Management of process control in innovative projects

Chapter 11
Risk management in the processes of controllability of the innovation project

Lecturer: doc. Polishchuk Volodymyr, DrSc.

Lecture content

- The concept of risk and uncertainty
- Classification of risks of innovative projects
- Risk management planning
- Analysis of project risks
- Planning of risk response measures

01

The concept of risk and uncertainty

Risk is organically linked to decision-making. Decisions are made in conditions of certainty (the outcome of the decision is known), risk (there is a certain probability that the event will occur, and some assessment can be made), uncertainty (the probability and consequences of the event cannot be predicted).

Decision-making processes for project management take place in conditions of uncertainty, this is under the influence of factors: incomplete knowledge of the situation, the presence of chance, the presence of force majeure. Thus, the project is implemented in conditions of uncertainty and risk. These two categories are interrelated.

Definition 1. Uncertainty of project activity is incomplete or inaccurate information about the conditions of the project, including related costs and results.

Sources of uncertainty are:

- stochastic nature of processes occurring in economic activity and society;
- lack of information needed to justify and make project decisions;
- the influence of subjective factors on decision-making (level of qualification of performers, their psychological state, conscious concealment of information, etc.).

All aspects of life and entrepreneurship are associated with risks. In general, the risk reflects the lack of our knowledge of future events. At the same time, we call favorable events opportunities, and unfavorable - threats.

Definition 2. Risk is the possibility or threat of deviation of the results of specific actions from those expected.

We offer stages of risk management in the process of assessing the level of implementation of an innovative project.

1. Formation of the list of risk factors:

- setting goals and objectives for identifying risk-oriented factors of influence;
- identification of risk-oriented factors of influence;
- analysis of risk-oriented factors of influence.

The first stage is to understand the specificity of the threat and the place of its possible manifestation.

Under the identification and analysis of risks means the study of its specifics and features, which are due to their nature and other features characteristic of this occasion. It is important to study future losses, as well as changes in risks over time, the degree of threat to a particular period.

2. Construction of models for risk assessment of an innovative project

The main purpose of this stage is to study and develop tools that will assess risk factors in project activities, as well as to study their negative impact on the controllability of complex systems.

3. Analysis, selection, and decision-making to reduce the threat of risk-oriented factors:

- choice of risk management strategy and tactics;
- selection of a program of action (scenario) for risk reduction;
- decision-making and organization of the developed program.

At this stage, the decision maker forms and selects an individual approach to the risk of a complex system. The need for this selection procedure is related to the different effectiveness of risk management methods and the different amount of resources required for their implementation. When choosing a risk and the method of its management, you should always take into account resource constraints and try to optimize their losses. To assess all resources can be summarized in one scale - financial.

Definition 3. Project risks are a set of risks that threaten the implementation of an innovative project or may reduce its effectiveness (commercial, economic, budgetary, social, environmental, etc.); the set of circumstances under which the probability of completion of the project objectives is reduced or eliminated; the set of risks that threaten the economic efficiency of the project, which is expressed in the negative impact of various factors on cash flows.

Risk has three main attributes:

1) a case involving risk;
2) probability;
3) consequence (action of risk).

The importance of risk is an indicator that can be used in the decision-making process and as a mechanism for risk control in the project:

$$VR = A * p, \qquad (1)$$

Where: VR - the importance of risk; A - threat (consequence, action) of risk (adverse event); p - the probability of its occurrence.

The probability of risk is a measure of the possibility that the consequence (action) of the risk will actually occur.

The probability of an event is the ratio of the number of cases of favorable outcomes to the total number of all possible outcomes.

The probability of occurrence of an event can be determined by an objective or subjective method.

Definition 4. Risk threat is a measure of the severity of adverse effects, the level of damage, or an assessment of potential opportunities associated with risk.

There are several types of cases that involve risk for an innovation project:

1. Cases that may occur.
2. Cases that will have major consequences if they occur.
3. Cases beyond your control.
4. Cases you know very little about.

Occurrence and types of risks at different stages of the life cycle of an innovation project

Pre-investment

- Error in developing the project concept
- Incorrect location of the project
- Attitude towards the local government project
- Deciding on the feasibility of investing

Investment

- Solvency of the customer
- Contingencies for construction work
- Exceeding construction deadlines, cost of equipment
- Late delivery of equipment
- Non-fulfillment of contractual obligations by contractors
- Untimely staff training

Operational

- Emergence of an alternative product (service)
- Insolvency of consumers
- Incorrectly defined volume and market segment in which the project product is sold
- Change in prices for raw materials, transportation; salary
- Changing the cost of capital and inflation
- Threat to environmental security
- Changing the attitude of the population to the project implementation

There are two types of risks associated with project preparation and implementation: systematic and non-systematic.

Systematic risk refers to factors external to the project, such as the state of the economy as a whole, and is beyond the overall control of the project. Examples of systemic risk are political instability, tax conditions, and factors related to government action. Other types of systematic risk reflect the influence of competitive factors, such as general market demand, the level of competition, commodity prices and labor in the industry. These factors need to be considered because the project is too small to change these factors.

Unsystematic risk - directly related to the project.

The level of profitability of production, the period of the beginning of development and the development process itself, the cost of fixed capital and productivity - all these are types of non-systematic risk. Other types of non-systematic risk include external factors that can be controlled or influenced within the project. These are project team salaries, project sales prices, raw material supplier prices, and even government taxes, such as customs and excise duties, and other taxes.

Innovation risk is the probability of losses that arise when an entrepreneurial firm invests in the production of new goods (services), which may not find the expected demand in the market.

The so-called risks of the micro-environment to which they belong can have a significant impact on the company's innovative projects:

- organizational risks (ineffective strategy of innovative activity of the enterprise, poor organization of divisions engaged in innovative developments, etc.);
- marketing risks (ineffective selection of appropriate marketing strategies to promote and implement innovations);
- product risks (inefficient selection of relevant technologies, resource suppliers, contractors, etc.);
- financial risks (lack of funds needed for the implementation of innovative projects, deterioration of the financial condition of the enterprise, etc.);
- risks of personnel management (inability of full-time employees of the enterprise to independently implement an innovative project, etc.).

In theory and practice, the most common methods of responding to risks are:

- avoidance of innovation risks, most often by eliminating the cause of such risks (for example, acquisition of property rights for ready-made innovative developments, involvement of a qualified contractor in the implementation of an innovation project, etc.);
- acceptance of innovation risks, which can be both passive (when consciously accept those risks that have a low level of negative impact on the implementation of the innovation project) and active (when developing an action plan in case of risks threatening the innovation project);
- optimization (reduction) of the degree of innovation risks (for example, through the creation of appropriate reserves, risk insurance, etc.).

02

Classification of risks of innovative projects

By the nature of the action, risks are divided into static (pure) and dynamic (speculative).

Static risks are the risks of loss of real assets as a result of loss of property, as well as loss of income due to the incapacity of the entity.

They always carry losses. Depending on the cause of losses, statistical risks are divided into the following groups:

- probable losses as a result of negative impact on the assets of the firm of natural disasters;
- probable losses as a result of criminal acts;
- probable losses due to the adoption of unfavorable legislation for the business firm;
- probable losses as a result of a threat to the property of third parties, which leads to the forced termination of the main supplier or consumer;
- losses due to death or incapacity of key employees of the firm or the main owner of the business firm.

Dynamic risk is the risk of unforeseen changes in the value of fixed capital due to management decisions or unforeseen changes in market or political circumstances.

It carries either losses or profits. It is difficult to manage. These include various types of political risks, economic risks, industry risks.

In **terms** of validity, **retrospective** risks (related to decisions made in the past but implemented now), **current** (related to current activities, changing under the influence of ongoing risk factors), **prospective** (related to possible changes in operating conditions) are **considered** subject to risk today, which may change the risk situation in the future).

Political and economic risks are considered according to the factors of origin.

Political risks are related to the instability of the state system, the activities of government agencies, ethnic and regional problems, the polarization of interests of social groups and more.

Economic risks are caused by adverse changes in the economic activity of the enterprise, country, market conditions, levels of government and more.

Commercial risk is the risk that arises in the process of selling goods and services made or purchased by an entrepreneur. The main causes of commercial risk:

1. reduction of sales due to falling demand (needs) for goods sold by the enterprise, displacing it by competing goods, the introduction of restrictions on sales;

2. increasing the purchase price of goods in the process of implementing a business project;

3. unforeseen reduction in the volume of procurement compared to the planned, which reduces the scale of the entire operation and increases the cost per unit volume of goods sold (due to relatively fixed costs);

4. loss of goods;

5. loss of quality of goods in the process of rotation (transportation, storage), which leads to a decrease in its price;

6. increase in the cost of turnover in comparison with the planned as a result of payment of fines, unforeseen deductions, which leads to a decrease in profits.

Commercial risk includes the following types:

1. risks associated with the sale of goods (services) on the market;
2. risks associated with the transportation of goods (transport);
3. risks associated with the acceptance of goods (services) by the buyer;
4. risks associated with the solvency of the buyer;
5. risks associated with force majeure.

According to the structural feature, commercial risks are divided into property, production, and trade.

Property risks are risks related to the probability of loss of entrepreneur's property due to theft, sabotage, over strain of technical and technological systems, etc.

Trade risks are risks associated with loss due to late payment, refusal to pay during the transportation of goods, non-delivery of goods, etc.

Transport risk should be singled out. Currently, transport risks are classified according to the degree of responsibility into four groups: E, F, C, D. For example, group E includes a situation where the supplier (seller) keeps the goods in their own warehouses (Ex Works). The risk is assumed by the supplier until the acceptance of the goods by the buyer. The risk of transportation from the seller's premises to the end point is already accepted by the buyer. Group C includes situations where the exporter, the seller, enters into a contract with the buyer for transportation, but do not assume any risk. The last group of terms - D means that all transport risks fall on the seller.

Production risks - risks associated with losses from cessation of production due to various factors and, above all, with the loss or damage to fixed and working capital (equipment, raw materials, transport, etc.), as well as risks associated with the introduction into production of new equipment and technology.

The main causes of industrial risk are:

1. reduction of the planned volumes of production and sales due to reduced productivity, equipment downtime, loss of working time, lack of the required amount of raw materials, increased percentage of shortage of products;
2. reduction of prices at which it was planned to sell products (services) in connection with its insufficient quality, adverse changes in market conditions, increasing demand;
3. increase in material costs due to overconsumption of materials, raw materials, fuel, energy, as well as due to increased transport costs, trade costs, overheads, and other additional costs;
4. growth of the wage bill due to exceeding the planned number of payments higher than planned, the level of wages to individual workers;
5. increase in tax payments and other deductions of the enterprise;
6. low discipline of supply, interruptions with fuel and electricity;
7. physical and moral wear of equipment.

Production risks - risks associated with losses from cessation of production due to various factors and, above all, with the loss or damage to fixed and working capital (equipment, raw materials, transport, etc.), as well as risks associated with the introduction into production of new equipment and technology.

The main causes of industrial risk are:

1. reduction of the planned volumes of production and sales due to reduced productivity, equipment downtime, loss of working time, lack of the required amount of raw materials, increased percentage of shortage of products;
2. reduction of prices at which it was planned to sell products (services) in connection with its insufficient quality, adverse changes in market conditions, increasing demand;

3. increase in material costs due to overconsumption of materials, raw materials, fuel, energy, as well as due to increased transport costs, trade costs, overheads, and other additional costs;
4. growth of the wage bill due to exceeding the planned number of payments higher than planned, the level of wages to individual workers;
5. increase in tax payments and other deductions of the enterprise;
6. low discipline of supply, interruptions with fuel and electricity;
7. physical and moral wear of equipment.

Financial risk is the risk that arises in the course of financial business or financial transactions, based on the fact that in financial business in the role of goods is either currency, or securities or funds.

Financial risks include:

1. currency risk,
2. credit risk,
3. investment risk.

Currency risk is the probability of financial loss as a result of exchange rates in the period between changes in exchange rates in the period between changes in the contract with individuals and production and production on it. The exchange rate, which is set taking into account the purchasing power of currencies, is very volatile.

03

Risk management planning

Project risks need to be managed. Risk management - a set of methods for analyzing and neutralizing risk factors. Risk management is a subsystem of project management.

Definition 5. Risk management is the processes associated with the identification, analysis of risks and decision-making, which include maximizing the positive and minimizing the negative consequences of risk events; includes processes related to risk management planning, identification and analysis, risk response, and risk control and management within the project.

The purpose of project risk management is to reduce the likelihood of adverse events and increase the manageability of the project implementation process.

According to the PMBOK, the following project risk management processes are distinguished:

1. **Risk management planning** - selection of approaches and planning of project risk management activities.
2. **Risk identification** - identifying risks that may affect the project and documenting the characteristics of these risks.
3. **Qualitative risk analysis** - the process of prioritizing risks for further analysis or action, which is performed by assessing and comparing their impact and probability of occurrence.
4. **Quantitative risk analysis** - the process of numerical analysis of the impact of identified risks on the objectives of the project as a whole.

5. **Risk response planning** - development of possible options and actions that help increase opportunities and reduce threats to achieve project objectives.
6. **Risk monitoring and control** - risk monitoring, identification of remaining risks, implementation of the project risk management plan and evaluation of the effectiveness of risk minimization actions.

Definition 6. Risk management planning is the decision-making process for applying and planning risk management for a specific project.

04

Analysis of project risks

Definition 7. Risk assessment is a regular procedure of risk analysis, identification of sources of its occurrence, determination of possible scales of consequences of manifestation of risk factors.

Definition 8. Risk analysis - procedures for identifying risk factors and assessing their significance, in essence, analyzing the likelihood that certain adverse events will occur and adversely affect the achievement of project objectives.

The purpose of the risk analysis is to provide potential partners or project participants with the necessary data to decide on the appropriateness of participation in the project and measures to protect them from possible financial losses. Therefore, the analysis can be conducted by each project participant.

There are the following types of risk analysis:

- qualitative - determination of risk indicators, stages of work at which risk arises, identification of potential risk areas and risk identification;
- quantitative - involves the numerical determination of the size of individual risks, as well as the project as a whole.

Qualitative analysis of project risks

Definition 9. Qualitative risk analysis is the process of presenting a qualitative analysis of risk identification and identification of risks that require rapid response. This risk assessment determines the importance of the risk and chooses how to respond. The availability of supporting information makes it easier to prioritize different risk categories.

The task of qualitative risk analysis is:

- identification and identification of possible types of risks;
- study of the causes of identified risks and the consequences of their actions;
- establishing potential limits for certain types of risks;
- providing a cost estimate of possible losses from the manifestation of risks;
- developing a system of measures to reduce and avoid risks.

Qualitative risk assessment methods:

1) Classification
2) Expert approach to risk analysis and assessment
3) Assessment of threshold levels

Expert risk analysis is used in the initial stages of work if the amount of initial information is insufficient to quantify the effectiveness and risks. The advantages of expert risk analysis are: no need for accurate source data and expensive software, the ability to evaluate before calculating the effectiveness, as well as ease of calculation. The main shortcomings include: difficulties in attracting independent experts and subjectivity of assessments.

The main results of qualitative risk analysis are:

1. Ranking of the general risk of the project. Risk ranking may mean that the overall risk of a project relative to other projects may be high or low. You can compare the risks of different projects in relation to each other.
2. List of risks by priority. Risks can be broken down by priority, by different number of criteria. This includes a rating: high, low, medium, or level of the hierarchical structure of works.
3. Risk list for additional analysis and management. Risks that fall into the high or medium category should be the main candidates for further analysis, including quantitative risk analysis, and for further risk management actions.
4. Trends in the results of qualitative risk analysis. At repetition of the analysis, the tendency - a trend in results of the analysis is shown. This trend can make risk responses or further analysis more or less urgent and important.

Quantitative analysis of project risks

Definition 10. Quantitative analysis of risks determines the probability of their occurrence and the impact of risks on the project, which helps the project management team to make the right decisions and avoid uncertainties.

Quantitative analysis identifies individual risks and the risk of the project as a whole in specific numerical indicators.

Quantitative analysis of project risks involves:

- selection of a system of indicators for risk assessment;
- substantiation and choice of methods for quantitative risk assessment;
- formation of an information base for quantitative risk analysis;
- construction of economic and mathematical models for evaluating alternative solutions;
- selection of a subset of priority (effective, optimal) solutions.

The main results of quantitative risk analysis are:

1. List of quantitative risks by priority. The list includes the risks that pose the highest threat, or represents the highest opportunity for the project, together with the extent of their impact (consequences).
2. Probable analysis of the project. This is a forecast of the potential project schedule and cost results (lists possible project completion dates or durations and costs with associated confidence levels).
3. The probability of achieving goals in cost and time. The likelihood of achieving project objectives under the current plan and with current knowledge of risks can be assessed using quantitative risk analysis.
4. Trends in the results of quantitative risk analysis. If the analysis is repeated during the project, then there is a sufficient amount of information in which there is a general trend, it can be used to make aggressive or less aggressive management decisions.

05

Planning of risk response measures

Definition 11. Risk response planning is the identification of steps that need to be taken to reduce threats and mitigate their negative effects.

Planning involves identifying and categorizing each risk. The effectiveness of response design directly determines whether the impact of risk on the project will be positive or negative.

The risk response plan contains a detailed description of the response measures to all identified risks and may include the following sections and documents:

- list of risks and opportunities of the project, their description, reasons, and degree of impact of risks on the project;

- risk owners and division of responsibilities;
- results of qualitative and quantitative risk assessment;
- choice of response measures (avoid, transfer, minimize or accept) for each type of risk;
- the level of risk (probability and impact) that is expected to be achieved through the application of the strategy;
- specific actions within the implementation of the chosen strategy;
- budget and response time;
- plan in case of adverse circumstances, neutralization plan, anti-crisis plan.

In practice, there are traditionally four methods of reducing risk:

1. **Avoidance** - simply avoiding activities or circumstances that involve risk, changing the project plan to eliminate the risk or eliminate its impact on the objectives and results of the project;
2. **Acceptance** is the preservation of responsibility for risk, willingness, and ability to cover all possible losses at their own expense, reserves are formed to cover possible losses;
3. **Transfer** - transfer of responsibility for the risk to the other party;
4. **Minimization** - carrying out own special measures to limit the amount of risk, creating special risk prevention systems.

Risk avoidance means simply avoiding project activities in cases where:

- project participants are unable to reimburse losses from the manifestation of risk;
- risks are dangerous in man-made and social terms (no matter how high the yield they predict);
- failure to regulate one type of risk is not accompanied by the emergence of other risks that are characterized by high levels.

Examples of risk avoidance are refusal to participate in excessively risky projects, refusal to cooperate with unreliable partners, and so on.

It is worth noting that risk avoidance is not always considered the optimal strategy for risk management, as for the most part the current refusal to make risky decisions may be due to untapped opportunities in the future. Risk aversion should be approached carefully because the possible positive results of activities in risky situations can significantly exceed the losses.

Acceptance (preservation) of risk is the refusal of actions and corresponding decisions aimed at reducing losses that may occur in the event of adverse situations. Responsibility for possible losses from risks rests with the risk manager. At the same time, taking responsibility, the latter must be convinced that the probability and magnitude of losses are insignificant in terms of achieving the objectives of the entity or is able to effectively cover losses (through loans and borrowings, government subsidies to compensate for losses, creation of reserve funds).

Acceptance of risk as an agreement in principle to indemnify on one's own is conditioned by two circumstances: risks are inevitable; risks are the potential for potential returns.

Different methods of protection are used to implement these methods. In management practice, the following are distinguished:

1. Distribution of risk between project participants (transfer of part of the risk to co-contractors).
2. Reservation of funds to cover contingencies.
3. Insurance.
4. Hedging.
5. Diversification.

Risk allocation occurs during the development of the project financial plan and contract documents. At the same time, project participants make a number of decisions that expand or narrow the range of potential investors. In the relevant negotiations, project participants show flexibility as to how much risk they agree to take.

Contingency provisioning is the creation of compensation funds at the expense of part of own working capital, this is involves establishing a relationship between potential risks that affect the cost of the project and the amount of costs necessary to overcome failures in the project. The main challenge in creating a contingency reserve is to assess the potential consequences of the risk.

Risk insurance is the transfer of certain risks to an insurance company. Many large projects may be delayed in their implementation, which may lead to an increase in the cost of work that exceeds the initial cost of the project. There are three ways to insure - property, accident insurance, loss insurance.

Hedging is the process of insuring against the risk of possible losses by transferring the risk of price changes from one person to another. It is carried out through the conclusion of a contract designed to insure a change in the price -hedge - between the party insuring the risk (hedger) and the party receiving the risk (speculator). The subject of the contract can be various assets - goods, currency, stocks, bonds, etc.

Diversification is the investment of financial resources in more or one type of innovation, this is the process of distribution of investments between different objects of investment, which are not directly related to each other.

Conclusions

In this lecture, the important concept of risk management in the processes of manageability of the innovative project is considered. To do this, the following were studied: the concept of risk and uncertainty; risk classification of innovative projects; risk management planning; project risk analysis; risk response planning. We can conclude that innovation risk may arise under the following conditions:

First, with the introduction of a cheaper method of production of goods or services compared to what is already used. Such investments will bring the business firm a temporary surplus as long as it is the sole owner of the technology. In such a situation, the firm faces only one type of risk - a possible incorrect assessment of demand for manufactured goods.

Conclusions

Secondly, the risk arises when creating a new product (service) on old equipment. In this case, the risk of incorrect assessment of demand for a new product (service) is accompanied by the risk of quality mismatch.

Third, the situation in which innovation risk may arise is the production of new goods (services) using new equipment and technology. In this case, the innovation risk includes the following risks:

1. A new product (service) may not find a buyer;
2. Non-compliance of new equipment and technology with the necessary requirements for the production of new goods (services);
3. Impossibility to sell the created equipment, because it is not suitable for the production of other products in case of failure.

References

[1]. Evaluation of start-up projects in conditions of risk and uncertainty, Polishchuk V., Publishing house "FOP Sabov AM", 2021.
[2]. Dovhan, L. YE., Mokhonko, H. A. & Malyk, I. P. (2017). Upravlinnya proektamy. K.: KPI im. Ihorya Sikors'koho.
[3]. Rukovodstvo k svodu znaniy po upravleniyu proyektami, 5-ye izdaniye/ Project Management Institute (PMI). – Project Management Institute, Inc., 2012.
[4]. https://www.cin.ufpe.br/~if717/Pmbok2000/pmbok_v2/wbs_11.5.html
[5]. https://www.mbaknol.com/project-management/project-risk-management-process/
[6]. SEVERIN, I., CARAMIHAI, M., AMZA, G., & LUPU, A. (2010). Risk assessment in project management: a practical tool. In Proceedings of the International Conference on Risk Management, Assessment and Mitigation, RIMA'10, April (pp. 160-163).

Thank you!