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SUBSTANTIATION OF THE INNOVATION AND INVESTMENT PROJECT USING THE METHOD OF REAL OPTIONS

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ABSTRACT

The main aspects of using the method of real options in substantiating the innovation and investment project are considered in the article. It was found that for the development and implementation of innovation and investment projects it is advisable to use the method of real options (ROV), which allows informed management decisions even in conditions of high uncertainty, as it can significantly increase the potential economic efficiency of investment projects. Two main methods are used to estimate the value of real options: the Black-Scholes option valuation model and the binomial model. The article describes the algorithm for implementing the methodology for evaluating an innovation and investment project with venture financing based on the method of real options. It is shown that investment projects

initiated but not yet implemented by the firm increase its value by an amount equal to the sum of the prices of real options for cash flows of these projects.

Key words: Cash Flows, Innovation Project, Investment Project, Real Options

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1. INTRODUCTION

The introduction of innovations is essential for the development of a modern enterprise. A high level of risk characterizes innovative projects, so the justification of their funding requires the use of unique methods and tools. To identify the investment attractiveness of the enterprise, the issues of selection of the leading indicators of stable development become relevant. If you imagine the company as an investor in real assets, the management can increase its value, adequately responding to changes in market conditions. In a crisis economy, it is essential to determine the effectiveness of investment projects with the identification of future risks and assessment of potential opportunities and effects. For the implementation of high-tech projects, it is necessary to justify their financing, taking into account the high degree of market uncertainty. With the advent of options and similar instruments (warrants, convertible bonds), investors were given the right to make decisions that would allow them to take advantage of an auspicious coincidence or reduce losses. The theory of real options is one of the methods of investment risk management, which takes into account both negative and positive consequences of risky events. Methodological approaches based on real options form a toolkit for identifying opportunities to reduce the uncertainty of an innovative project through the creation of options. The underlying asset is the income generated by this innovative project. The management system has managerial flexibility in making decisions about the further implementation of such an innovation and investment project.

2. OBJECTIVES OF THE STUDY

In the framework of this study, the following problematic issues are identified:

- to determine the features of the application of the method of real options to justify innovation and investment projects;
- to develop a method of identifying and evaluating real options when substantiating innovation and investment projects.

3. THEORETICAL SECTION

3.1. The Essence of the Innovation and Investment Project

Innovative projects have a higher degree of uncertainty about the future. Therefore, the outcome of investment in innovation is complicated to predict. Lack of information support at the planning stage of an innovative project can lead to miscalculations. The lack of historical data on similar projects complicates the process of forecasting the development of an innovative project.

In the conditions of innovation of the investment project construction of a decent number of cash flows becomes a rather tricky task.

Assessing the strategic effect of a project is extremely difficult. Innovative projects require significant initial investment with a long payback period. Such projects often include several stages that are not typical of current investment projects: research and development, pilot testing, the study of the characteristics obtained, product marketing research, patenting, and so on. Each of the stages requires additional investments. Initial investments, for example, in research and development work, are a necessary condition for further project implementation. Initial investments are part of a chain of interconnected projects that create new opportunities for future growth (a new generation of goods or technologies, access to new markets).

During the implementation of an innovative project, it is proposed to assess it based on a system of indicators that characterize the economic, investment, environmental and social effects (Tkach I. et al., 2019). The investment result is one of the main for the sustainable development of the company in a market economy. It is estimated using the methods of calculating net discounted income (NPV), profitability index (PI), internal rate of return (IRR), a simple payback period of the innovation project (PP), discounted payback period (DPP) (Zybareva O. et al., 2019).

Currently, the most widely used traditional methods of project analysis, in particular the method of discounting cash flows, or NPV (Net Present Value). The purpose of discounting was first defined formally (Fisher I., 1930), but it received general recognition only after 50 years. However, in the field of evaluation of innovative projects, the use of the standard method of discounted cash flows is questionable. The investor company acts as a passive participant in the investment process while ignoring managerial flexibility. The purpose of discounting cash flows is not able to take into account the ability of companies to respond to changing environmental conditions, as well as to quantify management flexibility (Khomutenko A. et al., 2019). Therefore, the NPV method may underestimate the cost of innovative projects. This is especially true in times of economic crisis when the value of money rises sharply, and capital investment is significantly reduced or stopped altogether (Tkach I., 2019).

The fundamental difference between traditional and optional approaches in the justification of the innovation and investment project is shown in Fig. 1.

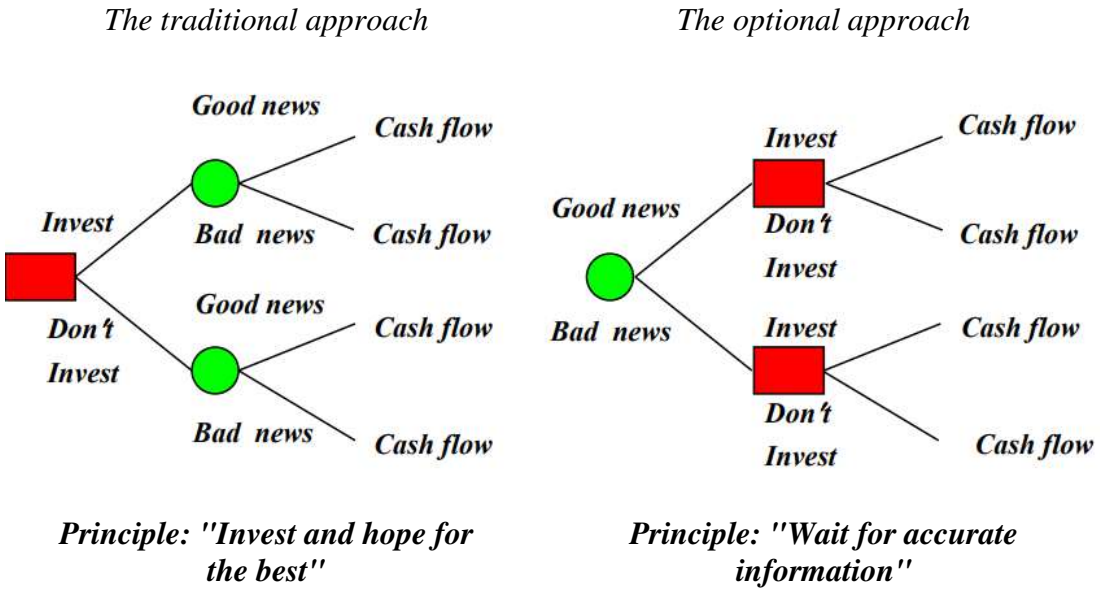

Figure 1 Characteristic and distinctive features of traditional and optional approaches in substantiating the innovation and investment project

Therefore, to assess high-risk projects, financial managers need more adequate tools for this, which would provide additional opportunities to take into account the uncertainties of the environment, the potential of the company and the further potential it acquires in the implementation of a particular project. Due to significant dynamic changes in the environment, traditional methods of discounting cash flows need to be complemented by other approaches that will provide tools for more flexible management decisions. One such method is the Real Option Valuation (ROV) method.

3.2. The Method of Real Options in Innovation Management

For the first time, the term "real option" was used by S.Myers, indicating that the corporation's assets can be considered as call options. The value of such "real options" depends on the reasonableness of the investments that will be made in the future. In general, an option is a standard document that certifies the right to buy or sell funds on certain terms in the future, with a fixed price at the time of concluding such an option or at the time of such acquisition at the discretion of the parties to the contract.

A real option is a tool to reduce the uncertainty of an innovation project by creating options, when the underlying asset is the income generated by the innovation project (Danylyshyn B. et al., 2019). There are a need and suitability of a priori creation of opportunities to obtain additional effects from the project, as well as their evaluation. Moreover, as an effect is considered as an increase in the value of the company's assets as a result of successful project implementation and reducing losses in case of failure. The real option is considered as a basis for a priori expansion of the adaptive capabilities of the investment project, from the standpoint of increasing its efficiency and (or) reducing risks. A priori adaptation is carried out at the pre-investment phase of project development and includes the following stages:

1. A priori identification and study of potential opportunities that may increase the investment attractiveness of the innovation project.

2. Making management decisions and implementing actions that contribute to the effective implementation of the identified opportunities.

The underlying asset is the asset on which the option contract is concluded. A real option-asset is the ability to manage the cash flow of a project by manipulating real assets to obtain additional effects from the project. The option is the right to exercise this opportunity, to get additional effects from the project, or, conversely, exit the project with minimal losses. An investor can create, increase or decrease project cash flows.

There are the following types of real options (Fig. 2).

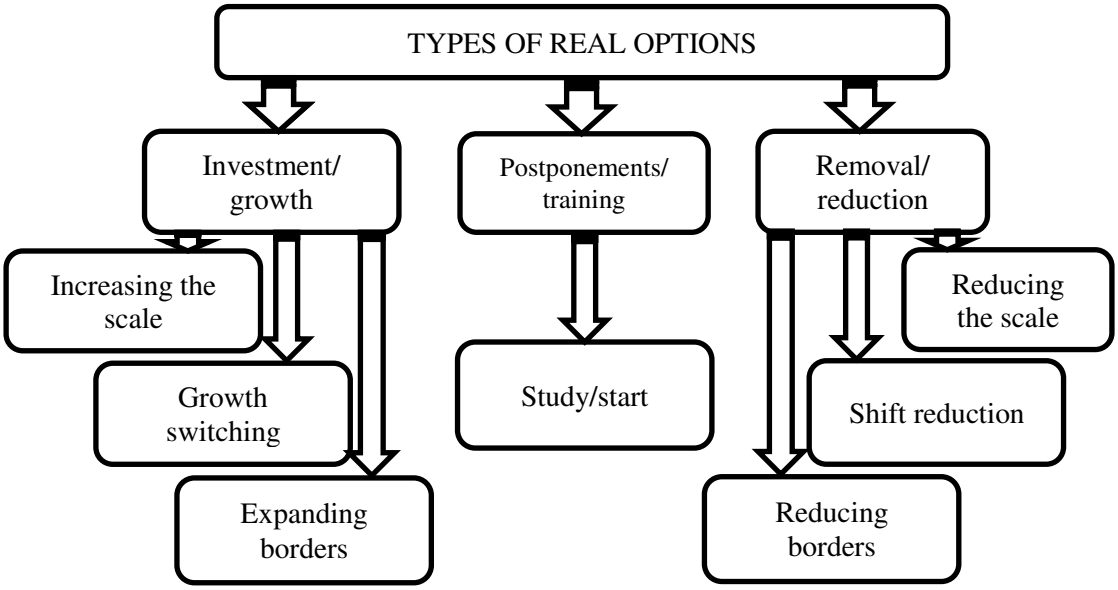

Figure 2 Classification of real options (compiled according to Copeland T., Keenan Ph., 1998)

The theory of real options should be used in the design of large-scale projects, provided that the projects are developed and controlled at the enterprise. Real options are fundamentally very similar to financial options, and therefore the pricing problem is related to financial options. They are called real because they do not exist in the financial market but in real business.

Table 1 presents the criteria of the investment project with the selection of the type of real options, which should be considered when justifying a particular project.

Table 1 Application of the theory of real options according to the criteria of innovation and investment projects

Criteria of innovation and investment project	Type of real option/correspondence to the financial option	Types of innovation and investment projects
Exclusive rights, the uncertainty of the price of the underlying asset	deferred payment option /American call option	Production of a new innovative product, extraction of natural minerals
Operational flexibility in the contract	project liquidation option/ American put option	Venture investment projects, a project to create a new product
Lack of connection between the project and long-term obligations	option to reduce or discontinue/American put option	Construction project, subject to falling real estate prices
Availability of operating reserves	extension option/American call option	Construction of an enterprise with excess capacity
Initial investment is necessary for the future development of the enterprise	growth option/ American call option	Applied GDR
Investments in the project can be made consistently	sequential investment option/ American call option	Project to promote a new series of products
Ability to switch to another technology, type of resource, market, the scale of activity	business switching option/American call option	Development of alternative energy projects

The fundamental difference between the method of real options from the standard

methods is that in this approach the enterprise is considered as a flexible managed system; management's ability to make decisions, adequate to the environment, are not ignored, but studied in detail and quantified.

To determine the methodological principles of modification of methods and models of the valuation of financial options, concerning real options is advisable to use the appropriate models, the characteristics of which are given in Table 2.

Table 2 Option models and their characteristics

Option's model	Evaluation process	Characteristics of the model
Binomial model	Discrete	*Advantages:* provides a clear understanding of option pricing. *Disadvantages:* requires a huge amount of source data.
Black-Scholes model	Continuous	*Advantages:* small amount of input data, continuous evaluation process. *Disadvantages*: a large number of assumptions distances the model from real processes.
Cox and Ross model	Discrete	*Advantages:* considers shorter periods, compared to the binomial model and significant price changes (price jumps). *Disadvantages:* price jumps, according to this model, can only be positive; there are difficulties in calculating the parameters of the abrupt process.
Merton's model (diffusion jumps)	Continuous	*Advantages:* improves the Black-Scholes model with the parameters of the abrupt process, i.e. takes into account price jumps. *Disadvantages:* difficulty in estimating the parameters of the abrupt process.
A model based on rainbow options	Continuous	*Advantages:* takes into account more than one source of uncertainty. *Disadvantages:* difficulties in calculating the volatility of several parameters.

Optional models were originally adapted to the needs of mining and energy companies; then they began to be used by companies in other industries: pharmaceutical, biotechnology, transport, etc.

The method of real options, in combination with the apparatus of fuzzy sets, is an essential area of improving methodological approaches to assessing the effectiveness of innovative projects (Gong J. et al., 2011). Uncertainty in estimating future cash flows is not stochastic, and the use of probability theory gives an erroneous level of accuracy. Therefore, the model includes subjective estimates and statistical uncertainty, which will allow investors to understand better the problem of making investment decisions. It is established that the symbiosis of the fuzzy set method and the real options method weakens the shortcomings of the real options method and partially removes the limitations of the models used to estimate the value of real options taken from the financial sector (Carlsson C., Fuller R., 2003).

Many business processes can be represented as options. Option valuation methods are successfully used because the investment is actually an option purchase, which gives the right to participate in the results of further development of the enterprise and/or project.

4. METHODOLOGY

For the development and implementation of innovation and investment projects, it is advisable to use the method of real options (ROV), which allows you to make informed management decisions even in conditions of high uncertainty, as it can significantly increase the potential economic efficiency of investment projects. Valuation of investment projects using the real options method is based on the assumption that any investment opportunity for the company can be considered as a financial option, i.e. the company has the right rather than the obligation to create or acquire assets for some time. The method of discounting cash flows (DCF) is used as one of its tools to evaluate real options. ROV assumes that uncertainty becomes a component of the problem to be managed. The future is seen as a set of alternatives and choices (options) that can add value. "Option" is considered as a hidden added value that affects the results of economic activity. In the ROV concept, the value of the real option consists of the NPV calculated by the DCF method and the so-called flexibility value.

$$NPV_{sum} = NPV_{stand} + ROV \quad (1)$$

Where

NPV_{sum} – total project cost;

NPV_{stand} – project cost calculated by DCF method;

ROV – real options value.

The cost of flexibility is due to the existence of the value of the development of innovation and investment project, its insurance, new knowledge.

ROV identifies two groups of additional opportunities contained in the innovation and investment project: the ability to change the parameters of the investment project over time; the execution of one project makes another project possible.

5. RESULTS AND DISCUSSION

5.1. Algorithm for Substantiation of Innovation and Investment Project by the Method of Real Options

Two main approaches are used to estimate the value of real options: the Black-Scholes option valuation model and the binomial model. The value of the real option is calculated according to the formula developed for the evaluation of financial options such as "call":

$$C = P \cdot N(d_1) - EX \cdot \exp(-r \cdot t) \cdot N(d_2) \quad (2)$$

where $d_1 = \left[ln\left(\frac{P}{EX}\right) + \left(r + \frac{sigma^2}{2}\right) \cdot t\right] \div (sigma \cdot t^{0.5})$

$d_2 = d_1 - sigma \cdot t^{0.5}$

d_1 – relative indicator that reflects changes in the cost of the project, taking into account the standard deviation of the average annual cost of the project;

d_2 – relative indicator that reflects changes in the value of the real option during the project, taking into account changes in the value of investments;

$N(d_1)$ – the cumulative normal probability of the density function. In the Black-Scholes formula, the value of $N(d_1)$ indicates the number of shares required for adequate copying of the European call option (hedging ratio or delta option) (Brayley, Myers, 2007), $N(d_1)$ is equal to insurance investment, and $N(d_2)$ – the cost of the loan.

Therefore, the Black-Scholes formula can be interpreted as follows: the value of the option is equal to the delta of the option multiplied by the current price of the underlying asset, minus the cost of the loan;

P – the share price, measured in monetary units. For a real option, it is the present value of the cash flows from the realization of the investment opportunity that the company will receive as a result of the investment project;

EX – the execution price, the reduced cost of investment for the project or liquidation value in case of rejection of the project, measured in monetary units;

r – risk-free interest rate, %;

$sigma$ – standard deviation of the return on the underlying asset per unit time during the analyzed period (with continuous accrual), %;

t – the period before the exercise of the option, the unit of time.

Initially, the Black-Scholes formula was used for financial options, so, accordingly, the notation in the formula is a category for the financial market. But when transferring calculations to the real business market, the indicators were transformed into business categories. In this case, in the Black-Scholes formula, P is understood the current value of the company's assets; under the execution price (EX) – the nominal value of the investment; t – time to maturity (if there are several forms of obligations – accounts payable, long-term and short-term loans – you should use the weighted average duration of these obligations), presented in the form of zero-coupon bonds with a maturity of equal t (time-prescribed) in the contract). The standard deviation of sigma characterizes the risk of the considered innovation and investment project. In the conditions of business of Ukraine, this indicator makes 35-45%, depending on a situation in the stock market.

The Black-Scholes formula does not include the value of the expected strength of the growth of the value of the underlying asset and takes into account only the growth rate of its variance. Therefore, when using the Black-Scholes formula should not take into account forecasts of growth in the price of the underlying asset, but should take into account forecasts of its volatility.

The derivation of the Black-Scholes formula is based on the idea of using the tools of random walk analysis (Brownian motion).

Characteristics of the parameters of the real option, calculated by the method of Black-Scholes (adapted from the financial option):

The price of the underlying asset is the market value of the order, which includes the cost of production, similar to that developed under R&D, taking into account the degree of utility, and multipliers defined for this product from the customer's point of view, expressed in monetary units. This is the value of NPV, calculated by the method of discounting cash flows (DCF).

Time to exercise the option – the time of execution of this order and the time after the execution of the order until the decision to exercise the option (can be estimated based on the terms of the project).

The exercise price of the option – the costs on the part of the customer for the deployment of production in the case of a positive decision on the basis of information received about the situation that has arisen after the implementation of R&D.

The volatility of the underlying asset – the standard deviation of the market value of the order, which is developed in the R&D for the period of development and implementation of the project, taking into account the needs of the customer and various risks.

Risk-free interest rate – the rate on government bonds.

The analysis shows that the Black-Scholes model will be correct for a very narrow class of option projects, as the model was designed to estimate the value of European call options, i.e. options that give the right to purchase the underlying asset on a strictly defined date. In contrast, real options, most are American options that can be exercised over a while.

The binomial model provides much higher flexibility in substantiating an innovation and investment project. The main idea of this approach is to model the value of the underlying asset based on binomial law. The stochastic behaviour of the asset value over time is simulated. Increasing the number of periods, we obtain a graphic figure – a binomial tree. There are two types of binomial lattices: recombining lattice and non-recombining lattice. In the recombination lattice, the intermediate node at step t_2 (S_{0ud}) is common to the upper and lower branches of the previous bifurcations (Fig. 3).

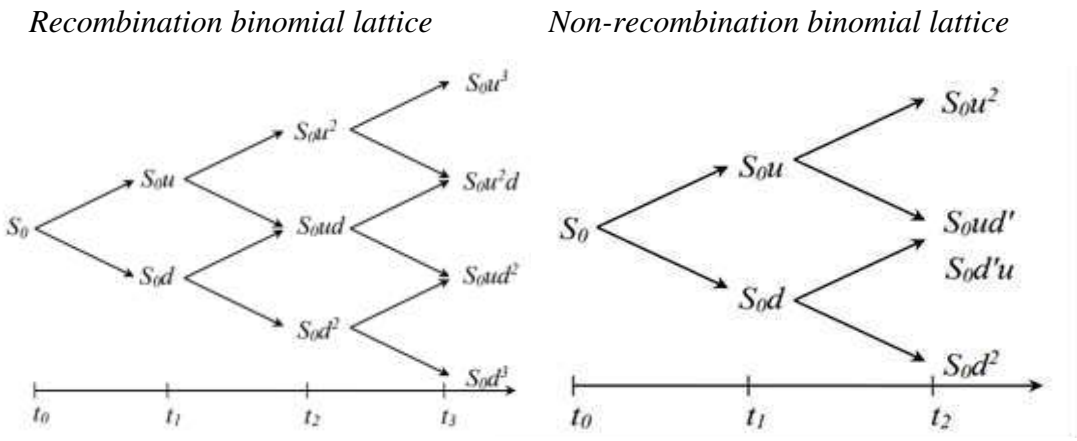

Figure 3 Binomial lattice (recombination, non-recombination)

The technique of constructing a binomial model (decision tree) is more cumbersome than the Black-Scholes method but allows for more accurate results when there are several sources of uncertainty or a large number of decision dates. The most significant problem of the binomial model is the need to assess the consequences of decisions in each node of the binomial decision tree and determine the probabilities of the value of the underlying asset up or down. Black-Scholes formulas for estimating the cost of a European call option, as well as Heske – for determining a two-stage compound European call option, are applicable only in the case of constant volatility in the value of the underlying asset.

Therefore, the main disadvantage of these models in estimating the value of real options is that their application requires the availability of a priori stochastic information, which is necessary to determine the probabilistic characteristics used in the models.

When using the method of real options in assessing the implementation of innovative projects in a hierarchical decision tree and simulation of possible scenarios for the implementation of a creative project must take into account the main parameters that affect the results and cost of the innovative project. These parameters are the cost of owning and implementing real options for the project, the uncertainty of future revenue streams, the expected commercial value of the project, the real value of the future revenue stream, the cost of additional investment in the multi-stage and multi-scenario implementation of the innovation project. , discount rate taking into account the risk premium (Tkach I., 2019). Cash flows are taken into account when estimating the value of an innovative project by the method

of real options in the hierarchical decision tree model and simulation of possible scenarios for the implementation of an innovative project.

When choosing a model for evaluating a real option, it is vital to take into account the sources of funding for the innovation and investment project.

For the case of venture capital, it is necessary to take into account the fact that the volatility of the price of the underlying asset changes over time. The algorithm for implementing the methodology for evaluating an innovation and investment project with venture financing based on the method of real options consists of the following stages (Baranov M., 2016):

Stage 1. Construction of the forecast financial model of the innovative project.

Stage 2. Estimation of economic efficiency of the innovative project by NPV method: (definition of NPV and IRR of the project).

Stage 3. Evaluation of the economic efficiency of the innovation project by the NPV method from the standpoint of the venture fund:

3.1. Determining the share of the fund in the authorized capital of the invested company.

3.2. Calculation of cash flows of the venture fund.

3.3. Calculation of the internal rate of return of the venture fund IRRv and the net present value of the venture fund NPVv.

Stage 4. Evaluation of the effectiveness of the innovation project for the venture fund using the method of real options:

4.1. Calculation of the value of the compiled call option, which is owned by the venture fund according to the modified Heske formula:

4.1.1. Determining the values of "input" parameters of the modified Heske formula:

a) the cost of acquisition at time T0 of the option called "call" I_0^v;

b) the exercise price of the compound (external) call option (venture fund investment at time T_1 in the acquisition of part of the shares of the risky company I_1^v;

c) the price of the internal call option (the value of implicit costs of the venture fund) I_2^v;

d) assessment of risk-free interest rate;

e) calculation of the current value of the underlying asset of the domestic call option (liquidation value of the project for the venture fund);

h) determining the level of riskiness of the venture company's operations.

4.1.2. Determining the threshold value of the company's shares.

4.1.3. Deciding on the exercise of an external option.

4.1.4. Deciding on the exercise of an internal option.

4.2. Calculation of efficiency indicators of venture fund investments taking into account the value of the call option.

The first two stages are designed to enter general information about the project and its main parameters. The third stage involves assessing the effectiveness of the investment project. Conditionally, it can be divided into three phases: NPV sensitivity analysis, simulation modelling of stochastic variables, economic and statistical analysis of simulation results. The fourth stage of the proposed algorithm involves the evaluation of real options for the venture fund. The binomial method and the Black-Scholes model can be used to solve this problem. The method of real options differs from the standard not so much the mathematical apparatus as the organization and direction of the process, so the analysis based on the option approach

is based on constant interdisciplinary interaction, involving experts from different fields of knowledge.

5.2. Characteristics of the Innovation and Investment Project

The strategy of increasing production efficiency based on the implementation of innovative projects provides for comprehensive mechanization of labour-intensive areas by replacing physically and morally worn-out equipment with modern, energy-efficient high-performance equipment using skilled labour. Consider an innovation and investment project for the introduction of new equipment at a manufacturing enterprise.

Traditional calculations by the classical method have shown that, despite the high social significance of the introduction of innovative equipment in the enterprise, its economic efficiency is unsatisfactory. The main reason for this was a significant lack of cash flow, unable even to cover operating costs in the first two years of the project.

If we present the cash flows of the project as a real option, then given the value of the latter, the NPV of the project is positive.

Let's calculate the value of such a real option according to the Black-Scholes model at a project cost of 208.455 million euros and the current value of the underlying asset (reduced value of cash flows generated by the project) of 116.619 million euros.

When determining volatility, usually calculate the variance of the return on shares of the company initiating the project, for which the option price is given. For a machine-building enterprise, the volatility rate is 53.72%. It is assumed that the standard deviation of profitability will reflect the risk inherent in the equity of the business as a whole. In practice, the so-called pseudo-risk-free interest rates are used as risk-free rates, which most often represent the level of yield on government bonds, increased by the amount of the premium, according to the country's risk – for Ukraine it is 8.21%.

The calculated parameters of the model for estimating the real option for the project in two scenarios (an initiative of the option holder and external support) are presented in Table 3.

Table 3 Calculated parameters of the model for estimating the real option for the project in different scenarios

Model parameters for evaluating real options	Marking	Values in scenario 1	Values in scenario 2
Expected cash flow, million euros	ρ	116,619	227,226
Expenditures for acquisition of project funds, million euros	s	208,455	208,455
Uncertainty (variance level), %	ϑ	53,72	53,72
Project validity, years	t	1	1
Time value of money, %	r	8,21	8,21
Indicator from the formula (2)	d_1	-0,7897	0,5274
	d_2	-1.2874	0,0245
Cumulative normal probability of density function	$N(d_1)$	0,2116	0,7214
	$N(d_2)$	0,0952	0,4852

Even though the NPV of the project is equal to -91.835 million euros, the real option for it is more than zero and is 5.596 million euros. That is, if the initiator of the project wants to sell his participation in the project a year before its start, he will be able to do so for 5.5 million euros.

The real options method allows you to analyze the project much more deeply than merely summarizing the cash flows and value of the option. While retaining all the advantages of the theory of discounted flows, it expands the possibilities of evaluating investment projects through additional accounting for the uncertainty of the future. An important indicator for this is the value of the option.

As in the case of financial options, the price of the real option increases in proportion to the growth of cash flows of the project (the price of the underlying asset). In this case, at the point of coincidence of the price of the underlying asset and the option strike (NPV = 0), the value of the option is equal to approximately 22% of the project value. Let's trace the dependence of the option price on the cash flows of the project for other cases of their change (Table 4).

Table 4 Dependence of the option price on the amount of cash flow of the project

ρ	d_1	d_2	$N(d_1)$	$N(d_2)$	C_{call}
50000	-2.4712	-2,9745	0,0068	0,0014	97 242
70000	-1,7963	-2,2985	0,0299	0,0110	399 197
90000	-1,2978	-1,8204	0,0899	0,0297	1 599 987
110000	-0,8999	-1,4107	0,1799	0,0801	4 203 999
130000	-0,5803	-1,0799	0,2900	0,1399	8 854 907
150000	-0,2879	-0,7914	0,3789	0,2147	16 024 448
170000	-0,0472	-0,5789	0,4901	0,2879	24 109 604
190000	0,1743	-0,3299	0,5682	0,3744	34 618 105
210000	0,3739	-0,1296	0,6449	0,4479	46 774 918
230000	0,5542	0,0578	0,7097	0,5099	60 345 537
250000	0,7217	0,2199	0,7655	0,5877	75 114 699

As can be seen from the above calculations, the increase in cash flows, under different scenarios and expectations from the project, has a significant impact on the option price. Quantitative characteristics of the project are cash flows: the higher their expected value, the more expensive the real option. The amount of money required to implement the project is treated as investment costs. The value of the real option is inversely proportional to their benefit. Increasing the time to expiration increases the value of the real option, as its owner gets more (over time) opportunities to use the properties of this option. The cost of the real option is also related to the volatility that characterizes price volatility.

According to options theory, the initiating firm of the project, by its authorship alone, is the owner of the real option, the value of which depends on the number of future cash flows of the project. This allows us to consider an unrealized project that is under development as an intangible asset of the firm, the value of which is equal to the option premium. The company can increase its assets by developing new projects. Such an increase in assets will undoubtedly affect its value. Thus, investment projects initiated but not yet implemented by the firm growth its value by an amount equal to the sum of the prices of real options on the cash flows of these projects.

At any stage of the pre-project work, the firm will be able to sell its status as an initiator and all related rights to any other interested participant or third parties, drawing up an agreement as a call option for the project at a price calculated according to the Black-Scholes model for real options.

Therefore, it is advantageous for the company to have as many large projects as possible, and it is not necessary to bring them to implementation. The project begins to work for the company before its application, increasing its intangible assets. In this case, the company has

three options: to execute the option after a while and start implementing the project; sell the option to an interested person at the stage of pre-project preparation; keep as a reserve. The package of investment projects of the company is its intangible assets. Depending on the term of the project, the option price changes.

Using the condition of inequality of zero prices of real options, the firm can determine the level of eligible costs for pre-project preparation - no more than the value of the option. It is impossible to predict the future cash flows of the project. The measure of cash flow deviation is the price of the real option, which reflects the probability of obtaining a positive NPV value during the project. The cost of a real option is a measure of a future project better than the discount rate and opens up new investment prospects for the entrepreneur.

6. CONCLUSION

This study describes the methodological approach to justify the implementation of innovation and investment project based on real options. The algorithm of realization of a method of real options at substantiation of the project is offered. The primary significance of the proposed algorithm is that it connects three components of the method of real options: valuation, risk management tool and structuring strategic decisions. This makes it possible to bring economic justification under management decisions. Within the algorithm, the real options method is integrated into the general scheme of substantiation of investment and innovation projects, allowing, depending on the situation, to abandon the application of the real options method, use it first or use this method during the project. It is proved that the price of a real option is higher the higher the present value of cash flows; lower project costs; more time before the expiration of the option; more risk. The most significant effect on the increase in the value of the option has the present value of expected cash flows. Therefore, to increase the investment attractiveness of the project, it is better for companies to focus on increasing revenues rather than reducing costs. The main difficulties of substantiation of the innovation and investment project by the method of real options are connected with reception of the reliable initial data necessary for calculation (time before realization of the possibilities put in the project, values of variance). It is also necessary to take into account the plurality and interdependence of real options (one project may contain several real options that affect each other, and the plurality of the underlying asset is possible if there are several sources of uncertainty). Also, it is essential to consider who, in addition to the owner of the real option will be able to take advantage of the results of the exercised option – the realized opportunity. In most cases, the amount of economic benefit can be changed by other market participants. Practice shows that traditional methods of project analysis can be supplemented by the results of real options analysis to improve the accuracy and quality of valuation of real assets.

The method of real options in the system of assessment and risk management of innovation and investment projects is the direction of further research.

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