INVESTMENT IN DEVELOPMENT OF ENTERPRISES INNOVATIVE ACTIVITIES

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Abstract. The aim of the paper is to determine the internal and external innovativeness of investment projects of enterprises, investment strategies of innovative activity, strategic gap. The activity of 19 enterprises of Kharkiv region during the period of 2014-2019 using multivariate analysis has been analysed. As the result, 3 enterprises engaged in innovation were selected. Their innovative projects were examined. 10 experts from each enterprise were interviewed. Participants were asked about innovation implementation, project changes, the need for organizational transformation, the complexity of integrating current knowledge, the level of impact, the scale of impact, and the scale of impact of the innovation project. These activities allowed to determine the internal and external innovativeness of investment projects of enterprises. On the basis of innovativeness of investment projects and investment attractiveness of enterprises certain investment strategies of innovative activity of enterprises have been substantiated.

1 Introduction

In accordance with the Concept Ukraine of Economic Development until 2030, its economy should develop according to the innovation-and-investment model. In recent years, some progress has been made in enhancing innovation. For example, the number of enterprises engaged in innovation activity in 2019 increased by more than 26% compared to 2010, though the innovations were carried out mainly at the expense of enterprises, as much as at about 60% of them, which contributed to the inhibition of their innovation activity. In this connection, the relevance of research into the topic of innovation development is based on the formation of its investment strategies of economic entities in general and machine-building enterprises in particular, as mechanical engineering is a leading branch of the economy, which creates the basic productive assets for other branches of the national economy. The main task of research and practical solution of the problem of formation of investment strategies of enterprise innovation activity is identifying the new effective approaches, methods, procedures to select types of strategies, to determine substantiation of their essence, orientation and innovative content. The formulation and justification of such strategies takes into account both the investment attractiveness of enterprises, which are the subjects of investment activity, and the innovative nature of proposals of investment projects, which are the objects of investment resources.

2 Data and Methods

Methods of analysis, synthesis, structural-logical and system analysis were applied to summarize the activity of enterprises. The activity of 19 enterprises of Kharkiv region during 2014-2019 has been analysed. A multivariate factor analysis was employed. On the basis of the analysis 3 enterprises engaged in innovative activity were selected, their innovative projects were analyzed. In 2019, 10 experts were interviewed (heads of planning, economic, financial, marketing divisions and deputy directors of economics of the surveyed enterprises). The participants were asked about innovations implementation, project changes, the need for organizational transformations, the complexity of taking into account modern knowledge, the level of consequences, the scope of consequences and the scope of consequences of the innovation project. This allowed to determine the internal and external innovativeness of investment projects of enterprises.

The results of previous studies of Blank, Illiashenko, Kannadhasan, Peresada, Vertakova, Yablons`ka-Agu, Zakharchenko were used to determine the investment attractiveness index. The investment strategies of innovative activity of the enterprises was offered. The essence and

measures sequence of the strategic plan were determined: factual and planned indicators for each measure; strategic reserve for each event; comprehensive assessment of significance.

3 Results

3.1 The essence of innovation

Successful development of enterprises in modern conditions is possible only on the basis of introduction of innovations. Innovation as a whole is the basis for ensuring of the competitiveness of enterprises. Product innovation drives consumer demand. However, the introduction of innovation requires significant amount of investment in the development, development, implementation, support and resuscitation of ageing. Therefore, investors must be prepared for the costs, losses, risks. It is possible to reduce the negative impact of these factors on the basis of qualitative and comprehensive evaluation of investment projects on the effectiveness of their investment. In the process of evaluating efficiency, it is also advisable to determine the innovative nature of the proposals of investment projects, comparing them with analogues, the possible consequences of implementation, the scale of distribution, the impact on the course of economic and social processes of the internal and external environment of enterprises within which their implementation is envisaged.

Rigorous analysis of recent publications on the problem has shown that the works of such leading scientists: Balana, Batukova, Bi`lovods`ka, Blanka, Dzubina, Ilyashenko, Peresadi, Pshinko, Yakovleva, Yablons`ka-Agu, Zakharchenko, etc. have been devoted to the issues of substantiation of the investment projects effectiveness. But in their scientific works the issues of definition and taking into account the innovative level of proposals of investment projects have not been covered sufficiently. It especially regards their impact and scale of distribution on the internal and external environment of the enterprise. This requires improvement and further development of evaluation of the innovation level of investment projects of Ukrainian economy enterprises.

On the basis of the analysis of scientific works, methodological proposals for estimation of the level of innovation of investment projects based on their main characteristics and factors of influence of the internal and external environment were updated.

3.2. Evaluation of project innovation

The level of project innovation is proposed to be determined by the expert method according to two indicators: an indicator of internal innovation, which characterizes the consequences of transformation at the enterprise; an indicator of external innovation, which characterizes the consequences of the project implementation in the external environment. It is advisable to determine the indicator of the internal innovation of the project in accordance with the characteristics presented in table. 1.

Table 1. Signs of internal innovation of the project [Source: supplemented by the authors according to Batukova, Blank, Dzyubi`na, Iastremska, Pshin`ko, Yablons`ka-Agu, Yakovlyev]

Degree of innovation implementation	The degree of change of the project object	The need for organizational transformation	Complexity of consideration of modern knowledge
Separate, i.e. single	Local	Inappropriate	A certain area of knowledge
Partial	One element of the system	Partial conversions	The related field of knowledge

Converting	One element completely, the other part	Transformation of the organizational structure of the enterprise	One science
Radical	The object changes completely	Transformation of business model of enterprise	Outside of one science, which involves the inclusion of related sciences in one scientific area
Transformational	A fundamentally new system	Changing the mission and strategy of the company	At the edge of several scientific fields, non-related fields of modern knowledge

According to the generalization of opinions of Batukova, Blank, Zakharchenko, Pshin`ko, Yakovlyev signs of project innovativeness are proposed. A set of features characterizing the transformation in the internal environment of the enterprise is also formed. This is done in accordance with the scale of their dissemination, the degree of transformation of the internal environment, organizational support for implementation and the essence of innovative knowledge. Features, presented in Table 1 fully characterize the quality of transformation of the internal environment by the degree of innovation. It is suggested to evaluate the innovativeness of the project in the range from 1 to 5 points. For each sign with an interval of one point.

The indicator characterizing the magnitude of the impact and consequences of the project implementation in the external environment is proposed to be determined using the features of Table 2.

Table 2. Score assessment of the features of the external innovation indicator [Source: supplemented by the authors according to Batukova, Iastremska, Illiashenko, Yablons`ka-Agu]

The level of occurrence of the consequences of the implementation of an innovative project	The scope of project implications			
	technical	technological	socio-environmental	financial
International	4 – 5	4 – 5	4 – 5	4 – 5
National	3 – 4	3 – 4	3 – 4	3 – 4
Regional	2 – 3	2 – 3	2 – 3	2 – 3
Subregional	1 – 2	1 – 2	1 – 2	1 – 2
Corporate	0 – 1	0 – 1	0 – 1	0 – 1

The proposed features take into account two criteria: the taxonomic level of emergence and dissemination in the external environment of the consequences of the project implementation and the types of economic efficiency that the project can provide. The suggestions presented are justified on the basis of the generalization of works of Batukova, Blank, Dzyubi`na, Peresada, Pshin`ko.

The ball points on the level of consequences of the project implementation are given in Table 2, are maximum. However, the experts evaluate the level and scope in the range from 1 to the value specified in a specific position in Table. 2.

The presented proposals are tested by analysing investment projects of three enterprises of Kharkiv region using the following methodological approach.

At the first stage, an expert group was set up at each enterprise. They consisted of 10 specialists from each enterprise who confirmed their level of competence as experts in the cross-poll.

At the second stage, the rank rating scale is selected (Table 2 and Table 3).

At the third stage, experts were interviewed for the proposed indicators of innovation. The ranking of importance of indicators is carried out. It is advisable to give a minimum value of 1 to the least significant parameter and a maximum value of 5 to the most significant parameter.

An the fourth stage, the consistency of the respondents' opinions was determined using the coefficient of concordance. The value of the coefficient of concordance for each of the three enterprises in terms of internal and external innovation is: 0.7 and 0.65; 0.68 and 0.77; 0.81 and 0.7.

At the fifth stage, the integral indicators of the investment project components of the impact of their impact on the external and internal environment were calculated. Indices of internal innovation by enterprises are respectively: 0.83; 0.38; 0.55. External innovation indicators: 0.56; 0.3; 0.54.

At the sixth stage, the calculated integral indicators are combined into the overall integral indicator of innovation of the investment project. The calculation was performed by the additive convolution method. The innovativeness of the investment project for each enterprise is 0.73; 0.35; 0.54, respectively.

Therefore, the calculations of the proposed methodological approach to assess the innovativeness of projects are characterized by three qualitative levels. This leads to the formation of different investment strategies. The concerns of the strategies are the choice of appropriate financing methods, effectiveness of investment strategies, and attractiveness for investors.

3.3 Investment strategies for innovation activity

According to Batukov, Bezdudnaya, Schroeder, the characteristics of investment and innovation processes are highly dependent. Therefore, the process of formation of investment strategies of enterprise innovation activity should take them into account. It is possible to combine these characteristics with the use of a matrix approach, which is based on the determined investment attractiveness of the enterprise and innovation of the investment project. It allows to position the enterprises in the matrix of investment strategies and to determine a clear dependence of the strategies on its investment attractiveness and innovativeness of the investment project.

The matrix of investment strategies at intervals can be divided into nine quadrants. The distribution of investment strategies according to the proposed classification features will allow enterprises to make sound management decisions on the formation of strategic alternatives to investing in innovation. The distribution of investment strategies is given in Table 3.

Table 3. Types of investment strategies of enterprise innovation activity [Source: supplemented by the authors according to Ansoff, Batukova, Bi`lovods`ka, Blank, Iastremska, Haines, Porter, Peresada, Schroeder, Yablons`ka-Agu]

Matrix quadrant number	A type of strategy by classification			
	feasibility	method of investing	the investment attractiveness of the enterprise	innovation of the investment object
1	non-investment	self-financing	Point investment	Low innovative investment strategies
2	cautious investing	leasing	Point investment	Medium innovative investment strategies
3	investment	corporatization	Point investment	Highly innovative investment strategies
4	preferred investment	lending, crowdfunding	Consistent investment	Highly innovative investment strategies
5	investment	corporatization	Consistent investment	Medium innovative investment strategies
6	cautious investing	leasing	Consistent investment	Low innovative investment strategies
7	investment	corporatization	Leadership in investing or leadership investing	Low innovative investment strategies
8	preferred	lending,	Leadership in investing	Medium innovative

	investment	crowdfunding	or leadership investing	investment strategies
9	preferred investment	self-financing	Leadership in investing or leadership investing	Highly innovative investment strategies

Generalization of strategies allowed to divide the proposed matrix into three zones. The first zone is the cautious investment of proposals with slight changes in the characteristics of the enterprises activity (quadrants 1, 2, 6). The second one deals with investing with changes in the characteristics of the enterprise, new to its internal environment (quadrants 3, 5, 7). The third zone covers active investment, which provides significant changes not only in the internal but also in the external environment of the enterprise.

Thus, the main stages of methodological support for the formation of investment strategies of enterprise innovation activity are defined: indicators characterizing the investment attractiveness of the enterprise are formed, their integration into an integral one is traced; investment innovativeness is determined; matrix of investment strategies is designed, its division into quadrants and distribution of investment strategies is made; positioning of enterprises in the matrix of investment strategies and definition of their types are identified; the strategic plan of measures for the implementation of the selected investment strategy based on their comprehensive assessment is development; movement of the enterprise by quadrants of the matrix is forecast; management decisions about the choice and implementation of the adjusted investment strategy for investing the enterprise's innovation activity are made.

Testing of methodological support is carried out at the same three enterprises that implement innovative projects. Since investment attractiveness is a separate complex topic of research, it is not presented in this article, but the results of previous Iastremska, Strokovych, Dzenis., Shestakova, Umans, Yablons`ka-Agu studies have been used. The integral indicator of investment attractiveness is calculated by the method of additive convolution with partial indicators taking into account material, financial, human, information and innovation-investment resources and results.

Thus, after choosing an investment strategy, it is advisable for each enterprise to determine the nature and sequence of measures of the strategic plan for its implementation. According to the developed proposals, it is advisable to carry it out in accordance with a comprehensive assessment of the event in accordance with strategic reserves and gaps in the following sequence: determination of actual and planned (control in accordance with the strategy) indicators for each event; calculation of strategic reserve for each event; determining a comprehensive assessment of the significance of an event on a strategic gap: the greater its quantitative value, the shorter the event must be implemented, since the size of the strategic gap takes into account both the importance of the event, and the strategic reserve.

After determining the factual and planned (control) indicators for each event, a strategic reserve for each event is calculated:

$$Ri = \left| 1 - x_{ifact} / x_{i\,cont} \right|$$

де Ri – reserve of i event;

x_{ifact} – factual value i indicator;

$x_{i\,cont}$ – planned (control according to strategy) value i indicator.

The above proposals for the calculation of strategic reserves for determining strategic measures for the implementation of the selected investment strategy are tested on the example of the first company on the indicators of its investment attractiveness for 2019, which are the lowest.

Table 4, according to the chosen strategy, shows the actual, control values of these measures indicators and their strategic reserves existing at the enterprise.

Table 4. Factual and planned values of performance indicators for the investment strategy

Event index	Value		Event reserve
	factual	plans in line with the	

		investment strategy	
financial stability ratio	0,5	0,8	0,375
coefficient of autonomy	0,6	0,9	0,333
fixed assets recovery rate	0,7	1	0,3
the share of workers who are inventors and innovators	0,5	1	0,5
material costs	0,7	0,9	0,222
the share of investment in intangible assets in the total investment in innovation	0,2	0,5	0,6
the share of investment in advertising	0,1	0,5	0,8
share of financing of capital investments at the expense of own funds of the enterprise in the total amount of sources of financing	0,15	0,5	0,7
the share of investment in research and development in the total investment in innovation	0,1	0,6	0,833
the share of investment in equity innovation	0,4	0,9	0,555
the share of other costs of innovation in the total cost of innovation	0,05	0,2	0,75
fund-raising	0,6	1	0,4
the amount of depreciation	0,3	0,9	0,666

A comprehensive assessment of the significance of the i-th event that characterizes its strategic divide is determined by the formula:

$$KOZi = Pi * wi,$$

де $KOZi$ – comprehensive assessment of the significance of the i event;

Pi – reserve of the i event;

w_i – significance factor of the i-th event.

To determine the significance of the i-th measure, it is advisable to calculate the factor loadings of the indicators that characterize the measure. Due to the fact, that the sum of the coefficients of significance of the measures should be equal to units, it is advisable to use the formula to determine them:

$$w_i = 1/SFN * FN_i$$

де SFN – sum of factor loadings on indicators characterizing strategic measures;

FNi – factor load of the i-th event.

The coefficients of significance, reserves of measures and a comprehensive assessment of their importance, which are included in the strategic plan for the implementation of the investment strategy, are shown in Table 5. The most important part of a comprehensive assessment of importance is the measure that needs priority of implementation.

Table 5. Significance coefficients, event reserves and comprehensive assessment of event significance (strategic gap)

Indicator characterizing the event	Weighting factor	Event reserve	Comprehensive assessment of the significance of the event
financial stability ratio	0,104	0,375	0,039
coefficient of autonomy	0,075	0,333	0,025

fixed assets recovery rate	0,075	0,300	0,023
the share of workers who are inventors and innovators	0,090	0,500	0,045
volume of material costs	0,134	0,222	0,030
the share of investment in intangible assets in the total investment in innovation	0,119	0,600	0,071
the share of investment in advertising	0,060	0,800	0,048
share of financing of capital investments at the expense of own funds of the enterprise in the total amount of sources of financing	0,015	0,700	0,012
the share of investment in research and development in the total investment in innovation	0,075	0,833	0,063
the share of investment in equity innovation	0,104	0,555	0,058
the share of other costs of innovation in the total cost of innovation	0,075	0,750	0,056
fund-raising	0,030	0,400	0,012
the amount of depreciation	0,045	0,666	0,030

The calculation of the comprehensive assessment of the significance of the strategic measures for the implementation of the investment strategy (Table 3) proposed allows to reveal their essence. In addition, it determines the sequence of actions.

First, it is advisable to undertake measures to increase the share of investments into intangible assets in the total volume of investments in innovation and the share of investments into research and development in the total volume of investments in innovation. The comprehensive assessment of significance is 0.071 and 0.063, respectively. Further measures to increase the share of investment in equity and the share of other costs of innovation are in the total cost of innovation (comprehensive value of 0.058 and 0.056 respectively). The following are measures to increase the share of investment into advertising (0.048) and measures taken to improve the financial stability of the company (0.039). Further follow the measures taken to increase the share of workers who are inventors and innovators. They are implemented by increasing the motivation to innovate, based on the development and updating of the Regulation on bonuses and implementation of staff competence development, based on training and internships (0,045) and the increase in the amount of depreciation through the use of methods of depreciation, such as accelerated, cumulative, etc. (0.030), decrease in material costs based on the introduction of resource-saving technologies (0.030), increase in the autonomy ratio based on reduction of credit obligations (0.025), activation of fixed assets recovery (0.023), activities aimed at increasing the share of financing of capital investments at the expense of the enterprise's own funds in the total amount of sources of financing (0,012) and growth of financial return (0,012).

The use of the proposed measures will allow the implementation of the chosen investment strategy of enterprise innovation activity.

4 Conclusion

Signs of quantitative determination of innovativeness of investment projects have been clarified. The internal features are as follows: the degree of implementation of innovations, the degree of change of the object of the project, the need for organizational transformation, the complexity of taking into account the field of knowledge. The external attributes are the level of occurrence of project implications and the scope of their occurrence, which are combined into an integral indicator, taking into account the importance of each attribute for obtaining the expected innovative result. The quantitative measures of the manifestation of the traits taken by expert methods with their integration into the integral indicator, take into account the importance of each trait for obtaining the expected innovative result. The validity of the expert estimates is confirmed by the calculation of the coefficients of concordance. On the basis of the proposed proposals, a methodical

approach to quantitative measurement of investment project innovation is presented.

The combination of investment attractiveness and innovativeness of the investment project is carried out in a methodological provision prior to the formation of investment strategies for the development of innovative activity of the enterprise. It is based on a well-founded matrix of enterprise positioning, according to the quadrants the investment strategies are distributed into. Testing of methodological support of formation of investment strategies of enterprise innovation activity is carried out at three enterprises that carry out innovation projects.

The implementation of the proposed methodological support at industrial enterprises will allow to substantiate the type of investment strategies of enterprise innovation activity in accordance with their capabilities.

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