakut and Amur mining and metallurgical complexes-clusters created here, since the fuel and iron ore resources of the metallurgical enterprises operating in the region are limited in terms of volumes and terms of processing. In the long term, it is assumed that the development of ferrous metallurgy will be characterized by involvement in the development of reserves of deposits primarily in Siberia and the Far East [28,31].

For fig. 11.2 the structure of the future far Eastern metallurgical cluster (DVMK) is shown.

The most important factors determining the creation of a mining and metallurgical cluster in the far Eastern region, as noted in the first Chapter of the thesis, are the demand of consumers for multi-grade metal and difficulties in interregional cooperation.

The far Eastern metallurgical cluster (DVMK) began to form on the basis of existing metallurgical enterprises in the East. At present, as it was noted in the first Chapter of the dissertation work, this is the only JSC «Amurmetal» operating in the region (Komsomolsk-on-Amur), which in the future, due to the transition to iron ore through the development of a small Budyur iron ore Deposit and the supply of ore from the Garin Deposit, will turn into a metallurgical plant with an annual capacity of 2.0 million tons of steel. The second basic enterprise will be located in the neighboring Chita region, Petrovsky-Zabaikalsky metallurgical plant, which melts scrap metal into steel in the amount of 1.5 million tons per year.

Table 11.1. Distribution of reserves, crude production and production of commercial iron ore, steel smelting in metallurgical clusters of Russia in 2011 and the projected values of these indicators for the period 2015-2020, mln t (%)*

Metallurgical cluster	***Reserves (A+B+ C1+C2)*****	***Extraction commodity ores in 2011г.***	***Production of commodity ore***		***Steel production***	
			2011г.	***2015-2020гг.***	***2011г.***	***2015-2020гг.***
northwest	2900 (2,9)	62,1 (18,74)	21,0 (19,3)	15,4 (8,9)	11,4 (16,7)	12,4 (17,5)
Central	64400 (65,1)	181,2 (54,7)	59,0 (54,3)	60,4 (35)	13,7 (20)	12,2 (17,2)
Ural	13410 (13,5)	64,31 (19,4)	17,9 (16,6)	13,6 (7,9)	33,9 (49,6)	30,0 (42,3)
Siberian	10790 (10,9)	21,2 (6,4)	8,932 (8,2)	10,8(6,3)	8,9 (13,0)	8,5 (12)
Long-range accurate	7410 (7,5)	2,51 (0,76)	1,77 (1,6)	72,4 (41,9)	0,5 (0,7)	5,3 (7,5)
Of the Russian Federation,	98900 (100)	331,3 (100)	108,6 (100)	172,6 (100)	68,4 (100)	71,0 (100)

* According to sources [25,28,31].

** As of 01.01.2012.

However, as noted by Grigoriev VP [26], both of the above options are not able to solve the strategic task of creating a full-scale DVMK due to the limited fuel and iron ore resources on reserves and terms of development. Further formation of the far Eastern metallurgical cluster will be continued at the expense of the newly created in the region of the South Yakut and Amur mining and metallurgical complexes-clusters.

In table. 11.2 aggregated data on the mineral resource base of iron ore in the far Eastern region of the Russian Federation are presented. Currently, the far East region is provided not only with explored and approved reserves of iron ore (table. 2.2.2), but also coking coals, non-metallic raw materials for metallurgy (flux, refractory) and almost the entire set of minerals necessary for the smelting of high-quality iron and steel, the production of various types of metal products.

Table 11.2. Iron ore Reserves in the southern part of the far East*

The subject of the Russian Federation	Iron ore district (ERR)	Balance sheet reserves by category, mln t			Off-balance sheet reserves, mln t
		A+B	A+B+C1	C2	
The Republic Of Sakha (Yakutia)	South Aldan	435,5	1454,3	365,7	179,8
	Charo-Tokinsky	268,1	2064,6	1867,4	-
Total on LRE of the Republic of Sakha (Yakutia)		703,6	3518,9	2233,1	179,8
Amur region	See-Saw	83,7	211,4	177,4	55,0
Jewish Autonomous region	Malachinski	87,2	722,6	32,3	302,3
Primorsky Krai	Ussuri	-	-	129,2	-
Total by region		***874,5***	***4453,0***	***2571,9***	***537,1***

* According to [28,31]

The iron ore base of the far Eastern region includes deposits of the Republic of Sakha (Yakutia), the Amur region, the Jewish Autonomous region and the Primorsky territory.

The primary resource base of the mining and metallurgical cluster created in the Amur region since 2003 is four deposits — Kuranakh titanium magnetite and Garin iron ore in the Amur region, Kimkan and sutar Iron ore — in the Jewish Autonomous region. The expansion of the resource base are planned due to the involvement of the ore deposits at Bolshoi seyim, Kostenginskoye and Orel-Sahalinskoe mining area located in the vicinity of priority sites. The cluster is focused on the production of metallurgical products with high added value and includes three new mining and processing plants and the far Eastern metallurgical combine (DVMK) operating in the region. The first — Olekminsky GOK on the basis of the Kuranakh field, put into operation in 2010, already carries out shipment of products — iron ore and ilmenite concentrates. The other two GOKs — Kimkano-Sutarsky (commissioning in 2014) and Garinsky (commissioning in 2015), based on the fields of the same name, will form one production chain for the production and enrichment of raw materials (iron ore concentrate) for DVMK, which, using advanced ITmk3 technology (Ironmaking Technology mark three), will produce granular iron (nugget), or direct reduction iron, a highly competitive raw material for electrometallurgical steel production. To this end, it is planned to build two modules with a total annual capacity of 1 million tons. tons of granulated iron of direct reduction at the first stage (2017-2018), followed by an increase in capacity to 2.5 million tons. In the future, on the basis of DVMK, it is possible to create a steel production. The innovative component of the large-scale project of creating a mining and metallurgical cluster implemented in the Amur region is the scientific and technical complex of ferrous metallurgy, including research institutes in the field of integrated design of mining enterprises, an experimental industrial plant and permanent industrial laboratories. The socio-economic effect obtained from the industrial development of the iron ore base and the creation of a mining and metallurgical cluster in Primorye is about 5.5 thousand new jobs, the construction of infrastructure and social facilities, the growth of revenues to the budgets of all levels and the gross regional product. Mining and metallurgical cluster in the Amur region - an example of a complex

approach to the creation of enterprises for the production of products with high added value, allowing for the effective development of mineral resources to ensure sustainable development of the region [35].

One of the most promising areas of the far Eastern region is southern Yakutia. Today the Republic is one of the most investment-attractive Russian regions. As an example, we can cite a successful Investment project «Integrated development of South Yakutia» [28,31,70,71], which is not so much about the extraction of minerals, but about the development of processing industries in this area (Fig. 11.3). Being one of the most investment-attractive regions of Russia, Yakutia currently acts as a «locomotive» for the socio-economic development of the entire Russian Far East.

The Republic of Sakha (Yakutia) has a rich natural resource potential, including for the creation of a base of ferrous metallurgy (rich reserves of iron ore, coking coal, the presence of non-metallic raw materials for metallurgy (flux, refractory) and almost all the set of minerals necessary for the smelting of high-quality iron and steel, the production of various types of metal products, etc.), which determines the industrial development of the region in the near and long term.

The best prospects for the formation of a mining and metallurgical cluster is in the southern part of the territory of the Republic of Sakha (Yakutia) (South Aldan and Charo-Tokinsky iron ore district), where all inferred resources of local iron ores (field desovskoe, taiga, Tarynnahskoe and Gorklith).

More than half of the estimated reserves of iron ore (table.11.2) are in Yakutia (79,0%) and including Charo-Tokinsky district. The latter has 46.4% of iron ore from all reserves of the far Eastern region and 58.7% of the reserves accounted for in Yakutia. Another feature of the Charo-Techinsche area is the size of the explored deposits. So, the average number of stocks of iron ore at each of the deposits of the Charo-Techinsche of the district is about 700 million tons, and given the stock S2 on three major objects, the average number of stocks each increased to 1,300 million tons of grain Size of the deposits allows for their development not only have a large production capacity for the extraction of ore, and a long, reliable life security. The latter plays a huge role in creating a single-production structure of cities, providing work to the population of the region for many years.

To solve the practical problems of organizational registration of territorial and industrial integration, to obtain a new impetus for the development of ferrous metallurgy in southern Yakutia, a cluster approach (cluster theory) should be used, which will increase the competitive advantages of the economy of the region and the metallurgical industry as a whole. To do this, first of all, it is necessary to identify the prerequisites and conditions for the formation of the mining and metallurgical cluster and to identify the organizational and economic characteristics of its functioning on the basis of iron ore deposits in the region, as well as to determine the effective structure of the cluster.

Since the further formation of DVMK will continue at the expense of the newly created in the region of the South Yakut mining and metallurgical complex-the cluster, it is also necessary to assess the economic efficiency of mining iron ore deposits, which will form the basis of this cluster.

In the mineral resource complex (MSK) of the country and in the development of iron ore deposits, in particular, there are significant sectoral features of the functioning of enterprises-subsoil users, which most directly affect the formation of clusters. These features are manifested not only in the implementation of the conditions for the creation of clusters, but also in the presence of the necessary prerequisites for the formation of clusters (Fig. 11.1.)

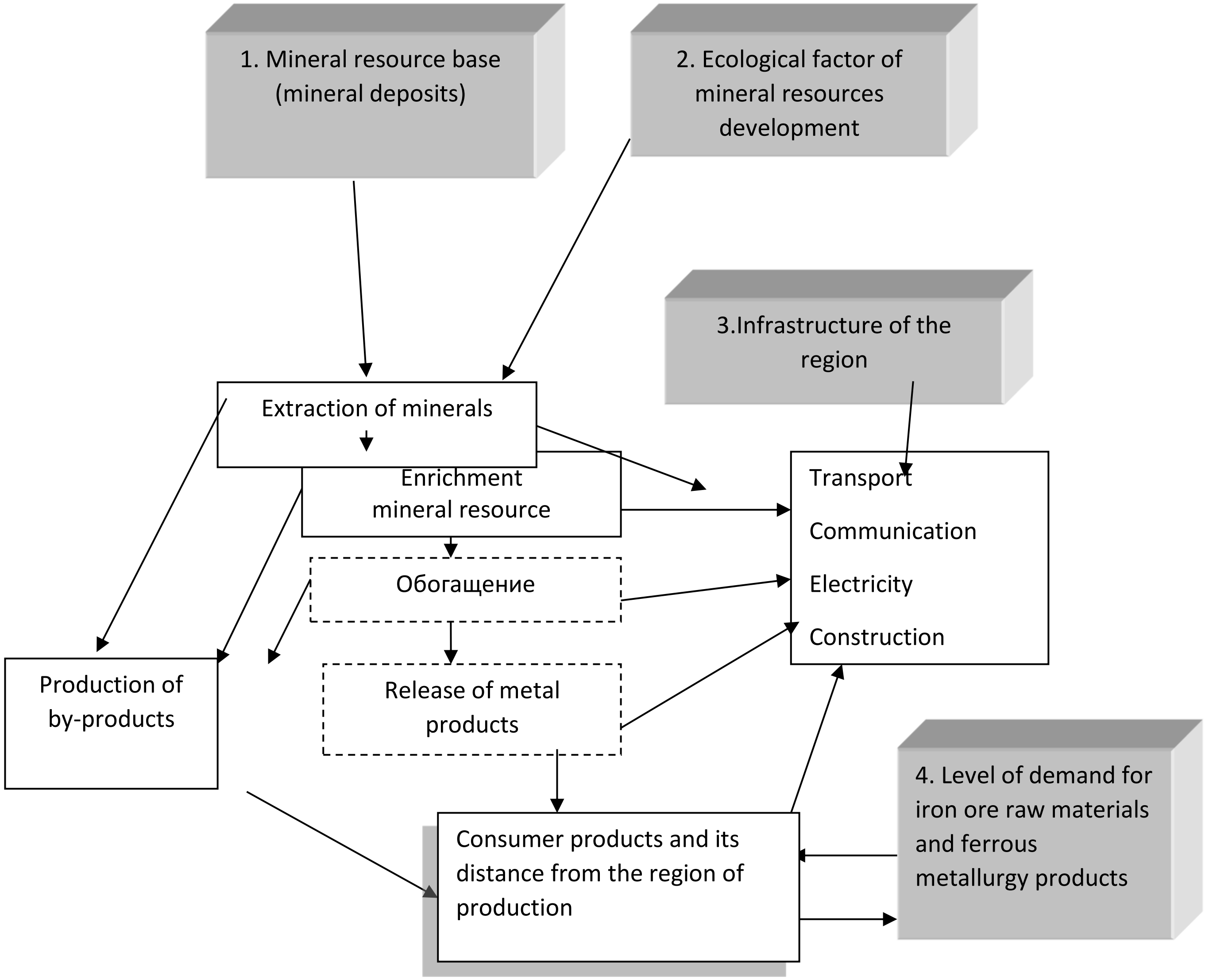


Fig. 11.1. Prerequisites for cluster formation in the development of iron ore deposits

From our point of view, the necessary prerequisites for the creation of clusters in the development of solid mineral deposits, which are due to the sectoral characteristics of the functioning of enterprises-subsoil users, include:

1) Mineral resource base (or presence of mineral deposits, in particular, iron ore deposits);
2) Environmental factor in the development of mineral resources;
3) The degree of development of the territory (the state of infrastructure in the region of future industrial enterprises of the cluster);

4) The level of demand for the cluster's products, in particular, iron ore and steel products.

Let us consider these necessary prerequisites for the creation of clusters in the development of solid mineral deposits, including mining and metallurgical, in more detail.

1. Mineral resource base (or mineral deposits, which are the basis of the cluster in Moscow time, and their characteristics (the size of deposits, the quality of mineral raw materials, the presence of associated components and the possibility of obtaining associated products, the demand for products, the economic parameters of field development, etc.)).

Types of created clusters, including in MSK, have a different composition of their enterprises depending on the scope of activity and the differences in the technological process of obtaining the «final product». By «end products» we mean the end result of the cluster's operations. The relationship and importance of each individual enterprise in the cluster can also be different.

Unlike other sectors of the national economy, clusters in Moscow time can be created only if there is an appropriate mineral resource base, i.e. mineral deposits.

At the same time, the development of each field of solid minerals requires an individual approach, which is associated with both the mining and geological conditions of the field development, and the specifics of the final product of the cluster. This peculiarity of the MSC will relate both to the choice of organizations breaded for inclusion in the cluster, and to the objects of non-core direction, to enterprises and organizations indirectly related to the main (profiling) objects. As a result, each cluster in the MSC as a result of different production conditions will be unique, formed individually. However, the basis of the cluster in the mining industries will always be associated with mineral deposits. They are not only the basis of the cluster, but will also determine its composition (the circle of its member enterprises) and, most importantly , the level of economic and social effect achieved from the development of the field.

Taking into account the considered prerequisite for the creation of a mining and metallurgical cluster, the iron ore deposits of southern Yakutia fully meet this requirement. More than half of the estimated reserves of iron ore in the far Eastern region of the country are in Yakutia (79.0%), including the South Aldan and Charo-Tokkin district. The large size of the explored iron ore deposits of southern Yakutia allows for their development to have a large production capacity for ore extraction and a long, reliable period of provision with reserves of the future enterprise.

In addition, South Yakutia has a number of minerals necessary for the production of iron and steel. These are coking coals, non-metallic raw materials, etc., which increases the value of this region for the creation of a mining and metallurgical cluster.

2. The second prerequisite for the creation of clusters in the development of solid mineral deposits is the environmental factor in the development of mineral resources.

This premise is restrictive from the point of view of creating clusters in the development of solid mineral deposits. In other words, the task is as follows: is it possible for future enterprises in the cluster to reduce the environmental impact of the development of iron ore and other fields to an acceptable level; it is possible in each case whether a compromise resolution of the conflict between economic benefits and possible environmental damage when placing mining and metallurgical industries on the territory, individual economic and environmental justification for the development of deposits and construction of a mining enterprise.

The ecological factor of mineral resources development is manifested in the necessity of production greening in the following areas:

– prevention of negative consequences of mining on the health of workers and the population of cities and districts;

– preservation of favorable natural environment and landscapes by carrying out ecological monitoring, prevention and elimination of negative consequences of development of fields (providing whenever possible reuse of the fulfilled underground excavations and pits, recultivation of lands, performance of forest plantations, etc.).);

– the continuous reduction of nature intensity of mining production (reduction of water abstraction, drainage of land for mines, quarries and dumps), reduce the consumption of heat and electricity per unit of finished manufactured products of the enterprise;

– continuous reduction of the impact of mining, processing and metallurgical production on the natural environment by reducing emissions of harmful substances into the atmosphere, wastewater discharges into water bodies and solid waste disposal.

3. The third prerequisite for the creation of a mining and metallurgical cluster is the degree of development of the territory (the state of

infrastructure in the region of future industrial enterprises), on which it is planned to create a cluster (availability of transport facilities, provision of electricity, labor, availability of social infrastructure, etc.).

This premise is a reflection of the industry specifics of mineral extraction. The development of the territory in the development of mineral deposits plays an important role due to the fact that the location of the developed field is not chosen by the investor, it is due to nature. In addition, the discovery of new deposits is becoming increasingly problematic in the developed areas. New, large and noteworthy deposits are usually located in remote underdeveloped areas. Therefore, the formation of clusters in the development of mineral resources located in areas with different degrees of development of the territory will require an individual approach.

When developing fields, there is a problem not only with the arrangement and life support of the future enterprise, but also no less acute is the problem of finding the future consumer of products of the mining and metallurgical cluster.

There are types of minerals where this factor will not be of significant importance, as at the stage of extraction and enrichment we already receive «final products». For example, the Dore alloy, «concentrate platinum», etc. In the development of objects for the production of precious metals, diamonds or piezo-optical raw materials, the proximity of consumers of these products to its producers will also not play a significant role. These final products can be delivered to the consumer from anywhere in the country, even by plane or helicopter. For example, for platinum, the content of mined ore may be less than 1 g/ m3 or 0.5 g/t. the Output of the final product will be small and a thousand times less than the volume of extracted ore.

Most types of raw materials, on the contrary, depend very much on the consumer and his location. These types of raw materials include iron ore. When developing iron, manganese, Apatite ores, coal and a number of other types of minerals, the proximity of the consumer to the producer turns into one of the most important problems of creating a cluster. Suffice it to say that the most common type of products of iron ore mining and processing plants is a concentrate with a content of Fe_2O_3 65-73 %. As a result, 35% to 28% of the output (concentrate) can be considered as waste rock, which has to be transported to the consumer (and the supply of iron ore concentrate is millions of tons per year).

Considering the third prerequisite for the creation of a mining and metallurgical cluster, we can again identify areas of southern Yakutia. The main advantage of the iron ore deposits of southern Yakutia is the presence of the Baikal-Amur mainline operating there. The railway tracks are only 5 km from the largest and most «rich» iron ore Deposit - Taiga. To Desovskogo deposits from the railroad distance is 25 km away and the railway communication in the district is the Federal highway «Lena». On the Eastern side of the South of the Republic there is an underground oil trunk pipeline of the ESPO system. In the area of high-voltage transmission line neryungrinskaya runs GRES-Nizhniy Kuranakh. In addition, the district operates Chulman CHP. Both stations operate on local fuels, using the resources Nuenglish coal basin.

The main geographical and economic difficulties in the area are severe climatic conditions (long winter, low temperatures), as well as high seismicity of the territory, which is estimated at 7 points on the Richter scale. The increased seismicity of the southern Yakutia regions imposes increased requirements for the construction of buildings and structures, as well as higher insurance premiums to cover the possible occurrence of losses from natural risks.

4. The fourth prerequisite for the creation of a mining and metallurgical cluster is the level of demand for the cluster's products, in particular, iron ore and steel products.

Taking into account the specifics of commodity production of enterprises of the mining and metallurgical cluster, maintaining the efficiency of their activities in order to recoup investments, the demand for commodity products of the cluster should be long-term and stable.

The products of the future mining and metallurgical cluster in southern Yakutia will have a steady demand.

In the domestic market, the demand for steel products is related to the demand in such industries as the construction of transport facilities, the construction of power lines, the development of new mineral deposits. It is in the far Eastern region that the plans for the development of the economy provide for the creation of new transport routes, electricity and gas supply, and the development of a number of mineral deposits.

In recent years, the demand for steel products has been consistently held by the Irkutsk region, the TRANS-Baikal territory and Buryatia. These regions are closest to the territories, which are considered deposits (taiga, desovskoe, Gorklith and Terindah). Demand for steel products in these areas, which are located in geographical proximity to southern Yakutia, is the highest in the far East region and has a pronounced upward trend.

The need for iron ore is not only related to domestic demand for steel products, but also to the growing demand for imports of this raw material, the main consumer of which is currently China. The construction of a mining and metallurgical cluster at the iron ore deposits of southern Yakutia will allow the supply of iron ore to the Western regions and export to China and the Asia-Pacific countries, which will provide a significant economic effect. According to IAC «Mineral» [38] in 2009 more than half of China's iron ore raw materials were imported - 628 million tons, or 20% of world exports. [28,31].

It follows from the above that the formation of an effective mining and metallurgical cluster in southern Yakutia has all the prerequisites for this:

- the presence of a rich mineral base of iron ore;
- the ability to reduce the environmental impact of the development of iron ore and other deposits to an acceptable level;
- the existence of a sufficiently developed infrastructure necessary for the development of iron ore deposits;
- availability of long-term and stable demand for commodity products of the mining and metallurgical cluster.

For the full and effective functioning of clusters in the development of solid mineral deposits, it is necessary to determine its composition and form an algorithm for creating a cluster.

As already noted, the composition of the cluster will depend to a certain extent, first of all, on the mineral deposits and their characteristics: the scale, geological and technological features of the development of objects, the quality of the extracted minerals and other natural and technological characteristics.

The composition of the cluster formed for the development of solid mineral deposits, and the effectiveness of its functioning will also depend on the system of interaction of enterprises belonging to the cluster.

For the conditions of development of iron ore deposits of southern Yakutia, the cluster structure for their development will also have its own, inherent only to this region, features.

The composition of the cluster in the development of solid mineral deposits can be represented as a system of three groups of participants:

- objects related to the cluster core;

- objects forming the periphery of the cluster;
- objects indirectly related to the cluster, but not included in it (non-core enterprises).

1. The core of the mining and metallurgical cluster. It includes facilities related to mining and processing.

The structure of the cluster in the development of solid mineral deposits will depend mainly on the indicators of the mineral resource base, on the basis of which the cluster is created. It is the mineral deposits that are the basis of the cluster. This provision fully applies to the structure of the mining and metallurgical cluster in southern Yakutia.

Mining and geological conditions of mining of mineral resources, the peculiarity of ores of a particular Deposit, its quality, technological properties of mineral raw materials, features of mineral processing schemes, characteristics of the resulting commodity products in the development of mineral deposits and its specific features will fundamentally affect not only the composition of the cluster, but also determine the interaction and interdependence between the objects of the cluster.

The basis of the metallurgical cluster is planned to be the desovskoye and taiga deposits. To create reliable and long-term resource base in the Foundation of the cluster, add two object is the iron ore Deposit Gorklith and Terindah.

For the mining and metallurgical cluster in South Yakutia, its core will be the mines (quarries) for mining of iron ores (taiga, desovskoe, tarynnahskoe, gorkitskoe), concentrator, metallurgical plant. The enterprises included in the core of the mining and metallurgical cluster will be vertically integrated. Between each stage of processing of mineral raw materials there is a strict interdependence and interdependence: from the volume of ore production to the amount of metal products obtained.

The composition of the planned enterprises in accordance with the Strategy of development of the Taiga and Desovskogo mining and processing of iron ores 4 deposits of southern Yakutia (taiga, desovskoe, tarynnahskoe, gorkitskoe) [28,31] included:

Taiga mine, which includes a quarry with a dump farm; crushing and processing plant (with a three-stage crushing and dry magnetic separation); concentrating plant with two separate lines for the acceptance of industrial products of SMS Taiga and Desov deposits, separate lines of grinding and wet magnetic separation; the necessary set of infrastructure and the necessary engineering and transport communications.

Desovski mine (structure is part of the Taiga GOK) will include career otvorenim economy; ore preparation factory with a three-stage crushing and dry magnetic separation; the necessary infrastructure and the necessary engineering and transport communications.

The composition of objects Tarynnahskoe GOK is similar to composition of objects Taiga Mining. Additionally, the structure of objects GOK is Goretskogo industrial site of the mine with the minimal necessary set of infrastructure.

In addition, the Strategy also provides for the option of organizing a metallurgical production – a hot-briquetted iron (HBI) production shop at Tarynnakhsky GOK.

Two concentrators will have an annual production capacity for processing 45, 0 and 27, 6 million tons of ore and producing 17.9 and 14.8 million tons of iron ore concentrate, and a metallurgical plant - smelting 3.2 million tons of iron and steel.

2. The periphery of the cluster. The periphery of the cluster will be related objects, i.e. enterprises that provide services to the enterprises that make up the core of the cluster, and objects whose activities depend on the activities of enterprises that make up the core of the cluster.

If the core of the cluster in the development of solid minerals is quite constant - it is the mining and metallurgical complex, the range of objects belonging to the periphery of the cluster will always be individual. This is due to the peculiarities of the mineral resource base, which forms the basis for the creation of a mining and metallurgical cluster.

Thus, for the iron ore cluster of southern Yakutia, its periphery can be attributed, first of all, to enterprises engaged in mining at existing and newly introduced deposits of such types of raw materials that are necessary for a metallurgical plant and a plant for the production of metal products.

In southern Yakutia, in addition to iron ore, coking coal deposits have been explored, there are deposits of manganese ores, non-ferrous metals, which will allow the future metallurgical plant to produce the necessary range of metal products, having its own raw material base for this. Therefore, the periphery of the future mining and metallurgical cluster in southern Yakutia should include enterprises and a number of mineral deposits in the region, whose resources will be in demand during the enrichment and metallurgical processing of iron ores. These objects can be referred to existing coal deposits (Neryungri), deposits of manganese (Usinsk), the Deposit of chromium (Zybinskoe), and a number of deposits of non-ferrous metals (Kolodinski, Gorevsky).

The peripheral part of the iron ore cluster of southern Yakutia should also include enterprises providing transport, energy, logistics and other services, construction organizations, etc., whose activities are necessary for the effective functioning of the mining enterprise, metallurgical plant and a plant for the production of metal products.

Most often, subsoil users have to deal with complex deposits of solid minerals. As a result, the extraction of the main mineral is often accompanied by the extraction and production of associated products. For example, building materials, rare and rare earth elements, gold, silver and much more.

Deposits taiga, desovskoe, tarynnahskoe, gorkitskoe treat complex fields. By-product iron ore deposits desovskoe and taiga can become the basis for the development of South Yakutia in such industries as chemical industry, building materials, transport, etc.

It is known that on the field desovskoye except iron ore raw materials there are reserves of boron that can become a basis of development of the chemical industry.

The presence of sand, gravel and cement raw materials extracted from the bowels of the earth in the form of overburden and tailings enrichment, will create enterprises for the production of building materials for industrial and residential construction.

Production by the future mining and metallurgical cluster of such types of metal products as fittings, ropes, wires, rails, etc. can become the basis for the construction of not only industrial and residential buildings, but also the basis for the construction of roads, bridges, tunnels, power lines in the far East region.

The activities of the enterprises included in the periphery of the cluster will largely depend on the requirements of the enterprises included in the core of the cluster. Therefore, it is here that one of the most important conditions for the creation of the cluster will be revealed - the synergetic effect, which can be expressed in the form of increased competition, the desire for qualitative fulfillment of the requests of the enterprises of the cluster core, reducing prices for goods and services, etc.

3. Objects associated with the cluster but not included (non-core objects). Their presence is necessary for the full and effective functioning of the cluster. The mechanism of interaction of the future cluster with the external environment will be implemented through the interaction with non-core objects.

The creation of a metallurgical cluster in southern Yakutia will have a direct impact on the development of related sectors of the economy. For the smooth and cost-effective operation of the enterprises of the mining and metallurgical cluster, it will be necessary to expand the volume of both existing production in the area and the creation of new production facilities. In addition, it will require a system of training, development of scientific research, creation of social infrastructure, etc.

The paper [31] proposes the following algorithm for creating a cluster in the development of solid mineral deposits, which should include the following stages:

1. Conducting research to identify the prerequisites and conditions for the creation of a cluster for the development of solid mineral deposits.
2. Evaluation of the resources of the region, ensuring the feasibility of creating a cluster.
3. Study of the socio-economic state of the region, the regional strategy of its development.
4. The formation of the cluster core.
5. Forming the periphery of the cluster.
6. Define objects that are associated with the cluster but are not part of it (non-core objects).
7. Development of regional cluster development strategy.
8. Determination of measures of state support of the regional cluster.
9. Evaluation of the effectiveness of the cluster in terms of synergetic effects and impact on the economy of the region and the industry by comparing with the existing organizational and economic form of development of the region.

12.3. Economic efficiency of development of iron ore deposits included in the mining and metallurgical complex of southern Yakutia.

Proving the feasibility of creating a mining and metallurgical cluster on the basis of iron ore deposits in southern Yakutia, it is necessary to conduct their geological and economic assessment. This assessment will determine the order of commissioning, determine the optimal volume of production and justify the production capacity of the future mining and metallurgical cluster.

The basic principles of geological and economic evaluation of deposits are formulated taking into account the peculiarities of market relations, the need to strengthen the functions of the state in the economic development of the country. Different principles and indicators, reflecting the different sides of the assessment, complement each other and contribute to the adoption of compromise decisions in the use of natural and industrial potential of the enterprise.

The principle of public demand for raw materials and the preservation of the environment is approved by the state approach, target programs for the development of individual regions, enterprises, and is regulated by domestic or world prices, as well as the state of the environment in the work area. This principle is implemented through freely set prices for raw materials and reduction of harmful effects on the environment during the development of the facility (environmental damage). The cost of ecological effect compensation is a mandatory component of future investments.

The principle of acceptable return on invested capital in the context of the formation of market relations is becoming increasingly important. The same economic indicators of field development are acceptable for some and not acceptable for other investors. Numerically, this principle is implemented through the profitability index (profitability).

The principle of mutual interest. When developing a field, each participant of the project seeks to meet their interests, which often contradict each other, so it is necessary to conduct geological and economic assessment based on the main goals of both the state, the owner of the subsoil, and take into account the interests of the investor seeking to recoup the invested funds as soon as possible. The implementation of this principle in the geological and economic assessment of deposits includes the definition of economic indicators such as budget efficiency.

The principle of full use of reserves is enshrined in the law of the Russian Federation «On subsoil» and is aimed at the rational use of non-renewable mineral resources. This principle is implemented when comparing several options for field development. The choice of the method of working out and the size of the conditions is based on the equality of marginal costs to the marginal income taking into account the indicators of net discounted income or through the indicator of the minimum industrial content.

The principle of the system approach assumes the most complete account of the main parameters influencing relationship of the person with the nature (volume of the fulfilled resources, technology, nature protection, social consequences).

Modeling of cash flows. In the market conditions, the stability of the financial condition of the enterprise is of particular importance, since the lack of funds can lead to its insolvency. To avoid this, it is necessary to simulate possible options for the development of the financial system: inflows, outflows of funds, their cash equivalents for a certain period of time. This principle is realized through the indicator of net discounted income.

It is proposed to create a mining and metallurgical cluster in southern Yakutia on the basis of 4 iron ore deposits. It deposits taiga, desovskoe, gorkitskoe and Terindah, stocks which are already counted and placed on the state balance. The total reserves of these fields are given in table 12.3.

When carrying out geological and economic assessment of iron ore deposits in southern Yakutia [28,71] of all explored reserves, reserves of the first stage of development are subject to assessment. This is especially true for the taiga and desovskoye fields, the development of which is planned both open and underground methods.

One of the important aspects of the choice of priority objects for development is the degree of their geological study, which is reflected in the category of explored reserves. The most explored are the tayezhnoye and desovskoye deposits. Detailed exploration has already been carried out at these fields, permanent conditions have been approved, reserves have been explored in categories B, C1, and partly C2. Selected areas of fields for priority development. Deposits Gorklith and Trynnah the degree of exploration is lower. For rice. 12.2 the data on the degree of exploration of iron ore deposits included in the mining and metallurgical cluster.

As follows from the data shown in Fig.12.2., the most explored and prepared for operation is the taiga field. At the Desovskoye field, there are also reserves in sufficient quantity for the design of the mining enterprise. Field gorkitskoe and tarynnahskoe explored in less detail. They have stocks only in categories C1 and C2. To put these fields into operation, it is necessary to conduct detailed exploration, which requires time and cost of exploration. In addition, these fields do not have a clear definition of what reserves will fall in the first place during the development of the object, only the total amount of reserves is indicated.

Table 12.3. Total ore reserves of deposits included in the mining and metallurgical cluster (as of 01.01.2012).) [according to 28, 31,70,71]

Fields	**Geologicas-Kie ore reserves thousand tons.**	**Including by category**		**Average content gland (Fe_2O_3), %**
		$B+C_1$	**C_2**	
Taiga	1408366	812004 (57,35%)	596362	37,0
including I stage of development	956210	812004 (84,9%)	144206	28,1
Desovskoe	600233	387469 (64,5%)	212764	26,7
including I stage of development	423120	387469 (91,6%)	35651	27,9
Gorklith including I stage of development	1850400 466000	454500 (24,6%) no data	1395900 no data	29,5 no data
Terindah including I stage of development	2440600 791500	769100 (31,5%) no data	1671500 no data	29,2 no data

involving fields in the development and creation of a mining and metallurgical cluster on their basis, it is necessary to conduct a geological and economic assessment of each of the planned facilities. Determination of the most important indicators of geological and economic assessment allows to determine the future production capacity of the metallurgical enterprise, the size of the necessary investments, as well as the need for workers. The latter position is very closely related to the development of infrastructure in the region. The creation of a chain of interconnected mining and metallurgical enterprises can solve major problems in the development of the territory of southern Yakutia.

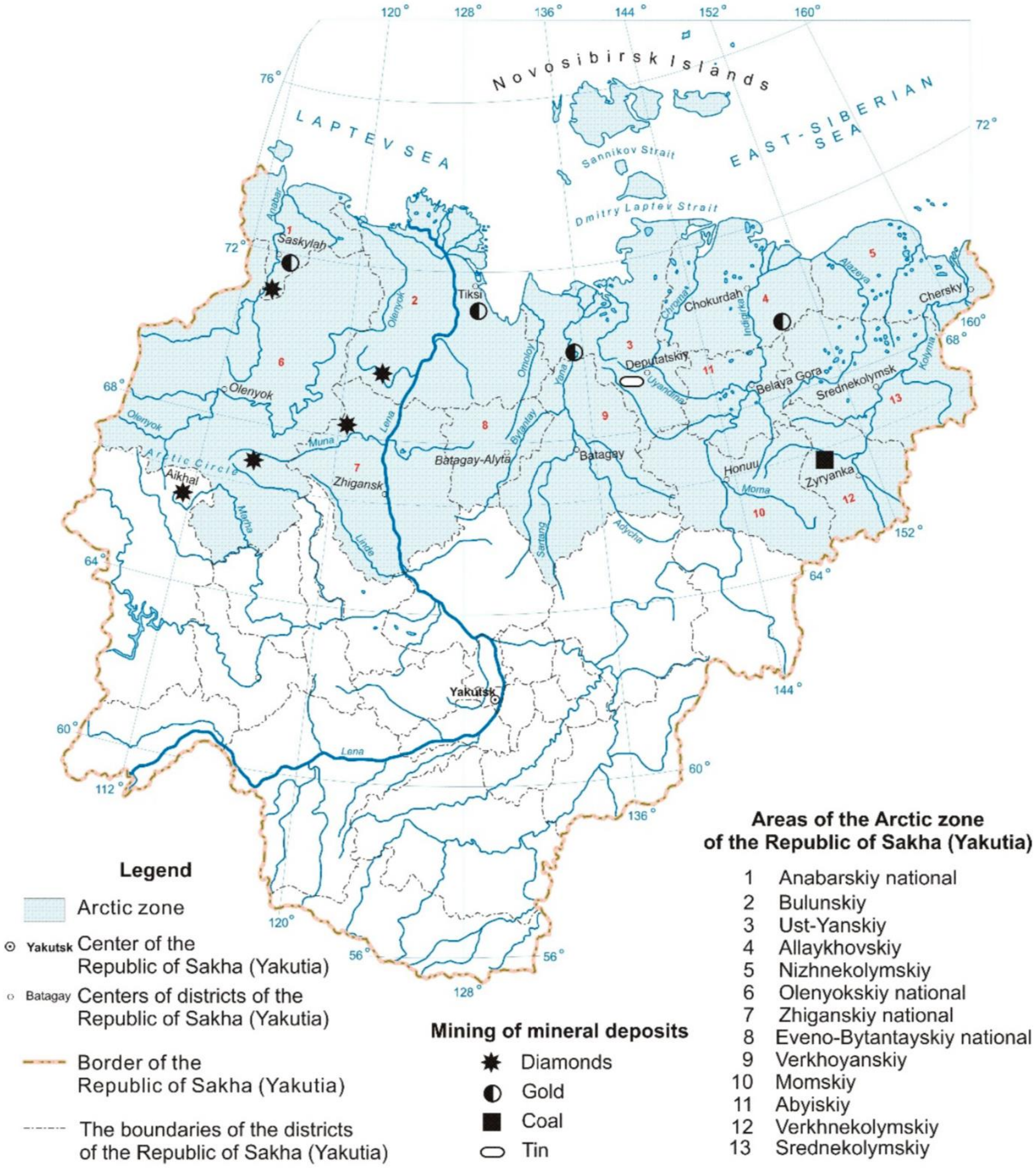


Fig.12.2. The degree of exploration of iron ore deposits in southern Yakutia

To justify the priority and, most importantly, the feasibility of

To assess the economic feasibility of the development of deposits in southern Yakutia, it is necessary to assess not only the presence and content of iron ore, but also their geological, mining features and technological compatibility of the extracted raw materials in the processing process. This is due to the creation of a single center for the processing of mined iron ore – mining and metallurgical cluster.

Geological structure of the area of deposits.

Taiga iron ore Deposit is located in the South of the Republic of Sakha (Yakutia) in the Central part of the Aldan plateau, in the basin of the river Great Lehmer. From Taiga deposits 120 km to the South is the village of Chulman, 150 km from the city of Narengi. The city of Aldan is 120 km North of the Deposit. The taiga Deposit is the largest in the South Aldan iron ore region. Structurally, the Deposit is confined to the North-Western closure of the Taiga-Leglier synclinal and has a horseshoe shape with a wingspan of the synclinal structure of 1100-1200 m. In the South-Eastern direction, the wingspan of the synclinal decreases to 450 m. the Stretch of the structure East-South-East, the drop of the wings is steep - 60-80°. The maximum depth of immersion of the ore horizon is 1200 m, the maximum width of the Deposit is 1520 m. the Total area of the Deposit is ~ 3 km2 with a length of 5400 m along the sole of the productive pack.

In total, 5 ore deposits have been explored at the field, localized in 2 stratigraphic levels. It is noted upland salinity (acharit, ludwigite) with an average grade of 0.91 B2OZ%. It is planned to develop the Taiga Deposit in the first place by the open method and only after a year - the transition to the underground method of mining.

Desovskoye field is also located in the South of Yakutia. It is elongated in submeridional direction for 20 km in a narrow strip with a width of 2-3 km and is divided into several sections. Area Desovskogo iron ore deposits of metamorphic rocks of the Fedorov and teetoncey Suite of lower Archean.

Structure Desovskogo field is relatively simple. Complex metamorphic rocks of the Fedorov suites within the field crushed in the synclinal fold, named Desovskoe. In terms Tesovskaya a synclinal fold has the shape of osculatory arc, convex to the North. Throughout its length, the Deposit has a North-Western direction.

To date, 17 iron ore deposits have been explored at the Desovskoye iron ore Deposit. All of them are stratigraphically confined to the ore pack of the mid-Feodor Suite.

The desovskoye field is also planned to be worked out in an open way. Only after the development of reserves within the open mining can there be a question of the transition to underground mining of the lower horizons of the field.

In areas of southern Yakutia in the territory of the Charo-Techinsche area is located two deposits of iron ore tarynnahskoe and gorkitskoe.

Field gorkitskoe geologically consists of two phases: the bottom-Gornitsky and actually Gornitsky, located to the North of the first. The bulk of ore deposits is concentrated in the Eastern and Western parts of the Gorkitskoye field itself. The deposits are elongated in the meridial direction and have a distance of 0.6 to 1.2 km from each other. In the Eastern Deposit contains approximately 80% of all reserves explored in C1. On the lower-Gornitzka section of the ore deposits also are East and West direction. However, the size of the reserves of these deposits is much smaller. In addition, there are significant layers of empty rocks, significantly exceeding the capacity of ore bodies.

In geological structure of the Deposit Terindah participate mainly metamorphic rocks berlinskoj retinue of the upper Archean. The field consists of four sections stretched from North to South. The main ore Deposit contains more than 74% of all explored reserves. Within the field there are three ore deposits.

Material composition of ore deposits.

The ores of the Taiga Deposit belong to the same magnetite type of ores with an admixture of sulfides. Iron ore requires enrichment.

Ores of Desovskoye Deposit also belong to the magnetite type. Ores are represented by two varieties: low-sulfur (oxidized) and sulfur, and the vast majority of reserves are sulfur ores (88% of reserves). Low-sulfur (oxidized) ores at the Deposit are insignificant and are mainly confined to the near-surface zone; the boundary sulfur content at contouring is 0.3%. The reserves of these ores account for about 12% of the reserves of the Deposit.

Primary ore deposits - magnetite interspersed with sulfides (pyrite, pyrrhotite, chalcopyrite). Ores in General are poor, with an iron content of total 20-40%, on average 25-27% of iron, requiring enrichment.

Mining ores on the deposits of the boreal and desovskoe involves the loosening of the mountain massif with the use of drilling and blasting. As already mentioned, proven reserves of iron ore is characterized by low iron content, which requires enrichment. Technologists developed a system of enrichment, which allows to minimize the cost of transport cost of shipping the ore to the processing plant. For this purpose, large-scale enrichment at crushing and processing plants is provided at the sites of the fields. The resulting intermediate product is fed to the Taiga beneficiation plant where the method of wet magnetic separation get iron ore concentrate with a content of 63-65% iron.

The composition of ore minerals of the Deposit desovskoe the same minerals of the ore deposits of the taiga, but their proportions are different, that does not prevent to carry out enrichment of ores mined by a single technology.

Goretskogo and Tarynnahskoe ore deposits have higher iron content. Rich ores having an iron content of more than 46%, and poor ores containing iron magnetite more than 10%. The average content of 29.5% total iron in Gorchitsa the field and 27.5% - in the field Terindah. The ore of these deposits require beneficiation. The most important factor that allows for joint development of deposits is the possibility of using a single ore dressing system. The latter includes three stages of grinding in rod and ball mills and four stages of wet magnetic separation. The resulting concentrate has an iron content of up to 71%-72%, which allows its use in the production of metal without additional enrichment. The absence of harmful impurities provides a high yield of commercial products with minimal losses during enrichment.

Mining conditions of mining.

Mining conditions of the Taiga Deposit are estimated as of average complexity. The Deposit is composed mainly of rocks of medium strength, the capacity of loose sediments is insignificant (from 2 to 6 m). The Deposit is located in the area of massive island distribution of permafrost. The territory of the Deposit belongs to the areas of increased seismic activity. Engineering-geological conditions of open-pit mining are complex.

At the same time, the hydrogeological conditions of opening and development of deposits can be described as quite simple. Flooding of the pits will occur due to fissure, fissure-vein waters and atmospheric precipitation. Water flows in the quarry are supposed to be pumped out with the help of open drainage.

The taiga field is worked out by one quarry of mountainous type, with a height difference of 140 m (from +1160 m to +1300 m).

Mining conditions Desovskogo field are estimated as medium complexity. The Deposit is located in the permafrost zone of the island with a depth of 50-190 m and increased seismic activity. The field is supposed to be worked not by one, but by several quarries.

Hydrogeological conditions of opening and development of deposits are quite simple. Flooding of the pits will occur due to fissure, fissure-vein waters and atmospheric precipitation. Water flows in the quarry are supposed to be pumped out with the help of open drainage.

Development of the field begins with the Central section. The length of the Central section of the Desovskoye field is 3.6 km. East - 2.7 km. Each section contains 5-6 ore bodies. the Central section of the field is worked out by two quarries. East section - one. The height difference in the Central section reaches 210 m, East - 240 m.

Field gorkitskoe and tarynnahskoe removed from areas for priority development. But according to geological-economic estimation of deposits, they may be developed together with the deposits of the boreal and desovskoe, as they have similar geological conditions and similar technologies of enrichment of ore. The purchased equipment and the factory built for ore dressing can be used for ore dressing of these two fields. Most of the deposits of gorkitskoye and tarynnakhskoye are planned to be worked out in an open way. As the field Gorklith and field Terindah is expected to work a series of pits which will be introduced in the testing gradually from quarries with the lowest Stripping ratio. According to the calculations, the reserves of these fields will be in demand not earlier than in 20-25 years, when the reserves of the desovskoye and taiga fields will be largely exhausted. In table. 2.4 the main technical and economic indicators of geological and economic assessment of deposits, which can represent the raw material base of the future mining and metallurgical cluster of South Yakutia, are given. All indicators are accepted for the first stage of development of fields. As can be seen from the table. 2.2.4, the mining and geological conditions of all four fields can be a reliable base for the future mining and metallurgical cluster.

The assessment of economic indicators of development of the considered fields allows to define economic expediency of investment of means in development, both from the state, and from the investor. It should be noted that the development of deposits involves a gradual increase in production capacity. It is planned to reach the maximum production capacity only in 4-7 years after the fields are put into operation. This allows not only to work out the technology of extraction and enrichment of ore, but also will make it possible to obtain a concentrate at the commissioning of the concentrator not full capacity, but only the first stage.

Table 12.4. Mining and geological characteristics of iron ore deposits of southern Yakutia, included in the mining and metallurgical cluster [according to 28,31,71]

№	Indicators	Food. ISM.	Taiga place-dénia	Desovskoe place-dénia	Gorklith-mechanical place-dénia	Terindah-mechanical field
1	Geological reserves of ore	MMT	956,21	423,12	466,0	791,5
2	Content of Fe in geological reserves	%	28,1	27,9	29,5	29,2
3	Toll	%	4	4	1	1
4	Dilution	%	4	4	8,3	6,15
5	Operational ore reserves	млн.т	956,21	423,12	503,1	834,9
6	The content of Fe in the operational inventory	%	26,98	26,78	26,8	27,4
7	Term of working off	лет	52	27	33	60
8	Annual production capacity (mAh)	млн.т.	30	15	15	12,6
9	Through extraction	%	82,1	72,3	74,3	74,3
1	Content of Fe_2O_3 in concentrate	%	56,6	51,7	67,0	69,3

Commissioning fields gorkitskoe tarynnahskoe and planned in a much later period, approximately 20-25 years after the commencement of mining Taiga and Desovskogo fields. This is the period when the annual production capacity of the taiga and desovskoye fields will begin to decline due to the transition of mining operations to deeper horizons, the construction of a mine for underground mining. Significant periods of provision with reserves betray stability and reliability in the work of large enterprises (mine, concentrator, metallurgical plant, servicing production, etc.), which is certainly one of the fundamental principles of investment reliability. In table. 11.5 the most important technical and economic indicators of development of fields are given. As can be seen from the table. 11.5 the development of all proposed iron ore deposits is economically feasible. Thus, the net discounted income of all fields has positive values, the payback period is 5-7 years, the budget efficiency for the entire period of field development is hundreds of billion rubles. But these data allow us to make another conclusion, which is based not only on the data of the table, but also on the materials of this Chapter. Development of the fields under consideration

Table 12.5. The Main indicators of economic efficiency of development of iron ore deposits of South Yakutia, included in the mining and metallurgical cluster [according to 28,31,71]

№№ n	**Indicators**	**Food. ISM-I**	**Fields**		
			Taiga and Desovskoe	**Gorkitskoe**	**Tarynnakhskoe**
11	Amount of investments in mastering	billion rubles	95,58	66,91	69,45
22	The cost of the commodity products per year (average index)	billion rubles	57,23	32,60	27,87
33	Operational costs per year on average	billion rubles	48,41	15,8	12,4
44	Gross profit for the year	billion rubles	8,82	16,84	15,46
55	Net profit for the year	billion rubles	6,69	12,96	11,83
66	NPV (BH)	млрд. rub.	73,69	69,98	112,46
77	Internal rate yields	%	21,7	23,17	28,61
88	Payback capexes'	years	6,4	7,0	5,0
99	Yield index	units shares.	1,86	2,04	2,62
110	Індекс доходностІ	billion rubles	98,97	235,48	343,18

it is very capital-intensive. Thus, even without taking into account the construction of a metallurgical plant, only the development of the Taiga and Desov deposits will require 95.58 billion rubles. If we calculate the indicator (UE) of the investment capacity of the field:

$$U_e = \frac{U}{A}, \qquad (12.1)$$

where U_e - the total amount of investment in the development of the field, rubles; A - the annual production capacity of the enterprise (t ore), it will be 2124 rubles/t for the Taiga and Desov deposits. For field gorkitskoe the specified index is already 4461 RUB/t, and Deposit tarynnahskoe - 5512 RUB/t.

The gorkitskoye and tarynnakhskoye fields still require additional exploration work, approval of permanent conditions, obtaining the right to develop fields and registration of rights and licenses. This may further increase the need for investment by at least 20%. Terms of carrying out the specified works are postponed for the long period as commissioning of objects is supposed not earlier than 2040. These objects give a reliable base for stable work of the mining and metallurgical cluster.

The determination of the economic efficiency of field development, as already mentioned, does not include the creation of external infrastructure in the total amount of investment. The latter can be higher in cost (for the gorkitskoye and tarynnakhskoye fields) than all the costs for the construction of mines, in connection with the construction of transport facilities and power supply facilities.

The difficult economic and geographical conditions in which large iron ore deposits are located, suitable for their inclusion in the priority development for the creation of a mining and metallurgical cluster, suggest a new approach to the solution of the issue, both from the state and the investor. One of the most important issues when choosing the objects for the cluster creation is the determination of the territory of the metallurgical enterprise construction. Ores of deposits of southern Yakutia are poor ores, the iron content in the extracted ore does not reach 30%. As a result of pre-enrichment and subsequent wet magnetic separation iron ore concentrate will contain 63-65% iron. This means that up to forty percent of the concentrate contains empty rock. With a concentrate output of 16.0 million tonnes, this is about 6.0 million tonnes. Transportation of such quantities over long distances can result in significant financial losses. The most acceptable solution to this issue is the construction of a metallurgical plant nearest to the field Tarynnahskoe site. In the works of MISIS proposed the construction of metallurgical enterprises of the system

Romelt. This technology allows to process concentrates with a low content of the main component, as well as to use not coking, but energy coals, which is preferable for this region.

The formation of a mining and metallurgical cluster in southern Yakutia has other characteristics that can be considered as starting prerequisites. For example, the activities of the cluster will cover several regions of the Far East, contributing to their development and increasing the level of their specialization; to attract a wide range of popular organizations and enterprises (suppliers of components, equipment, specialized services, as well as professional educational institutions, research institutes and other supporting organizations), which will increase the level of employment in the region, as well as strengthen the role of the state as an interested person in the implementation of the investment program for the development of the region and contribute to the solution of a number of social problems in the region.

12.4. Economic and social consequences of the creation of clusters for the integrated development of the mineral resource base of the region

The development of production is always attractive to the state. The creation of new enterprises allows to solve both social issues of a particular region and the country as a whole, and to increase the flow of funds to the state budget.

The creation of an industrial cluster in a territory that previously did not have industrial enterprises requires significant investments both in the creation of the cluster itself and in the creation of the necessary infrastructure, primarily transport and energy. In poorly developed areas, it is the cost of infrastructure that can significantly increase the overall need for investment and adversely affect the cost of future output of the cluster being created. This situation is particularly evident in the creation of clusters aimed at the integrated development of the mineral resource base of the undeveloped territories of the country.

The construction of mining enterprises, as a rule, removed from the transport routes, electricity supply systems, companies providing services to the manufacturing, from suppliers and consumers. In such circumstances, the investor finds himself in more difficult conditions when choosing an object for investment. The investor's interest in the creation of mining enterprises will increase only if the indicators of economic efficiency of investments in the future enterprise will be acceptable (even better at a higher level) for the investor than in other objects of investment.

The creation of vertically integrated clusters in the extractive industries makes it possible to bring suppliers and consumers of mineral raw materials closer to each other and significantly increase both social and economic efficiency of production for both the investor and the state budget.

In General, the interests of the state and private investors in the creation of the cluster in the development of mineral resources can be represented in the following form:

- economic effect of creating a cluster for the budget at all levels;
- economic effect of the enterprise, which is part of the cluster;

The factors determining the economic effect for the state are shown in Fig. 12.3.

As can be seen, the reduction of costs of the enterprise (investor) arise in connection with a more rational use of resources in the implementation of production activities. The latter arise mainly as a result of the close relationship with the production of enterprises that consume the products of the mining complex, their territorial proximity, acceleration of deliveries. In addition, the development of the infrastructure of the region allows mining enterprises to get rid of such activities as transportation of personnel (delivery of watches), the provision of public and household services and auxiliary production services, etc.

A. Economic impact of the cluster

Determination of the effect of the investor from the commissioning of iron ore deposits of South Yakutia is presented in section 12.3. As shown, the development of all four fields (desovskoe, taiga, Gorklith and Terindah) are attractive to investors and allow you to have net profit and payback of capital investments (all money invested will be repaid in 5-7 years after the start of exploitation).

One of the most important indicators in the selection of fields planned for development is the indicator of budgetary efficiency.

For the investor, the choice of the development option and the feasibility of investing in a particular object is determined on the basis of indicators such as the BH, the payback period, the internal rate of return of the project. All these indicators allow the investor to choose the most appropriate option of development.

Enterprise (investor)

Economic consequence

- No cost for the construction of the permanent camp;
- No cost of delivery watches;
- No concentrate transportation costs;
- No costs for the delivery of material resources;
- Acceleration of the period of work in progress;
- Reduction of working capital requirements;
- Reduction of the tax base by reducing the cost of non-production and services:
    - property tax;
    - the tax to incomes of physical persons.

State (budgets of all levels)

Economic consequence

- Growth of personal income tax and social contributions;
- The increase of the tax on extraction of mineral resources;
- Growth of environmental payments;
- Property tax increase;
- Growth of corporate income tax;
- The growth of VAT;
- Increase in the number of enterprises paying taxes.

Fig.12.3. Scheme of forming of economic effect when creating a cluster

As you know, in the Russian Federation the owner of subsoil is the state. The interests of the state, as the owner of the subsoil, when calculating the economic efficiency of investments are expressed only indirectly, through future tax revenues and payment for licenses for mining.

The definition of budget efficiency involves the definition of cash flows to the state budget in the transfer of subsoil use to investors.

From the cost of future production of enterprises included in the cluster, the budget will receive the following funds:

– tax on extraction of mineral resources;
– contributions to social funds;
– environmental payments;
– local taxes and fees;
– tax on personal income, etc.

From the profits will be paid property tax and income tax. When shipping a product overseas, the state will come from customs duties. In addition, the sale of products by enterprises paid VAT (value added tax).

Employees of the enterprise are taxed on the income of individuals. New jobs, the need for qualified personnel leads to both an increase in the wage Fund and an increase in contributions to the budget.

Table 12.6 shows the estimated revenues to the state budget at different levels of government.

Table 12.6. Revenues to the state budget[28,31]

Types of taxes and revenues		**Just %**	**Including budget level**		
			Federal	**Regional**	**Other**
1	The tax to incomes of physical persons	100 (13%)	1%	99%	-
2	Contributions to social funds	100 (30%)	95,5%	4,5%	-
3	Industrial accident insurance	100*			
4	The tax on mineral extraction, iron ore	100*	40%	60%	-
5	Land tax	100**	-	100%	
6	Water tax	100**	-	100%	
7	Environmental payments	100**	-	100%	
8	Wealth tax	100 (2,5%)	-	50%	50%
9	Profit tax	100 (20%)	7,5%	14,5%	20%
10	Local taxes and fees	100**	-	100%	
11	Customs duties, fees				
12	Customs duties, fees	100	100	-	-
Tax					

* The amount of tax depends on the type of mineral raw materials
** The amount of tax is determined by local authorities

A distinctive feature of enterprises operating in the field of subsoil use is the presence of a tax on mining. The value of the tax ranges from 2%

to 8% of the value of the first commercial products for solid minerals. This type of tax is one of the main types of payments of the enterprise.

Another feature of payments for mining companies is the high amount of payments for compulsory insurance against industrial accidents and occupational diseases. Mining and exploration are dangerous activities (high delicatamente, the possibility of rock bursts, explosiveness, etc.). In General, for the enterprise, these contributions make up 5-8 % of the amount of the wage Fund.

Budget efficiency does not consist only of cash inflows. To stimulate the investor, the state, starting from the Federal level and ending with the competence at the local level, can adopt a system of payments of tax amounts. Such solutions can be established for a certain period or for the entire period of operation of the mining enterprise.

Budget revenues can be represented by the following formula:

$$\sum_{1-t}^{1-n} BP = \sum_{1-t}^{1-n} FB + \sum_{1-t}^{1-n} PB + MB \qquad (12.2.)$$

where: BP - total budget revenues; FB - revenues to the Federal budget; RB - revenues to the regional budget; MB - revenues to the local budget; n - type and size of tax payments; t - year.

Taking into account the uneven revenues, the total budget effect can be determined on the basis of discounting.

In addition to revenues to the budgets of different levels, the enterprise or territory may have tax benefits. In this case, the budget effect will be reduced by the amount of benefits provided to the enterprise.

The development of undeveloped areas of the country is associated with a number of difficulties and risks. In order to attract investors to these regions and create a more economically interesting environment for the investor, the state is considering a number of proposals to reduce the tax burden. So it is proposed at the initial stages of development of mineral deposits to reduce or completely exempt enterprises from the payment of tax on mining, reduce the amount of income tax, reduce VAT. Currently, these proposals are only discussed in the State Duma of the Russian Federation, their regulatory characteristics and applications are not legalized today.

In this case, the revenues at each level of the budget will be equal to:

$$\sum_{1-t}^{1-n} BP` = \sum_{1-t}^{1-n} FB` + \sum_{1-t}^{1-n} PB` + \sum_{1-t}^{1-n} MB` \qquad (12.3.)$$

where: BP'- budget revenues after deduction of tax benefits.

The basis of the new cluster, which is planned to be created in the South of Yakutia, are deposits of iron ore. Under existing tax deductions the investor's interests in the development of the fields desovskoe, taiga, Gorklith and Trynnah are met and all money invested will be repaid in 5-7 years after commencement of exploitation.

Table 12.7. Budgetary efficiency from the development of iron ore deposits in southern Yakutia (desovskoe, taiga, Gorklith and Terindah), million rubles[31]

Fields		**For a year/ for the entire period of mining**
1	Desovskoe	3665,7/98974,5
2	Taiga	
3	Gorklith	7135,2/235478,8
4	Terindah	6863,6/343181,0

Budgetary effect for example, the development of iron ore deposits in southern Yakutia (desovskoe, taiga, Gorklith and Terindah) when creating a mining and metallurgical cluster calculated on the basis of project feasibility indicators for the development of these deposits (table.12.7).

B. Social impact of cluster creation

Determination of the amount of cash revenues to the country's budget is currently one of the priorities in the selection of objects for the development of mineral resources. However, we cannot assume that only the receipt of financial flows determines the interests of the state. The state is interested in the development of the economy of remote and underdeveloped areas, in the integrated and rational use of mineral resources, in solving a wide range of social problems in these regions. Social issues have to be addressed at all levels of government, starting with the enterprises of the mineral complex, put into operation.

For fig. 12.7 the main directions of social consequences during the commissioning of enterprises of the mineral sector and the creation of an industrial cluster on their basis are presented.

The creation of the mining and metallurgical cluster considered in the work will have an impact on the change in the socio-economic situation in the territory of southern Yakutia, the Irkutsk region and adjacent territories. These territories today are little developed, subsidized, not having the opportunity to solve the most important social problems facing them.

Enterprises	*Social consequence*
	- job growth: mining enterprises 1500 metallurgical complex 1100 people. Only 2600 people. -additional jobs (9000 people) in related industries; -professional development of employees; -reduction of staff turnover at enterprises, etc.

State	*Social consequence*
	- development of the economy of underdeveloped areas; - consolidation of personnel in underdeveloped regions; - the growth of industrial production; - growth of demand in the service sector, growth of employment in the service sector; - improving the social status of the territory, etc.

Fig. 12.7. Social consequences of cluster creation

Thus, it can be stated that the definition of the economic results of the cluster should include the calculation of the following key indicators.

1.The determination of the economic effect:

-for the state budget;

-for an investor.

2. Determining the social consequences of creating a cluster:

-for an enterprise;

-for the state (territories of regions).

3. Determination of the most important economic indicators in the creation of clusters in the extractive industry:

-for the state (growth of value added, development of new territories, GDP growth);

-for the enterprise (reduction of production costs, reduction of capital intensity, reduction of risks).

It should be noted that the improvement of economic indicators of the enterprise is the basis for solving social problems of the whole region. The more jobs will be created with a stable, sustainable wage, the higher the need to improve the quality of housing and communal services, the higher the demand for household services, the need for quality education, trade, etc.

The growth of added value, as a result of the creation of clusters in the development of the mineral resource base of the regions. One of the most important tasks facing the Russian economy at the present time is the transition to the production of products with a high share of added value. The greatest preference in the newly developed territories of the country is given to the extraction of mineral resources, a significant part of which is often without enrichment, or at best with the production of concentrates is supplied mainly abroad. Further production «chain» for the processing of mineral raw materials (up to the production of machinery, equipment, chemical products) is carried out in other countries. Russia also receives imports of ready-made products, makes payment at prices that are much higher than the prices for the production of the same products within the country.

In the conditions of market economy, growth of economic independence of the regions of the country and the assessment of the activities of individual industries, the state is increasingly interested in the indicators of the domestic regional product, and, accordingly, in the indicator of added value in the production of products. The most important task of economic development of the country until 2030, especially in new, underdeveloped industrial regions of the country is to create industries with a high share of added value.

The concept of value added is reflected in a number of documents at the Federal level. The most important is the Tax code of the Russian Federation, which defines in detail the methodological approaches to the definition of «value added» [28,31]. The principle of determining the value added in this work is adopted on the basis of methodological approaches that currently exist in the country.

The added value of products is:

$$\sum Oi\ (C\text{-}Z_{M})=DC \qquad (12.4.)$$

where: C - the price of this type of product; ZM-the cost of the enterprise for raw materials, fuel and other materials in the production; DC-added value; OI-volume i type of product.

At different levels of production, the share of value added is always different.

Table 12.8. Calculation of value added in various industries

Field of activity		Price structure			3M share in price	Added value	
		Ed. for ed.	Price RUB.	3м		%	RUB per unit of production
1	Oil industry	1 th. oils	15500	3600	20	80	11900
2	Petrochemical industry	1 л. gasoline's	32000	16000	50	50	16000
3	Iron ore extraction	1 th.	3500	700	20	80	2800
4	Black metallurgy	1 th.	6500	2925	45	55	3575
5	Metal products	1 th.	13000-15000	7700	55	45	6300

In order to determine the value-added expression, the cost structure at different limit levels is considered. In table. 12.8 product prices and material costs of production are taken on average for the last three years.

As can be seen in table 12.8, the higher the limit stage, the lower the proportion of value added in relative terms. If the share of added value in the sectors of the mineral complex reaches 80% in the price of products (this is the oil industry, iron ore mining, etc.), then the share of added value is significantly reduced and drops to 45-50% in the processing of oil, iron production, production of metal or metal structures. This situation is understandable. In the extraction of minerals there is no such element of cost as raw materials. All costs associated with material resources include the cost of auxiliary material, fuel, electricity. With a higher degree of redistribution, the basis of costs for the cost element «material costs» is «raw materials». The cost of «raw materials» significantly increases the cost of material costs and becomes the basis of the entire amount of costs. The added value taking into account the levels of redistribution can be presented in the form of a formula:

$$\sum DC = C_1K_1 + C_2K_2 + C_3K_3 \ldots \qquad (12.5)$$

where: K-the share of value added at this stage of processing; C - the price of products at this stage of processing.

The calculations show that a higher redistribution in the production of products has a higher value added. Even a decrease in the value added factor in total output costs does not reduce the absolute value of the indicator under consideration. Thus, in the extraction of minerals from the earth's interior and primary enrichment (obtaining concentrate for solid minerals, refined oil, enriched coal), material production costs do not exceed 20-25% of the total cost. In this case, the share of value added in the total cost will be 75-80%. At higher stages of processing, the role of raw material costs increases significantly and reaches a cost of 50% and above. So, in the jewelry industry it can reach up to 90%. This means that a higher level of redistribution has a lower coefficient of value added.

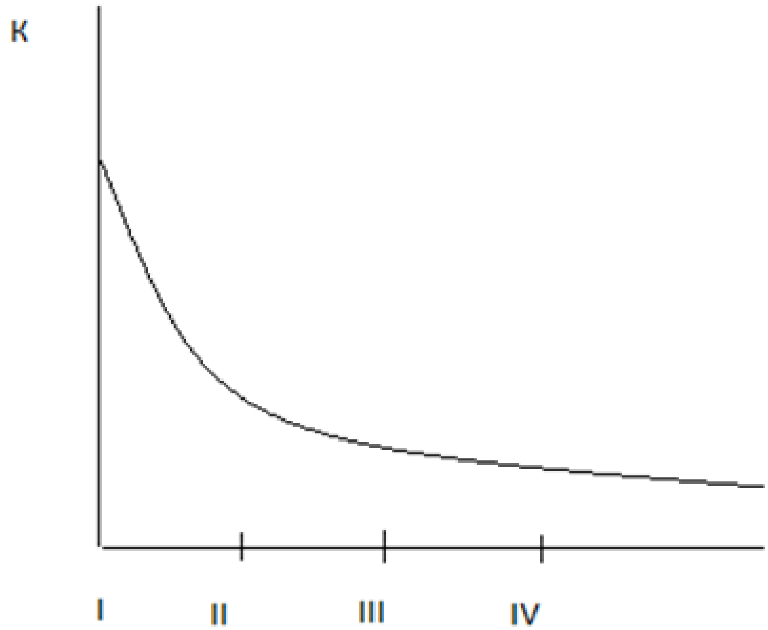


Fig. 12.8. The dependence of the share of value added on the level of redistribution.

For different areas of activity, this curve may be slightly different, but the trend of reducing the value added coefficient is for all types of production.

This situation is due to the increase in prices for products of higher processing. In table. 12.8 aggregated indicators are presented for individual areas of activity where there is a relationship between different levels of redistribution. As can be seen, the higher the level of redistribution, the reduction in the value added ratio, the amount of value added per unit of production increases.

For fi. 12.9 the tendency of growth of the added value at transition to higher level of redistribution is shown.

Fig. 12.9. Added value in product price

As can be seen, a decrease in the share of value added does not mean a decrease in the monetary value added per unit of output, on the contrary, there is an increase in the value of expression.

The role of value added in the country's economy is of great importance, both in terms of budget efficiency and in terms of socio-economic problems. According to the Tax code of the Russian Federation, a significant part of taxes and contributions to state funds is paid from the added value, because it is part of the cost of production. These are such deductions as: contributions to the pension Fund; social insurance contributions; deductions for health insurance; environmental payments; local taxes; mineral extraction tax and a number of other revenues.

In addition, the profit of the company pays taxes: property tax; income tax.

In addition to taxes and payments of value added is the payment of wages in enterprises.

The amount of wages is one of the most important socio-economic instruments of economic development. The main thing is that at higher stages of processing requires more skilled work, work more highly paid. The presence of a population with a sufficient level of remuneration not only increases the amount of tax payments, but also stimulates demand for products, stimulates the development of services, small businesses, etc.

The supply of raw materials abroad, without bringing the raw materials to the final product, leads to the loss of not only jobs, but also to huge economic consequences, such as enterprise profits, taxes at all levels, the wage Fund, etc. In Fig. 12.11 shows the relationship between the growth of value added and the improvement of the socio-economic system.

If there is a supply of semi-finished products, and especially ore, to other countries, Russia loses value added in an increasing amount, loses more skilled jobs, loses interest in the use of high technologies.

Fig. 12.10. The growth of added value when creating a cluster

The growth of added value in the context of a vertically integrated steel cluster will be formed due to the growth of the degree of redistribution. At the same time, at each stage of the creation of steel products, additional added value is created. There is a reduction in production costs at each stage of processing by reducing the cost of delivery of raw materials. Costs are reduced through the use of local raw materials (prices may be local or regional).

The effect of reducing the need for working capital. In addition to reducing the cost of steel products, consumers in underdeveloped areas can significantly reduce the need for investment by reducing the need for working capital. Reducing the need will arise as a result of the reduction of working capital (due to inventory).

Fig. 12.11. The relationship between value added growth and socio-economic efficiency

As you know, the need for production stocks for each specific type of raw materials or purchased products required for production is determined by the formula:

$$PPZ_j = O_i M_j C_j (t_1 + t_2 + t_3 + \ldots) \qquad (12.6)$$

where prz-the cost of inventories j raw material; O-release i products in natural expression; Mj-the j material in the form of raw materials per unit of product i; - why don't-the unit price of j raw material; t is the loop time of a stock (in the warehouse, in transit, the time between two deliveries, safety stock, etc.)

Reducing the need for working capital of enterprises consuming cluster products can be achieved mainly by reducing the delivery time and stock time.

The cost of production increases by the sum of expenses on its delivery to the consumer:

$$C_{nj} = C_{Pp} + T_{T\text{-}T} \qquad (12.7)$$

where C_{nj}- the price of the product including delivery; C_{Pp}- the producer price of output(mostly world prices); $T_{T\text{-}T}$- delivery costs (transportation, loading, unloading, security, insurance).

If we return to the example of the creation of a mining and metallurgical cluster in southern Yakutia, it should be noted that for Eastern Siberia and the Far East, the delivery of large quantities of ferrous metallurgy materials leads to a significant increase in prices. Suffice it to say that the prices for a number of metal products are almost doubled. For objects located in underdeveloped areas, the price increase may be even higher. The need of the industry of the Far East for metal products is determined by huge volumes (table.12.9). Almost all metal products are supplied to the regions of Siberia and the Far East from the Central European part of the country and from the Urals. There are deliveries from Kazakhstan, Ukraine and even Western Europe.

Table 12.9. Commercial products of the metallurgical complex supplied to the regions of Siberia and the Far East

Indicators		Price RUB.	GP-slabs	
			t/year	th. rub.
1	Billets	18000	5000000	90000000
2	Cast iron ingots	14500	200000	2900000
3	Granulated blast furnace slag	600	1500000	900000
4	Dust ustk	2500	250000	625000
5	Coke nut	8000	250000	2000000
Subtotal				96425000

Delivery of such a number of products requires not only additional costs for delivery, but also «freezes» the funds of enterprises for the entire time of delivery.

When creating a cluster, prices for the supplied steel products are reduced by reducing the cost of delivery, storage and logistics. In addition, the total inventory time is reduced. The latter is reduced in the conditions of the cluster due to:

1. Delivery time. Now it is equal to 15-30 days, within the South Yakut cluster there will be a maximum of 5-10 days.
2. The time between two deliveries is practical: it becomes exactly 2-3 days, instead of 10-15 days.
3. Reduce the time of insurance stock to 2-4 days instead of 10-15 days, and often more.

Reduction of stock time (total time loop) of material values for the enterprise significantly affects the need for working capital.

The need for working capital on production stocks in General can be represented by the formula:

$$ObC_{PZ}= \sum_{1-P} Q_i\,(C_i+T_{-Ti})(t_1+t_2+t_3...)=\sum_{1-P} Q_i\,(C_i+T_{+T4})D_i \qquad (12.8)$$

where: ObC_{PZ}- the sum of working capital changes in inventories; Q_i- the need of the enterprise in the i type of raw materials; C_i- the price of the first raw material material; T_{-Ti}- the cost of delivery of the i type of raw materials from the supplier to the consumer; $Д_i$- term of stock I type of raw materials.

The stock period for consumers in Siberia and the far East will change both due to lower shipping costs and due to stock periods. The latter may change as a result of the construction of its own metallurgical enterprise in the territory of South Yakutia several times. According to the consolidated estimates, the stock time is reduced by at least two to three times (from 45 days to 12-16 days).

For example, the calculation of savings on working capital requirements for a conditional organization was performed (table. 12.10).

Table 12.10. Calculation of working capital savings in the construction of a metallurgical plant in South Yakutia (figures conditional)

№ p. p.	**Indicators**	**Ed. izmer.**	**Ural**	**South. Yakutia**
1	Consumer of metal products		Khabarovsk	Khabarovsk
2	Supply distance	km	~10000	3600
3	Scope of delivery	t	500	500
4	Cost 1 kg/km *	RUB	4,0	4,0
5	Shipping cost 1T	RUB.	40,0	7,2
6	Price per 1 kg of metal products	RUB	18000	18000
7	Stock time	days	35	10
8	The need for the amount of working capital	million.	1015,0	126,0
9	Savings (increase)	million.	+889,0	-889,0

* the cost of transportation of 1 t/km is taken into account insurance

From the data given in the table. 12.10, it is clearly seen what economic consequences the construction of a mining and metallurgical cluster in the East of the country will have. Suffice it to say that the transportation of 1 ton of metal products at a distance of 10 thousand km is higher than the cost of the metal products, increasing the cost of acquiring the necessary material resources more than twice. Increasing the time of the stock in transit, storage of materials in the warehouse leads to an increase in the need for working capital, increasing them to a billion rubles.

With supplies so remote from the consumer, providing the necessary range of raw materials requires more than 10 times the growth of the need for working capital. For example, the delivery point of steel products at a considerable distance from the metallurgical plant, which is planned to be built in South Yakutia, was specially adopted. Reducing the «shoulder» of supply and reducing the time of stock due to faster delivery of steel products to the consumer, reduces the need for working capital to the enterprise. If the supply of steel products from the Urals to each ton requires working capital in the amount of 2.0 million rubles., when entering the metallurgical enterprise in southern Yakutia will require only 252.0 thousand rubles.

According to the integrated calculations, it can be said that for the selected destination, the reduction in the need for working capital for metal products that are supplied from the Central regions of the European part of the country, from the Urals, from Kazakhstan, the need, depending on the location of the consumer of this type of product will be reduced significantly.

Revolving funds are part of the investment, and reducing the need for this type of financial investment is one of the factors that ensure the attractiveness of investment projects in areas where the development of the district's infrastructure is planned as a priority in the near future. Construction of Railways, bridges, sea ports, oil and gas pipelines are the most metal-intensive types of work.

The approach of suppliers of steel products to its customers leads to another positive pattern: the acceleration of turnover of receivables and payables. The increase in the turnover rate of accounts receivable and accounts payable not only helps to reduce the need for funds, and hence in General in the working capital of the enterprise, but has the most favorable impact on the financial condition of the enterprise.

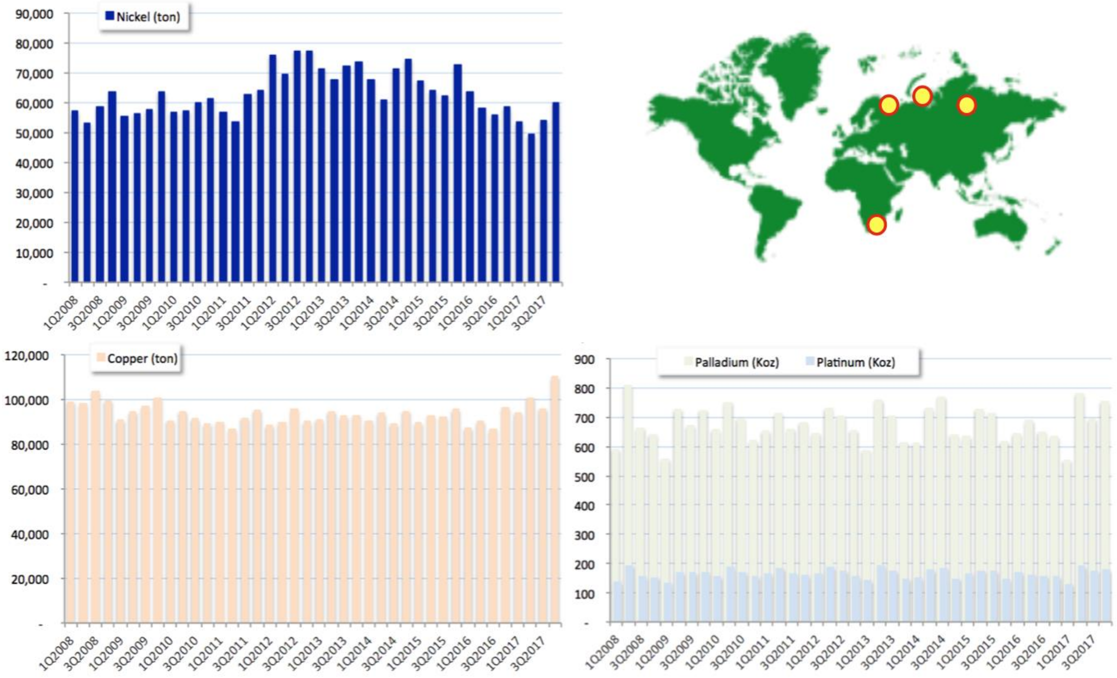


Fig. 12.12. Layout of metallurgical clusters in Russia in 2020 [25]

12.5. Integration of enterprises of clusters functioning in the mineral complex of the country

Currently, in Russia for the development of domestic industry, improving the competitiveness of enterprises in a particular region or industry is widely used cluster approach, which is the organizational design of the territorial-production integration of indirect and direct participants in this economic model [27].

The cluster approach is also a factor and incentive for the development of the country's mineral resource complex, especially in Siberia and the far East. So, in particular, in Russia already functioning (North-West, Central, Ural, Siberian) and continues to form mining and metallurgical clusters (far East).

As a rule, the composition of the mining and metallurgical complex (cluster) includes a metallurgical plant, a number of mining and processing plants, serving industries, etc. [28,70]. Since in the mining and metallurgical complex, the metallurgical combine is the enterprise of the final product, it can become the head (anchor) enterprise of the cluster.

Technological connection between the enterprises of the cluster, their dependence on each other makes it necessary to organize joint and several responsibility for the final results of work. Mutual assistance between enterprises of the cluster can be carried out in various forms:

from consultations to outsourcing and mutually beneficial financial support.

This article is devoted to the solution of one of the tasks of support of the enterprise included in the mining and metallurgical cluster by means of the enterprises of this cluster. We are talking about the financial support of the parent enterprise of the cluster (metallurgical plant) of its supplier enterprise (mining and processing enterprise).

Suppose that the metallurgical plant credits the supplier of iron ore raw materials by prepayment for T months at the expense of subsequent deliveries of raw materials by the supplier according to the scheme proposed in Fig. 12.13. Namely, the parent company, receiving shipments volume during T months, does not pay the supplier of iron ore, and in the subsequent 12-T months pay discount **α %.**

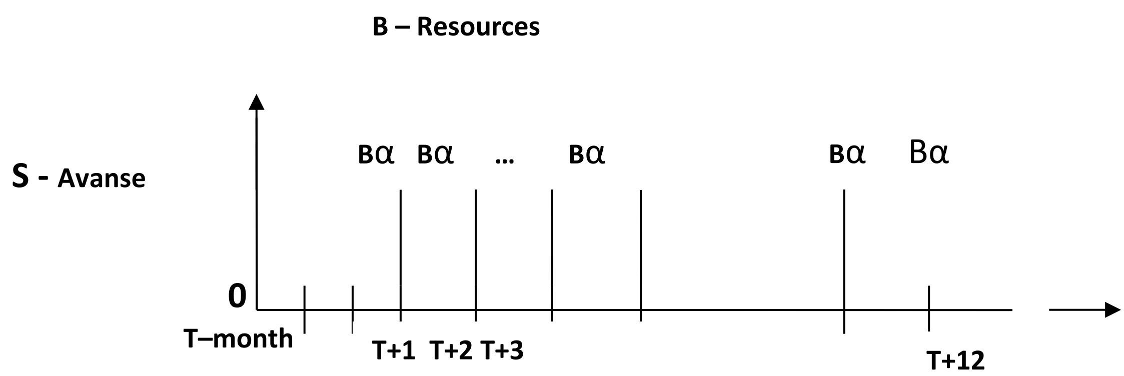


Fig.12.13. Terms of prepayment to the supplier of raw materials and delivery of its products to the plant in case 1

If the metallurgical plant is no equity to pay the Deposit mining and processing company for T months to supply them iron ore plant, he can take the credit for RK %. Thus, if the increase in profits of the metallurgical plant at the expense discounts of α % with prices of products of mining and processing enterprise will exceed the cost of the loan to the Bank, the plant is beneficial to go to prepay for T months. For the supplier of iron ore raw materials, the benefit is that if there is a shortage of its own working capital, it will not have to take a loan for the production of its products. At the same time, the supplier of iron ore raw materials, having received an advance payment, will earn more profit than if he used a loan under the RS.p .%.

1. Consider the case when the metallurgical plant has enough money to make an advance payment for T months. And the plant receives products from the supplier of raw materials according to the scheme shown in figure 1. In this form of interaction we obtain the following results.

Profit and smelting plant (P1) without pre-payment will be:

$$P1 = 12NC - 12B - ZP, \qquad (12.9.)$$

where N – the monthly volume of supply at the price of C per unit of production; B – the cost of the supplied iron ore raw materials supplier; ZP – other costs.

In the case of prepayment mill supplier for iron ore for T months, the profit of the plant will be:

$$P_2 = 12\ NC - TB - 12B(1-\alpha) - ZP. \qquad (12.10)$$

It is advantageous for the plant to make an advance payment for raw materials if $P2 \geq P1$.

Substituting the values of $P2 \geq P1$, we obtain:

$$12NC - TB - 12B(1-\alpha) - ZP \geq 12NC - 12B - ZP. \qquad (12.11)$$

From the expression (12.11) it follows that $\alpha \geq T/12$. At T =3 months supply of iron ore must be at a discount of more than 25%. As follows from further calculations, this situation will not be beneficial to the supplier of raw materials.

2. Consider the same option of supplying raw materials using the procedure of compound interest according to the scheme shown in Fig. 12.14. Suppose that the metallurgical plant has enough own funds to make an advance payment for T months for the supply of iron ore mining and processing enterprise. If the volume of supplies of raw materials per month will be In thousand rubles, and the advance payment will be made for T months, and the metallurgical plant gives the supplier a credit T*In thousand rubles. as for the supply of raw materials at a discount of α %, the parent company, receiving the supply of raw materials in volume Within T months does not pay the supplier, and in the next 12 months pays at a discount of α %. Giving credit to the supplier volume*T, the parent company withdraws from your turnover*Tonnes thousand RUB If guaranteed income RG % per annum (for example, Bank Deposit or % on bonds, etc.), the plant loses

$$B(1+P_1) \qquad (12.12)$$

where P1=RG/12 (in shares %), but at the same time wins on free delivery within T months (on account of prepayment) and at a discount α % in the subsequent (12-T) months of delivery (Fig. 12.14).

The parent enterprise beneficial to go for prepayment if will be executed the ratio:

$$BT(1+P_1) \leq \sum B/(1+E) + \sum B\alpha / (1+E) \quad (12.13)$$

where E is the net profit margin

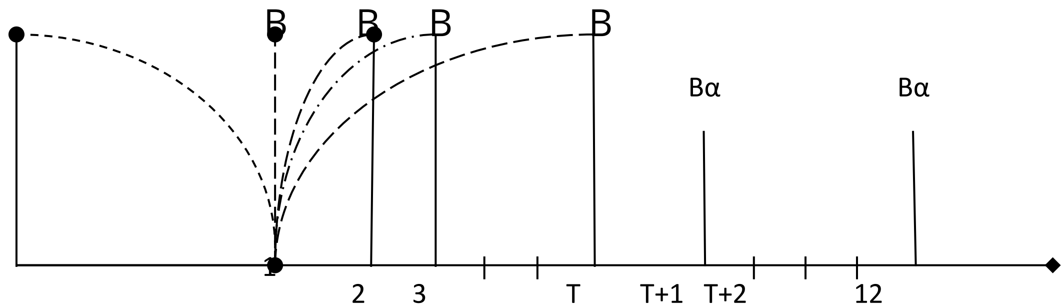


Fig. 12.14 Terms of prepayment to the supplier of raw materials and delivery of its products to the plant in case 2

Simplifying the ratio (12.13), we obtain:

$$T(1+P_1) \leq [(1+E)-1]/(1+E)*E+\alpha\{[(1+E)-1)]/(1+E)*E\} \quad (12.14)$$

From the ratio (11.5.6) for the given E, P1 and T it is possible to obtain the lower limit of the discount α, which would satisfy the parent company.

Consider the benefits for a supplier who, with a shortage of own funds, would have to take a Bank loan under the RS.p.% per annum for T months. Let the supplier receives an advance payment for T months. The supplier for T months will produce N units of production with cost C and deliver it to the plant within T months at the price B, and within (12-T) at a discount of α %, while the supplier for the first three months will not receive payment from the plant, the first T months of supply of the supplier are in repayment of prepayment for T months.

In this case, the supplier's profit will be:

$$Pc = B(1-\alpha)*(12-T) - C1 \cdot N*12, \quad (12.15)$$

where C1 – the unit cost of production of the supplier.

And in the case of a loan, the supplier's profit will be:

$$P\kappa = 12B - 12C1 \cdot N - B*T(1+ \cdot Pc.P. \cdot T/12) \quad (12.16)$$

If PS ≥ PC , the supplier is advantageous to go to the prepayment for T months at a discount to the price of its products by α %.

Using the relations (12.15) and (12.16) we obtain:

$$B(1-\alpha)*(12-T) - 12\,C1 \cdot N \geq 12B - 12*C1 \cdot N - BT \cdot Pc.P. \cdot /12 - BT. \quad (12.17)$$

If PS ≥ PC , the supplier is advantageous to go to the prepayment for T months at a discount to the price of its products by α %.

Using the relations (12.15) and (12.16) we obtain: If PS ≥ PC , the supplier is advantageous to go to the prepayment for T months at a discount to the price of its products by α %.

Using the relations (12.15) and (12.16) we obtain::

$$\alpha \le Pc.P.\cdot T/(12- T). \qquad (12.18)$$

From the ratios (12.14) and (12.18) we obtain the lower and upper limits of the discount α from the price of raw material supply by the mining and processing enterprise, satisfying both the supplier of raw materials and the metallurgical combine.

Consider the proposed algorithm for a specific example.

Let the percentage of credit Bank supplier of iron ore raw materials RS.p. is 15% (0.15).

Guaranteed income RG = 6% (0,06), then P1 = 0,005 (0,6:12). The plant makes an advance payment for 3 months, E =6%. To find the boundaries of the markdowns for the products of the supplier, meet supplier and factory. According to the ratio (6) we obtain:

3(1+0,005) ≤ [(1+0,06)-1]/ (1+0,06) *0,06+α{[(1+0,006) - (1+0,06)]/(1+0,06)*E }

Calculating, we obtain:

0,035 ≤ α ≤ 0,050, or percentage: 3,5% ≤ α ≤ 5,0%.

Direct accounting shows that the profit of the plant in case of prepayment to the supplier and delivery of its products to the plant according to the scheme presented in figure 12.14 will be greater than if the plant does not make an advance payment without a subsequent discount of the price by the supplier.

Profit of the plant without prepayment PK1 = 12NTS – 12V –ZP, and in the case of prepayment PK2 = 12NTS – TV – (12-T)In(1 - α), where N monthly production of the plant at the price of C, B –raw materials costs supplied by the supplier, ZP - other costs. The plant is advantageous to go on an advance payment if PK1 ≤ PK2. Substituting the values of PC1 and PC2, we obtain:

$$12NC - 12B - ZP \le 12NC - TB - (12 - T)B(1 - \alpha) - ZP. \qquad (12.19)$$

From formula (11) we obtain an obvious inequality:

(12 – T) > (12-T)*(1 - α), i.e. the plant will not only return the advance payment, but also receive a large profit.

b) Consider the case when the plant has no own circulating assets for the implementation of the payment provider for T months, and he takes the credit volume·T thousand RUB under RK% per annum, which will extinguish in the course of the year. Repayment of the loan by the combine is carried out in the following order. During the first T months, starting from the month of the first delivery of products, the loan is repaid in the amount Of thousand rubles. at the end of each T months. Starting from the month T after the start of supply of products by the manufacturer of raw materials –supplier, the plant repays the loan in the amount of·α thousand rubles. (see Fig.21.14.).

It is advantageous for the plant to make an advance payment of T months at a discount from the delivery price of α%, if the condition is met:

$$TB(1+P\kappa) \leq TB + B\,\alpha(12-T) \qquad (12.20)$$

From the ratio (12) it is possible to obtain the lower limit of the discount from the supplier's product price satisfying the plant, it is determined from the inequality $\alpha \geq TRK/(12\text{-}T)$

Example 2.

Using the data of example 1. we add the condition that the plant takes a loan from a Bank under the RK = 14.5% per annum. Calculating get:

$\alpha \geq 3*0{,}145/(12\text{-}3)$ i.e. $\alpha \geq 0{,}038$ ($\alpha \geq 3{,}8\%$)

Thus, we get that the plant is profitable to go to advance payment T=3 months with a discount on the price of the supplier's products more than 3.8% (3.8% ≤ α.). Given the solution of example 1. find that the supplier of raw materials discount should not exceed 5.0%, ie 3.8% ≤ α ≤ 5.0%. The specific value of discount α can be established in the process of negotiations between the supplier of raw materials and the plant. The Bank is advantageous to go on an advance payment, as when performing conditions (12) he will return the loan with interest.

Bank granted a loan for 12 months at P =14.5% per annum and the loan will be repaid once at the end of the year, by the end of the loan repayment period the debt of the plant will be TV*(1+0.145).

If the plant will accumulate incoming funds TV and (12-T)*B*α on Deposit at 0.0125% per month by the end of the year on his account will be the amount of 4.51, which is much more debt on the loan at the end of the year 3.35 V.

These schemes of support of enterprises within the cluster can be played in the form of a business game in the process of training of personnel of enterprises of the cluster, as well as students of economic specialties. One group of students plays the role of a Bank, other groups will represent the interests of the plant and the supplier.

The possibility of mutual financial support of enterprises within the cluster, closely technologically related to each other. The anchor enterprise of the cluster, which produces the final products, as the most interested enterprise in the full and timely supply of raw materials (components) in addition to outsourcing, can provide financial assistance in the form of prepayment to the supplier for T months, followed by the delivery of its products by the supplier at a discount price of α% with mutual economic benefit for each subject of the cluster.

Conclusion

Russia has enormous natural resources, which are a solid Foundation for sustainable economic development and are attractive for international cooperation. The peculiarity of Russia's natural resource potential is its large scale and complexity. No country in the world has such a range of mineral deposits – from oil, gas, coal to almost all metal and non-metallic minerals. Exploration and mining industries provide an average of 30% of GDP and about 50% of exports. The export of mineral raw materials and products of its processing forms about 80% of the country's foreign exchange earnings.

The order of the Government of the Russian Federation of 21.06.2010 N 1039-p is accepted «Strategy of development of geological branch till 2030».

Russian President Vladimir Putin said that the exit of the Russian economy from the crisis is the main result of 2017. He believes that the country's economy has entered the stage of sustainable development and growth. But there are still a number of unfavorable conditions for the development of domestic production. These are not only international sanctions, but also, above all, the internal problems of the country's enterprises. In his address to the Federal Assembly in December 2016 President Vladimir Putin actually said about the exhaustion of the inertial model of economic development: «If we do not run to the full extent of the new growth factors, the years can hang near zero. And so we have constantly squeezed, to save, to delay or postpone their development. And we can't afford that.» It is possible to speak about full intensification of production only when from year to year efficiency of each separate type of the resource participating in production increases, i.e. from year to year return from unit of each type of a resource increases.

One of the reserves of growth and intensification of production is the improvement of management mechanisms of enterprise management.

The monograph discusses the concepts of efficiency and intensity of resource use, their definition, method of calculation and economic interpretation. The efficiency indicator is the ratio of the final result to the cost (resources) and characterizes the output of the final result from the resource unit.

Intensity index is the ratio of the final result index to the resource consumption index and characterizes the percentage of change in the final result in the reporting period compared to the base.

The following management mechanisms to improve the efficiency and intensity of production are considered:

1. Methods of improving the efficiency of intangible assets as a source of innovation, know-how, IDR.

2. The method of evaluation of the complex indicator of the intensity of resource use and the method of complex assessment of the intensity of production, their monitoring and on the basis of the formation of a balanced system of indicators and standards for business units and individual performers.

3. The organization of the analytical service, which would be able to carry out the work of paragraph 1, to be the «think tank» of the organization of advanced management. Advanced management (advanced management) - are methods, techniques to eliminate or prevent adverse events or uncertainties faced by managers, as well as the development of normative and methodological materials for the organization of management in the event of these adverse events.

4. One of the reserves for increasing production efficiency is the human factor as a source of creative initiatives and innovations. The necessary conditions for the activation of creative activity of personnel, such as:

1) Interest and participation of all levels of the management staff of the enterprise;

2) Organization of group and individual reviews of proposals and initiatives;

3) Development of regulations to stimulate initiatives and implemented proposals;

4) The reports of the heads of the subordination of creative activity of assigned staff

5) Organization of visual agitation about the results of the activities of creative groups or individual employees

6) Development of mentoring.

5. The experience of implementation of 5S system (lean system) in the United metallurgical company on the basis of the experience of the Japanese company Toyota is considered. The 5s system is based on 14 principles of Deming, methods of forming management teams and initiative groups, development of efficiency and quality circles. By the end of 2017, there were more than 310 small initiative groups at the Vyksa metallurgical plant (VMZ) alone, which is part of the United metallurgical company (OMK), with more than 1,900 employees. Just a small initiative groups implemented around 900 projects, over 300 is in the works.

6. The mechanism of improving the efficiency of enterprises of the mineral complex on the basis of the formation of clusters. The assessment of economic efficiency of development of the fields entering the mining and metallurgical cluster of southern Yakutia is given. The model of integration and solidarity mutual assistance of enterprises of clusters operating in the mineral resource complex of the country is proposed.

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Chapter 3. Advances research for exploration

13. GIS in exploration

The development of software for the intensification of geological exploration is characterized by the following areas (the structure is shown in Fig. 13.1):

1. Development of geographic information systems (GIS) for various services of the industry (Geology, Geophysics, engineering Geology and hydrogeology, geo-ecology, mining, etc.).
2. Development of project management software systems.
3. Development of software for management of exploration processes (works) in real time, i.e. for automated process control system (APCS).

The essence of these areas – the creation of an integrated computer-aided design (CAD) exploration.

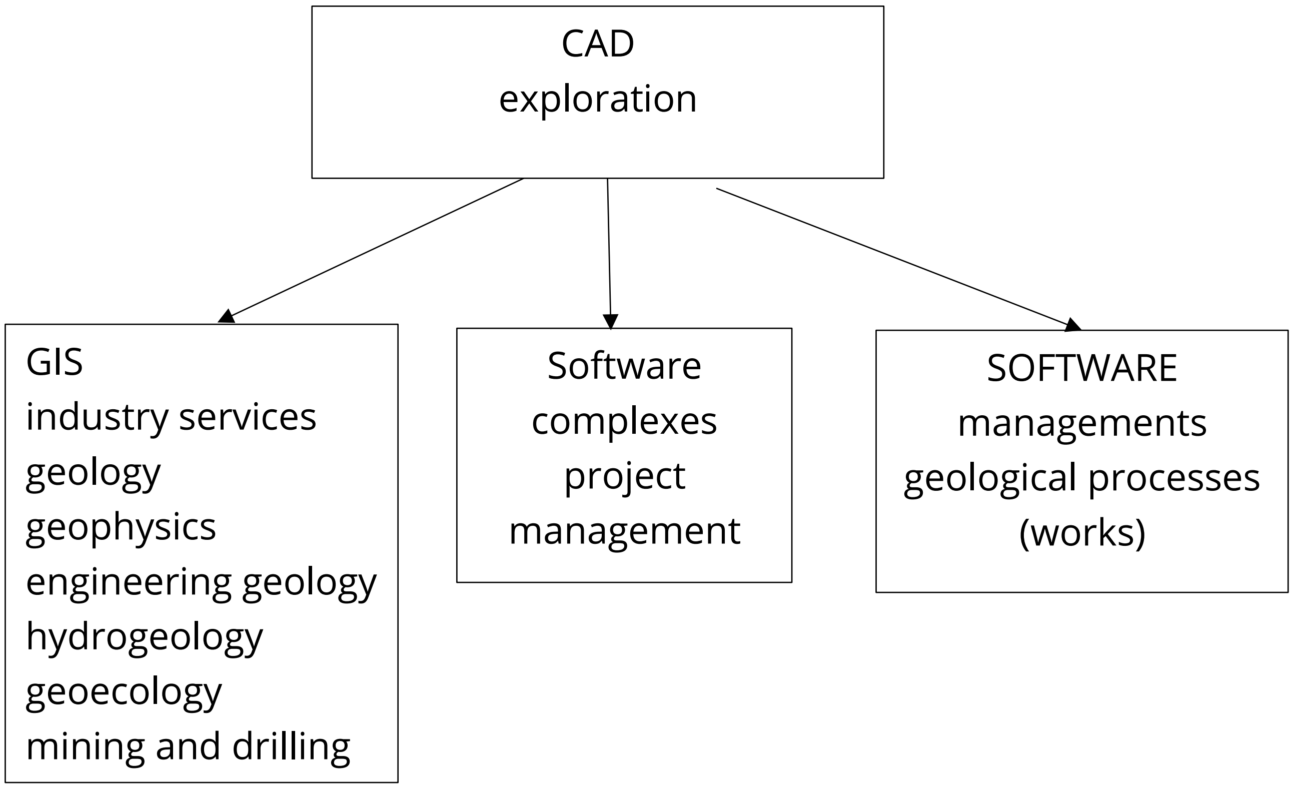

Fig. 13.1. CAD structure of exploration works.

13.1. The emergence and development of geographic information systems (GIS)

For the first time, the theoretical foundations of GIS were formulated by scientists from Canada and Sweden (late 1960s – early 1970s). Development focused on the processing of spatial data. The work of the Swedes focused on GIS land accounting specialization, in particular, the Swedish land data Bank, designed to automate the accounting of land (land) and real estate. Scientists of these groups have formulated original ideas that have allowed to lay the Foundation of these GIS fundamental principles. So, the main principle that brought GIS from a range of databases, General purpose, consisted in the introduction in a number of attributes of operating objects of the characteristic space, in whatever form mestoobitaniya coordinates, in the hierarchy of administrative facilities, in terms of belonging to cells in regular networks the division of a territory) it may clear.

1970s - the years of synthesis and critical analysis of the functioning of the GIS. During this period, a large number of theoretical developments. And only in the late 70's began to appear new GIS projects.

In the 80-ies abroad GIS began to develop dynamically. By the mid-80s more than 500 geographic information systems were already functioning in the world. Commercial GIS programs are being developed and sold. The range of tasks to be solved is becoming wider.

Since the late 80's – early 90 began the development of GIS in Russia. First developed specialized GIS. In the early 90s, the first Russian commercial GIS appeared, and immediately began the «influx» of imported GIS.

Since the mid-90s in Russia began active development of GIS programs, which partly continues to the present time.

It is important to pay attention to the links between GIS and cartography. The relationship between cartography and GIS is manifested in the following aspects:

1 Topographic maps – the main source of data for GIS;

2 Geographic and rectangular coordinate systems and cartographic mapping serve as the basis for the coordinate reference (geographic localization) of all information received and stored in the GIS;

3 Maps – the main means of geographical interpretation and organization of remote sensing data and other information used in GIS (statistical, analytical, etc.).);

The 4-Layer representation of features has direct analogies to the element-by-element division of the thematic content of maps.

Geographic information systems are directly related to remote sensing. The data obtained by remote sensing methods and provided with a binding, can serve as the basis for the selection of features.

Also, data for the creation of geographic information systems can be obtained in applied Sciences (Geology, Geochemistry, Geophysics and others).

According to the architectural principle of construction of geoinformation systems distinguish:

- close;
- open.

Closed systems are characterized by low price, pre-defined class of tasks, simplicity of the interface and rapid development of these systems by users.

Open systems have a certain set of functions and are equipped with a special device for creating and embedding special applications by users, thereby expanding the capabilities of basic GIS. Open systems are more expensive and can be adapted to a wide class of tasks.

On the territorial scope of the following GIS:

- global;
- continental;
- national (state);
- regional;
- subregional;
- local (local).

By the subject area of modeling are distinguished:

- urban (municipal);
- environmental;
- land;
- geological, etc.

Functional capabilities distinguish GIS

- universal (instrumental);
- special;
- GIS viewers.

Geographic information systems use 4 types of data:

- spatial data;
- attribute data;
- symbol libraries;
- metadata.

Spatial data contains information about the spatial position of features and describes their geometry. Attribute data describes the qualitative and quantitative properties of features. Library of conventional signs contain the standard conventional signs, symbols and the received symbols to display features in a particular subject area. Metadata usually contains information about the data itself, i.e. data sources, data acquisition methods, the specific implementers of the data, etc.

13.2. Operation of generalized GIS

The set of functions implemented in GIS depends primarily on the purpose of the system as a whole. The General scheme of GIS operation is shown in Fig. 13.2. In different systems, individual blocks are implemented differently and are limited to different sets of functions. Let us consider the scheme.

As can be seen from the figure, in the functioning of GIS can be identified three main stages:

- data collection;
- data analysis, modeling and storage;
- presentation of the results.

Data collection. At this stage: primary data are collected using different methods and technologies. Their primary processing is the correction and unification of heterogeneous data (bringing to a single coordinate system, to a single storage format, bringing into line with graphical and attribute information, etc.). As a result, a set of data is formed, which can be stored in the form of archives, as well as transferred to the next level (for further processing and modeling). The source data in a GIS can be attribute, spatial, or both in standard formats. These data should be presented and described by appropriate data models, spatial and attribute information correlated.

Data analysis, modeling and storage. At this stage, unified data analysis and modeling are carried out, connections between different parts of the model are established, redundancy is eliminated, data integrity and consistency is checked, primary and foreign keys are defined, metadata is formed, etc. Within the stage, data interpretation, secondary characteristics of the parameters of the object or phenomenon under study are obtained. When performing analysis and modeling, specialized modules aimed at solving certain tasks are widely used. The operations and functions of this phase are the basis for research. At this stage, the digital model of the object of study is finally formed. The results of the stage are recorded in the database.

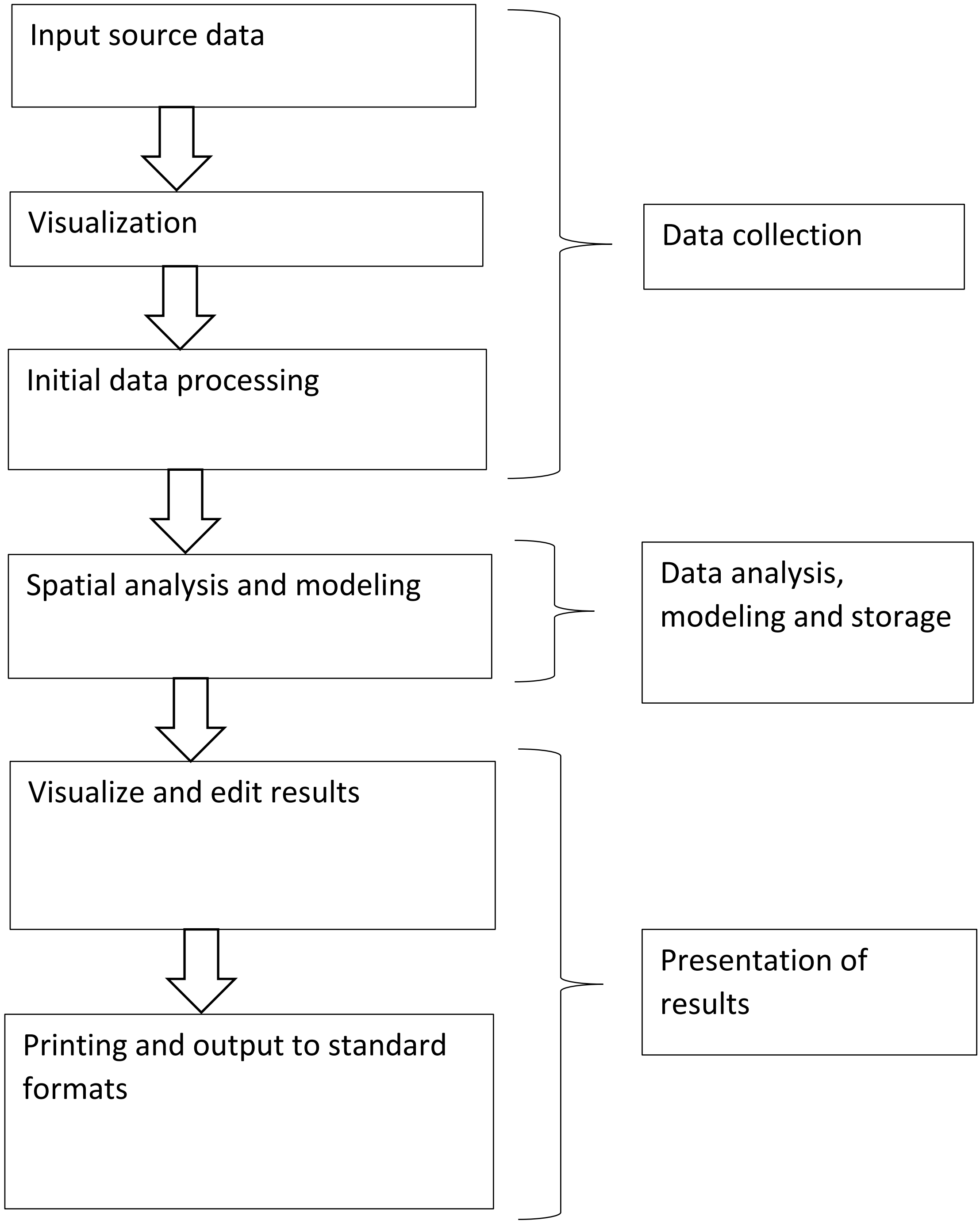

Fig. 13.2. The block diagram of the generalized GIS

Presentation of the results. At this stage, based on the digital model of the object of study, digital maps are formed, which are presented visually. The data obtained are evaluated and edited by the user. Further reports and documents (electronic copies of text documents, results of inquiries, electronic cards with observance of requirements of standards of registration of cartographic information, etc.) from which hard copies can be received are formed. The results of data processing are stored in internal and external GIS formats for archiving and further use.

13.3. Features of some modern GIS

The use of certain types of GIS platforms has become a tradition in some industries. Currently, there are a large number of both commercial and freely distributed GIS platforms in the world.

We present the features of some GIS actively used in geological production and research organizations.

ArcGIS is a commercial GIS platform for building GIS of any level. ArcGIS is used to create, manage, analyze, and visualize any spatial information, analyze relationships between features, model geographic processes and phenomena, and easily create data, maps, globes, and models in desktop software products, then publish and use them in desktop applications, web browsers, and in the field, through mobile devices. For developers, ArcGIS gives you all the tools you need to create your own applications. The ArcGIS platform is the best solution for building enterprise GIS.

Throughout the world, ArcGIS tools are used to improve organizational workflows and solve a variety of tasks based on a geographic approach:

1) Manage assets and data, including the integration of different systems, management of territories and services, facilities management, and customer relations;
2) Planning and analysis, such as forecasting and risk assessment;
3) Business applications for the creation of situation-analytical centers, monitoring and tracking; data collection in the field; bypass, maintenance and operation of equipment; routing;
4) Decision support systems and access to information.

AutoCAD Map is a commercial GIS platform, designed for infrastructure planning and management. By integrating CAD and GIS data, users are able to make more informed design and management decisions. Due to the intelligence of models and tools, compliance with industry and government standards is ensured. The integration of spatial information into the database makes the data available to all professionals, helping to improve the quality, productivity and efficiency of object management.

Bentley Map is a commercial GIS platform that is a complete desktop GIS that can be used to create maps, plan, develop, and manage infrastructure. Bentley Map enhances underlying MicroStation capabilities of the system with the goal of providing functions of creation, maintenance and analysis of geospatial data with a high degree of accuracy. The system provides for the creation, storage, maintenance, analysis and sharing of two-dimensional and three-dimensional geospatial data. It can be used to build your own GIS applications. The main task of Bentley Map, according to the developer, is the creation and preservation of geospatial information in the management of infrastructure facilities throughout the life cycle. For example, intuitive 3D editing tools allow you to create high-quality spatial data, giving you the flexibility to customize.

Intergraph is a commercial GIS platform with an open architecture. The platform includes a tool GIS – GeoMediaPro, and a wide range of specialized modules that provides solutions to any problems associated with providing multi-user access to spatial data, their display, including 3D, editing, analysis and publication (distribution).

gvSIG is a free, open source GIS platform designed for creating, editing, and analyzing vector maps. gvSIG is a software product with source code distributed under the GPL, which ultimately allows you to make changes to it and add new features. Already now there is a large set of plug-ins that extend the capabilities of the program. gvSIG inherits the principles of the ArcView GIS interface, so its development will not be difficult for users of this program. gvSIG is a geographic information management tool with an intuitive interface that works perfectly with both raster and vector formats. gvSIG has been developing from the government grant of Spain (transport Ministry of Valencia) since 2003.

MapInfo is a commercial GIS platform, widely used for digital mapping. In addition to traditional DBMS functions, MapInfo allows you to collect, store, display, edit, and process map data stored in a database based on the spatial relationships of features. In addition to its own formats, MapInfo work without the need to convert image data formats: ArcView Shape File, ESRI ArcSDE, ESRI Geodatabase (mdb), ARC/INFO E00, AutoCAD DXF/DWG, Intergraph/MicroStation Design DGN, SDTS, VPF, and tabular data in the formats Access, Excel, Lotus 1-2-3, xBASE, and ASCII. Universal translator MapInfo allows the import and export data to other

GIS and CAD systems (ESRI Shape File, AutoCAD DXF/DWG, Intergraph/MicroStation Design DGN, AtlasGIS, ARC/INFO E00). MapInfo has the ability to work with data in raster formats GIF, JPEG, TIFF, GEO TIFF, PCX, BMP, TGA, BIL, etc., including the latest compressed raster formats – ECW, MrSID, JPEG2000. The built-in SQL query language, thanks to its geographic extension, allows you to select features based on their spatial relationships. MapInfo has the function of finding an object or group of objects by various characteristics, as well as their combinations.

Quantum GIS is a free GIS platform for professional spatial data processing. The GDAL library supports more than 50 raster and more than 20 vector formats, including ESRI (Shape), MapInfo (mif/mid and tab/dat), Autodesk (DXF), and others. It has its own raster image processing module that allows you to perform georeferencing and has several raster transformation algorithms. At the moment, the platform is more a «build it yourself» constructor than a complete solution that can be installed and run as a ready-made solution, as in the case of commercial platforms. In the absence of costs for the purchase of licenses, the cost of implementing the system can be more significant than for paid systems. There are practically no complete standard solutions for applied or specialized tasks, which would also be distributed as free software.

GIS panorama is a commercial GIS platform that offers an extensive list of software products, both for General purpose and specialized solutions for a particular area. Is one of the main technological platforms of the enterprises of the former of Roskartografiya for the preparation of digital images and traditional topographic maps. Consists of tools for creating and editing electronic cards in multi-user mode, perform various measurements and calculations, overlay operations, construction of 3D models, processing of raster data, creation of orthophotos, creation of a matrix of heights, layers (geological) matrices, tools, thematic mapping, preparation of maps for publication, work with GPS receivers to provide remote access to cartographic data, etc.

13.4. GIS INTEGRO (http://www.geosys.ru)

This is one of the interesting domestic developments in the field of GIS. March 29, 2018 the GIS system INTEGRO is included in the register of domestic SOFTWARE.

Software and technology complex GIS INTEGRO was developed in FSUE SSC RF Vniigeosystems (1998 - 2015), today its support and development is provided within the activities of the Department of Geoinformatics «Vniigeosystems» fgbi «VNIGNI». The complex provides all the necessary tools for the preparation of GIS projects and cartographic base of production and research works, as well as includes specialized modules for applied geological and geophysical research.

The GIS functionality INTEGRO

1) Visualization of GEODATA in 1D/2D/3D;
2) Mapping of rasters and vectors;
3) Create and edit vector data with support for intra-and inter-layer topology;
4) Semi-automatic raster tracing;
5) Work with regular and irregular networks;
6) Spatial analysis of vectors and surfaces;
7) Design and printing;
8) Internet publication;
9) Multi-window interface with synchronization of images by plane and depth;
10) Download specialized formats (SEGY, LAS);
11) Extended block of solution of prognostic and diagnostic tasks;
12) The analytical apparatus of processing gravity data;
13) Creation and processing of three-dimensional models (cubes);
14) Automated construction of sections and sections;
15) Work with well data;
16) Tools for the preparation and design of geological maps to meet the requirements of Rosnedra LDCs.

The basic package of GIS INTEGRO provides all the necessary tools to perform cartographic work and prepare GIS projects and cartographic databases. The following tasks are implemented using the base block:

1. Collection of baseline data for the study areas
2. Digitization and mapping of maps, profiles, sections, logging diagrams
3. Systematization and cataloguing of data
4. Creation of linked spatial data sets for their processing and integrated interpretation (maps, profiles, wells, 2D and 3D models)
5. Design and printing of working and final materials

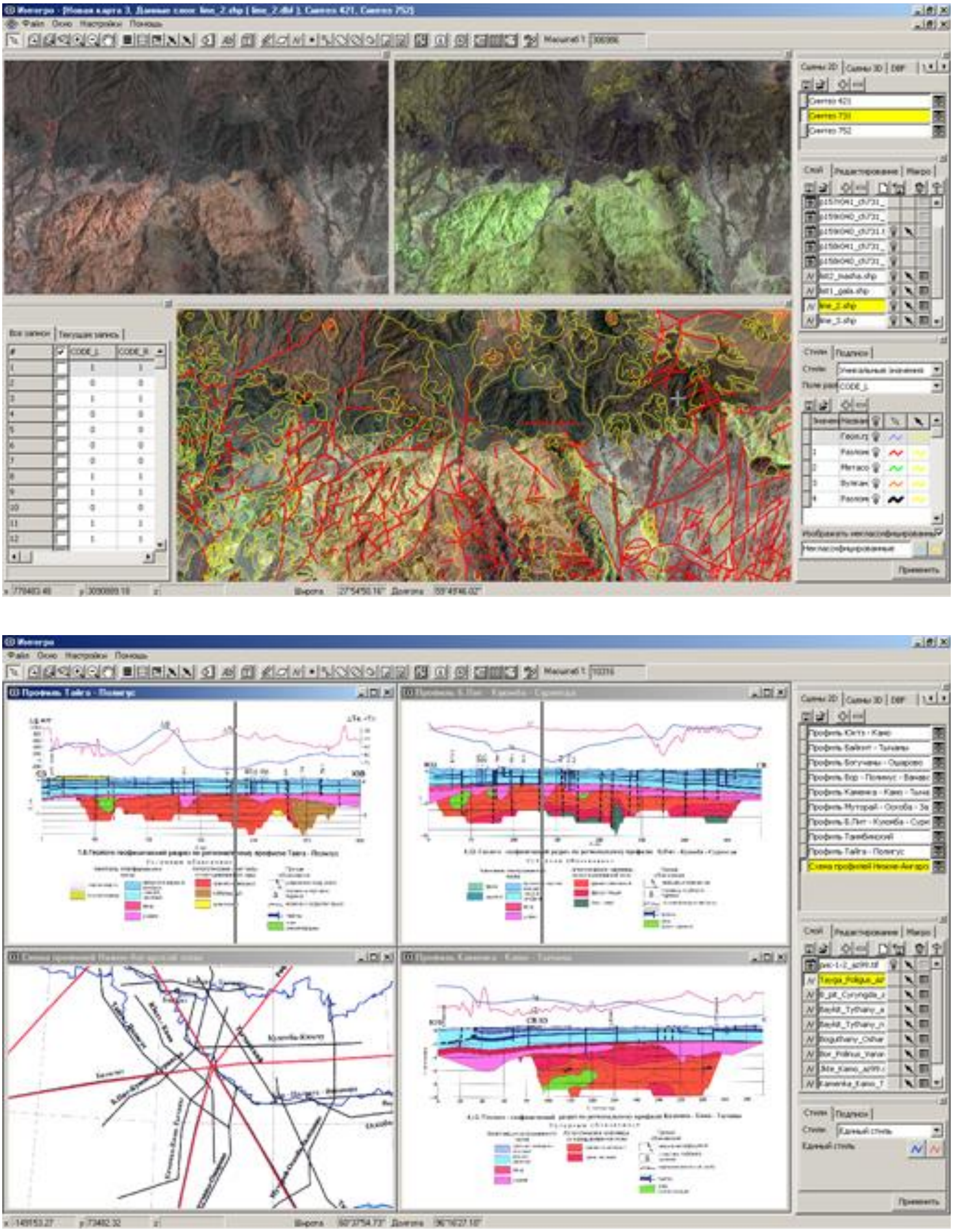

Fig. 13.3. Experience in GIS INTEGRO.

13.5. Development of project management software systems

In exploration and oil and gas production organizations in order to increase the intensity and quality of work is often used software aimed at project management.

One of such software systems is ORACLE PRIMAVERA. Due to its high cost in the exploration industry, this product is used by several large companies.

Information system based on ORACLE PRIMAVERA allows you to perform the following functions:

1. Project management of the enterprise of various complexity.
2. Interaction with information products used by the company (for example, SAP automated planning system).
3. Support of firm structure (adaptable to any company).
4. Assessment of existing risks, forecasting and analysis of market trends.
5. Support of various methods of project management.
6. Multipurpose use.
7. Calculation of the impact of the current process on the degree of utilization of the company's resources.
8. Analysis of project groups and budget allocation among them.
9. Creation of an environment for interaction of all persons involved in the projects.
10. Distributed decision tasks (from the management of time sheets to calculate the budgets of various complexity).
11. Accumulation, storage, dissemination and analysis of information.

One of the most successful and popular domestic software systems for project management is ADVANTA (http://promo.advanta-group.ru).

Here are the main features of the program.

For project management (Fig. 13.4):

1. Convenient and functional Gantt chart
2. Setting and acceptance of tasks, control of the schedule of performers
3. Electronic archive of project documents
4. Resource management — planning and time tracking
5. Planning of payments, control of payments, analysis of BDR and cash flow statement

6. The control panel of project indicators online

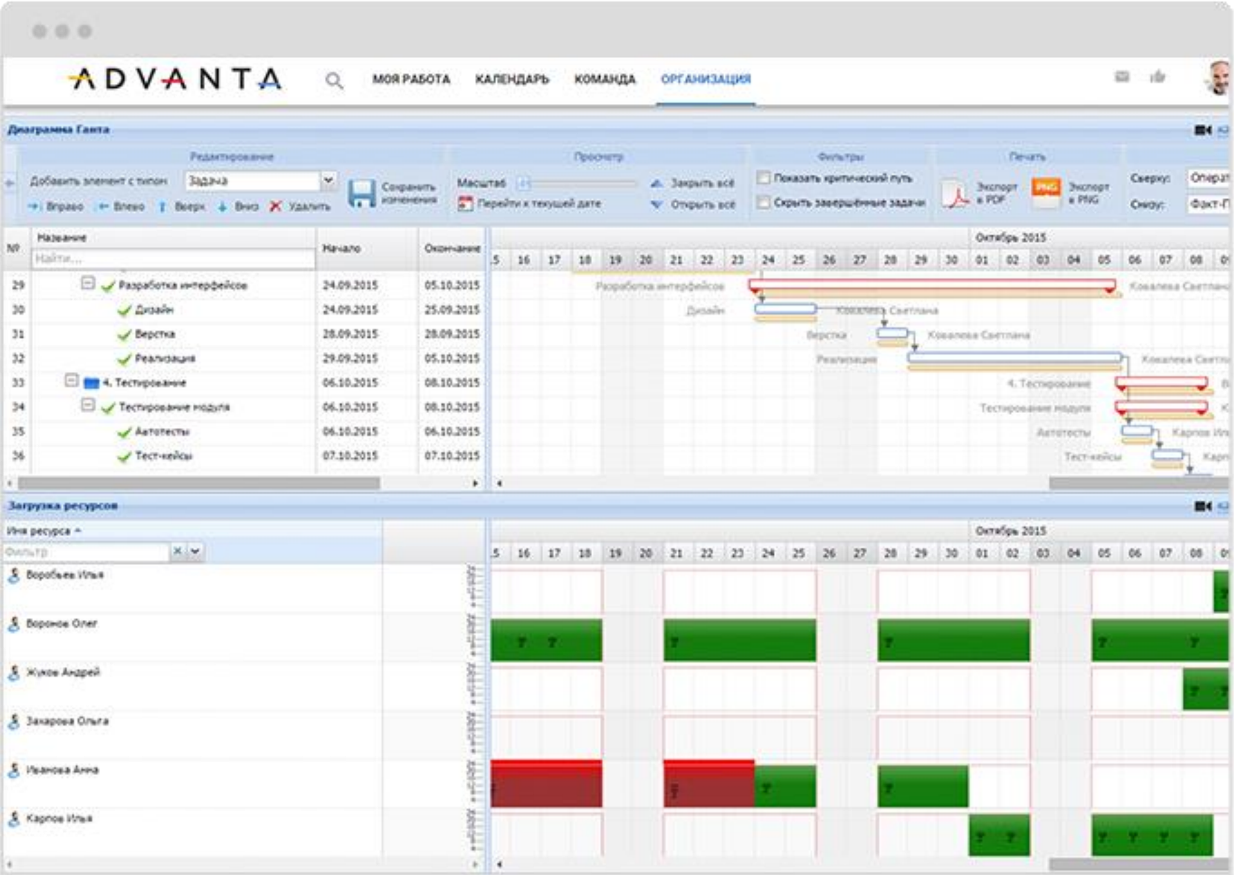

Fig. 13.4. The interface of the ADVENT program. Project management.

Full picture of the project portfolio (Fig.25.5):

1. Building a multi-level hierarchy of the project tree
2. Project evaluation and rating
3. Resource balancing, unit load analysis
4. Mastered volumes, customizable system of indicators
5. Project portfolio dashboard
6. Analogue Of Microsoft Project Server + Sharepoint

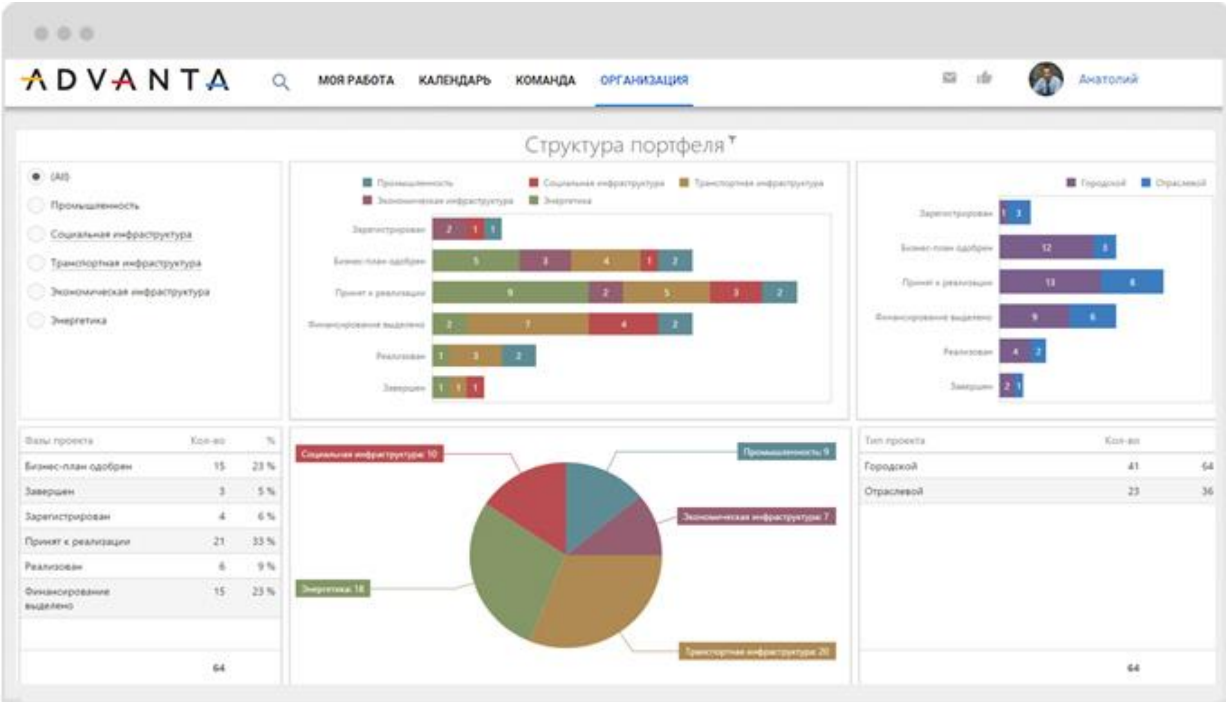

Fig. 13.5. The interface of the ADVENT program. Project portfolio.

Convenient collaboration tools (Fig.25.6):

1. Personal office for each employee
2. Live feed of the event, a flexible notification subscriptions
3. Online discussion of working issues
4. Coordination of documents with custom routes
5. Joint calendars, minutes of meetings

In the domestic software market, the ADVENT project management program is not the only one, this sector of the market is developing dynamically today; there are also freely distributed programs, but their smoothness and comfort of use are not yet satisfied with many consumers.

13.6. Software ACS TP in exploration

In modern conditions, it is important not only to conduct high-quality technological preparation of exploration, but also to automate some of them.

The importance of this approach was understood in 1980-1990. To do this, the industry invited teams of developers who own the issues of creating automated process control systems, but no major changes in the automation of production processes have occurred. Yet an important Foundation was laid. The main reason is that those specialists had only a superficial understanding of geological exploration, it took a lot of time to understand the essence.

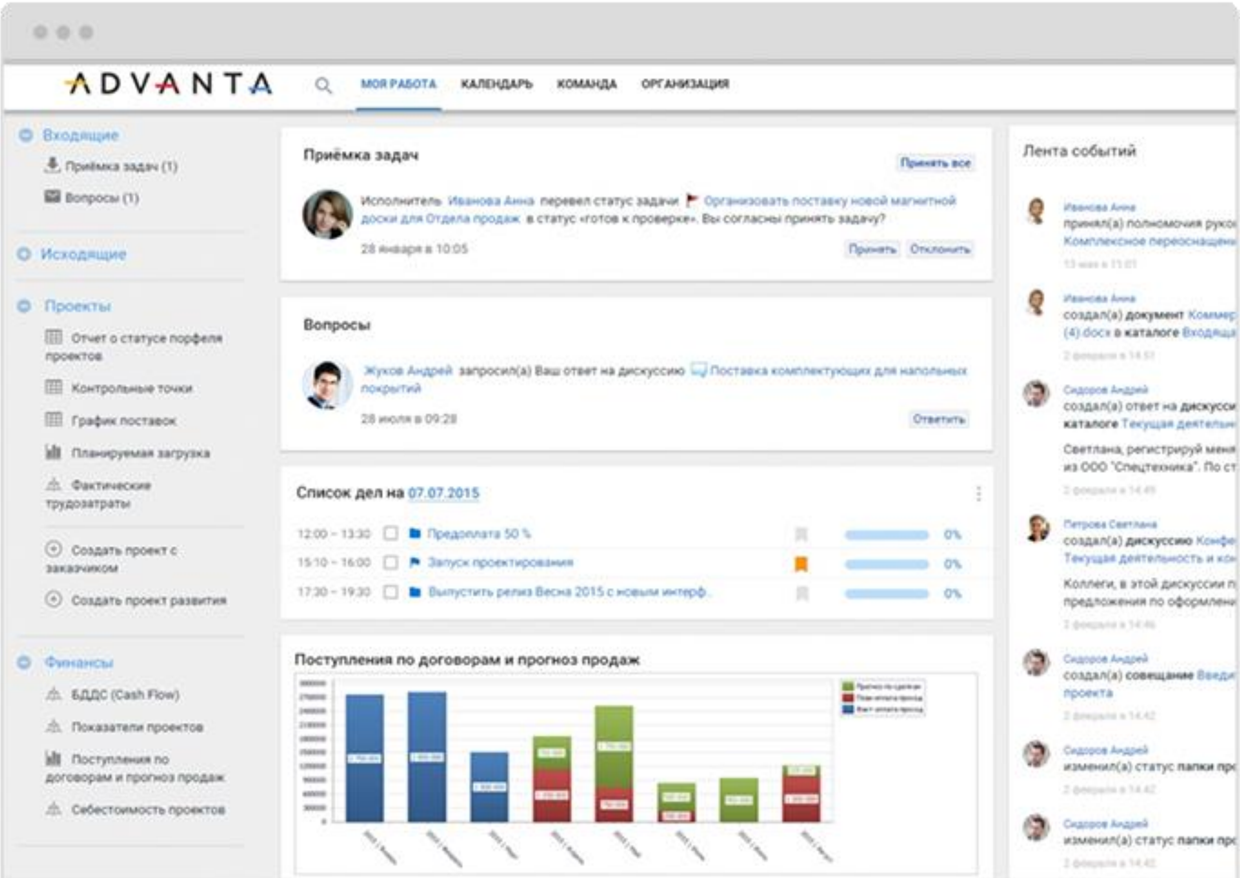

Fig 13.6. The interface of the ADVENT program. Conducting joint work.

For fig. 13.7. the left arrow (up) shows the path that the programmer took: to write a program (SOFTWARE), he created an algorithm (AO) developed on the basis of technological rules (TO).

In the right part of the figure, two counter arrows show that the exploration technologist, knowing well THAT, begins to create an algorithm (AO) automation and finishes its creation together with the programmer. This is an important point, as it determines the need to prepare modern technologists who know the intricacies of creating algorithmic support.

The importance of automation of labor-intensive processes is undeniable, but the APCS should not just perform the task, but do it effectively and in the best way, i.e. optimally.

Issues of optimization of exploration processes we began to deal with in the 80-ies under the leadership of the Minister of Geology of the USSR EA Kozlovsky.

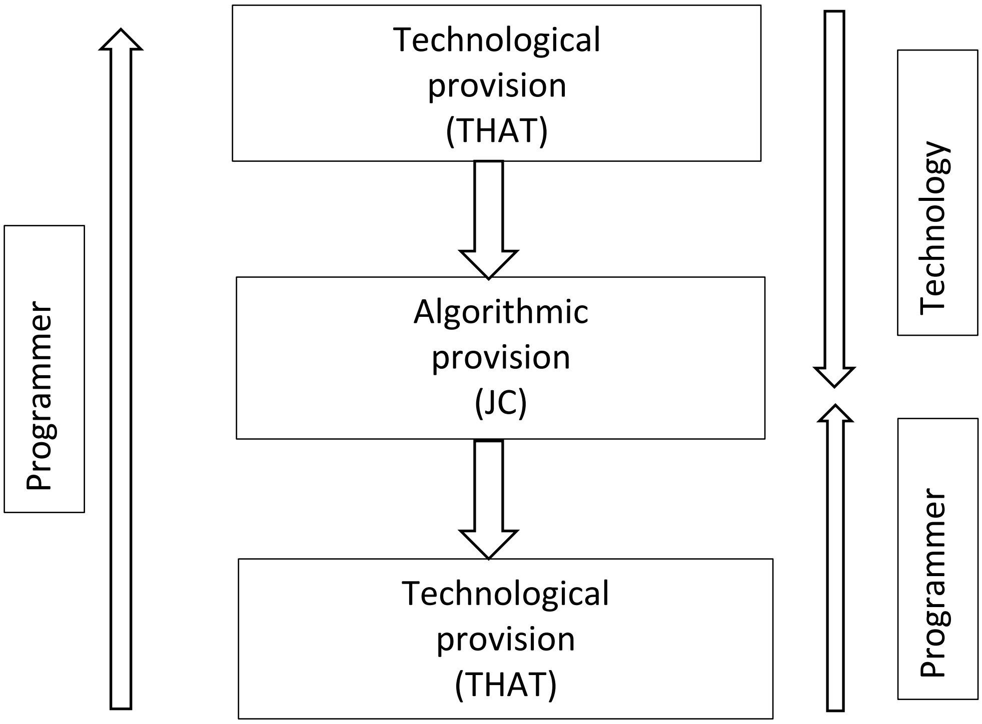

Fig. 13.7. The structure of the software APCS

The technological process can be optimized only by setting the optimization criterion. At the top level of enterprise management, this criterion is often the system:

I. e. minimization of cost of works at productivity not less than planned.

Such formulation is clear to the head of the enterprise, but is perfect unclear to the worker. That is why a comprehensive technological preparation of production is necessary to bring the task of the upper level to the level of the worker, who can control several (usually 2-4) process parameters. For example, in exploration drilling is:

axial load on rock-cutting tools;

rotational speed;

the consumption of cleaning agent.

As the basic criteria for automatic control over the channel «axial load» were adopted:

$$\frac{V}{P} \to max \quad and \quad \frac{V^2}{P} \to max$$

It should be noted that started in 1980-1990-ies the research and development of software implementing the automation of the exploration process are of great interest, as the problem of automation of heavy operations today is one of the urgent tasks of intensifying the development of the industry.

13.7. Elements of algorithmic support of automatic control system of drilling on the control channel «axial load»

Currently, one of the most effective methods of scientific knowledge is modeling, and in particular the method of mathematical modeling. This term can be defined as the process of building (or choosing) and studying models to gain new knowledge about the process being studied. Both rocks and rock-cutting tools are specific solids, the process of interaction of which could not be described by one generalized model until now. Today, with the advent of intelligent information systems, new methods of modeling processes are developing.

To solve the problem of intensification of geological exploration, theoretical studies of the features of the pair «rock – rock-cutting tool» («rock-AT») [1, 2] were carried out, which allowed to establish the proximity of the following models to real conditions:

$$V = V_0 \cdot e^{-at}$$

$$and$$

$$V = V_0 - kh$$

These expressions determine the dependence of the change in the mechanical speed of drilling V during mining AT the initial velocity V0 from the drilling time t, sinking at H. the Coefficients «a» and «k» are experienced and characterize the pair «rock-AT».

As a result of working out a sufficient number UNDER different conditions, a model was obtained:

$$V(t, v) := v \cdot e^{\frac{-v^p \cdot [R+(B-v)^q] \cdot t}{m}}$$

The calculation of the dependence of the penetration h on the drilling TIME t was made in accordance with the expression:

$h(t, v) := \int_0^t v \cdot e^{\frac{-v^p \cdot [R+(B-v)^q] \cdot t}{m}} dt,$

where: p, R, B, q, m – coefficients taking into account the design parameters AND physical and mechanical properties of the rock.

We also consider the method of finding the optimal values of the parameters of the drilling regime, adopted for the intensification of exploration.

A comparative analysis of the effectiveness of the «axial load» control channel search procedures allowed us to dwell on the Kiefer-Wolfowitz procedure based on gradient methods for finding the extremum of unimodal functions. The procedure is based on the following scheme of transitions:

$$x_{i+1} = x_i + \frac{a_i \cdot [z(x_i + c_i) - z(x_i - c_i)]}{c_i}$$

where: $z(x_i + c_i)$ and $z(x_i - c_i)$ – z-values at points $z(x_i + c_i)$ and $z(x_i - c_i)$ respectively;

a_i , c_i – members of a sequence of non-negative real numbers.

At the initial stage, the dependence of the optimization criterion on the axial load K=f(P) is approximated by a function of the form:

$K=AP^2+BP+C$

Then, in accordance with the method of transitions, we obtain:

$$a_{i\,\text{о}P\text{т}} = -\frac{1}{4A} \cdot \left[1 + \frac{2\sigma}{\text{c}_{i\,\text{о}P\text{т}}^2 \cdot (4AP_i + 2B)^2}\right]^{-1}$$

$$\text{К}_i = \frac{2 \cdot \left(\frac{B}{2A} + P_i\right)^2 \cdot \sigma^2}{c_{i\,\text{о}P\text{т}}^2 \cdot (4AP_i + 2B)^2 + 2 \cdot \sigma^2}$$

In the course of further research, the Kiefer-Wolfowitz procedure was modified. The basis of the modification was that each calculated point could be used for the current iteration step and for the next one. This has essentially halved the scheme to find the optimum, which is an important factor in the intensification of exploration.

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14. Modern problems of foreign economic activity in the mineral sector

The mineral resource complex is one of the most economically stable and socially significant sectors of the Russian economy, the main donor of the country's budget system and the main source of funds for the transfer of domestic industry to a new technological order. In the long term, even if the initial model of economic development is abolished, the importance of mineral resources for Russia will not decrease. With the increase in the standard of living will also increase the specific consumption of energy, metals and other minerals.

The basis of the Russian mineral resource complex is the mineral resource base (SME) - a complex of proven and estimated reserves, localized and projected mineral resources. The distinctive features of SMEs in Russia are its scale and complexity. Almost all known minerals are found in the bowels of our country. Russia is one of the world leaders in the extraction, production and export of natural gas, oil, coal, iron ore, Nickel, platinoids, gold and many other minerals. On the other hand, in Russia there is an acute shortage of reserves of a limited number of strategic minerals, such as manganese ores, bauxite, uranium ores, etc.

In the process of mining, proven mineral reserves are spent in the subsoil, so in the long term, if the development of SMEs is continuous, the newly identified reserves compensate those that were repaid during production. At the same time, a violation of the optimal balance between the localization of projected resources, the increase in reserves and the extraction of minerals is undesirable in any direction. The shortage of reserves leads to a decrease in the production of raw materials and, as a consequence, to negative consequences for the country's economy and its social sphere, given the export-raw material orientation and dependence of the Russian economy. Excess reserves indicate inefficient investments, when the return of funds invested in exploration and exploration is transferred to the distant future, which will reduce the inflow and interest of long-term investments necessary for our side.

The huge wealth of our country's territories with energy resources is an absolute competitive advantage on the world stage, but, as practice shows, such wealth creates great problems for Russia both in political form and in the economy. The entire economy of Russia, from small and medium, financial, monetary, trade, social and other spheres, more or less depends on the commodity orientation of Russian exports. Such a deep dependence has recently had a negative impact on the economic situation in the country, as Russia is a hostage to the price environment for mineral raw materials, which is not managed and does not affect fully, and therefore there is a high dependence and uneven revenues from export raw materials, which can be clearly seen on the time horizon of the last ten years.

At the present stage of development of the world economy and international trade, the determining factor in the situation in the country is its internal resources and the degree of its integration into the world economic system. Russia has long been a leader in energy reserves and production. In 2014, Russia ranks eighth among the world's oil reserves - 93.0 billion barrels, which is 5.5% of the world's reserves and the second in terms of oil production - 531.4 million tons or 12.9% of world production [5]. The Russian Federation is a member of the international intergovernmental organization OPEC and has a significant impact on the world energy market. Russia's participation and influence on the oil market through the OPEC+ agreement mechanism is very indicative [4].

Export potential is an integral, organic part of the national economy. It represents the ability of the national economy to produce products that are competitive in world markets and to export them in sufficient quantities at world prices. Its strategic role is that it should become a tool for enhancing the existing and potential competitive advantages of the Russian economy in the international division of labor, a means of promoting our country's exit to the path of stable and accelerated quality economic growth. In this regard, the problem of development and diversification of the country's export potential is the deepest and most complex [3].

The structure of exports is the ratio of the share of different types of goods in the total volume of exports of the country. The structure of Russian exports has not changed for many years, there is a minimum growth or decrease in the share of a certain type of goods, but there are no significant changes, which means that there is no change in the direction of the economy in the country. The structure of exports of basic commodities of Russia is presented in table 14.1 [1, p. 8].

Table 14.1. The main export goods of Russia (with a specific weight of at least 1%).

Name of goods	As % of total exports		
	2015 g.	2016 g.	2017 g.
Crude oil	35,2	34,5	33,0
Mineral oils	18,6	19,7	20,7
Natural gas in gaseous state	12,4	11,8	12,8
Coal	2,2	2,5	2,2
Semi-finished products of iron and non-alloy steel	1,5	1,5	1,2
Raw aluminum	1,3	1,2	1,2
Natural gas, liquefied	0,7	0,9	1,0
Machinery, equipment and vehicles	5,0	5,1	5,4

Based on the data presented in Table 1, it can be concluded that a significant part of Russian exports comes from fuel and energy products. The main export goods of Russia are energy resources (oil, gas, coal, etc.), which account for 72% of its exports. Production and consumption of these resources is growing rapidly every year. Oil and gas are one of the main bases of the Russian economy, the most important source of cash flows from the country's export operations.

To date, such a disproportionate ratio of elements in the structure of exports is a problem for the Russian economy as a whole. The role of Russia - the exporter of raw materials - has long been defined in the world market. According to many experts, the domestic economy is irreversibly dependent on its raw materials, that the reorientation of the Russian economy is necessary, and the simple extraction of energy resources will not be able to keep the economy of the whole country for a long time.

Due to the ambiguous political situation in the world, there were difficulties in foreign trade with Western countries, so there was not only a reduction in imports and exports of goods, but also a reorientation of trade to the East. In 2014, China became the main trading partner of Russia, with a trade turnover of 88.117 billion us dollars, and trade with the EU countries decreased by 8.8% to 381.1 billion dollars. Export of the most important types of fuel and energy carriers to foreign countries in 2013 in quantitative terms amounted to: crude oil - 207.9 million tons, petroleum products - 141.1 million tons, natural gas - 138.0 billion cubic meters, coal - 127.7 million tons, in turn, the export of the most important types of fuel and energy complex to the CIS countries in quantitative terms amounted to: crude oil - 286.6 million tons, petroleum products - 10.3 million tons, natural gas - 58.4 billion cubic meters, coal - 112.9 million tons.

Producers of mineral raw materials from other countries, especially in the country where breakthrough discoveries have opened in various mining regions, have a significant impact on the competitiveness of the Russian mineral complex. An example of such competition is the so-called «shale revolution», in which, first, the United States, and then European countries and China saw an opportunity to reduce their dependence on natural gas imports. The world's shale gas reserves are still small; they are estimated at 12 trillion cubic meters, but it has not actually started. The shale boom in the United States has helped the emergence of companies specializing in the maintenance of gas production - exploration and drilling. High competition led to a sharp decline in the cost of shale gas production, and the peculiarities of the us market ensured its high efficiency. The cost of production of shale gas in the United States today is estimated at 70-120 dollars per thousand cubic meters. After the United States, drilling began in 2006 at the horn river shale field in Canada. By 2015, the volume of gas production at this field could reach 40 billion cubic meters per year. And by 2020, Canada will produce 200 billion cubic meters of shale gas per year. In 2010, TransCanada Corp. constructed and put into operation the first pipeline to transport shale gas from Mostovskogo field in the backbone network. In Europe, great hopes are associated with the development of shale gas, almost all EU countries are involved in the exploration and exploration of shale gas. The most successful projects were in Sweden (project Alum Shale), Poland (Silurian Shale), Austria (Mikulov Shale) and Germany. The largest reserves of shale gas in Europe are in Poland, and the geological structure of the Polish fields turned out to be similar to the Texas fields. Own shale gas in the European market so far, but has significantly increased the supply of liquefied gas from Qatar and other countries. The sharp increase in domestic production of shale gas in the United States has led to a reduction in imports, and liquefied gas suppliers have shifted to the European market. The consequences of the oil shale revolution for the Russian fuel and energy complex are ambiguous. Until recently, Russian officials stressed that they do not believe in the success of natural gas production from poorly permeable rocks. But times and technologies change and place other accents. In the summer of 2012, the Russian Ministry of economic development warned that Gazprom may face problems with sales in Europe as soon as the necessary opportunities for the export of cheap shale gas are created in the US. The main export risks will appear in 2018-2019. According to the forecasts of the Ministry, the average gas price in 2018 will decrease from 400 to 366 dollars per thousand cubic meters. That is, as a result of the Slavic revolution in the US and the increase in the share of spot contracts, PJSC Gazprom will no longer be able to maintain high prices in long-term contracts. The very concern about the threats of shale gas remains calm, but cannot completely ignore the problems. In the summer of 2012, an agreement was reached with Total and Statoil, partners in the Shtokman gas project, to suspend it due to too high costs [2]. The shale revolution has a direct bearing on this event, although it is not directly mentioned.

Since the end of 2014, the rapid decline in oil prices has become an urgent problem, which has had a significant impact on the Russian economy. There are several reasons for the fall in prices: the first is the OPEC policy, which contributed to the preservation of production levels in major OPEC countries and the rapid growth of oil production in countries such as Iran (after the lifting of sanctions) and Iraq (recovery after the war), which was observed from 2014 to 2016. But it should be noted that not all countries support this policy, for example, Venezuela, Iran and four other OPEC countries began to fear that there will be too much oil. The second factor is the restoration of Libya as an outstanding player in the world oil market. And the last reason is the us market entry. As you know, there are many oil fields in the United States, but to avoid the shortage of valuable raw materials inside the country, oil exports were banned. At the same time, the United States is one of the most important consumers of oil in the world, the huge volumes of oil purchased by this country, allowed to keep the cost at a high level. But since 2010, the rate of oil production in the United States has grown rapidly, allowing the country to enter the world market as an oil exporter. Thus, the situation remains tense and unresolved. This is also why Russia has imposed sectoral sanctions on the commodity sector in order to squeeze one of its main competitors. In the end, one of the solutions to this problem is the destruction of competitors in the market, determination of prices or the reduction of oil production, creating shortages and thus higher prices, but none of the leading countries are not ready to reduce oil production. At the same time, since 2016, OPEC member countries, together with independent producers (Russia and Norway), managed to agree on freezing oil production at the achieved level and not inflating so excessive supply. The last action had its results and now the price of oil has returned to a more or less comfortable level for our side - $ 50-60. per barrel.

According to experts, if the current situation continues, maintaining the pace of economic development will become more difficult. Large-scale structural changes are necessary for further growth of the Russian economy. But it is extremely difficult to destroy the current system.

Large Russian oil and gas companies are monopolists, they dictate prices in the domestic market, set their own rules. It can be argued that no company will agree to restructure the current economic structure. One solution in this situation could be to change the extractive industry itself. It may be necessary to focus the oil and gas industry on innovative technologies related to new technologies, equipment and equipment, which, in turn, should be produced in Russia, and not to buy from direct competitors. We are talking here primarily about service equipment for the development of offshore fields, hydraulic fracturing technology and inclined drilling. Thus, the production of new equipment in the country will entail the burden of many related industries: metallurgy, chemical industry, innovation centers for the creation of new technologies and much more. Then Russia will become more competitive in the world market and in other sectors of the economy.

The relevance of the problem of foreign trade in the mineral sector (in the broad sense of the term) for Russia, given the fact that raw materials are traditionally the most important geo-economic advantage of the country, there is no doubt. At the same time, Russia, which as a result of market reforms is truly integrated into the world economic system, is positioned as a typical representative of the «raw material» model of development, which, according to many experts, can not provide a satisfactory rate of growth in the welfare of the population, on the one hand, macroeconomic stability, international competitiveness and national security - on the other. The raw material model, in contrast to the innovation model, usually seems to be synonymous with everything archaic and inefficient. Russia often receives an indecent role of an immense appendage not only of the leading countries, but also of China. To overcome the «raw curse» that can destroy the domestic economy, we must immediately «get off the oil needle» to avoid the notorious «Dutch disease». In this regard, the prevailing view is that, given the high prices of hydrocarbons and minerals, there are no practical incentives for innovative development, infrastructure development and robotics, which are essential elements of competition and future growth in the quality of life of the population. There is therefore a need for a rapid shift from mineral resource orientation to innovation, as natural resources are not primarily renewable, and the innovative resource of knowledge and intelligence contained in human capital is virtually unlimited and reproducible on an expanded scale.

In our view, there is nothing more dangerous than an ill-conceived attempt to destroy the economic system that has developed over the previous decades. The high efficiency of the commodity sector is based on natural and competitive advantages, and the diversification of the economy, overcoming the dependence of raw materials should not lead to an artificial restriction of the development of some industries in favor of others. Most likely, economic policy should be aimed at forming the contour of «raw material innovation», that is, the effective use of both development resources. At the same time, we should not forget that, despite the «backwardness» of the raw material model and macroeconomic structural distortions, it was the margin of the mineral sector that ensured the survival of the Russian economy in the most difficult period of reforms and created prerequisites for economic growth and modernization. In recent years, it was the mineral sector with a huge solvent demand, secured by exports, which put forward the demand for scientific and technological innovations. Deep processing of raw materials (growth of the share of additional product in the economy) and the growth of integration of the Russian economy into the world economy requires the use of innovative technologies for the production of a variety of products with high added value. At the same time, the raw materials sector can initiate the creation of high-tech industries in engineering and shipbuilding, which concentrate the latest achievements in the development of new materials, information technologies (revolution 4.0), power plants and vehicles of a new type. In addition, in all scenarios of transition to innovative growth of resource-intensive economy of Russia, qualitative renewal of fixed assets due to the widespread introduction of resource-saving technologies, both domestic and foreign, is extremely important, in demand by business and the public and requires the inclusion of all layers of specialists and managers in this process.

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15. Analysis of the effect of sectoral sanctions on the development prospects of the oil and gas sector of the Russian Federation

2014 was a turning point in the political and economic relations between the Russian Federation and Western countries that decided to impose economic sanctions against Russia against the background of the Ukrainian conflict. Naturally, this was the reason for the deterioration of the economic situation in Russia, however, was not a key factor, since the Russian Federation until 2014 showed a slowdown in GDP growth due to structural problems of the economy (Fig. 15.1).

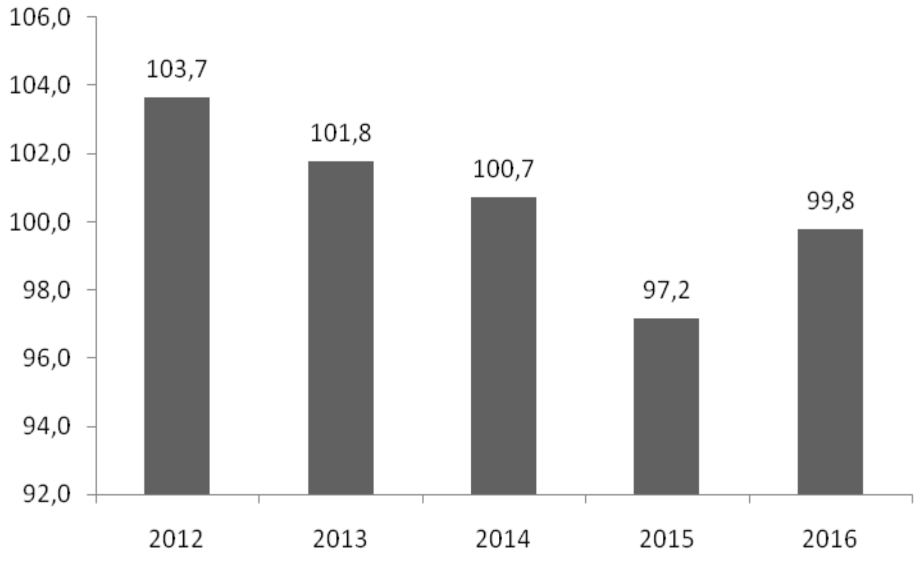

Fig. 15.1. Dynamics of the gross domestic product volume index (as a percentage of the previous year)

Source: data [4]

As noted by V. Kholodkov [8], the main reasons for the decline in the country's economy were: violation of the industry balance, which consists in strengthening the role and dependence on the fuel and energy sector and the degradation of the manufacturing industry; disproportions in trade relations, manifested in Russia's dependence on European markets and underdevelopment of other areas of energy exports; active involvement of the domestic financial sector and companies in external loans against the background of a significant outflow of capital from the country (Fig. 2); inconsistency of foreign policy to foreign economic relations.

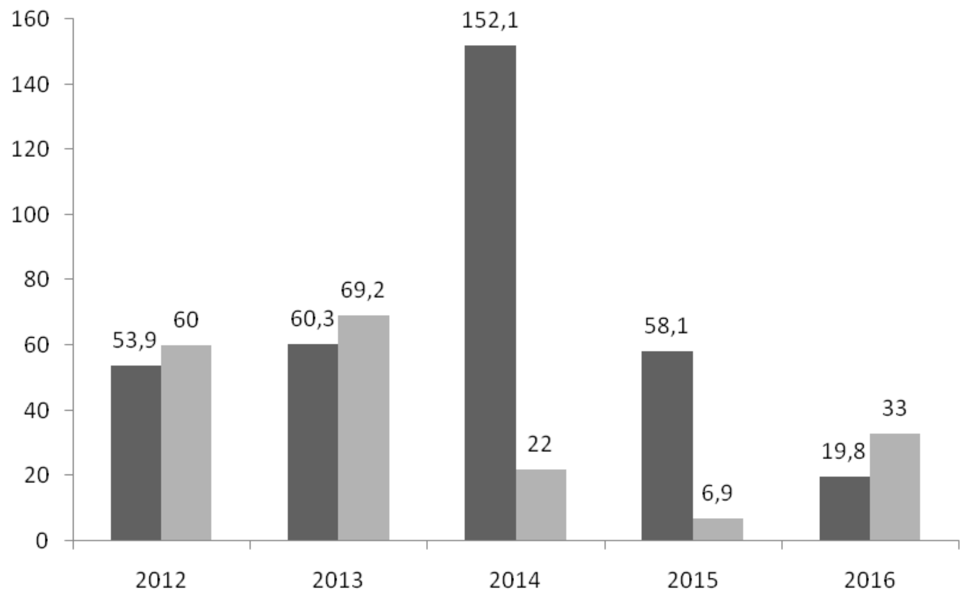

Fig. 15.2. Dynamics of capital outflow and direct investment in Russia, USD billion

Source: compiled by the author according to the Central Bank of Russia [7]

The sectoral sanctions imposed on Russia are directed against the main competitive sectors of the economy: oil and gas, nuclear, aviation and space, military, as well as banking, in order to reduce the share of domestic companies in European and other markets, as well as to intensify competition from the United States [6]. Given the fact that today the main industry providing economic growth in the country and the inflow of currency is the oil and gas industry, which accounts for 50 to 80% in the structure of exports [9], it is particularly important to study the effects of sanctions in the future on the prospects for the development of the oil and gas sector, which was the purpose of this study.

The analysis of trends in the development of the world oil market in 2012-2016 shows the annual growth of oil production and consumption, but in 2013 and 2016 there was a slowdown in the growth of demand and supply for oil (Fig. 3). At the same time, in 2013 there was an excess of demand for oil over its production. In General, in 2016, the demand for oil on the world market grew by 6.74%, and production volumes increased by 6.63%, compared to 2012. In 2015, there was the most significant increase in world demand for oil since the beginning of 2012, which showed an increase of 2 million barrels. day, which was due to the fall in oil prices by 47.1% from 98.95 in 2014 to 52.39 dollars. per barrel in 2015.

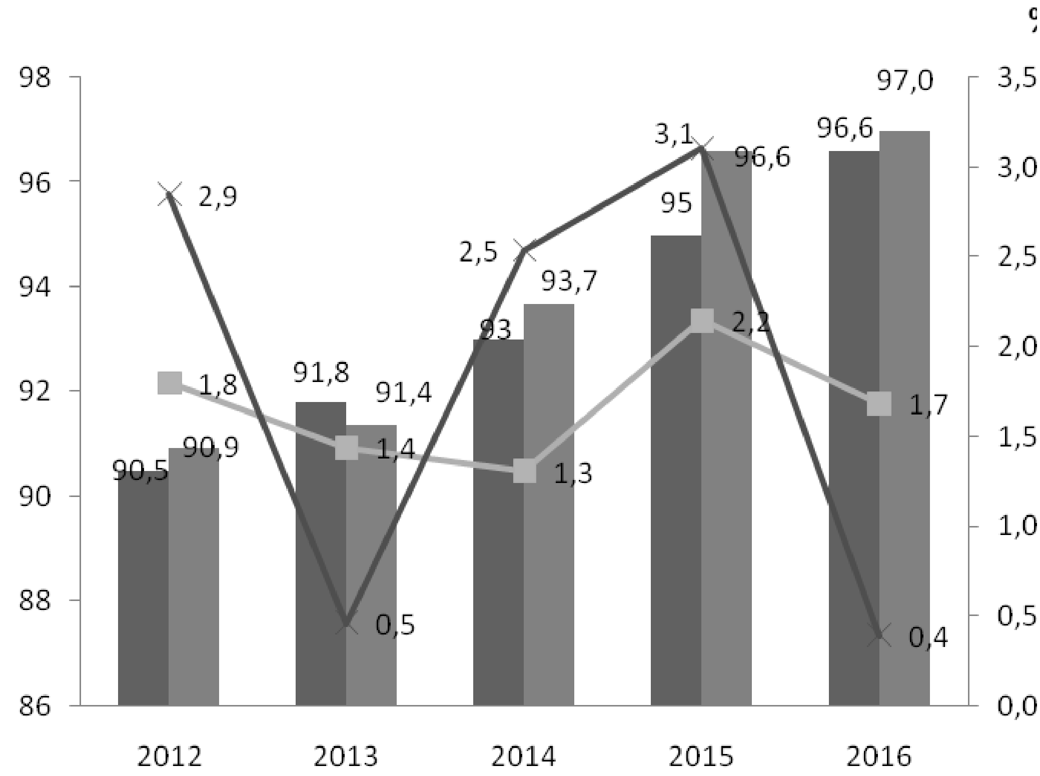

Fig. 15.3. Dynamics of oil production and consumption in 2012 - 2017 in the world

Source: compiled by the author according to [3]

The world leaders in oil production in 2012-2016 were the USA, Russia and Saudi Arabia (table. 1). It should be noted that Russia, both before and after the imposition of sanctions, increased oil production. In General, the increase in 2016 compared to 2012 amounted to 5.68%. According to IEA forecasts [3], Russia's share in 2017, compared to 2012, is expected to be almost at the same level, 11.91% against 11.80% (which will also be due to a reduction in production under the OPEC agreement, the us share in 2017). it will grow to 13.39% against 10.1% (the US did not support the restriction of production under the agreement with OPEC), and the share of Saudi Arabia in total oil production in 2017 will be 10.35% against 10.46% in 2012.

Currently, the following sectoral sanctions have been imposed on the Russian oil and gas sector: restrictions on joint projects and other operational restrictions against domestic oil and gas companies, their subsidiaries and enterprises engaged in auxiliary activities; a ban on the export to the Russian Federation of technologies for oil production and processing, as well as technologies in exploration; refusal to invest in promising projects in the oil and gas sector and from joint activities in projects in the oil and gas industries, namely the prohibition for foreign companies to participate in offshore projects, deep-sea drilling and ultra-deep continental drilling on the Bazhenov Suite [6]. The sanctions, first introduced on July 31, 2014, restrict access to the European and American capital markets for Russian banks with state participation, their subsidiaries, companies from the energy, oil and gas and defense sectors, which makes it difficult to obtain long-term investments and loans, which are so necessary for Russia and its sectors of the economy for progressive and structural development.

The opinions of the researchers were divided about the possible negative consequences of the sanctions in the oil and gas sector and other industries on the economic growth of the country.

Thus, experts of Capital Economics note that the development of the Russian economy mainly depends on energy prices, not on sanctions. A significant drop in the Russian economy was observed a year after a sharp decline in prices, and not after the introduction of sanctions in Q1 2014 [1]. At the same time, it should be noted that if energy prices are instantaneous impact on the Russian economy, the sanctions regime destroys and affects the long-term development and competitiveness of the country.

Table 15.1. Oil production by country in 2012 – 2016, million barrels per day

Countries	2012	2013	2014	2015	2016	Growth, % 2016/2012	2012, specific weight	2016, specific weight
OPEC								
Saudi Arabia	9,51	9,4	9,53	10,12	10,42	9,6	10,46	10,75
Iran	3	2,68	2,81	2,85	3,55	18,3	3,30	3,66
Ірак	2,95	3,08	3,33	4	4,41	49,5	3,24	4,55
UAE	2,65	2,76	2,76	2,93	3,03	14,3	2,91	3,12
Kuwait	2,46	2,55	2,61	2,75	2,88	17,1	2,71	2,97

Venezuela	2,5	2,5	2,46	2,46	2,24	-10,4	2,75	2,31
Nigeria	2,1	1,95	1,9	1,77	1,47	-30,0	2,31	1,52
Angola	1,78	1,72	1,66	1,76	1,71	-3,9	1,96	1,76

Countries	2012	2013	2014	2015	2016	Growth, 2016/2012, %	2012, specific weight	2016, specific weight
Algeria	1,17	1,15	1,12	1,11	1,11	-5,1	1,29	1,14
Other OPEC countries	3,17	2,67	2,1	1,66	1,59	-49,8	3,49	1,64
Total crude oil	31,3	30,46	30,28	31,65	32,63	4,2	34,42	33,65
Total gas condensate	6,28	6,26	6,36	6,49	6,69	6,5	6,91	6,90
Total OPEC	37,58	36,72	36,65	38,14	39,31	4,6	41,32	40,54
The share of OPEC, %	*41,32*	*40,19*	*39,12*	*39,49*	*40,54*	*-0,78*	-	-
OECD								
America	15,86	17,11	19,03	19,98	19,46	22,7	17,4	20,1
USA	9,18	10,24	11,94	12,99	12,54	36,6	10,1	12,9
Mexico	2,92	2,89	2,81	2,6	2,46	-15,8	3,2	2,5
Canada	3,75	3,97	4,28	4,39	4,45	18,7	4,1	4,6
Chile	0,01	0,01	0,01	0,01	0,01	0,0	0,0	0,0
Europe	3,46	3,35	3,32	3,48	3,52	1,7	3,8	3,6
Britain	0,94	0,89	0,86	0,97	1,03	9,6	1,0	1,1

Norway	1,91	1,85	1,89	1,95	2	4,7	2,1	2,1
Dr. countries	0,6	0,61	0,57	0,56	0,49	-18,3	0,7	0,5
Asia Oceania	0,56	0,48	0,51	0,46	0,43	-23,2	0,6	0,4
Australia	0,48	0,4	0,43	0,38	0,35	-27,1	0,5	0,4
Dr. countries	0,08	0,08	0,08	0,08	0,08	0,0	0,1	0,1
Total OECD	**19,88**	**20,93**	**22,86**	**23,92**	**23,4**	17,7	21,9	24,1
The share of OECD, %	*21,86*	*22,91*	*24,4*	*24,76*	*24,13*	2,3		
Non-OECD countries								
The countries of the former Soviet Union	13,62	13,88	13,87	14,03	14,2	4,26	14,98	14,64
Russia	10,73	10,88	10,91	11,09	11,34	5,68	11,80	11,69
Dr. countries	2,89	3	2,95	2,94	2,86	-1,04	3,18	2,95
Asia	7,82	7,67	7,71	7,91	7,61	-2,69	8,60	7,85
China	4,18	4,18	4,22	4,34	4,03	-3,59	4,60	4,16
Dr. countries	3,64	3,49	3,5	3,58	2,73	-25,00	4,00	2,82
Europe	0,14	0,14	0,14	0,14	0,14	0,00	0,15	0,14
Latin America	4,18	4,17	4,4	4,58	4,49	7,42	4,60	4,63
Brazil	2,16	2,12	2,35	2,53	2,61	20,83	2,38	2,69
Other country	2,03	2,06	2,04	2,05	1,88	-7,39	2,23	1,94
middle East	1,46	1,35	1,31	1,27	1,26	-13,70	1,61	1,30
Africa	2,27	2,3	2,31	2,07	1,94	-14,54	2,50	2,00

Total non - OECD countries	29,48	29,52	29,73	30	29,64	0,54	32,42	30,57
Share of non - OECD countries, %	*32,42*	*32,31*	*31,74*	*31,06*	*30,57*	-1,85		
Total non - OPEC	53,35	54,64	57,03	58,45	57,65	8,06	58,67	59,45
Share of non-OPEC countries, %	*58,67*	*59,81*	*60,88*	*60,51*	*59,45*	0,78		
Total supply	**90,94**	**91,36**	**93,68**	**96,59**	**96,97**	6,63	100,00	100,00

Source: compiled by the author according to [3]

Moreover, a number of researchers believe that Russia is not in danger of complete economic alienation due to the globalization of markets and mutual integration of world capital. In particular, the imposition of sanctions against such companies as Rosneft, NOVATEK had a negative impact on the revenues of BP (UK), Exxon Mobil, Total, etc., which own large stakes in these enterprises or participate in projects in Russia (Fig. 15.4).

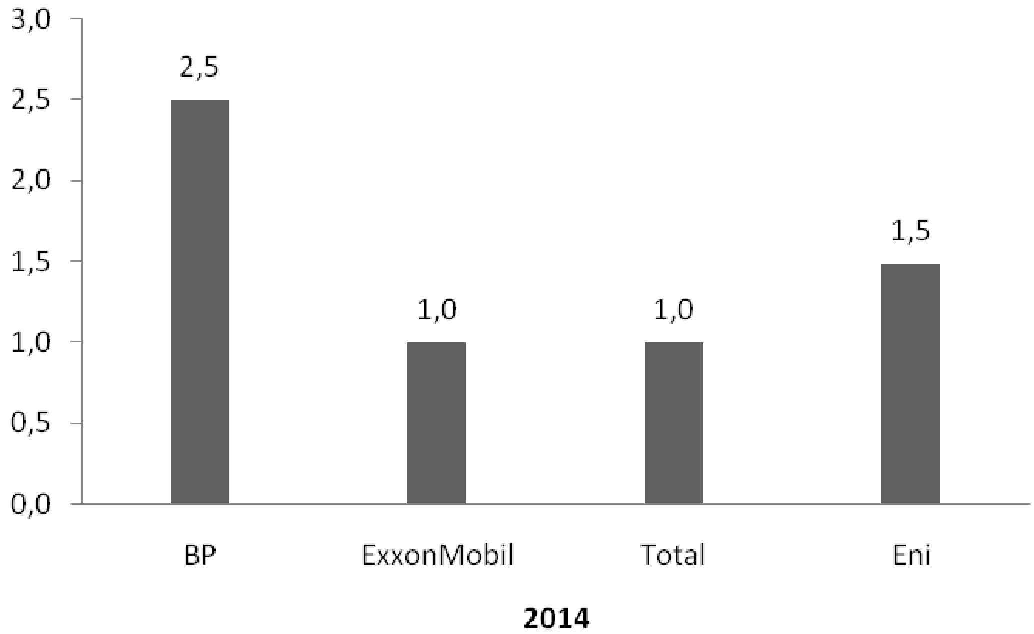

Fig. 4. Losses of foreign companies from ownership of Russian assets after sanctions were imposed in 2014, USD billion

Source: compiled by the author according to [5]

Thus, the shares of Rosneft in 2014 fell by 54% (however, the main reason was the decline in oil prices), while, immediately after the introduction of sanctions, they fell by 15%. In General, BP estimated its losses from the depreciation of Rosneft shares as a result of the introduction of sanctions in 2014 in the amount of $ 2.5 billion. In addition to the losses associated with the fall in the share price of NOVATEK, Total also lost its shares in such Russian projects as Yamal LNG (20%), a decrease in the share of participation, Shtokman (25%), thermokarst Deposit (49%), JV for the development of Bazhenov Suite, etc., its losses for 2014 as a result of the introduction of sanctions, the company estimated at $ 1 billion. [5; 9].

Considering the gas sector, it is worth noting that currently Russia covers about one third of Europe's natural gas needs (more than 5 million barrels per day), while the dependence of different countries is in the range from 0 to 100%. At the same time, having an oversaturation of the domestic market due to the growth of shale gas production, the US needs new markets, which against the background of lower prices becomes attractive for Europe. However, there are a number of objective reasons of technological nature, which make it difficult to export American gas to European markets, and, consequently, to reduce the market share of Russia:

– insufficient number of regasified LNG terminals in Europe (a matter of time and investment);

– lack of export LNG terminals in America (several ports are already under construction, including the first terminal in Louisiana);

– the presence of long-term contracts with Gazprom for the supply of gas to European countries [9].

Moreover, Gazprom is strengthening its competitive position by developing gas fields all over the world, not only in Russia. In this regard, in order to develop its gas industry and enter the European gas market, the US, in our opinion, is lobbying for tightening and maintaining anti-Russian sentiment and sectoral sanctions, which in the long term will weaken the technical and technological competitiveness of Russian energy giants and will allow the US to take a significant share in this market.

Among other things, and the presence of constant pressure on the Russian oil and gas sector, Russian companies are gradually adapting to the new working conditions under the sanctions, which allowed, for example, «Gazprom Neft» and «Surgutneftegas» to continue the development of shale deposits. At the same time, to reduce the possible negative consequences, both Russian and foreign companies begin to use shadow schemes of work that are beneficial for both sides [1]. None of the business structures is not profitable, because each side of cooperation receives its own benefits from such cooperation, so it is more of a geopolitical benefit of the countries building a sanctions regime against Russia.

Other experts note that the introduction of financial and technological restrictions may have the following negative consequences for the fuel and energy complex:

– «freezing» of projects for the development of new fields in the field of unconventional oil, mainly on the shelf of the Arctic and Black seas, Bazhenov formation, as well as shale oil (table. 2). Thus, according to the Federal Agency for subsoil use – Rosnedra, the share of hard-to-recover oil in the structure of reserves is 60% [2]. At the same time, the sphere of shelf development and technologies and equipment for increasing oil recovery from reservoirs are most dependent on imports (about 90-95%)[5]; - significant slowdown in the implementation of the project to build a gas pipeline on the bottom of the Baltic sea «Nord stream-2», which will limit the supply of Russian gas to the European market;

– acceleration of the rate of decline in oil production at existing fields in Western Siberia, which will mainly be due to the ban on the use of horizontal drilling technologies or multi-zone hydraulic fracturing (in particular, about 42% of new wells of Gazpromneft were drilled in 2013 by using the horizontal method) [2];

– reduction of exploration volumes and increase of oil reserves. The decrease in reserves has been observed since 2014, while in 2016 compared to 2015 they decreased by 20.8%, which in the long term necessitates the development of deposits with unconventional oil [2];

– loss of affordable long-term financing for energy companies.

In General, experts estimate the possible damage from technological and financial sanctions in the oil and gas sector of the order of 1-1.5% of GDP annually, while oil volumes may decrease by 5% (or 25-26 million tons per year) over the next three years [1; 8]. Moreover, in the long-term planning horizon without the development of its own modern technologies for oil and gas production, field development and intensification of oil recovery, the decline can continue and will continue to grow the cost of production of hydrocarbons.

Table 15.2. Joint projects with foreign companies in the field of unconventional oil production in Russia Terminated due to sanctions in 2014 [5, P. 12]

Project name	Project participant	Project description
Prinovozemelsky sites (the well «University-1»)	Rosneft, ExxonMobil	The project was stopped by ExxonMobil due to sanctions. Rosneft is unable to continue the implementation of this project due to the lack of necessary technologies and experience in deep-sea shelves.
Black sea (land «The Tuapse deflection)	Rosneft, ExxonMobil	
Western Siberia (Bazhenov Suite)	Lukoil, Total	The project was stopped by Total in may 2014, the project was planned to invest in two years about 120-150 million dollars. Total have used the technology of hydraulic fracturing.

According to experts, companies will need 3 or more years to reduce the negative consequences [1].

Among the positive aspects of the introduction of sanctions can be noted the intensification of import substitution policy in Russia, which aims to reduce dependence on imports by 2020 (table. 15.3). On average, it is planned to reduce the share of imports in consumption from 10 to 20% by 2020, The significant reduction in the share of imports is expected in the field of catalysts for basic processes of oil processing up to 45% from 100% in 2014

Table 15.3. Directions of import substitution in the oil and gas sector [5, P. 13]

Technological direction	Share of imports in in consumption, %	
	Fact 2014 г.	Plan 2020 г.
Equipment and technologies for drilling horizontal, directional and multi-hole wells	60 – 83	45 – 60
Technologies and equipment for geological exploration	40 – 85	30 – 70
Equipment and technologies used for offshore projects	80–90	60–70
The technology of liquefaction of natural gas	50 – 67	40 – 55
Catalysts for basic oil refining processes	60 – 100	20 – 45

The most striking example in the field of the import substitution policy is the project of company «Gazprom Neft», which is associated with the creation of a complex of Russian technologies high-tech equipment for the purpose of exploitation of the deposits of the Bazhenov formation. According to this project, the implementation of import-substituting technologies will be made by 2025, so that the annual production level will reach about 2.5 million tons, followed by an increase in this indicator. The cost of the project is estimated at 7.5 billion rubles.

Summing up the results, we note that the introduction of sectoral sanctions against the oil and gas sector of Russia at the moment did not significantly affect the production performance of the oil and gas industry in 2014-2016, however, in the long term, it is possible to increase the problems associated with the development of offshore and shale projects, drilling for deep oil, development of services and technologies due to the lack of necessary technologies and equipment for the development of such types of fields and deposits. Moreover, the problems will increase not only for Russian enterprises, but also for their foreign partners, with whom various joint projects have been concluded. For Gazprom, due to its strong market position in the European market and the lack of technical capacity to supply gas from alternative suppliers (USA), sanctions will most likely not be adopted in the near future and will not affect the work of the monopoly, but in the long term Gazprom's position will be trampled by companies from the United States.

Thanks to the activation of the policy of import substitution, the share of imported technologies should be reduced by 2020, however, as experts note, this will not be enough, and therefore, Russian oil and gas companies will need to focus on finding new external suppliers from Asian countries and the Middle East. As the world practice shows, for the successful implementation of the policy of import substitution, much more time is needed, especially in such complex areas as oil and gas and geological exploration.

In order to ensure the financing of oil and gas companies ' projects, the reorientation of Russian companies from Western European partners to Eastern investors (China, India) that do not apply sanctions against Russia will become relevant. As well as establishing a dialogue with companies of these countries and governments on financing exploration and production projects in Russia.

Iran's experience has shown that, despite the sanctions, positive GDP growth is possible, however, the country will annually lose from 1 to 2% of GDP, which will not allow the state's economy to develop effectively.

Thus, the sanctions have not an immediate, but a delayed long-term effect, and in order to counteract them, Russia needs to develop its own modern technologies for geological exploration and oil service. The relevant policy should be considered at the highest state level and adopted for implementation by the main relevant departments.

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16. Tax reform in the oil and gas sector of the Russian economy – advantages and disadvantages of the transition from met to met

Russia has one of the world's largest potential fuel and energy resources. About 6% of the world's proven oil reserves and 17.5% of natural gas reserves are concentrated on 11.5% of the Earth's territory, in a state where less than 2% of the world's population lives [1, 10]. The oil and gas industry in Russia remains and will remain one of the Central sectors of the economy in the Russian Federation for many years to come. In recent years, mining in the structure of the country's GDP is 10%, and in this sector, the oil and gas industry has an overwhelming weight. In terms of exports, the oil and gas sector is the undisputed leader in influence and importance – the basis of Russian exports in the first half of 2017 to foreign countries have traditionally been fuel and energy products, the share of which in the commodity structure of exports to these countries amounted to 66.6% (in the first half of 2016– 62,3%) [5, 7]. Therefore, in modern conditions, it is the raw material vector that determines the directions of the economic policy of the state, as well as stimulates and ensures the development of other industries. The commodity sector allows the state and the economy to pass and smooth out financial and economic crises, acting as a kind of buffer both in terms of cash and in terms of the source of growth for many sectors of the economy, as it was in 2008 and 2015.

The system of taxation of oil and gas production over the past three to four years has undergone major changes in the form of a transition from a flat, unified rate of tax on mining to a complex formula that takes into account the specific conditions of hydrocarbon production and characteristics of deposits. These changes were reflected in the tax reform adopted at the end of 2014, the so-called tax maneuver as a forced measure and a reaction to the economic crisis that occurred at the end of 2014. In addition to the differentiations the formulas of the tax on extraction of mineral resources for oil and gas, were to increase the base rates of this tax and reduced the export duty on oil. For the most part, the current taxation has become burdensome for subsoil users, especially oil companies, which contradicts the task of stimulating production and entails risks to reduce production and development of new fields. The situation is aggravated by the fact that due to the effect of sectoral sanctions, Russian oil and gas companies have to look for more expensive financing of their new projects and they are now cut off from effective technologies in exploration and service. Due to the importance of the industry as a global exporter and the leading sector of the Russian economy, the resolution of the problems of the efficiency of tax reform of the oil and gas sector is of scientific and practical importance at the international and national levels. The direction of improving the efficiency of the oil and gas sector is the basis for the stabilization and prosperity of the Russian economy, which determines the relevance and timeliness of the scientific priority of research problems.

Fundamental issues of implementation and efficiency of tax reform in the oil and gas sector are devoted to research by scientists such as: E. Gorbunova [2], S. Aboura [12], J. Chevallier [12], M. Alekseeva [13], A. Chernyavskiy [13], M. Betz [14], M. Partridge [14], M. Farren [14], D. Lund [15, 16], A. Orlov [17], P. Söderholm [18], N. Svahn [18], A. Mautina [18]. Astafieva [1] and other scientists. But, despite the presence of numerous studies on this subject, there are still debatable questions about the advantages and disadvantages of new types of taxes as a complementary factor in the development of the oil and gas sector of the economy on the example of the Russian Federation. In this regard, the purpose of this study and the formulation of topical issues was to identify the advantages and disadvantages of introducing a tax on additional income for oil and gas companies in the Russian Federation in order to achieve a balance of interests of the state and oil companies.

Russia ranks among the top ten countries with the largest oil reserves, second only to the Middle East, Canada and Venezuela, and as of the end of 2016 ranks 6th in the world among the oil leaders.

And it only on the explored and put on balance stocks of raw materials. And if we take the reserves and resources of the Russian Arctic, Eastern Siberia, the Far East, Russian shelves and deeper horizons, Russia can be here a world leader in hydrocarbon reserves.

In addition, Russia is one of the absolute world leaders in oil production, ranked second after Saudi Arabia. Crude oil production is 10112 thousand barrels per day. That is, Russia is now ahead of such giants as the US and China by 7% and 135%, respectively.

Russia occupies one of the leading places in the world system of energy resources turnover, actively participates in the world trade in them and in international cooperation in this sphere. At present, the Russian Federation occupies a leading position in terms of oil production and provides 12.4% of world trade in oil [6, 11].

The international importance of the fuel and energy complex Russia is complemented by the strategic importance of oil and gas companies in the national economy, which is one of the fundamental stable functioning and actively developing industrial complexes of the Russian economy. The financial potential of the Russian Federation is directly proportional to the potential of oil and gas companies. This is due to the fact that about 10% of GDP and more than 35% of Federal budget revenues are revenues from the oil and gas sector.

Oil and oil products are also the main products of Russian exports, the share of which from year to year is characterized by a stable positive trend of its development. Over the past fifteen years, the share of petroleum products in Russia's exports increased by 19.5% and as of 2015 reached a share in the export structure of 54.7%.

In modern conditions, the oil and gas sector is characterized by the highest level of tax burden in the country. Due to the fact that the tax regime in the industry is focused on maximizing the revenues of the state budget, such types of taxes as mineral extraction tax (met) and export customs duties (for oil, gas and oil products) account for an average of about a third of the total tax exemptions in GDP [4].

The share of taxes in the price of oil products exceeds 53%, in the price of gas – 62% [9]. As a result, the high level of taxation causes:

– growing trend of non-payments to the budget;
– irrational use of natural resources;
– reduced energy security;
– reduced competition in the industry;
– lack of incentives to invest in exploration and development of technologies for the search and production of carbohydrates.

The combined application of customs duty and met results in a high marginal tax rate on price rents. With the price of oil above $ 25. to Barr. the state receives almost the entire increase in revenues from exports, while the company remains less than $ 20. to Barr.. At a price of $ 60. to Barr. this amount is $ 17. to Barr. From these funds all operating costs should be covered, capital investments made, income tax paid, etc. [3, 4, 9].

The formed tax system is focused on the effective withdrawal of price rents at brownfields (Mature fields) with average depletion, but is not adapted for investment in the development of fields in the early stages of development, as well as in the maintenance of production at highly developed fields. In the context of the need to support the oil and gas sector, which is affected by sectoral sanctions and there is not a stable trend of growth in oil production in order to maintain production at the current level, the state is constantly introducing more and more benefits (manual and point adjustment and regulation of the sector), the tax system is becoming less manageable, and the volume of non-regulated production is declining. Thus, the share of oil production without benefits under met decreased from 95% in 2007 to 68% in 2017. By 2020, the share of preferential oil may exceed 35-40%. This all leads to an imbalance in the system and investors ' confidence in the uniform rules of tax administration, which affects investments in the sector.

The possibilities of maintaining and preserving production under the current tax system in Russia are practically limited. The administration of benefits is becoming more complicated, and problems that were absent at the time of the introduction of benefits, such as sectoral sanctions on the oil and gas sector of the Russian Federation, are accumulating. This has a negative impact on the investment climate in Russia in General and in the oil and gas segment in particular.

The most important direction of improving the tax system in the oil industry is the development of approaches to support the growth rate of oil production, to economically stimulate work on the low-yield Fund and the commissioning of idle wells, to create prerequisites for the development of new regions and oil provinces, to stimulate exploration. Currently, about 40% of oil is extracted from unprofitable, low-yield wells, the operation of which to improve the economic situation of the industry must be optimized for better and efficient use of the well stock [6].

In the current conditions of functioning of the oil and gas sector in Russia and in order to create conditions for its sustainable development, the issue of reforming the taxation system of the oil industry by shifting from taxation of gross income to income tax or financial result was actively discussed.

Since January 2015, Russian oil companies have been operating under new tax conditions. The idea was that by the end of 2017, the duty on dark petroleum products would gradually increase, while the duty on gasoline would decrease. In order not to hurt the budget, it was decided to sharply increase the met (mineral extraction tax) [3]. The benchmark is the abolition of export duties on oil and petroleum products.

So far, the tax reform in the oil industry covers only three years. In 2015, the duty on crude oil is 42%, in 2016 it will decrease to 36% and in 2017 — to 30%. Thus, the met rate for oil in 2015 was increased to 775 rubles per ton, in 2016 it will increase to 856 RUB, from 2017 to 918 rubles, and the Duty on diesel fuel is in 2015, 48%, and in 2016 will drop to 40% in 2017 – 30% - petrol – 78, 61 and 30%, respectively. The duty on fuel oil in 2015 is 76%, in 2016 it will grow to 82%, and by 2017 it will reach 100%. Thus, in 2017. oil companies expect a 100% export duty on fuel oil – the state is pushing companies to upgrade refineries, which should increase the production of gasoline and raw materials for petrochemistry [6].

But in the context of the geopolitical crisis and actions against Russia and the oil sector, in particular the sanctions regime, the tax maneuver developed in June 2014, when the price of oil exceeded $ 100. per barrel, was not effective. When the new tax regime began to work, Brent oil was trading at $ 54. per barrel and subsequently fell below $ 35. to Barr. Now the prices are around 60 dollars. the bar. Annual losses of oil companies in Russia from the tax maneuver will amount to about $ 5.5 billion. [4, 6].

Under the circumstances, the task of the state is to find a new balance between the interests of the country's budget and the oil and gas sector in the changed conditions that determine the devalued and, most likely, further devalued ruble and a new level of oil prices.

The main disadvantage of the system of taxation, based on revenue, is that it in General does not include the cost of production, and investment. Oil companies pay two main taxes – met and export duty. In the process of reforming the tax regime of the Russian oil and gas sector, the possibility of introducing one tax instead of these types of taxation is being considered, which is much more flexible than the current tax system. The government of the Russian Federation is considering the possibility of pilot application of NDD on a number of new developed fields. The proposed tax reform of the Russian oil industry, which would replace current revenue-based taxes based on profits, could help avoid a decline in Russian oil production in the next few years and encourage investment in the industry.

Now the Russian Government has approved the draft law on NDD. According to the project, the pilot implementation of the NDM will be extended to four groups of fields: the first group – new fields in Eastern Siberia with a depletion of less than 5%; the second group – fields that benefit from export duty; the third group – existing fields in Western Siberia with a depletion of 10% to 80% (quota of not more than 15 million tons per year on the actual applications of companies); the fourth group – new fields in Western Siberia with a depletion of less than 5% with total reserves of not more than 50 million tons per year.

It is planned that the system will first be tested on pilot projects. If the new system is effective, it will be extended to the entire oil industry in about five years. The basis for the calculation of the NDT is the estimated revenue from operating and investment activities for the exploration and production of hydrocarbons in the licensed area, reduced by the amount of actual costs, met, export duties, transport costs, etc. At the same time, met and export duties will be significantly reduced.

The introduction of the NDT is the exchange of existing benefits for individual fields for a new tax levied on cash flow. Although the impact of the PDM on the industry still looks limited, its implementation will give the Ministry the opportunity to abolish the export duty on oil, and, according to some estimates, will bring the budget of about 600 billion rubles of additional income. Also, the purpose of the introduction of the NDD is the potential reduction of the tax burden on the oil and gas sector of the country as a stimulating factor in the development of the industry. According to the analytical assessment of the Moscow oil and gas center EY, the aggregate tax burden on the oil and gas sector of Russia with the introduction of the NDD regime will decrease, starting from the level of oil prices in the amount of $ 50. to Barr. and above [9].

On the basis of analytical evaluation and literary generalization, the following advantages of the introduction of NDD can be identified:

– PDM stimulate investments in the development of new fields (zero tax in the first years of mining, when carried out major investments);

– NDM reacts to changes in the external economic conditions of production – world prices (the lower the selling price, the lower the tax, and Vice versa);

– The NDT allows to predict the effectiveness of investment projects quite accurately, since it is a calculated value (the change in the excise tax is actually difficult to predict);

– automatism of calculation of this tax significantly increases its objectivity, as the NDD takes into account the mining and geological and economic conditions of hydrocarbon production;

– PDM takes into account the changing conditions of production in the process of exploitation of deposits, i.e. its depletion (depletion of deposits, the tax is reduced).

Thus, the NDM will provide for oil companies a certain level of guaranteed profit regardless of external factors, will expand the range of developed fields and more correctly distribute the tax burden on the oil industry and will create new jobs.

But, despite the significant advantages of the introduction of the tax NDD in the oil and gas sector of the Russian economy, it can be argued that there are certain shortcomings of the proposed tax maneuvers. The current system on the basis of the severance tax and customs duties in the current environment is not optimal. Its advantage could be stability, but in modern conditions it is not provided by the state: every year the rates of met change, new benefits are introduced, exchange prices for raw materials change greatly. However, a complete transition to taxation based on economic results does not guarantee optimality either:

– there will be excessive incentives for reinvestment;

– there will be a risk for budget revenues;

– it is difficult to administer it as opposed to met and export duties, for which the rates are the same for all projects. NDD takes into account the specifics of each field, the profitability of its development, the economy, and therefore the introduction of NDD requires a transparent system of separate accounting for each individual project;

– differentiation increases the risk of corruption of tax inspectors.

Accordingly, even if such a transition occurs, it will take a lot of efforts of the supervising agencies to achieve the goals.

It is preferable to not complete the transition to taxation of profits, and a balanced mix of tax on the basis of the gross figures and tax on the economic result of production. Moreover, the level of profit taxation should be significantly lower compared to the record 80% of the bill on the NFR (tax on financial results), which creates excessive incentives for reinvestment. Based on the international practice and considering the Russian specificity, appropriate overall level of taxation of profits in the range of 50-60%. NDD can be used for new fields with the preservation of a certain rate of met, which will increase as the customs duty decreases.

In order to implement this approach, it is necessary to assess the effectiveness of both the export duty exemption methodology and the existing tax exemptions for met for regions where this methodology is not applied, and to compare the effectiveness of the NDT under different parameters with the corresponding existing benefits. In particular, it is necessary to assess how budget revenues will change under certain oil prices and external macroeconomic conditions, including the exchange rate of the Russian ruble.

Thus, the mechanism for the introduction of a new type of tax NDD in the oil and gas sector of the Russian Federation should be based on a long-term strategy of reform of tax and customs tariff policy in the oil industry. The key objective of such a strategy is a balance between budget and investment efficiency. Minimization of risks of budget revenues and oil companies should be taken into account. The reform should be long-term and implemented in stages synchronized with the development of the oil industry. The formation of a comprehensive system of administration and analysis of the effectiveness of various tax instruments in the industry should be ensured. Only such an approach will ensure the effectiveness of tax reform in the oil and gas sector, will contribute to the formation of a holistic platform of measures to ensure sustainable growth of the national economy in the framework of an integrated approach.

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17. Analysis of contemporary challenges in the exploration industry of the Russian Federation and the relevance of the transformation sector for progressive development

To assess the feasibility and importance of changes in the field of resource availability of the Russian Federation, it is necessary, first of all, to have a clear idea of the prospects for the demand for a particular type of minerals in the future. It should be borne in mind that minerals are inherently «exhaustible and non-renewable» resources, and their availability is estimated by the ratio of the volume of explored reserves and the volume of their production and use. The development of the direction of rational use of mineral resources is also essential in the field of resource provision for the strategic perspective, without this component there will be no complete picture of the strategic development of the country in the field of mineral resources [5].

The modern stage of post-industrial development of society is characterized by significant changes in approaches to the use of natural resources, including their irreplaceable part. This can not impose its imprint on the changing trends of demand for certain minerals. This is particularly true in the field of energy. Attempts to prevent the inevitable shortage of nonrenewable energy resources has led to the development of a number of projects based on renewable sources of energy (wind energy, water, sun, thermal sources and so on) and on the development of innovative methods of production in order to increase sweeeet available stock. Nevertheless, the shortage of energy resources takes place almost all over the world and in the foreseeable future, the use of hydrocarbons as a source of energy will continue in increasing volumes. According to the U.S. Department of energy (U.S. Department of Energy), for at least the next 25 years, the main source of energy in the world will be oil. Thus, by 2040 it will produce at least 30% of the world's energy. At the same time, the share of its consumption reduction in comparison with the current level will not exceed 3%. As for natural gas, the growth rate of its consumption will be the highest among hydrocarbons [14].

Taking into account the above, it is extremely important to analyze the current state of Affairs to ensure the resources of the national economy of the Russian Federation. In particular, one of the most important aspects of this problem is the reproduction of the mineral resource base (SME). SMEs are minerals in the form of deposits that can be involved in the sphere of social production [1]. Reproduction, in its classical sense, is the reconstruction of the spent factors of production (natural resources, means of production) through their subsequent production [11].

It is the problems with the reproduction of SMEs that are the most obvious for modern Russia. The essence of these problems lies in the extremely intensive development of extractive industries, the resource base for which are the reserves of minerals created in the Soviet era. One of the consequences of this state of Affairs is the increased risk that falls on companies that acquire licenses for the right to use the subsoil at the earliest stages of geological exploration [15]. As a result, many companies are forced to invest in additional exploration of the fields obtained under the license, and not in the discovery of new ones. It is important to keep in mind that the reproduction of SMEs can be achieved both by improving production technologies, intensification and large-scale introduction of innovative production methods, and through exploration. The expansion of the resource base is provided solely by the increase in the volume of exploration and additional exploration of promising resource areas [11].

The difference in approaches to the interpretation of the optimal ratio between the necessary volumes of mineral resources and the rate of their production and the problems of reproduction of SMEs can be summarized as follows:

1. The amount of proven reserves of mineral resources fully ensures the functioning of industrial production and export needs. Large-scale exploration may be delayed indefinitely.
2. Efforts should be directed to more rational use of the potential of «old» deposits. At the same time, the development of exploration has an auxiliary role.
3. Replenishment of SMEs is possible only through large-scale exploration activities in new, insufficiently explored areas in the previous period.
4. The intensity and methodological orientation of exploration require regional differentiation. At the same time, in regions with developed production infrastructure, the expanded reproduction of SMEs

should be carried out through the use of new exploration methods. In the new, promising areas, it is now sufficient to conduct limited exploration, which are designed to provide a reserve for the development of the mineral resource base in the subsequent period [6].

It should be noted that none of the above points of view in essence has a strict scientific justification. In the USSR, the ratio between reserves and production was determined by the regulated excess of reserves growth over the planned level of production. Thus, as an example, let us consider oil production, in accordance with the recommendations of the state plan [7], the excess of oil reserves of categories A, B, C1 over the planned level of production should have been 25-30-fold. This method was used in the development of planned indicators of the industry in the 70-80-ies of the last century. Subsequent practice has shown the failure of this approach [14].

It is useful to turn to the analysis of the situation with the supply of raw material base of the largest domestic and foreign oil companies. It is obvious that the current state of the raw material base of oil companies is far from the parameters recommended by the state plan. Nevertheless, even in such a «reduced» form, the task of providing raw materials to the mining and processing industry is becoming increasingly difficult.

The problem of a significant reduction in the rate of provision of the extractive industry with the relevant raw material base is international in nature. The dynamics of the change in the ratio between the world's oil production and the growth rate of its proven reserves (figure 2) shows that, since 1984, there has been a gap in this ratio, which is aggravated to this day. Not the best way things are in Russia. As noted in [12], since 2005, the volume of production of minerals such as gas, gold, coal, oil, iron ore significantly exceeds the increase in their reserves. With regard to such minerals as coal, ferrous metals, etc., the situation with the replenishment and development of the mineral resource base is even more difficult, because these minerals are less export-oriented than oil and have a lower margin, which accordingly does not spur the company to the expanded reproduction of this raw material. At the same time, new significant discoveries are practically not made, and the increase in production is obtained, mainly on previously discovered fields by their additional exploration along the contour. The growth of reserves in industrial categories is only about 5% of the annual production growth. There are several significant, in our opinion, reasons for this situation:

The weakening of the state's influence on the formation of the mineral resource base.

Source: compiled by the author according to Hughes GSR Inc.

In the USSR, the exploration was the prerogative of the Ministry of Geology. At the same time, all work was carried out exclusively at the expense of budgetary funds. Currently, the basic cost of restoring the resource base are borne by the subsoil [3].

The consequence of this weakening was the chronic underfunding of the industry as a whole and a significant reduction in the volume of exploration drilling in particular. The reason for this is, in our opinion, a decrease in the investment attractiveness of exploration. Thus, according to the authors [12] back in 2010, the President of PJSC LUKOIL V. Yu. Alekperov announced a 65% reduction in investment in geological exploration. The reasons for this step, he called the existing order in which the explored deposits are transferred to the state, and not to the subsoil user who made the discovery. In addition, exploration costs are reimbursed only if they are completed with a positive result. The same is essentially stated in the «Strategy for the development of the geological industry until 2030» [10] where, along with other factors hindering the development of the mineral resource base, it is noted that «the current system of state regulation of subsoil use relations does not create sufficient conditions for attracting investments of subsoil users in exploration».

In this light, a comparison of the relative share of revenues of domestic and foreign mining companies allocated to the compensation of reserves is indicative. It is obvious that a significant difference in the amount of funds allocated for this purpose by foreign and domestic companies is precisely the result of a different approach to the motivation of such investments.

• **Significant changes in the composition of commodity stocks.**

Among the indicators characterizing these changes are the following:

1. Depletion of reserves in traditional mining areas.
2. Reduction of the size of reserves of newly discovered fields. Over the past half century, there has been a decrease in the average reserves of oil fields discovered in Russia by more than 30 times.
3. Significant increase in the share of hard-to-recover reserves (TIZ). This type of hydrocarbon is an important reserve for replenishment of resources. Currently, the share of TIZ in the total balance of hydrocarbon

reserves in Russia is more than 65% [10]. At the same time, as the development of traditional reserves, the share of TIZ will continuously grow and it should be borne in mind that the cost-effective technology of TIZ production in this case requires the use of fundamentally different, much more expensive and knowledge-intensive methods.

4. The total reduction of oil recovery factor (CIN). This decrease is one of the consequences of the above increase in the share of TIZ in the inventory structure. This figure has now fallen to 0.3 compared to the average of 0.45 during the Soviet period.

5. Complication of geological and geographical conditions of discovery and development of new deposits. This aspect of changes in the structure of raw materials reserves is also accompanied by an increase in the territorial gap between the areas of extraction of raw materials and its consumption.

6. Over the past decade and a half, the mining and exploration sector in Russia as a whole has developed in accordance with international trends. Nevertheless, since the majority of mineral resources increase in their reserves does not make up for the volume of production, and revenues to the state budget are formed mainly at the expense of extractive industries, the advanced development of the system of reproduction of mineral resources is a decisive condition for the dynamic development of Russian industry and society as a whole.

7. In accordance with the «Strategy of development of the geological industry until 2030» [10] it is planned to transfer the geological industry of Russia to a new level. The tasks assigned to the holding include the following:

– to increase the level of study of the territory of the Russian Federation to 50 by 2020%;
– by this time it is necessary to increase to 60% the level of study of the territories of the Russian Federation affected by dangerous processes and phenomena;
– to ensure the growth of funding from extra-budgetary sources by 40% by 2020;
– carry out legislative reforms to ensure the consolidation of the right of subsoil users to develop fields discovered in the course of their exploration.

The success of the implementation of the tasks depends largely on how well-coordinated and effective will be the joint actions of all parties involved in the implementation of the task. At the same time, at the moment we can identify a number of factors that somehow hinder the development of exploration in Russia.

• Lack of incentives and government support for exploration.

In accordance with the current Tax code of the Russian Federation, any exploration can be carried out only at the expense of the profit of the subsoil user enterprise. At the same time, developed mining countries have a different system in which these costs are part of the cost of production.

Extremely complex and time-consuming system of obtaining and transferring rights to use subsoil plots.

The disadvantages of the current system include the inability of the right to use subsoil to serve as the subject of transactions between market participants, low level of protection of property rights in subsoil plots (the right to use subsoil can be terminated in addition to a court decision), extremely long, time-consuming and costly auction procedure

• Limited opportunities to attract Bank capital to Finance exploration.

• Excessive secrecy of geological information and its provision exclusively on a fee basis.

Geological information obtained at the expense of subsoil users is transferred to the state geological funds for storage, but is issued for review only with the written permission of the owner.

Summing up the results of the study, we can draw the following conclusions about the feasibility of some steps to transform the system of exploration:

1. Improvement of approaches to the use of the state subsoil Fund.

Depending on the degree of study and the amount of budget funds invested in exploration, it seems appropriate to differentiate the approach to the distribution of subsoil plots. Thus, P1 sites with proven and pre-estimated reserves may be assigned to that part of the Fund, the distribution of which may be made in accordance with the current rules. The main task of the state in this case should be to obtain compensation of budget funds spent on exploration. The second part of the subsoil can be all other areas. Here, the main task of state regulation should be to attract investment in the initial stages of exploration, so the turnover of such sites is desirable to make free.

2. Improving the licensing system for exploration.

In our opinion, such licenses for exploration in the areas related to the second part of the subsoil can be issued on the basis of applications of potential subsoil users. Thus any property claims to the subsoil user to produce impractical. The license should reflect the right of the subsoil user to conduct exploration and development of the field in case of its discovery. Among the obligations of the subsoil user should include the minimum level of costs for exploration and reporting on them in a strictly regulated form. It is desirable to make the turnover of licenses free, and the termination of the license – to carry out on the basis of a court decision without reaching the minimum levels of investment in exploration and providing poor reporting information.

3. Increase of state support measures for exploration.

Such support should be provided in the area of taxation and should include full or partial exemption from income tax on funds allocated for exploration. With the aim of attracting third-party investors highly desirable would be the introduction of the mechanism of assignment of tax privileges on investments in exploration.

4. The increased participation of private capital in the financing of the IRT.

Given the increased risk of exploration business, this aspect of the problem can only be realized by creating a system of private equity markets. In developed industrial countries, this form of attracting investment from large and small investors is quite successful in the form of special investment funds, venture capital and stock exchanges. Of course, this direction of development can be implemented only in the case of ensuring the free receipt and circulation of rights to use the subsoil, exemption from income tax funds allocated to exploration and obtaining unlimited access to geological information.

Summing up, I would like to Express hope that the set of proposed measures will have a positive impact on the transformation of the geological industry and will have a significant impact on its progressive development in providing the Russian Federation with the necessary resources and means for further prosperity. This actual direction of research requires more detailed and systematic immersion in order to form their road maps in specific areas of activity and implement them in the implementation at the level of the state and companies. Such system work including plans to be engaged also the author's collective of rggru.

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18. The damping mechanism in the regulation of oil products market in Russia is the imperfection of the drastic changes

18.1. The essence of the tax maneuver and the role of damping mechanism in the regulation of the oil products market

If in December 2017, Brent crude oil cost about 60-63 dollars. for a barrel, in April 2018 its price exceeded $ 70. per barrel. Similar dynamics were typical for WTI, Dubai Crude and other oil brands. The growth of world oil prices entered the period of the highest indicators in the spring of 2018. As a result, gasoline producers raised the prices of the domestic market of oil products of the Russian Federation by 10%, and the main players announced the need for further price increase by 10-11% (against the background of a weak ruble [3]).

It should be noted that the «manual» regulation of the market of petroleum products has not become a panacea, since its measures:

– we increased the budget burden generated by the customs subsidy, the beneficiaries of which were not only refineries and domestic consumers, but also the economies of the Eurasian economic community. Already at the beginning of 2018, the amount of the subsidy reached 1.1 trillion. RUB [4, c. 3; 11, p. 7]);

– we synthesized an increase in the share of counterfeit and surrogate motor fuel, with its local deficit in the regions of the Russian

Federation, where a high proportion of independent automobile filling stations (namely: in Irkutsk; Chita; Krasnoyarsk and Altai Krai [7]).

In our opinion, the negative consequences are related to the specifics of the agreement between the largest oil companies, the Ministry of energy and the Federal Antimonopoly service of Russia [1]. In accordance with its terms, restrictions were imposed on small wholesale prices of gasoline and diesel fuel in the domestic market of the Russian Federation (the cost was fixed at the price level of may 2018 to March 31, 2019). Naturally to maximize margin:

1) major oil refiners diverted most of their retail fuel to network refueling, limiting small-scale wholesale sales of petroleum products to independent gas stations. However, such measures only may-October 2018 the lost profit of oil refineries (from the freezing of prices for gasoline and diesel fuel) has exceeded 150 billion rubles. including 18.5 billion RUB for PJSC «LUKOIL», is 16.3 billion rubles for Rosneft, 22.5 billion rubles. for «Gazprom Neft» and 16.7 billion rubles for «Surgutneftegaz» and Bashneft oil refinery [4, p. 3; 11, p. 7];

2) independent automotive filling stations were looking for alternative suppliers, resulting in counterfeit and surrogate motor fuel in regions where the high proportion of independent filling stations reached 60%.

Given the complexity of the situation, it became obvious that from January 1, 2019 it was necessary to initiate a tax maneuver aimed at a gradual (from 2018 to 2024) transition from «manual» regulation of the oil market to regulation based on the integration into the taxation system of the oil industry of internal mechanisms for damping negative trends and preventing price fluctuations (dampers).

The practice of tax maneuver is not new for Russia. In different periods, it allowed regulators to solve various tactical and strategic tasks in the oil sector.

The first tax maneuver (1994-1996) was carried out after the price hikes for Brent crude oil, as a result of the accumulated influence of strikes of oilmen in Nigeria, the crisis in Iraq and other factors. Given that this brand is linked to the price of Russian oil Urals, there was a decline in oil companies ' revenues. As a damper, the abolition of export duties on oil was used, while increasing the excise tax on it (without compensation for oil refining).

Later, the government conducted other tax maneuvers in the oil industry [9; 4]:

1) in 2011-2017 (against the background of the need to eliminate customs subsidies for fuel oil production). As a basis for the maneuver, an increase in export duties on dark oil products to the level of 66% of the export duty on oil was used, and from January 2015 to the level of 100%;

2) in 2014-2017 (after Brent crude futures started to decline consistently). During this period, there was a 9% drop in the level of profitability of oil companies [11, p. 99]. Therefore, the oil duty was used as a mechanism for damping negative trends (or damper) (it was reduced from 60% to 55%);

3) in 2015-2017 (against the background of inflation growth and investment compression in 2015, There was an 11% decline in oil companies ' revenues. The transformation of the calculation of export duties on oil and petroleum products (EP) is used as a mechanism for damping negative trends (damper). EP produced by reduction from 55% to 30% with increasing the tax on mineral extraction (met) and the reduction of excises on petroleum products.

Depending on the goals of the legislator, the tax maneuver is always based on specific changes in the tax system and the payments it provides to the budget. Namely: replacement of one or several taxes by others or refusal of them; proportional redistribution of revenues to the budget; introduction of protective EP for oil and oil products; stimulation of domestic oil companies.

Tax maneuver 2018-2024 years. the fourth for the oil industry. It is based on the amendments to the Tax code of August 3, 2018 and the Law «On customs tariff» (FZ № 303-FZ «On amendments to certain legislative acts of the Russian Federation on taxes and fees»).

18.2. Specifics of completion of the tax maneuver 2018-2024. Damping mechanisms in the regulation of the market of petroleum products

If oil barrels extracted in the Russian Federation are subject to customs duty, cash receipts to the budgets of 2017-2018 would increase by 2.9 trillion rubles [4]. This does not happen because the current system of duties is aimed at reducing the export parity of oil prices in the domestic market of the Russian Federation (i.e. netbacks). About 50% of the extracted oil is duty-free (because it is intended for domestic needs of refineries), and the fiscal burden is directed at its exporters (excluding exports to the EAEU market) [5, c. 13]. The prices of export parity for oil are reduced more than for oil products, and the consequence of the difference in duties on oil and oil products is an additional subsidy to the domestic consumer (in particular duties on oil alcohol - 55% of the duty on oil, for other light oil products - 30% of the duty on oil [5, c. 13]).

Due to customs subsidy budget annually loses [5, p. 13]: 1,4 trillion rubles. from the increasing revenues of sales; $ 1.3 trillion. RUB from consumers of the Russian Federation; 0.1 trillion from duty-free oil supplies to the market. As part of the tax maneuver, measures are planned from January 1, 2019, as a result of which the fiscal burden from exports will gradually be redistributed in the domestic market of the Russian Federation. Provided [8, 4]:

– gradual reduction of EP for oil and oil products (excluding certain types) - from 30 % to 0% (2019-2024). Thus, until 2024, the EP rate will be reduced by 5 % annually (until it reaches 0%). This will eliminate the customs subsidy for oil refineries;

– increasing rates of mineral extraction tax by 30% at constant preferences (in years 2019-2021) i.e. to reduce the value of EP for oil and petroleum products (although the Ministry of Finance and the Ministry of energy have not agreed on the appropriateness of including in a future of rising tax rates 2016-2017). It is assumed that the measure will return to the budget of the Russian Federation part of the lost benefits from duty-free oil supplies within the Eurasian economic Union.

The allocated measures, according to forecasts [4, p. 3], have to increase the income of the state at the expense of economy of means which were directed on customs subsidizing earlier. By the end of 2019 the impact of changing the customs of the subsidy is not large (about 94 billion rubles), however, in the baseline scenario, it will be described processes slowing growth up to 493 billion rubles to 2024 (Fig. 18.1).

Compensation of export duties by the rate of NDP will lead to an increase in the susceptibility of the domestic market to external prices for raw materials. This initiative is undesirable given the current disparity between domestic market prices and export netbacks. Therefore, since 2019, a mechanism for reverse excise duty on oil sent for processing has been provided. The mechanism is not directly related to the tax maneuver

[4, p.16], but is provided by a damping tax deduction (based on flexible amendments to the export alternative index).

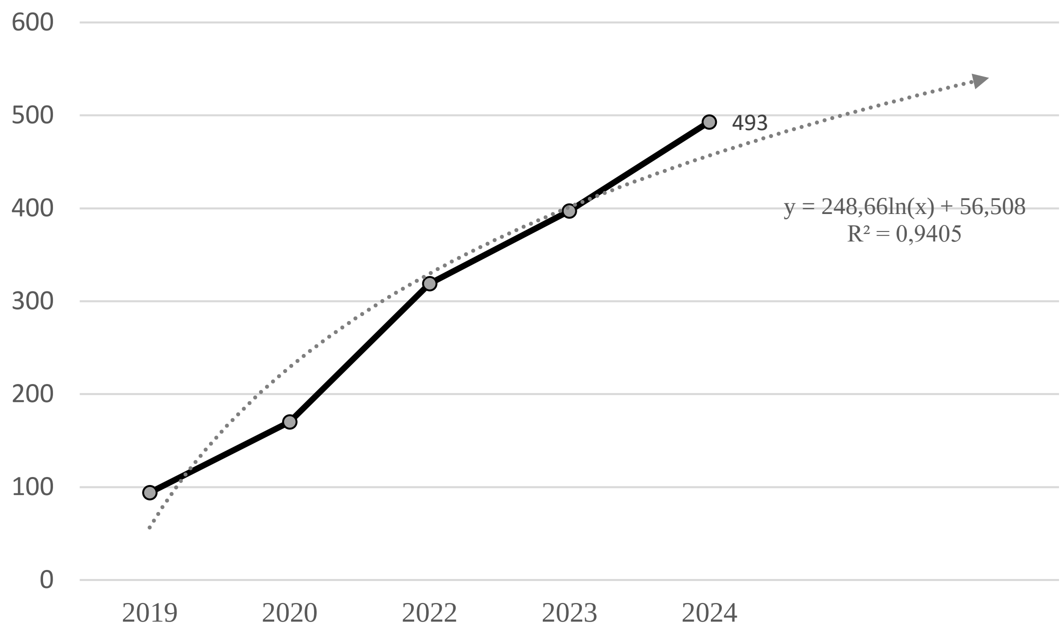

Fig. 18.1. The scenario of increase of effect from replacement of the customs subsidy by the return excise, 2019-2024 source: developed on the basis of [4, p. 3]

The reverse excise mechanism provides for additional logistics allowances for tax deductions for refineries producing fuel for the domestic market of the Russian Federation. At the same time, the effect was targeted, provided [8]:

– allocation of beneficiaries. They are the entities that meet the criteria of the recipient of the allowance, namely: processed 600 thousand tons of oil for the last reporting period or concluded an agreement with the Ministry of energy on the modernization of production for 2015-2024 (in total from 60 billion rubles); meet the key parameters of effective oil refining (i.e., during the quarter, the production of oil products is more than 10% of the processed oil, and the total volume of their supplies to the domestic market is more than 5 thousand tons);

– differentiation of tax deduction values (based on the logistic coefficient from 1.05 to 1.5). The division is focused on compensation of high transportation costs of remote oil producers. In particular, the logistic factor of 1.05 will be able to apply the Omsk refinery, 1,1 – Kochenevsky and Antipinsky oil refinery, 1,3 – Ukhta refinery, 1,4 – Angarsk refinery, a 1.5 – Achinsk refinery [2].

According to the forecasts of Vigon Consulting at a high export price of oil (based on its growth rates for September-October 2018 [4, p. 23-25]) from January 1, 2019, the mechanism of reverse excise compensates for refineries a certain share of the difference between the export price of gasoline and diesel fuel and the «conditional domestic price». Namely:

– in 2019 (under the restrictions of small wholesale prices for gasoline and diesel fuel) up to 60%;

– in 2020-2024. (in terms of price range, adjustable levers reverse excise tax) of up to 50%.

For remote producers of oil products possible reimbursement of lost revenue from 77до 89% [4, p. 23-25].

18.3. Disadvantages of damping mechanism of reverse excise in the regulation of petroleum products market

The main disadvantage of the damping mechanism of the reverse excise is the algorithm of correction to the export alternative index (due to which the key price of oil products or the benchmark is adjusted).

The amendment is determined by the result of subtraction of the average export price of oil (export netback in the seaports of the North-Western Federal District) and the target price of the domestic market for gasoline and diesel fuel (based on the price levels of the current month, with an indexation of 5% per year) [4, p. 23]. At the same time, if the target price of the domestic market:

1) below the export netback (taking into account 10% of the upper limit of the price corridor) – oil refining receives a tax deduction. So target price:

– in 2019 from 5 thousand/RUB /t for diesel fuel and 5,6 thousand/RUB /t for gasoline AI-92;

– in 2020, 5.25 thousand/RUB /t (in 2021 - 5,5125 thousand/RUB /t) for diesel fuel and 5.88 thousand/RUB /t (and 6,174 thousand/RUB /t by 2021) for gasoline AI-92;

2) above the export netback (excluding the lower limit of the price corridor) - oil refining companies pay a share of this difference in the budget.

Therefore, an amendment to the export alternative index at the time of pricing is not known. Export netback can be calculated at any time (the market price of oil at the end consumer minus the cost of its delivery from the place of production), and the internal price is extremely sensitive to the basic parameters, including:

1) netback itself and internal wholesale price (it changes approximately at the same rate as netback);

2) the exchange rate of the national currency to the major reserve currencies of the world (including the dollar).

For example, with a high export netback of $ 78./Barr. and rate 68 br for dollars., the total value of the tax deduction would be 840 billion rubles., however, if the exchange rate of USD. the ruble decreases to 63.9 rubles. for dollars. the total amount of tax deduction will be 704 billion rubles (Fig. 2).

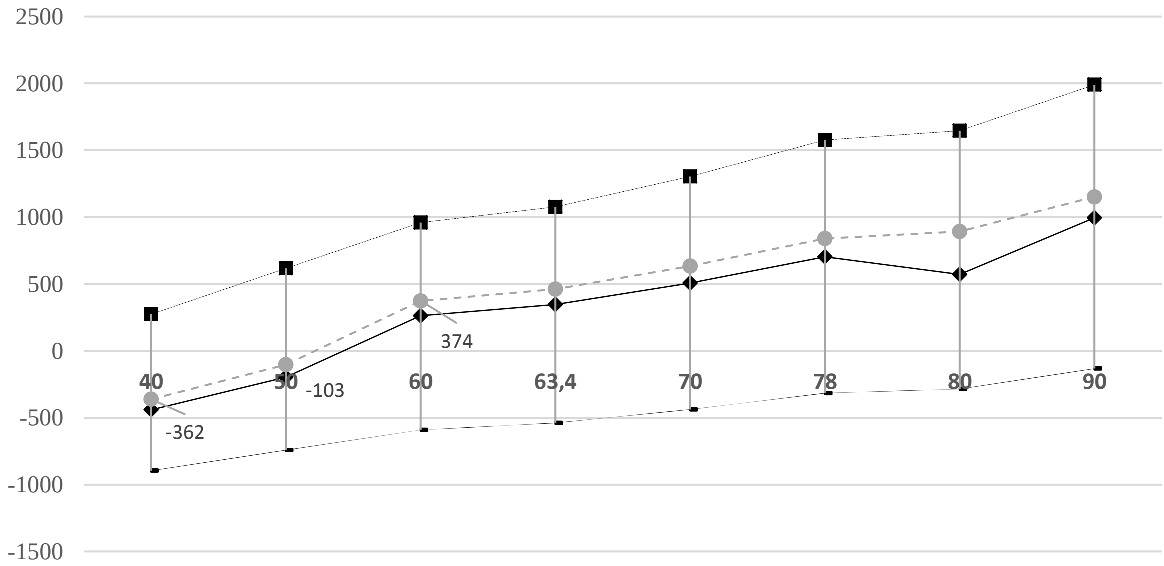

Fig. 18.2. Illustrative calculation of the total amount of tax deduction/ premiums from the damper taking into account changes in the basic parameters, billion rubles.

Source: developed on the basis of [4, p. 27] taking into account the growth of excise duties and VAT since 2019.

Given the complexity of calculating the correction to the export alternative index in volatile markets, it is calculated based on the average values for the month. Therefore, there is a problem of correctness of such calculation.

The damping mechanism does not contain incentives to reduce the domestic wholesale price of petroleum products. For example, based on the scenario of the Ministry of economic development at the end of 2019, the total tax deduction (from the amendment to the export alternative index) may amount to 347 billion rubles. In the case of a positive damper, nothing stops oil refineries from raising domestic prices within the basic 10% and receiving an additional premium from each transaction.

There is a problem of joint accounting for the rights to tax deduction for gasoline and diesel (in the framework of the reverse excise, it is applied if the average wholesale prices do not increase by more than 10%). It is natural that such a right is not received by the subject, which exceeded the permissible level of prices - the deduction should be targeted and determined as the sum of the daily price values of the hotel subject (for each type of fuel).

Taking into account the specifics of forecasts, starting from 2020 (with projected $ 59.7)./Barr. and $ 63.9./Barr.) the amendment to the export alternative index may become negative [4].

The possibility of abrupt changes in the amendments to the export alternative index leads to the fact that from the source of payments provided by the budget, it will be periodically transformed into a source of individual payments. This transformation is contrary to the principle of tax certainty.

If we consider the amendment to the export alternative index as a basis for calculating the premium (without taking into account the boundaries of the price corridor [8]), which the entities of the oil products market will be obliged to pay to the budget, there is a need to compensate the difference paid at the expense of the domestic market.

It is advisable to set the lower threshold value for the indicator of excess of the export netbuka in which the prize is reset to zero (taking into account 10% of the lower border of the price corridor). Then the oil refining companies will set the price at the level of minimum indicators.

18.4. Disadvantages of damping mechanism of redistribution of fiscal burden from exports to the domestic market

As part of the formation of a damping mechanism for redistribution of the fiscal burden, it is assumed that the met will pay all participants in the industry, regardless of the volume of exports with the same benefits and preferences, including:

– reduced tax rate for the development of new fields;
– benefits and reduced rates for hard-to-recover oil fields.

This means that, for example, Rosneft will retain a deduction from the met for the Samotlor Deposit (provided from 2018). In order to increase oil production in fields with complex production conditions, the company was granted the right to receive a deduction of 35 billion rubles for 10 years. Also, pilot projects will be continued to introduce a tax on added income (NDD) for fields with complex production conditions (the law on the introduction of NDD in oil production in Russia came into force) - these are 35 license areas of LUKOIL, Gazprom Neft, Surgutneftegazom and independent oil companies [11, p. 67].

Given that the NDT will be applied separately from the met - the legislative initiative will lead to a preferential tax regime, and, consequently, the risks of reducing the compensatory impact of the met. Regulators may be faced with the desire of companies:

– to reduce oil production not only in traditional but also in new regions (due to the increase in mineral extraction tax exemptions and the associated increase in production costs). The Ministry of Finance and the Ministry of energy have already tried to provide additional revenues to the budget by increasing the met for oil by 46% in 2015 and 53% in 2016, with a gradual decrease in the EP for oil to 42% in 2015, 36% in 2016 and 30% in 2017 [11, p. 67]. But revenue growth did not happen because of falling oil prices [11, p. 69];
– overestimate the costs of deposits operating on the NDD (understated profit from which tax is charged).

The way out may be the differentiation of tax systems (met and NDD) on the criterion of maturity of worked deposits [12, p. 18]. Namely, piloting of young and newly introduced oil and gas fields on the system of NDD, and on the current Fund of the worked-out fields and which are in the phase of production stagnation, with difficult extracted oil on the differentiated met. To ensure that the differentiation of met does not synthesize corruption risks, it is important to determine the criteria for deposits that are provided with reduced rates or lowering coefficients.

Summary. The presence of the EP makes it possible to set high taxes only on exported resources. Severance tax increases the production cost of oil in General (the base of taxation is the minerals extracted). Despite the fact that in parallel with the mechanism of redistribution of the fiscal burden, the mechanism of reverse excise begins to work, there is a risk that in the event of an increase in the rate of met and the negative amendment to the export alternative index, they will be included in the price of petroleum products and shifted to domestic consumers. A more subtle adjustment of the damping mechanism or its replacement with a floating excise mechanism will give a predictable and controlled transition to a modified system of taxation of the oil and gas industry without price shocks to the consumer.

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19. Economic cooperation sectors of the economy as the impetus for the development of mineral sector in terms of sanctions pressure

The mineral resource complex is an important, if not a key part of the Russian economy at the present time and plays a significant role in the future of its development. At the same time, there is an urgent need for active innovation and import substitution policy, which will contribute to the production of competitive equipment for the mineral complex and its further development, as currently the main trend in the development of the mineral resource base in the world is the introduction of innovative technologies for the extraction of mineral resources, which allows deeper integration into the processes of rational use of mineral resources (the main trend of development of society in different areas of the economy in recent decades).

In our country, there is a significant gap between the development of new technologies and their industrial and commercial use and implementation in everyday industrial life. The situation is aggravated by the peculiarities of the sanctions period, when for a number of reasons there is an urgent need to replace imported equipment, traditionally attracted to the mining and exploration industries, domestic, especially acute is swinging oil industry that «feeds» the Russian economy and is the basis for the development of innovation in related industries.

In the strategy Of economic security of the Russian Federation for the period up to 2030, approved by the decree of the President of the Russian Federation dated may 13, 2017 № 208 among the main tasks for the implementation of the direction relating to the sustainable growth of the real sector of the economy, including the mineral resource complex, called the expansion of the use of production, technological and innovative potential of the organizations of the military-industrial complex, enterprises of metallurgy and machine-building for the development of civil production and modern technology using the potential of formed partnerships with foreign companies [10].

Today, without exaggeration, we can say that we are almost talking about the revival of the production of mining and geological exploration equipment on the basis of the domestic machine-building complex. Since the end of 80 - ies of the last century, in all sectors of the fuel and energy Complex and MSK (mineral complex), we stubbornly moved to Western mining equipment and technology, losing the unique research and development and production facilities and personnel that were during the Soviet Union and allowed to lead in some areas of development of mineral complex. This happened in all sectors of mining, as well as their transportation and processing. In addition, today in this area almost 100% Western software, digital economy in the Western version, which does not provide the basis for the dynamic development and earnings of its own Russian IT-school and potentially undermines the national defense of the country.

Of course, meeting the needs of the mineral complex is a problem of national scale. Production of oil, gas and other minerals is the basis of the resource support for the life and development of our state. The independence of Russia in the technology of mineral resources is a matter of national security and it is on a par with the issue of the defense of the Russian Federation. This is all the more obvious in the context of the anti-Russian sanctions of the EEC and the US, which affected this sector of the economy, when Western companies ceased to supply effective equipment and technologies to Russia» [7].

The aggressive political behavior of European countries and the United States, the political crisis and sanctions are among the factors under the influence of which the stability of the Russian economy was undermined, which is now expressed in the form of the annual lag of the Russian economy from the world economy – since 2013, the Russian economy has never been able to overcome the average growth rate of the world economy . Thus, the issue of economic security, in the conditions of geopolitical aggravation and sanctions pressure, becomes even more urgent [9].

One of the negative effects of the sanctions was the reduction of investment activities of large Russian companies and the closure of access to foreign technologies, which caused an increase in Federal budget expenditures to support the activities of these enterprises and related industries. The basis of financing for companies under sanctions was the national welfare Fund, as well as pension savings of citizens [5].

Over a short period of time, the sanctions have significantly affected all the components of Russia's economic security: the financial sector, the food industry, and the defence industry.

There is a significant reduction in trade turnover, development of high-tech industries and economic growth [3].

Despite the fact that it is believed that the sanctions play an extremely negative role in the economic development of Russia, but this is not true, because our country has the opportunity to develop its own production, to revive scientific potential, to form alliances on the basis of partnership with individual foreign countries, allowing to develop a modern production base. Thus, in the conditions of sanctions, Russia can follow the path of development of domestic production and import substitution. World practice shows that import substitution is one of the most effective ways to abandon imports and optimize production within the country. The Russian economy, which is currently characterized by a large share of imports in GDP, may have great potential to replace it.

An import substitution program is being actively developed and is already being implemented, which is typical for metallurgy, oil and gas infrastructure (there are already many examples). Russia is looking for new partners in the field of high-tech industries (for example, Asian countries such as China, Vietnam and India). The growth rate of domestic production is gradually recovering.

Nevertheless, it cannot be said that the paradoxical prospects of the Russian economy (which were revealed after the imposition of sanctions) can fully compensate for the losses arising from their introduction and influence (Fig. 19.1).

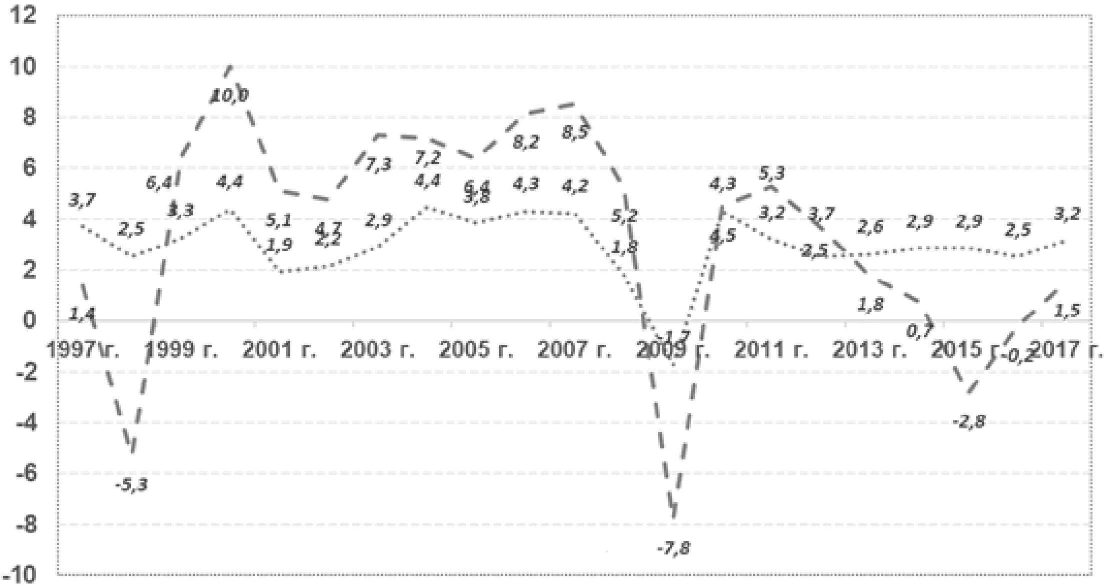

Fig. 19.1. Dynamics of GDP of the World and Russia (at the annual level) 1997-2017

As can be seen in figure 1, since 2011, the GDP level has been declining, and after 2013 there is a negative trend, which is clearly associated with the introduction of sanctions against Russia. Compared with the pre-bankruptcy year 2013, where GDP growth reached a maximum of about $ 2,231. 8 billion.. in 2015, there was a drop to $ 1331.2 billion.

In addition, there was a significant decline in imports and exports (Fig. 19.2, 19.3), which is also a direct consequence of the introduction of anti-Russian sanctions and protective measures of Russia itself.

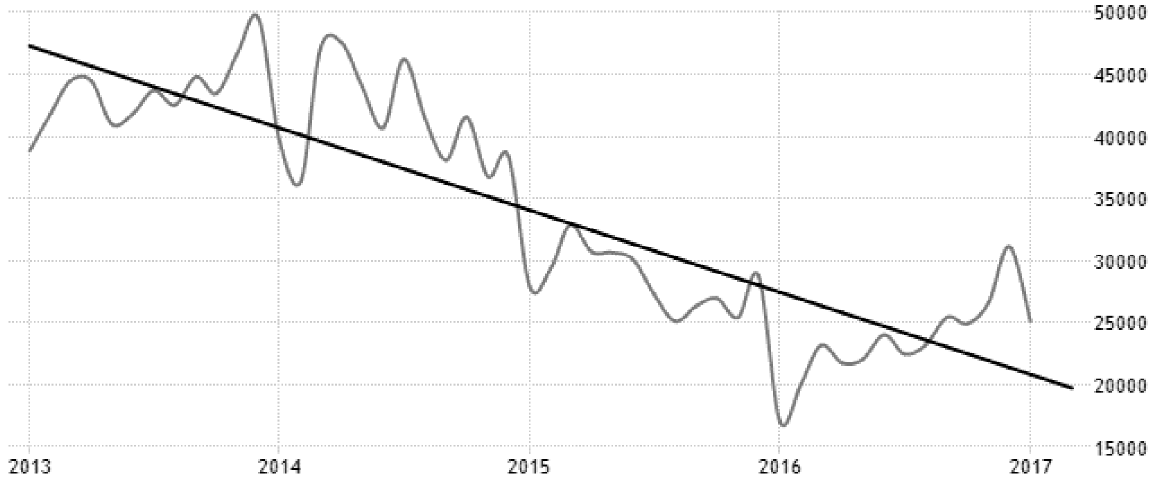

Fig. 19.2. Dynamics of exports of Russian goods (in us dollars), 2013-2017

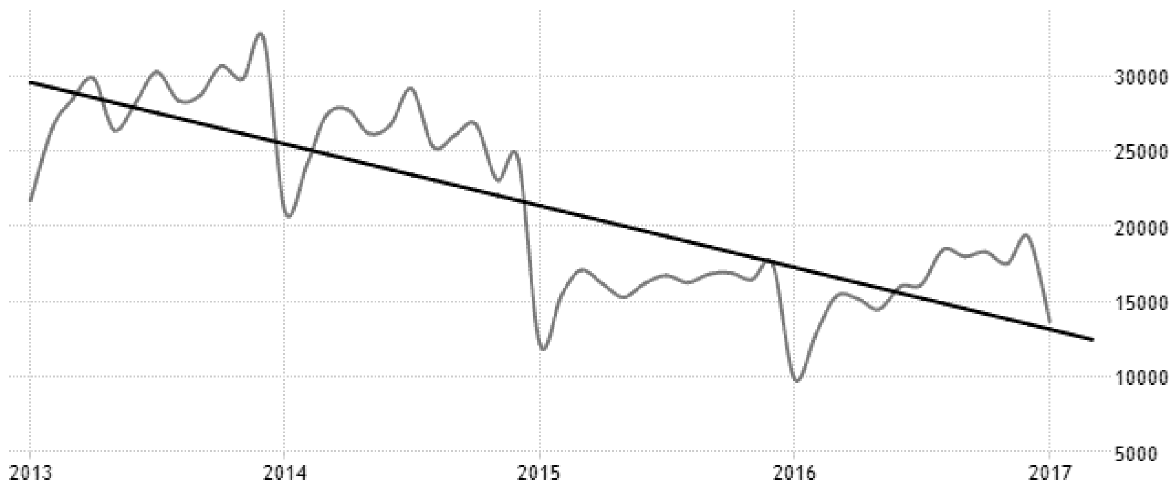

Fig. 19.3. Dynamics of imports of Russian goods (in us dollars), 2013-2017

The mineral resource complex of Russia and in particular the geological exploration division are the main elements of the system, which are experiencing the main blow and deprivation due to sanctions and other structural difficulties of the Russian economy. At the same time, in recent years, the exploration industry has been able to overcome price demons, overcome the consequences of overproduction in certain areas and types of raw materials and forced to retreat the threats associated with a lack of liquidity [8].

The rehabilitation process included unavoidable write-offs, the sale of impaired assets and the reduction of capital investment and exploration budgets. As a result of applying the guidance of the rational mechanisms of cost control, alternative funding, and technological achievements of the recovery process moved forward, and the industry is now at a crossroads. In what direction will it continue to move and how are the state and business ready to work together for the benefit of development and economic and technological independence of the mineral resource complex? Much depends on this decision. Now on the agenda are many investment projects designed to give economic and financial impetus to the accelerated development of individual industries [12].

Analyzing similar moments of previous cycles (without additional sanctions pressure), we can look into the past and understand that mining companies have made serious mistakes. The lack of investment in exploration and capital investment in expansion of production and infrastructure during the recent recession has only exacerbated the problems of the super-cycle, which have already been caused by demand from China and other developing countries. Companies in the industry had to make purchases at a high price, not always effective, to meet their production ambitions and meet the high demand then. In 2012, the cycle began to shift, and we saw the beginning of record write-offs of investments made at the highest point of the cycle, excessive debt relative to the real value of assets and, finally, financial difficulties throughout the sector. Are we destined to repeat history, or will we remember this time as a turning point for the industry, to take into account the new realities of the functioning of the Russian economy?

The mining and exploration sectors have long development cycles and the investment horizon should be as long but predictable. Partly significant opportunities have already been missed, for example, the increased ratio of the price of stock to earnings per share and ratios P/NAV, which would attract foreign investment to a greater extent. But if you are guided by intuition, sound logic and awareness of the quality of the mineral sector of Russia, we can assume that at the moment this is the point of the cycle is the best time for investment.

In 2018, none of the companies from the top 40 list announced the start of new projects, although commercial production was started at five large fields. Here the analysis concerns the largest companies in the world.

Now we are really seeing a different, more confident investment behavior of companies from developing countries, in particular, it is worth remembering the dominant position of China in recent mergers and acquisitions. That is, it is the developing countries that are now more concerned about the need to carry out the investment process and lay the mineral and raw material basis for their further economic development, and Russia should not remain on the sidelines in this process.

For developed countries, the trend is not so unambiguous, since the second half of 2018, companies from the top 40 list announced a significant increase in the number of positive stages of projects and a decrease in the number of negative stages. At the same time, we can recall the decision of the Freeport of reducing the rate of capacity utilization to a level of 75% for the extraction and processing and operation of the mining complex of Sierrita on open mining of copper and molybdenum, located in the city of Tucson (Arizona), in response to lower prices. Another example is Glencore's transfer of its black Star field in Queensland (part of the mount ISA complex) to maintenance mode after the full development of existing reserves. This trend continued throughout 2018.

Individual companies in the industry have already invested in technology development and cost control measures. It is hoped that these initiatives will be sustained throughout the cycle and that we will not see missed deadlines and inflated capital project costs, as has happened in the past.

However, operating costs are bound to increase again in this cycle, as factors such as exchange rates and wages are almost impossible to control. And in the absence of investment in exploration and new projects, the top 40 companies may again find themselves in conditions of a decrease in the number of projects in operation, a reduction in reserves and obsolescence of equipment and facilities when the cycle accelerates. This scenario assumes that, if China's effect is excluded, growth will again be dictated by mid-market capitalised companies and young companies whose own valuations will temporarily soar upwards and trigger another round of aggressive mergers and acquisitions by top 40 companies.

It is very easy to criticize, especially when investment decisions are made in real time and require investor confidence in management to make long-term decisions. But will governments be strong enough to abandon short-term gains? Do companies have the necessary versatile and talented managers who will be able to take advantage of this temporary respite and lead the company into a successful future? Will they be able to make tough and rational decisions?

We're counting on that. A possible positive example is the recent announcement by Rio Tinto's management that the new Director General has been given «extensive powers for ten years». It is obvious that the activities of the mining sector should be more attractive to the market, so it can resist the pressure from shareholders, associated, for example, with the payment of dividends at the low point of the cycle.

We expect that China will continue to be the main driving force for commodity prices, and thus will determine the fate of the top 40 companies and other commodity enterprises from around the world. In addition, we are seeing new players emerging in the consumer sector, whose presence is growing in the background.

Should the industry take seriously the question posed by Apple: «will we ever be Able to completely stop mining on Earth?»or to the statement of Elon Musk that he guarantees that in 100 days he will be able to stop the energy crisis with the help of battery technologies? Regardless of whether the mining companies want to believe in these and many other ideas, to take some of them on Board, it is very important that they recognize the forces that currently determine the spirit of change. Are the efforts of mining companies sufficient to show that they take into account the interests of all stakeholders, not just shareholders? Industry representatives have proven that they have strengthened their balance sheets, but are extractive companies doing their best to show that stakeholders ' interests are also actively taken into account?

Can the industry support their origins? BHP has already been faced with the strong influence of shareholders demanding such changes. To date, most of the companies from the top 40 list have not announced their intentions and are in the process of determining the transformations of their development strategies, which is also relevant for Russian business structures of the commodity sector in conjunction with the response to sanctions pressure.

But given the increased sustainability of their balance sheets and the increase in value estimates, they have options for further action, and they should make informed decisions.

Although traditional mining companies dominate the top 40 list (including Russia), they should ensure that they are flexible enough to adapt. It is important to understand that the rules are changing. More than half of the top 40 companies from developing countries are partly owned by local authorities or the state, which means that they have access to financing outside the traditional capital markets.

Thanks to its successful actions, the world's major mining companies managed to carefully bypass the collapse of the market in 2008, to cope with the fall in prices, to keep and complete investment projects of the super cycle. Now that they are preparing for action, it is important that their leadership draw on lessons learned in the past, focus on sustainable long-term development and avoid the recurrence of negative developments that have led to overproduction and asset depreciation.

Today, for Russian large raw materials companies and companies in the exploration industry, it is necessary to adopt the way and the techniques that are used by world analogues in terms of attracting and managing investments. For Russian raw materials companies, taking into account import substitution programs, the state in the face of the defense industry can and should come to the rescue, creating and supplying complex high-tech production with modern equipment, highly qualified specialists and great innovative potential. All this potential can and should work for the development of mineral resources and other sectors of our economy.

Miners have repeatedly noted that the mining industry, the military-industrial and construction complex has many points of contact. Such cooperation will allow miners to ensure technological and innovative development of mining industries, especially engineering, to solve the issues of import substitution, to ensure industrial and environmental safety of mining. And all this thanks to the use of the capabilities of research, design organizations and industrial enterprises of the military-industrial complex.

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20. Features and trends of the digital transformation in the russian mining industry

Currently, in almost all sectors of the economy there is a dynamic growth in the volume of generated and processed information, which is used in various functional areas of business: production, logistics, marketing, Finance, etc. Accordingly, improved technology to manage information flows. Enterprises are adapting to new conditions, looking for reserves to improve the efficiency of data. New digital technologies make it possible to streamline business processes, increase the overall return on investment in fixed assets. There are many ways of using digital technologies, however, the maximum effect can be achieved only in the case of integrated implementation of information systems, that is, a complete digital transformation of the company.

Digitalization of business in many countries is stimulated and supported at the state level. Our country is implementing the program «Digital economy of the Russian Federation», which provides special legal, organizational and financial conditions for enterprises developing this area. According to forecasts, as a result of the implementation of the measures laid down in the program, more than 10 large technological companies with a high level of international competitiveness, dozens of industrial digital platforms (including «smart cities», digital medical and educational organizations, etc.) will function effectively in Russia by 2024. At the same time, many domestic companies are making efforts to implement the main provisions of the Program «Digital economy of the

Russian Federation» in their business. More than 500 small and medium-sized enterprises specializing in the development of various digital technologies are expected to start operating in the coming years [7].

The most acute problem of digital transformation is facing the industrial sectors, in particular, the mining industry. In the current situation, when the demand for natural resources is unstable, mining companies are trying to increase their flexibility, to respond quickly to changes in market conditions. In addition, it is of particular importance to increase the rationality of the use of existing resource potential, as well as reducing production costs. Digitalization of business processes acts as one of the main tools for solving these problems. According to McKinsey forecasts, by 2025, the use of digital technologies in the global mining industry will reduce costs by 17% [2].

Under the digitalization of the mining industry we will understand the complex use of the latest digital technologies: the use of remote control equipment and robotics, the use of remote centralized dispatching technologies, high-precision satellite positioning of excavators and other equipment, the use of digital portable devices for monitoring the health of workers, three-dimensional modeling of objects, predictive analytical processing of geological data, etc. Digital mining is an enterprise that has integrated industrial automation systems and business applications. This integration makes it possible to form a unified system of planning, execution of tasks, accounting and control of the company's activities, increase management flexibility and responsiveness to changes in the external and internal environment.

The digital transformation of the mining enterprise allows linking processes in the value chain into a single system: from mining and mineral processing to the production of final products and their delivery to the port/warehouse. Many companies begin transformation with digitization only small segments of this chain and implementation of automated technologies.

The basis of digitalization of business processes, as well as digitalization of production in General in mining campaigns is the «principle 4E» [4]:

– unified digital model of the company;
– a single database of attribute information;
– single coordinate field;
– unified information exchange system.

The automated production system, built on this principle, is a common basis for the main processes of the mining company: evaluation of raw materials reserves, mining and minerals, maintenance of transport infrastructure, production planning, etc. The use of the «Principle 4E», makes it possible to solve the problems associated with the inconsistency of data generated in various departments of the company, and allows you to quickly (in real time) to obtain information for management decisions at various stages of the planning process: from the development of the strategy to the formulation of current tasks to staff.

In Russia, as in many other countries, digital technologies are being introduced in the mining industry at a rapid pace. The key factors affecting this process include: increasing the productivity of hardware, the development of robotics, the development of new management technologies and the development of artificial intelligence technologies, as well as changing approaches to the organization of the process of mining.

At present, automated control systems of the mining and transport complex (ACS SCC) are already widely used in open-pit mining. The use of these systems makes it possible to operate mining equipment in optimal conditions, improve the efficiency of mining processes.

In addition to the automated process control system at mining enterprises, other digital systems are used: mining planning, process control system (automated process control system), MES (Manufacturing Execution System – production Executive system), MRO (information system of maintenance and repair), ERP (Enterprise Resource Planning – enterprise resource Planning system), etc.

The largest Russian mining companies are actively working in the field of digitalization of their production processes, implementing many technological projects.

For example, the mining and metallurgical plant of PJSC MMC Norilsk Nickel, currently invests heavily in the modernization of its it infrastructure, forms the basis for digital transformation. The company plans to update almost all data centers (data centers) by the end of 2019.

PJSC « MMC «Norilsk Nickel» is actively implementing the program «Technological breakthrough», which introduces a set of special solutions for the automation of processes in the production of raw materials, its enrichment and production of metallurgical products. In particular, at the enterprises of the holding implemented a digital system that allows for the positioning of mining equipment, to reduce fuel consumption, improve the efficiency of scheduling production accounting, metallurgical balance. In addition, the company uses simulation systems of equipment and processes, which makes it possible to determine the optimal number of mining equipment.

The company uses advanced technologies to reduce industrial injuries and increase the return on the use of resources. At Norilsk Nickel, robotics is being introduced, which makes it possible to reduce the number of personnel involved in heavy and routine work. Technologies are used: «big data», «virtual augmented reality», «artificial intelligence», «digital twins», etc. Based on the latest digital technologies, the company introduces the concept of «green metallurgy» and minimizes environmental damage by supplying «pure metals» to manufacturers of catalysts for cars (including hybrid), as well as batteries for electric vehicles.

PJSC «MMC «Norilsk Nickel» in 2018 received the award «IT-LEADER» in the nomination «ferrous metallurgy» the project on introduction of system of communication and positioning of equipment and workers in the mine «polar». This project is aimed at improving the safety of personnel during underground work, involves the use of individual tags, portable radio systems for each employee, as well as an automatic system «anti-Arrival», which notifies drivers of vehicles about approaching people or equipment. This system also enables monitoring of various production processes at the mine (e.g., movement of rock mass).

During 2019, the company plans to put into operation the system of electronic trading of metals and issue its cryptocurrency Stablecoin, provided with metals owned by Norilsk Nickel. A special platform will be opened for electronic trading. Token sales are expected to exceed $ 1 billion. The use of blockchain technology will allow the company to receive short-term financing on favorable terms [1].

The Russian copper company (RMK) is also actively implementing projects to digitalize business processes. Involved a significant amount of operational calculation, automatiseret many routine procedures is remote monitoring of parameters of technological equipment, etc. So, in 2019 put into operation control system and industrial monitoring Miheevsky GOK. With the help of digital systems, operators control the parameters of various units at the concentrator – from gyration crushers in the mines to pumping stations of circulating water supply.

The six RMK enterprises implemented ERP system. These systems allow personnel to monitor the availability of components in warehouses, plan current needs and automatically generate applications for the purchase of components. Thus, the level of inventory is optimized, the accuracy of budget planning is increased, the process of equipment repair is optimized, the efficiency of management decisions development is increased. Currently, more than 70% of the processes in RMK are automated.

The process of digital transformation in Polymetal is gradually taking place. In particular, one of the enterprises of «Polymetal» – «Silver Magadan» – introduced a system of management of underground mining. The system is already in operation in the test mode at the Lunnoye field (Magadan region). The developer and integrator of the project is the company «VIST Group». With the help of the software created for the experimental site, the reporting of the production sites of «Silver Magadan»was automated. This takes into account all the specifics of underground mining. The system allows you to control the operation of underground dump trucks and loading and delivery machines operating in a single cycle.

The next example of digital transformation in the mining industry is the Siberian coal energy company (SUEK). It is a large company that exports 40% of coal produced in the «East Bay section». The remaining 60% of coal is supplied for the needs of domestic utilities. At the beginning of 2019, the project on automation and robotization of the well drilling system at one of the company's facilities – the tugnuisky section (Buryatia) began. It is planned that drilling rigs, with the help of sensors and specially developed algorithms will perform basic operations, which are currently controlled manually [8].

In the summer of 2019, a project on the use of robotic dump trucks in SUEK's quarries in Khakassia was launched. It is planned that this technique will not only ensure the safety of workers, but also give the opportunity to optimize the parameters of coal mining processes (width of the loading zone, the parameters of the road network). In addition, the innovation will solve the acute problems associated with the shortage of qualified personnel and reduce the cost of repair of mining equipment [3]. The project is jointly implemented by the Russian company «Tsifra», engaged in automation of production processes, and one of the world's largest manufacturers of quarry equipment – BelAZ plant, which signed an agreement on strategic partnership. On the basis of the plant created an innovative research center specializing in the development of unmanned vehicles and artificial intelligence.

Robotic dump trucks operated remotely should be widely used in situations where conditions have been formed in the quarry that are unfavorable or dangerous to humans (for example, high gas content, high probability of collapse, etc.) [6].

Of interest is the project currently being implemented to implement a system of integrated automation of metallurgical production (from ore mining to metal rolling) at ZSMK EVRAZ on the platform «foresight». The contractor has prepared a mathematical model for the optimization of all stages. EBITDA was chosen as the main optimization criterion. Based on the model, the technologists choose the best composition of raw materials and equipment loading parameters. At the same time, in some cases, in order to achieve optimal performance of the entire production chain, a temporary decrease in efficiency is allowed in certain areas. The introduction of the system has led to a revision of the schemes of motivation of personnel and approaches to control the efficiency of production. The system processes about 80 thousand variables per month and about 350 thousand per year.

The mining and metallurgical company metalloinvest is implementing a comprehensive program of business digitalization «Industry 4.0». Management has set a goal – to unify business processes, increase efficiency and flexibility to respond to changes in the external and internal environment. Digital transformation is carried out on the basis of SAP ERP-system (s/4HANA core). The integrated system of management of production and economic activity of the company is formed.

Within the framework of the digital transformation program, metalloinvest, in addition to the introduction of SAP, launched a number of projects, in particular «Electronic document exchange», «Rapid closing of the reporting period», «Contract work», «Self-service services», «Information security» , etc. the Total number of «add-ons» over the main control automation system is more than 20 [5].

The main expected results of metalloinvest's digital transformation are: reduction of labor costs and optimization of management costs. In addition, the SAP system will enable the company to respond quickly to customer requirements regarding the characteristics of the finished product, to act in accordance with changes in market conditions. Business transparency and flexibility are expected to increase.

The introduction of digital technologies in mining enterprises allows to fully automate most of the processes. As a result, labor productivity and sales volumes increase, competitiveness increases.

In the mining sector, there is a positive trend of reducing the number of accidents and the level of occupational injuries. For example, in the coal industry since 2010, there has been a 40% reduction in accidents (taking into account information on all objects controlled by Rostekhnadzor). Mortality from accidents decreased by about 50% [9].

In introduced at the mining enterprises integrated automation systems stored a significant amount of data about production processes. However, in many cases, the level of development of data analysis subsystems in these systems is quite low. Another problem is the lack of integration of different subsystems with each other. Thus, for example, the operating modes of the company at the operational level and at the level of short-term planning are analyzed by different employees using different software products. This uses arrays of data that are not related to each other.

There are also difficulties in the field of predictive Analytics: issues of production activities are solved upon the occurrence of certain situations. The used automated analytical systems do not allow to foresee many problems in advance and to make the corresponding administrative decisions in advance.

Enterprises of the mining sector have invested heavily in technology to enhance the analytical potential of applied automated systems. One of the most promising areas in this area is the use of artificial intelligence (AI) technologies that can improve the efficiency of decision-making and planning processes at all stages of value creation. With the help of artificial intelligence increases productivity and safety, reduces costs, increases the efficiency of joint work of different groups of personnel. Mining companies assess the prospects of various areas of improvement of analytical systems and AI systems based on the practical experience of other companies in the sector, as well as the experience of companies in other industries. Thus, the optimal areas for investment in new technologies are identified.

An important area of digital transformation of mining enterprises is the digitalization of the supply chain. Digital supply chains (DSNs) are gradually being formed in the industry, but this process is still at an early stage of development. Companies that will be able to select the optimal set of solutions and form a fully integrated supply chain (from career to port) will not only combine their operational processes, but also increase business transparency, will be able to use assets more efficiently, increase productivity and operational efficiency, which will eventually lead to a tangible reduction in production costs.

Moreover, the digitalization of operating and management activities of mining enterprises allows them to transform the basis of management of the efficiency of mining enterprises in terms of the risks of sanctions, which increases the speed of reaction and decision-making [10].

In order to fully unlock the potential of digital transformation, it is advisable for mining companies to introduce «Industry 4.0»technologies. For «Industry 4.0» typical use «Internet of things» (IoT) and application in production management «CPS» (Cyber-Physical Systems, CPS). The following areas are most actively developing: augmented reality, industrial Internet of things, big data, business Analytics, cloud computing technologies, Autonomous robotics, vertical and horizontal system integration, additive manufacturing (in particular, 3D printing), information security, digital modeling technologies.

In the field of technology implementation «Industry 4.0» are leading the following countries: USA, Germany, UK, Netherlands, Sweden, South Korea. Many countries have developed and are implementing special government programs to support the introduction of these technologies in various industries, including mining.

With the introduction of «Industry 4.0» technologies, the processes of using all tangible assets are digitalized through, and a single digital ecosystem is formed, which includes partner enterprises operating at different levels of the value chain. The concept of «Industry 4.0» implies a digital transformation and vertical integration of the processes of all companies involved in the chain. All functional areas are digitalized: logistics, marketing, production, Finance, etc. At the same time, information on business processes, economic efficiency, strategic and tactical plans is available to the relevant specialists in real time within the framework of the General information network. Augmented reality technologies are used to summarize and analyze available data, and data formats are optimized for cross-platform applications. Horizontal integration is also carried out, which goes beyond internal business processes and includes partners and customers. To ensure integration, various technologies are used: from production process monitoring systems to strategic planning systems.

The main components of the «Industry 4.0» concept and related digital technologies are shown in Fig. 20.1.

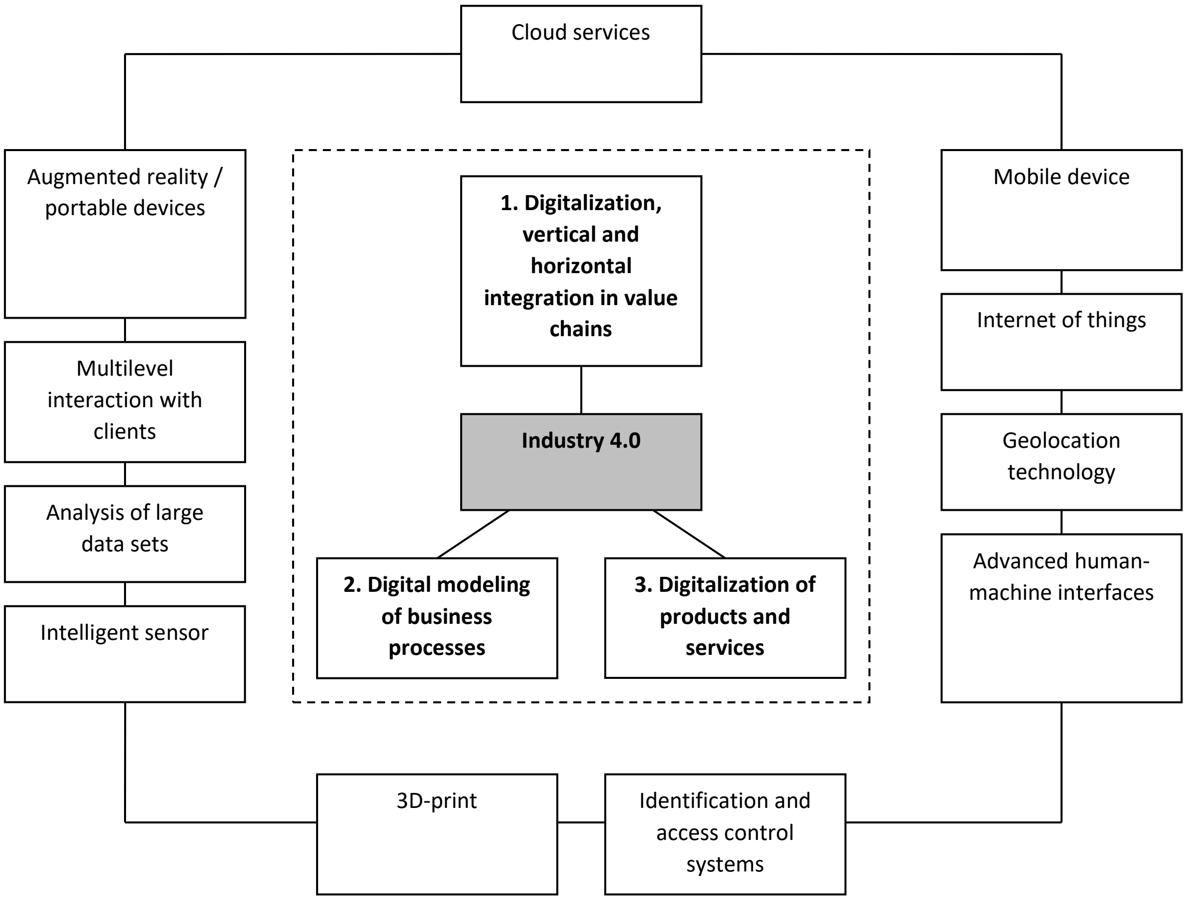

Fig. 20.1. Main components of the «Industry 4.0» concept and related technologies

The program «Digital economy of the Russian Federation» can be considered as a starting point for technological transformation of the mining industry within the framework of the concept «industry 4.0». At the same time, a complete transformation is impossible without the integration of technological platforms used in the mining sector. It is advisable to create a system that can be conditionally designated as an «industry integrated platform», to which all mining companies, as well as interested state bodies, should have access. This platform should be based on the principles of «Industry 4.0» and allow its participants to receive the most important information about the state of the market in real time.

The creation of such a system in the mining industry provides for comprehensive research in the field of industrial cyberphysical systems and the industrial Internet of things.

Within the framework of the «industry integrated platform» it is necessary to create a database on innovative technologies of the mining industry, to ensure universal access to this database and its regular updating. In the future, this database should include effective technologies for mining, based on the use of artificial intelligence and robotics of the second and third generations. On the basis of innovative technologies that make it possible to move to fully automated production processes, it is possible to combine individual links in the value chain using Autonomous cyberphysical systems. Of course, this will require the development of new spatial planning solutions specific to the mining industry.

The most promising areas and technologies that can be implemented in the mining sector within the framework of the implementation of the «industry 4.0» concept are reflected in the table. 20.1.

Table 20.1. Implementation of the industry 4.0 concept in the mining sector

Production process	**Promising areas and technologies**
Exploration of mineral deposits	Virtualization of search and exploration processes. Remote sensing of the earth. Geographic information systems using three-dimensional geological modeling technologies.
The extraction of minerals and the formation of reserves	The use of automated and robotic technologies for mining. Technology of desolate excavation of minerals. Geoinformation technologies based on digital modeling of physical processes. The use of «Intelligent mine» and «Intelligent cut» systems based on Internet of things technologies.
Processing of minerals and waste	The use of Internet of things technologies in the enrichment and processing of minerals and waste, the use of systems such as «Intelligent concentrator». Application of innovative chemical technologies for the production of products with high added value. Application of biotechnologies and nanotechnologies.
Transport	The use of automated transport. The use of systems such as «Intelligent transport», based on the technologies of the Internet of things.

For effective digital transformation of the mining sector, it is necessary to develop and implement mechanisms of state support for this process. The state should stimulate the production of domestic digital equipment and software used in the extraction and processing of minerals. Special attention should be paid to industrial Internet of things technologies and cyber-physical systems.

For the development of the mining industry within the framework of the «industry 4.0» concept, it is necessary to provide the industry with qualified personnel. For this purpose, it is necessary to use an integrated approach to the development of the personnel training system, which involves the use of advanced technologies and training techniques that meet international standards. It is necessary to use well-established in the world practice forms of training, for example, a partnership between educational organizations and industrial enterprises, in which the order for the training of specialists on specially designed programs with the involvement of the future employer in the educational process. In addition, a significant direction of improving the human resource potential of the mining industry is the training of employees in continuing education programs. These programmes should cover all major categories of workers, from senior management to staff, engineering and maintenance personnel.

It should be noted that the changes in mining enterprises within the framework of the «industry 4.0» concept not only allow for revolutionary technological changes in the industry, but also carry certain threats and risks. First of all, digital transformation, automation and robotization of production lead to the release of low-skilled personnel. Naturally, part of the released labor force is retrained and employed. However, this process is very costly and faces many challenges.

The use of Industry 4.0 technologies is fundamentally changing the supply chain ecosystem around mining enterprises, especially in terms of service delivery. This ecosystem is becoming high-tech. This means that enterprises, having automated production, begin to need more it services (consulting in the field of digital technologies, support for the functioning of computer equipment and software, maintenance of robotics, etc.). At the same time, the demand for traditional services (repair of mechanical or semi-automatic equipment, transportation of employees, catering services, personnel insurance, etc.) is falling. In the process of developing digitalization programs, enterprises should pay special attention to these risks.

So, mining companies are actively involved in the digital transformation of the Russian economy, they are introducing the most advanced technologies to improve productivity, reduce costs, improve product quality, integrate supply chains. In addition, for large companies in strategic terms, digitalization of management procedures and production processes is a big step towards business transparency, that is, to increase the interest of investors, including foreign ones. Complex digitalization leads to the fact that all the main processes of the company become logical, understandable, and the influence of the human factor is minimized. In General, the introduction of new digital technologies, including elements of «Industry 4.0» in the practice of the industry forms the basis for the creation and development of a new intellectual mining industry in Russia.

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21. Analysis of classifications of factors of sustainable development of coal mining enterprises

Currently, coal is the fifth basic product exported by Russia, after oil and petroleum products, gas and ferrous metals, the proceeds from the sale of which is about $ 10 billion. per year [1]. In this regard, the issues of ensuring the sustainability of enterprises of the coal sector, due to the negative impact of a number of factors on their activities against the background of the crisis in the country, are of particular relevance. Identification of factors affecting the work of coal mining enterprises is one of the most important functions of managers in the enterprise and a necessary condition for the formation of a system of indicators characterizing the effectiveness of their development.

The research of literary sources shows that the problems of sustainable development of enterprises in the context of identifying factors affecting their activities are reflected in the works of such classical scientists as M. porter, Arthur A. Thompson-ml., A. J. Strickland III, D. R., R. Grant and others Among the Russian scientists dealing with the classification of the factors influencing efficiency of functioning of enterprises of different ownership forms, can be noted: E. A. Lamonova, K.

V. Kolpakov, D. R. Khairullina, T., Kirillov, etc. However, the factors influencing the development of coal mining enterprises are not given enough attention, which actualized the research topic.

The aim of the study is to identify the factors affecting the activities of coal mining enterprises, for the subsequent determination of indicators of their sustainable development and identify mechanisms of influence on them.

Under the sustainable development of the enterprise, in a broad sense, we understand its internal changes due to the increase in the level of adaptation of the enterprise to the influence of external factors, an increase in the quantitative indicators of the enterprise, qualitative changes in its structure, a gradual increase in the complexity of equipment and technology [2].

Given the fact that the company is usually considered as an open system, the majority of authors tend to believe that its development is influenced by both external and internal factors [5, 6, 8] (table. No. 1). At the same time, internal factors depend on the work of the enterprise itself, and external factors do not depend on its activities. External factors are unmanageable, however, the company in one way or another can influence them.

In addition to the place of occurrence, the factors affecting the activities of coal mining enterprises are also classified: according to the environment of operation, time of impact, constancy of impact [3] and the sphere of impact [4, 9].

Table 21.1. Factors affecting the sustainable development of coal mining enterprises

Author	**Number of factor groups**	**Types of factors**	**Characteristic**
Topoleva T. N.	**3**	Operating environment	External (consumer demand, competition, contractual relations with suppliers and contractors, contact audience, etc., natural and geographical location; political situation, socio-cultural relations, etc.))

			Internal (production, management, Finance, marketing, innovative development, economic stability, social stability, management stability, innovative stability, information stability).
		Exposure time	Long-term (NTP, climate change, legal regulation of economic activity, the world market, etc.)); Medium-term (stage of the economic cycle, consumption structure, resource security, social structure of the economy, etc.)); Short-term (labor productivity, organization of production, qualification of personnel; the level of prices in the domestic market, etc.).)
		Constancy of exposure	Permanent (culture and traditions of economic activity, total income of market entities); Periodic (economic growth rates, technological innovations, financial market trends, etc); Non-periodic (investment activity of the enterprise, modernization of the economic system, political crises, etc.).
Komissarova M. A.	**6**	Mountain-geological	At the macro level (geographical location, climatic conditions); At the meso level (proven reserves, coal quality, etc.)) At the micro level (thickness, amount of overburden, occurrence).
		Production and technical	At the macro level (level of NTP development); At the meso level (level of mechanization and automation, etc.)) At the micro level (security of production processes, technical condition of equipment).
		Organizational and technological	At the macro level (investment and innovation policy in the country); At the meso level (level of cooperation, concentration of production, etc.))

			At the micro level (system of opening and development of structure of technological process).
		Financial	At the macro level (pricing, tax and credit policy of the state); At the meso level (credit and price policy, etc.).) At the micro level (formation and distribution of profits, reserves, costs; pricing strategy).
		Socio-economic	At the macro level (income level, demographic structure); At the meso level (unemployment rate, quality of life, etc.)) At the micro level (motivation, payment system, staff stability, discipline in the workplace).
		Environmental	At the macro level (environmental norms and regulations, current legislation); On the meso level (formation of coal waste, impact on the atmosphere, water) At the micro level (compliance with environmental standards, the use of waste-free technologies).
Ruyga I. R., T. V. Zubanova	**2**	External	Competition between different types of energy resources, mainly from gas companies; Falling coal prices on world markets; Shale gas production growth; The need to switch to an innovative way of development of fuel and energy industries in many countries, including the coal industry in Russia; Reducing the share of coal in production, displacing it from the energy balance and replacing it with renewable energy sources; Increased competition from other coal producing and exporting countries;

			The slowdown in the economies of Europe and Asia, including China, which is the largest importer of coal.
		Internal	At the micro level (the fall in the profitability of production, increase the social burden, the need to ensure security at the facilities in connection with the increase in the share of coal produced in adverse conditions, differences in the capacity of reservoirs, volumes of overburden, the conditions of deposition, the requirements of environmental regulations, problems with the staff, the dependence of industry on imports of advanced technology and equipment, approaches to formation and distribution of profit, reserves, costs, price strategy). At the macro level (falling coal prices in the domestic market, investment and innovation policy of the state, the level of development of NTP, transport problems, tax, credit and price policy of the country, environmental regulations, current legislation, the presence of inefficient coal mines).
E. V. Yarotskaya, A. A. Potapov	**2**	Internal	Incorrect assessment of the economic potential of the enterprise, violation of the agreed schedules of suppliers of raw materials, components, lack of highly qualified personnel of the coal mining industry, loss of property of the enterprise, high depreciation of equipment, power outages, high accident rate of underground mining of coal seams, low level of technological discipline.
		External	Political factors, changes in tariffs for rail freight, changes in tax legislation, changes in interest rates on loans.

Filimonov F. Yu.			Instability of demand and prices for coal products on the international market; Stricter environmental requirements for the use of coal; The desire of countries to reduce dependence on coal imports by increasing the use of renewable energy sources.
Antonov Y. V.	**2**	Controlled (internal)	Complex technological production chain; Features of geological and ecological situation in the region; The level of safety of the work.
		Uncontrolled (external)	The development of market economy; International relations development; Changes in the socio-political environment; Inflation process.
Yakovlev V. L., Kravchuk I. L., Nevolina E. M.	**2**	Internal	Industrial dispute; Production safety level; Security breaches.
		External	The growth of competition in the coal markets; Conditions for the development of complex structural deep-seated mineral deposits.
Deborah J. Shields	**4**	Production	Resources, exploration capacity, production (mining) capacity, use of energy (minerals, materials).
		Socio-economic	The level of income and expenditure in the region, the level of income and expenditure in the country, cultural, social and spiritual needs, capital.
		Institutional and legal	Legal framework, institutional framework, capacity to conduct and use research and development.
		Environmental	Environmental conditions, management of extraction and processing, the level of reclamation - remediation-restoration of the extraction of coal, environmental emissions.

Source: compiled by the author according to [1, 3-9]

A feature of the classification proposed by M. A. Komissarova is a detailed description of the types of factors affecting the activities of coal mining enterprises at different levels (macro, meso and micro levels) [4]. As a disadvantage, we can point out the fact that the author positions these factors as factors only of the external environment, although most of the factors at the micro level (with the exception of mining and geological) are controlled, that is, internal factors.

Among the shortcomings of the classification of factors developed by Ruiga I. R. and Zyubanova T. V. [5], we highlight the fact that the authors, considering the factors at the macro level, classify them as internal, whereas in essence, these are external factors that are difficult for the enterprise to influence and manage.

Antonova Ya. V. [7] the factors influencing activity of the companies of a mineral-raw complex conditionally divides into the controlled and uncontrollable enterprise. The disadvantage of the proposed approach is that it is very narrow and does not cover the possible range of factors affecting the effective development of enterprises involved in the mining industry.

A feature of the classification proposed by Yakovlev V. L., Kravchuk I. L. and Nevolina E. M. [8] is that the authors focus on the production conflict and ensuring the safety of the production process in the group of internal factors.

Deborah J. Shields [9], based on the classical works of van horn James K. [10], Thompson-ml. Arthur. A. [11], identifies 4 groups of factors (production, socio-economic, institutional,legal and environmental). Among the advantages of this classification should be noted production factors that take into account the volume of proven resources, production capacity, as well as environmental factors that reflect the impact of the environment on the activities of the coal industry, emissions, the possibility of restoring coal mining. As shortcomings we will allocate that fact that the majority of the considered factors belongs to the external factors which are not amenable to management.

A common disadvantage of all the classifications considered is that most of the factors presented in them are not quantifiable, which does not allow to clearly assess the effectiveness of their impact on the development of the enterprise. For example, it is not clear how to assess the spiritual needs of the population, the development of international relations, the level of development of the legal framework, the requirements of environmental standards, institutional framework, etc.

In General, systematizing the factors affecting the activities of the coal industry, it can be concluded that the most optimal is their classification by spheres of influence, and not by place of origin, as it will reveal indicators that evaluate the effectiveness of the development of the enterprise in this industry. Since the most complete classification is Komissarova MA, we propose to Supplement it with some factors that allow you to subsequently build a system of quantitative indicators that assess the level of development of the enterprise [4, 9, 12]:

– in the group «production and technical» factors must also take into account the volume and structure of production, the innovative level of development of the company, the level of depreciation of fixed assets, safety and energy production, the production capacity of the enterprise;

– in turn, the group «socio-economic» factors should be divided into several subgroups: 1) marketing factors – the market share of the enterprise, consumer preferences, the presence of regular customers, the quality of products; 2) personnel factors – the availability of qualified specialists, working conditions affecting the level of constancy and turnover of personnel; 3) macroeconomic – changes in coal prices, coal consumption, inflation, exchange rates;

– the group «financial factors» should be supplemented with such internal factors as: the ratio of own and borrowed funds, the availability of own working capital, the availability of liquid assets, the amount of attracted investments, the level of profitability and profitability of the company, the amount of accounts payable, etc., allowing to assess the financial stability of the enterprise;

– in the group «mining and geological» factors is an important factor of incorrect assessment of reserves of the field, leading to the loss of the field in the recalculation of reserves.

– to open a new group of «infrastructure» factors and fill it with the following factors: macro level – the development of transport infrastructure in the region, the level of prices for transport within the country and the region, the prospects for the development of communication routes; micro level – tariffs for the transportation of coal for the enterprise by road, rail and sea transport.

Thus, the critical analysis of approaches to definition of the factors influencing sustainable development of enterprises in the coal industry, have helped to clarify existing practices of researchers from the point of view of formation of system of indicators evaluating the efficiency of the company. Further research in this direction will be devoted to the selection and justification of quantitative and qualitative indicators to assess the level of development of the coal mining enterprise on the basis of a refined classification of factors affecting their activities.

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22. Transformation of methodical bases of management efficiency of mining enterprises under conditions of risk the sanctions impact

Mining is one of the key sectors of the Russian economy. It technologically and organizationally merged companies, mining, enriching, processing and selling of ore and nonmetallic raw materials. Demand for mining products has been consistently high in recent years, regardless of the turbulence in the economies of developing and developed countries and regardless of the political environment. At the same time, a significant share of products is exported. The share of the industry in GDP is about 10%, and the share of our country in the world mining production reached 9.7%. According to this indicator, Russia ranks third after the US and China. Russia has the world's largest ore reserves. The Russian Federation produces more than 45 types of mineral products. All this characterizes a significant contribution of the domestic mining sector to the modern world economy[3].

However, the importance of the mining industry and its scale are also associated with high risks that need to be adequately assessed to ensure the economic security of not only the industry, but also the country as a whole.

G. Yu. Boyarko identifies the following strategic industry risks of the mining industry: external measurable risks (tax, price and other economic risks), internal measurable risks (mining, technological and geological risks), external non-parametric risks (legal risk group) and internal/external non-parametric risks (information and environmental risk group)[1].

Assessment of the parameters of development of mining enterprises shows that the effectiveness of the industry depends critically on the ability of management to assess and predict adverse situations and take effective measures to counter risks[12]. Risk management is an essential component of the strategic management system of modern mining enterprises. The most successful development programs are developed and implemented by those companies in the industry that are able to find the optimal balance between risks and benefits.

In recent years, the functioning of the Russian mining industry has been significantly affected by economic risks associated with foreign policy tensions caused by the crisis in Ukraine and the subsequent sanctions war between Russia and Western countries. This we associate primarily with the competition of developed countries in the face of their anchor businesses and interests with Russian companies from the mineral market.[14]

In 2014, the us President signed several decrees on imposing sanctions against the Russian Federation. In particular, accounts were blocked, entry into the United States was prohibited and assets of a number of persons working in various sectors of the Russian economy were frozen. In subsequent years, the package of sanctions was expanded to the confrontation joined the EU countries, Canada, Japan, Australia, New Zealand and other us-dependent States[6]. The sanctions affected:

– oil, gas, coal and other mining industries (sanctions against enterprises and their subsidiaries, restrictions on the export of technology and equipment) – the actions of sectoral sanctions both on the activities of the companies themselves and on the management of these enterprises;

– banking sector (freezing of accounts of Russian legal entities and individuals, credit restrictions, restrictions on the placement of financial resources in us and European banks);

– military-industrial complex (restrictions on foreign trade operations related to military and dual-use products);

– other industries (targeted sanctions against individuals and legal entities).

Russia has imposed counter-trade restrictions, mainly on imports of agricultural products from the United States and European countries.

The sanctions imposed on Russia, as well as the changes that have taken place in the world commodity markets, undoubtedly had an impact on the economic condition of the country and its strategic sectors. Revenue of many Russian companies has significantly decreased. This fully applies to the mining industry. This industry has always reacted immediately to crisis situations. The crisis in the financial sector leads to a decline in industry and construction. As a result, the demand for metals[13] and other products, raw materials for the production of which are supplied by the mining industry, is sharply reduced. Industry enterprises are forced to develop anti-crisis strategies. The problems of regulating the volume of raw materials production are solved: the work of part of the capacity is suspended or productivity is reduced. Currently, mining companies are reducing investment in development, which affects the dynamics of development of new fields and, accordingly, the profitability of the business. At the same time, it is correct to realize that the main consequences of sanctions and, as a consequence, the decline in investment activity of companies will affect the operating performance of mining companies in 2020-2022, since the investment cycle of mining enterprises is greatly stretched in time.

The main risks associated with the investment activities of mining companies, currently include: the complexity of forecasting the dynamics of prices for minerals, problems with the purchase of necessary equipment and technologies as a result of sanctions restrictions, the volatility of the ruble, restrictions on attracting financial resources from abroad.

The problems of the mining industry that have arisen as a result of the sanctions restrictions are compounded by the fact that the industry has been deeply integrated into the international economic space in recent decades. During this time, the foreign economic activity of the domestic mining industry has covered many regions of the world. This took place against the background of accelerating globalization processes and increasing the level of integration of various countries extracting minerals into the system of world economic relations. The role of the world trade organization as a regulator of foreign trade relations between producers and buyers of raw materials in the world market has increased. Russia's accession to the WTO has increased the dependence of many domestic industries, including mining, on large international financial and industrial groups[9].

In the conditions of foreign policy instability and severe financial constraints, there is a significant reduction in the volume of investment in new fields, enterprises abandon many promising projects, the terms of the implemented development programs are shifted.

For example, the commissioning of the Natalka mining and processing plant in the Magadan region by Polyus Gold was postponed from 2015 to 2017. Due to financial difficulties, the company had to revise the scenarios for the development of the project and attract new partners for its implementation.

Postponed commissioning of steel rolling plant of the company «Nonelectrical» from 2015 to 2016[8]. The shift in terms was associated with the problems of attracting credit resources from abroad.

After the introduction of sanctions, the average minimum Bank loan rate reached 13.9% per annum. This is the highest figure since mid-2010. However, rates were not raised for all industries. In particular, a number of metallurgical enterprises managed to achieve relatively favorable credit conditions.

The overall indicator of credit availability for industrial enterprises has decreased. In particular, in 2015, 27% of the surveyed heads of mining enterprises noted that the current availability of credit for them is below the norm[8].

In recent years, the situation is extremely unstable in Russia's largest coking coal company – Mechel. Approximately 20 per cent of its debt is owed by foreign banks. Sanctions restrictions against Russia have caused this company serious problems with access to sources of funding. The shortage of working capital has led to the fact that in 2014 coal production by Mechel decreased by 17% compared to 2013 – to 17 million tons, steel production – by 13% – to 3.18 million tons. The production of electric steel at Izhstal and Chelyabinsk metallurgical combine was stopped (Mechel announced the termination of production of low-margin products at these enterprises). In addition, the company's revenues decreased due to the sale of the Mechel Service global sales network[8].

The volume of coal production in 2015 fell due to the shutdown of Mechel Bluestone (USA) and a 15% reduction in production by South Kuzbass (Kemerovo region) due to a shortage of working capital. Mechel's debt during this period was approximately $ 8 billion. However, the total volume of coal production at Russian Mechel enterprises increased by 5% due to domestic supplies and exports. Almost all divisions of the company are currently profitable, despite the unfavorable price environment in the coal, ore and steel markets (Fig. 22.2).

Despite the fact that the sanctions have significantly complicated the conduct of business in the mining industry, it can be stated that in recent years there has been no significant decrease in the capitalization of most companies in the industry in rubles, in foreign reserve currency capitalization has decreased. In terms of imports of mining products, Europe remains the largest foreign trade partner of Russia.

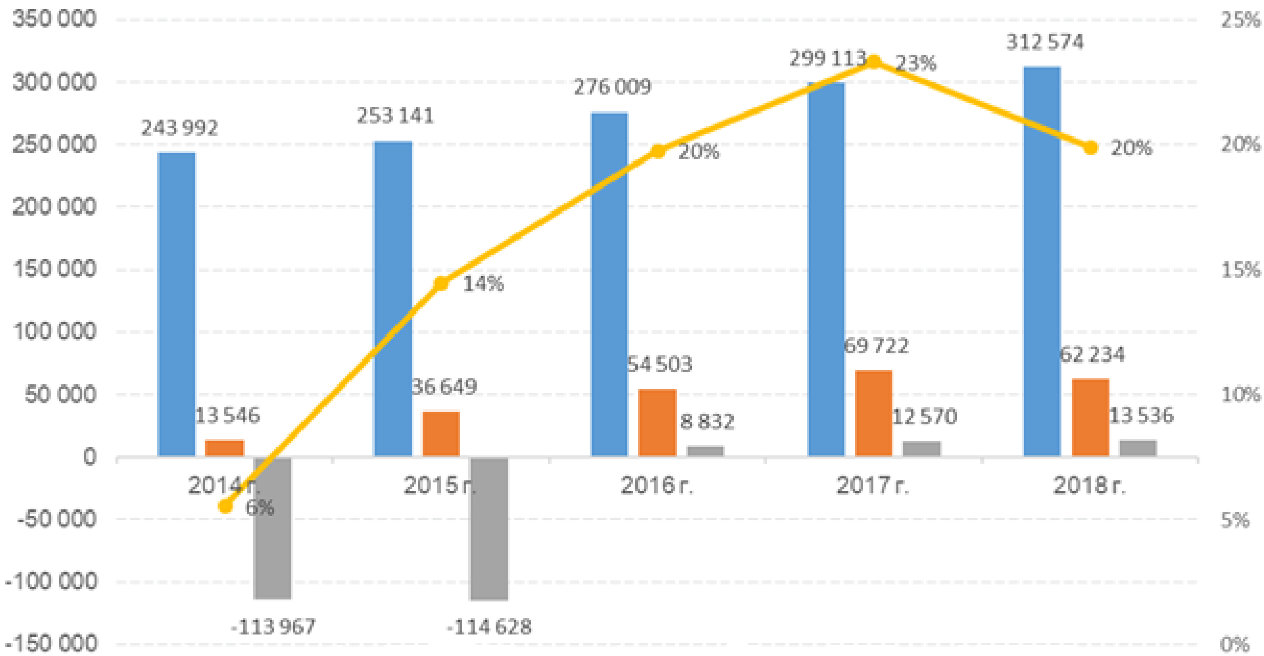

Fig 22.1. Financial results, «Mechel», mln. [7]

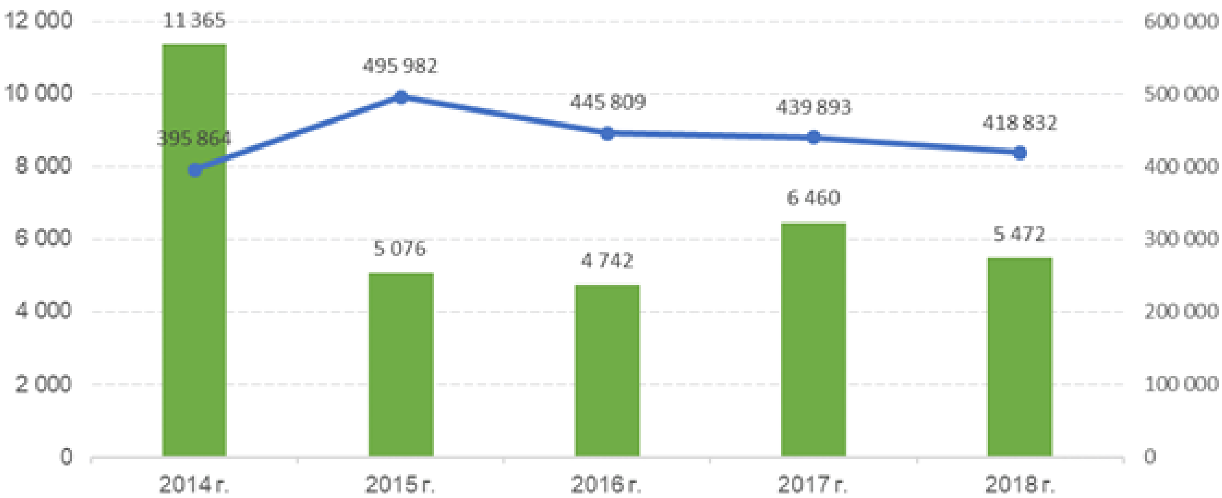

Fig. 22.2. Debt vs Mechel investments, mln RUB[7]

For example, deliveries to the EU in 2018 amounted to 55% of Norilsk Nickel's revenue and 15% of Severstal's revenue. The industry is to some extent dependent on the supply in the United States: the impact of sanctions on Russian exports. On the other hand, prices of mining products are rising due to restrictions. Thus, the decline in supplies in kind is offset by rising prices.

Certain problems exist in the field of equipment and technology procurement. However, in recent years, the Russian mining company pereorientirovanija on Chinese manufacturers that make up a strong competition to the US and the EU. In addition, the majority of suppliers from the European Union continues to cooperate with Russian enterprises, fearing the final loss of a capacious market. In the long term, it is possible to predict the effect of import substitution programs implemented in Russia in the field of equipment production and saturation of the market with domestic equipment.

Adaptation of most domestic mining companies to the terms of the sanctions was to search for new promising niches for business optimization expenses (in particular, reduction of staff, automation due to the cheap IT solutions and better management of the chain of formation of cost) and decommissioning work (preservation or sale) of ineffective divisions, assets. A measure such as reducing or expanding the range of products is relatively rare. We can make a preliminary conclusion that the majority of domestic mining enterprises adhere to the anti-crisis strategy such as «stop and wait» (pit-stop) – concentrate on the anchor business (product), in the mining industry it is ore and primary processing.

In recent years, as a rule, the scale of innovative activity of companies has been reduced. For example, in large mining enterprises in 2015-2018 there was a decrease in R & d costs. In such a situation, we can expect that innovation activity will be focused on cost optimization, rather than on improving the efficiency of the business as a whole and the production of new products. Many companies are reducing planned investment in development and diversification and are concentrating on key markets and segments. However, it is impossible to consider such a strategy effective: in the last few years, the best results were achieved by enterprises that actively introduced new business models, invested in strategic assets, developed new markets and certain promising niches. For example, Severstal actively invests in startups and venture funds. To date, the company has already invested several million dollars in funds Chrysalix

Robo Valley and Pangea Ventures[2]. With the help of these funds, Severstal was able to investigate the effectiveness of various business models and technologies in the early stages. First of all, the company is interested in technologies in the field of energy, smart materials, automation, as well as additive and digital technologies.

In January 2018, the owner of Severstal PJSC Alexey Mordashov was included by the US authorities in the so-called Kremlin report containing a list of persons close to the President of the Russian Federation, against whom sanctions restrictions may be applied in the future. Political risks did not have a significant impact on the company's operations. Severstal presented investors with a new large-scale strategy with a five-year planning horizon. During this period, the company intends to double the investment program to $ 1.4 billion. without reducing dividends and without resorting to large loans[2].

Among the most important priorities of PJSC Severstal are changes in the management structure. Outsourcing plays a key role in this process. In the last few years, the gold mining division Nord Gold has acted as its main object. The share of this company, which ranks third in the country in terms of gold production, in the total revenue of Severstal reached 20%[10]. Thus, «Nord Gold» was, in fact, a hedge division for the main profile direction (ferrous metallurgy). To date, Severstal has finally separated this division from its structure, and all resource divisions within Severstal have focused exclusively on the extraction of iron ore and coal.

We note such a significant direction of Severstal's anti-crisis policy as structuring of foreign assets. In particular, in 2014, the company finally withdrew production from the United States (were sold plants «Severstal Columbus» and «Severstal Dearbom», and received income of more than $ 2 billion.). At the same time, the company implemented in Balakovo a technological project for the production of small long products with a capacity of 1 million tons and an approximate cost of $ 600 million. However, the company did not close its important raw material projects, such as the operation of the Putu iron ore Deposit in Liberia [10]. Such a strategy as getting rid of foreign assets that are difficult to manage and are at risk of sanctions (sale of assets in the US), as well as the separation of assets (in fact, turning into a foreign organization with appropriate management and business principles), strongly dependent on sales in foreign markets – this is one of the correct scenarios for responding to emerging risks. The example of RUSAL Oleg Deripaska's situation and the blocking of the company's operations from abroad proves that the actions to remove the current Russian shareholders from the operational management of the mining companies are correct and protect the current cash flow and business of the companies.

Currently, annual investments of JSC «Severstal» exceeds 50 billion rubles, including about 20 billion rubles is directed to technical re-equipment and modernization of production facilities. A research and design center in Cherepovets has been formed, the work of which is focused on the development of metallurgical production, in particular, on the production of new high-quality steel grades.

Another mining and metallurgical company MMK has been working with a group of mathematical modeling and system-analytical studies for three years. This group has developed and implemented several models based on big data technologies and artificial neural networks. So far, they are aimed at optimizing the work with raw materials and the first processing, which is significant in terms of obtaining a potential economic effect. The contribution of the first conversion to the cost of steel products is about 80%. For example, a model for optimizing the supply and consumption of coal raw materials is working successfully. It predicts how much raw materials should be supplied to the enterprise, what kind of raw materials should be of the composition in order to eventually get the required quality coke. In 2018, the plant has saved more than 500 million rubles due to the use of this model. The model has been working in the company since February 2017 and is MMK's own development. It is based on the analysis of data of coke and blast furnace production since 2011. The model calculates the optimal quantity, quality and cost of coal according to the characteristics of the coke produced from this raw material. A similar model has been developed to manage the supply of iron ore and iron production. [15] This is an example of how companies in the mineral sector, where it would seem that much has been optimized and honed over decades of work, find applications to innovations and IT solutions and effectively implement them.

The anti-crisis strategy of the above-mentioned Mechel company, which was on the verge of bankruptcy in 2014-2016, is of interest. To date, the company has been able to restructure a large debt – syndicated loan of $ 1 billion. before a group of foreign banks – and stabilize their financial condition. The company relies on point investments in the most promising projects. The main points of growth of PJSC Mechel are the universal rail mill and the Elga field (Yakutia) with reserves of 2.2 billion tons of coking coal[11]. To raise the necessary funds, the company issues Eurobonds, bonds, and other financial instruments.

In 2018, Mechel produced 4.3 million tons of coal on Elga, which brought the company about 4.5 billion rubles of operating profit. Currently, the main share of coal is supplied to the domestic market. However, not so long ago started shipping for export. In the conditions of tense relations between our country and the West, the company focuses primarily on the Asian market. In particular, a significant amount of supply of thermal coal falls on the Chinese company Jidong Cement. Also, coking concentrate is shipped for export – more than 400 thousand tons have already been delivered[11].

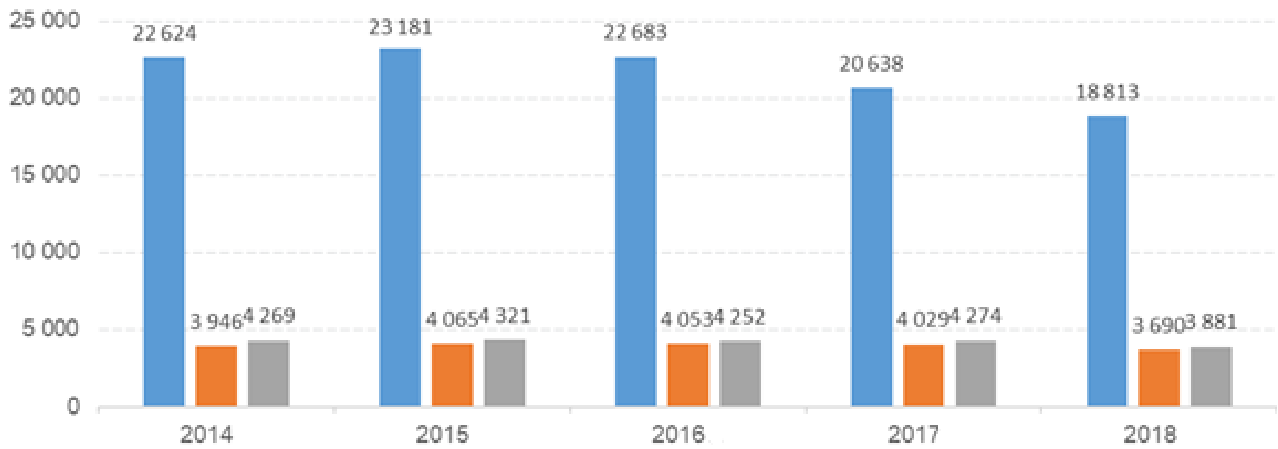

Fig 22.3. Production results of Mechel, thousand tons.[7]

A project to upgrade stainless steel production facilities at the Chelyabinsk metallurgical plant is under development. Now this type of steel is mostly imported. Thus, this project is also a promising point of growth. The company is considering the application of the best technologies and best practices available in the world. Active negotiations with several equipment manufacturers are underway. In addition, it is planned to increase production at the «southern Kuzbass». Mechel has licenses that are currently not in the active development phase.

In recent years, in the reports of PJSC Mechel, political tensions and sanctions, which may affect the company's ability to attract financing, have been singled out as a separate risk. However, Mechel does not plan to stop offering its shares on the new York stock exchange[11]. This decision is rational, primarily because the listing on this exchange is an indicator for the financial community that corporate governance in the company is organized at a high level. Leaving the new York stock exchange would have a negative impact on the company's valuation.

In April 2018, the United States introduced another package of sanctions against Russia, in particular, made the «black list» (SDN-list) O. Deripaska and controlled him «RUSAL», «Basic element», En+ Group and «GAZ Group». Entering into this list means that the assets of the company or an individual are blocked in the United States, and American citizens are prohibited to maintain any business relationship with the person involved in the list, including transactions with equity and debt instruments[4].

As part of the anti-crisis strategy, from the very beginning, representatives of Deripaska companies held talks with the us Government on options for removing enterprises from sanctions. As a result, Deripaska agreed to reduce its share in energy-metallurgical En+ from about 70% to 44.95%. In addition, Deripaska has less than 35% of the voting shares of En+[5]. Companies have made changes to their management structure. New members of the Board of Directors of the companies, half were to consist of citizens of the US and the UK. The heads of the companies were dismissed, and the companies themselves, under the terms of the agreement, should work on conditions of maximum transparency.

Deripaska himself remained in the sanctions list. The businessman's assets, in which he owns 50% or more, remained blocked in the United States.

Thus, the structures of O. Deripaska were able to achieve the transformation of the management system and ownership structure, which allowed to escape from sanctions and normalize economic activity. However, the transformation had a negative impact on the national security of Russia, as control over one of the strategic sectors actually passed to the United States.

According to the results of the analysis of the activities of Russian mining companies in the conditions of sanctions risks, several groups of anti-crisis strategies implemented by them can be identified:

1. Protective strategy of diversification (JSC «Severstal», JSC «NLMK», JSC «MMK»): improvement of efficiency of innovative activities, expansion of the product line, improving product quality and export supplies, investment in development of production capacities.

2. Rational diversification strategy (PJSC RUSAL): reduction of personnel, optimization of working capital use, improvement of product quality, focus on sales of products in the domestic market, increase of

equipment productivity (in particular, optimization of capacity utilization schedule), increase of corporate governance efficiency.

3. Strategy of moderate product diversification (PJSC MMC Norilsk Nickel): development of own divisions, increase of stability in labor collectives, modernization of production facilities, reduction of costs and increase of production volumes, closing of units with low profitability.

4. Conservative rationalization strategy (Mechel PJSC): decrease in investment volumes, increase in the company's capitalization, decrease in the share of borrowed funds in the capital structure, focus on the most profitable markets.

5. Strategy of joint-stock transparency and independence (PJSC RUSAL, PJSC Severstal, PJSC MMC Norilsk Nickel): reducing the degree of influence of the majority shareholder in the operating activities of companies (primarily mineral resources segment) exposed to the risk of sanctions and political impact and thereby reducing the risk of negative impact on cash flow.

Thus, in the conditions of sanctions pressure, the majority of Russian mining companies implementing the «reduction strategy». This is especially true in the short term. The introduction of foreign economic restrictions and the government's policy of import substitution have encouraged companies in the industry to review their asset portfolios and focus on core production capacities, as well as to reduce operating costs and sell non-core assets. At the same time, the decline in investment and the release of assets hamper the long-term development of mining companies.

The authors believe that in the current situation, the so-called «investment strategies», which involve investment in innovation and diversification, will be more effective for mining companies. Crisis phenomena should be considered as an opportunity for strategic business transformation.

Companies should keep their operating costs at the same level in order to take advantage of all market opportunities arising from sanctions, and to ensure their competitive advantage in the future, after the lifting of restrictions.

Mining companies should invest in the following areas:

– investments in marketing activities: research of changes in market conditions and the formation of optimal product offerings, as well as the search for new promising foreign markets (mainly Asian);

– investing in digital technology and digitalizing operations to optimize business processes;

– investing in the formation of new and optimization of existing supply chains in order to maximize the satisfaction of foreign customers and reduce logistics costs;

– investments in human capital and personnel motivation system;

– investments in improving the efficiency of corporate governance (interaction with investors).

Under the sanctions, mining companies should pay maximum attention to domestic reserves, which will make it possible to reduce dependence on global financial markets and minimize external risks. Such reserves include:

– long-term reserves – increase business efficiency in the future by using pre-formed competitive advantages without significant transformation of these advantages;

– stabilization reserves – use of existing competitive advantages and available resources to maintain a stable production activity of the company at the current level without significant changes;

– advanced reserves – focus on improving the efficiency of economic activities by strengthening existing ones, as well as obtaining new strategic advantages.

The authors believe that the main internal reserves of Russian mining companies are: quality, information, financial, innovative and resource (table. 1).

Table 22.1. Use of internal reserves of mining companies in the conditions of sanctions

Problems of development of mining companies under sanctions	**Internal reserve**	**Characteristic**
Complication of access to external funding	Financial Resource	• financing under state programs; • obtaining preferential loans; • financing from profit.
Restrictions on the supply of technological equipment	Resource	• go to the Russian and Chinese counterparts.

Reduction in demand	Informational Quality Financial	• introduction of advanced product quality management systems; • process optimization; • in-depth market research of market demand; • reducing production costs (e.g. by Contracting with domestic or Asian suppliers of machinery and materials).
Outdated production and management technologies	Innovative	• purchase of innovative companies and startups; • increased investment in R & d; modernization of production capacity.
Break of previously formed partnerships	Resource	• search for new partners in Asian countries.

Effective development of mining companies in the current situation involves the development of several promising scenarios, taking into account both the possible reduction and increase of sanctions risks.

In order to adapt to dynamically changing foreign policy and foreign economic conditions, it is advisable for mining companies to adopt and implement multi-stage programs using the real options method, which takes into account the possibility of changing conditions and choices. Using this approach will provide flexibility, consistency and continuity of organizational, economic and technical measures, a rapid transition to more effective programs, taking into account changes in internal or external factors. In table. 2 the authors offer examples of such programs.

Table 22.2. Anti-crisis programs for mining companies

Optimization area	Strategic program
1. The increase in volumes of extraction of mineral raw materials	
Development of new fields.	Investing in new production facilities.
Minimization of losses in the production process.	The introduction of new production technologies..
2. Increased production of end products	
The increase of the coefficient of extraction of mineral raw materials (of KIMS).	Construction of new, as well as reconstruction and modernization and enrichment, metallurgical and chemical production facilities.

Increasing the recovery rate and increasing the number of finished products due to new assets.	Purchase of new production assets (companies).
Increase in production of final products at the expense of KIMS.	Development of man-made subsoil plots.
3. Reduced production costs	
Business combination.	Related diversification through mergers and acquisitions.
Optimization of management structure and production processes.	Implementation of organizational innovations, outsourcing of management technologies.
Innovative activity in the sphere of production technologies.	Introduction of new equipment and technological modes at all production stages.
Automation of production and management.	Introduction of domestic automation systems.
4. Pricing management	
Implementation of management innovations (including marketing), optimization of pricing at all levels.	Conclusion of long-term contracts. Discounts for volume and loyalty, transfer pricing. The formation of centers of financial responsibility.

Mining companies need to be flexible, adequately assess changes in market conditions, be able to acquire promising assets in a timely manner and get rid of unprofitable divisions. Flexibility and responsiveness to changes in the external environment are key success factors in the face of uncertainty and risk.

Companies need to increase innovation activity. This applies to all types of innovation (process, product, management, etc.). According to the author, the use of the open innovation model (flexible policy on R & d and intellectual property) will contribute to the achievement of maximum freedom in the exchange of knowledge and the formation of sustainable links between the various elements of the management system.

Thus, in order to successfully adapt to the sanctions restrictions, Russian mining companies must introduce new business models and management technologies, invest in innovative activities. Innovations should be aimed at increasing the volume of mining, reducing production waste, optimizing the processes of enrichment of raw materials, chemical and metallurgical production. The mining industry is dominated by large vertically integrated companies that have significant resource potential for innovation. Nevertheless, the main problem for relatively small companies in the industry is the lack of investment resources, which arose due to the complication of access to Western financial markets. A decisive role in stimulating investment processes can be played by the state, which has a share in the capital of the largest domestic banks. The authors believe that investment should be considered as a driver of innovative development, and not as a subsidy to enterprises that adhere to outdated management models.

To minimize the risk of sanctions must be combined strategy of cost optimization and innovation strategy. Cost reduction should come at the expense of innovative project and research activities. With this approach, companies will be able to fully use the opportunities that open up to business during the foreign policy crisis.

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