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RESEARCH ON THE PROBLEMMATICS OF ANTI-CRISIS INNOVATIONS FINANCING IN BUSINESS STRUCTURES

Abstract. The research on the anti–crisis innovations financing in business structures is determined by the need for modern scientific–based methods of crisis management in economic process. In order to prevent negative financial results in activities of all business structure entities, it is necessary to take measures of the anti–crisis program in terms of innovations introduction. The use of innovations joint financing by an integrated association is able to increase the business structure's economic efficiency and helps to prevent crisis situations. The mechanism for funding anti–crisis innovations in business structures is developed in this paper in order to clarify approaches to crisis management. The interpretation of terms "business structures innovations" and "anti–crisis innovations" is substantiated. It is proposed to include the Institute of innovations into the business structure, where an innovation fund should be created aimed to finance anti–crisis innovations. The theoretical and methodological approach to the economic efficiency estimation of business structures that implement innovations to avoid possible crisis phenomena is developed. The investment risk estimation method for BS participants which invest into a company that may be in a crisis is proposed.

Keywords: crisis, anti–crisis management, anti–crisis innovations, business structure, business structure innovations, Institute of innovations, innovations financing, innovation fund.

JEL Classification: O32, G32

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ДОСЛІДЖЕННЯ ПРОБЛЕМАТИКИ ФІНАНСУВАННЯ АНТИКРИЗОВИХ ІННОВАЦІЙ У БІЗНЕС–СТРУКТУРАХ

Анотація. З метою уточнення підходів до антикризового управління у статті дістав подальшого розвитку механізм фінансування антикризових інновацій у бізнес–структурах. Обгрунтовано тлумачення термінів інновації бізнес–структур та антикризові інновації. Запропоновано до складу бізнес–структури включити Інститут інновацій, в якому буде сформовано інноваційний фонд для фінансування антикризових інновацій. Розроблено теоретико–методологічний підхід до оцінювання економічної ефективності бізнес– структур, які впроваджують інновації для уникнення можливих кризових явищ. Запропоновано метод оцінювання ризику вкладень сум грошових коштів учасників БС у підприємство, яке може опинитися в кризі.

Ключові слова: криза, антикризове управління, антикризові інновації, бізнес–структура, інновації бізнес–структури, інститут інновацій, фінансування інновацій, інноваційний фонд.

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ИССЛЕДОВАНИЕ ПРОБЛЕМАТИКИ ФИНАНСИРОВАНИЯ АНТИКРИЗИСНЫХ ИННОВАЦИЙ В БИЗНЕС–СТРУКТУРАХ

Аннотация. С целью уточнения подходов к антикризисному управлению в статье получил дальнейшее развитие механизм финансирования антикризисных инноваций в бизнес–структурах. Обоснованы термины инновации бизнес–структур и антикризисные инновации. Предложено в состав бизнес–структуры включить Институт инноваций, в котором будет сформирован инновационный фонд для финансирования антикризисных инноваций. Разработан теоретико–методологический подход к оценке экономической эффективности бизнес–структур, внедряющие инновации во избежание возможных кризисных явлений. Предложен метод оценки риска вложений сумм денежных средств участников БС в предприятие, которое может оказаться в кризисе.

Ключевые слова: кризис, антикризисное управление, антикризисные инновации, бизнес–структура, инновации бизнес–структуры, институт инноваций, финансирование инноваций, инновационный фонд.

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Introduction. The study of anti–crisis innovations financing in business structures (BS) is determined by the need for the modern scientific–based methods of crisis management in economic processes. In accordance with the world trends in economic, scientific and technological processes development, the need for anti–crisis management arises not only during the steady economic functioning of integrated groups, but also during structural shifts implementation. Practical experience shows that crises in integrated financial and industrial capital associations are not only possible, but they reflect their own innovation development rhythms of each individual entity.

It should be noted that the BS creates favorable conditions for development and implementation of various innovations, since it is easier to solve issues of financing, material support for searches, accelerated implementation of new developments in a business structure than as an individual member of the association.

Research analysis and problem statement. The study of theoretical and methodological principles for innovations joint financing aimed to prevent crisis phenomena in business structures predetermines the following tasks:

- investigation of innovations joint financing mechanism in business structures;
- clarification of the "innovations" definition for further use in business structures, in particular for crisis situations prevention;
- development of theoretical and methodological approach to assessing economic efficiency of business structures that implement innovations aimed at preventing possible crises.

In order to prevent negative financial results in all business entities activities, it is necessary to take measures of the anti–crisis program for introducing novelties, i.e. innovations. Innovations, as a rule, are significant capital– and science–intensive novelties implemented in the development of the main productive force (person), equipment, technology, science, computer science, subjects of labor. Innovations may have a cross–sectoral character, requiring significant risky investments, infrastructure development and comprehensive support from the state.

Innovation is an important management tool in order to ensure the effectiveness of the BS's activities for Grynova V. M. [1]. Researches give grounds to assert that BS innovations are not only technical and technological developments but also new products, new financial and credit services, insurance, investment, trust and leasing services, new favorable conditions for customers, including prices, etc., which allow to improve the activity of such integrated associations.

The question of science and practice integration is widely investigated by domestic and foreign scientists. The main complications of the innovation process are associated with the stage of scientific achievement implementation, which requires a significant financial resources investment in re–equipment, marketing research, etc. The peculiarity is that costs are not redeemable and investments are redundant at this stage, but these investments may pay off in future Kosachjev Yu [2].

The efficiency of innovative technologies is explored by Klejner G. [3]. Enterprises and business structures operation and innovative projects realization are among research objects. In the working paper Belenky V.Z. [4], the optimal strategy for innovation project investing on the basis of economic dynamics statistical model is substantiated, where the possibility of the technology's spin–like change is laid down, depending on the level of the innovation fund's filling.

In this regard, we explore the dynamic model of a vertically integrated business structure, which has financial and credit links. Taking into account approaches [2], we are trying to show that the use of innovations joint financing by an integrated association increases the economic efficiency of the BS and helps to prevent crisis situations.

Research results. Investigation of the innovations joint financing mechanism in the BS was carried out for a situation where there is a steady market demand for products of the integrated group and a stable financial and credit system. At the same time, we believe that all macroeconomic indicators that influence the efficiency of the BS (price level, level of interest rates on loans, discount rates, etc.) change over time in a slow manner, i.e. when we evaluate the investigated processes characteristics, we neglect these changes. BS entity's profit is used as the economic efficiency indicator. Increase of production competitiveness and usefulness is considered as a result of scientific and technological achievements introduction.

It is advisable to create the Institute of innovations (perhaps it is going to be an innovation institute, innovation firm, innovation center, venture capital company, etc.), where an innovation fund is proposed to be formed in order to accumulate the necessary amount of financial resources within the BS.

The Institute of innovations should be included into the industrial and financial capital integrated group at a stable stage of its development.

To ensure the process of renovation (new products development and introduction, fixed assets modernization, new technologies introduction), BS entities should have the appropriate potential (R&D, designing, rationalization facilities production, etc.).

It is necessary to understand that Research and Development (R&D) of business structure entities is the number, qualification, efficiency of employees' work in the field of R&D, the degree of equipment fit–up, the level of management and organization. While introducing new products

and technologies, a close relationship with fixed assets reproduction should be ensured. The existing potential should be used also during reconstruction and modernization activities. Modernization serves as the main form of fixed assets reproduction in order to increase the production efficiency. It involves a close relationship between investments in fixed assets renewal and major repairs. Each BS entity must have the capacity to produce the intended output.

It is advisable to propose the creation of a centralized R&D Institute or the Institute of innovations in a business system that may be used for applied fundamental research and renovation processes that are essential for development of BS. It is also advisable for some participants to have R&D units that focus on the maintenance and improvement of products and technologies. It is necessary to preserve and increase the potential of mentioned institutes and units for scientific saturation of the production process.

Thanks to the unified management, the manager of the BS's Institute of innovations manages the necessary capacities for preparation and implementation of the production renovation process. It has positive influence on concentration, improvement of own management activities and resource mobilization. An important aspect of the manager's activities at the BS's Institute of innovations is the effective organization of cooperation with scientific and technological units that exist in the BS entities. Also the manager is responsible for implementation of the strategic plan for scientific and technological development of the BS, as well as for rationalization and use of fixed assets, carrying out a unified policy on fixed assets' reconstruction, modernization and rationalization in the BS.

The innovation fund formation of the BS's Institute of innovations provides for mobilization of all possible financial resources, including third–party donors involvement on the basis of the share participation. The revenues sources of the innovation fund can be diverse: commercial bank loans, state interest–free loans, investment capital of legal entities and individuals in the form of equity participation in the joint project, own financial resources and other funds.

The bank, which is a part of such a group and act as an investor, receives a research work plan. As a rule, bank's representatives, as well as other donors, create board of directors of the Institute of innovations, participate in its functioning and influence the resolution of all issues. As a result, banking institutions can rely on the share of profits from mass production.

Let's consider the dynamic model of the vertically integrated group (BS), which includes the industrial enterprise A – producer of the main products; the manufacturing enterprise B – consumer of the main products and at the same time the enterprise, which is at risk of falling into crisis; the commercial bank – C; the Institute of innovations – I (fig.1).

Let's suppose that there is such an innovation project aimed to create a new technology that allows releasing new competitive products. Innovation project implementation requires additional costs by attracting part of the resources from the production sector. Project completion depends on the level of the innovation fund accumulations at the Institute of innovations.

Thus, we consider the deterministic model of innovations investing with a known threshold value of IF^* that is sufficient to complete an innovation project. The moment T^0 corresponds to the moment when the innovation fund volume reaches the value of IF^*. So there is an instantaneous transition of enterprise A to the new technology and new products manufacturing starts at both enterprise A and enterprise B, which has been in danger of getting into a crisis condition. The choice of financial resources allocation model (function) for the innovation project implementation may be carried out in accordance with the resource consumption dynamics in similar projects. Continuous or piecewise continuous functions correspond to the resource allocation dynamics during the project life cycle in the most adequate way, since the dynamics progression is an important feature of project implementation [8]. It is assumed in this model that the active investor of the innovation project is producer A, bank C, and the Institute of innovations I. The Institute of innovations I which implements the innovation project may use own funds and funds of third parties on the principles of share participation, herewith total funds amount is equal to IF_0. Then the share of financial participation in the innovation transformations of all business structure participants is be equal to $Q_c = IF^* - IF_0$. At the same time, the bank's share is $FR_c = \gamma_c Q_c$, where $\gamma_c = \gamma_b FR / Q_c$ $(0 \leq \gamma_c \leq 1)$, and the amount of proceeds from the of enterprise A deductions are $(Q_c - FR_c)$.
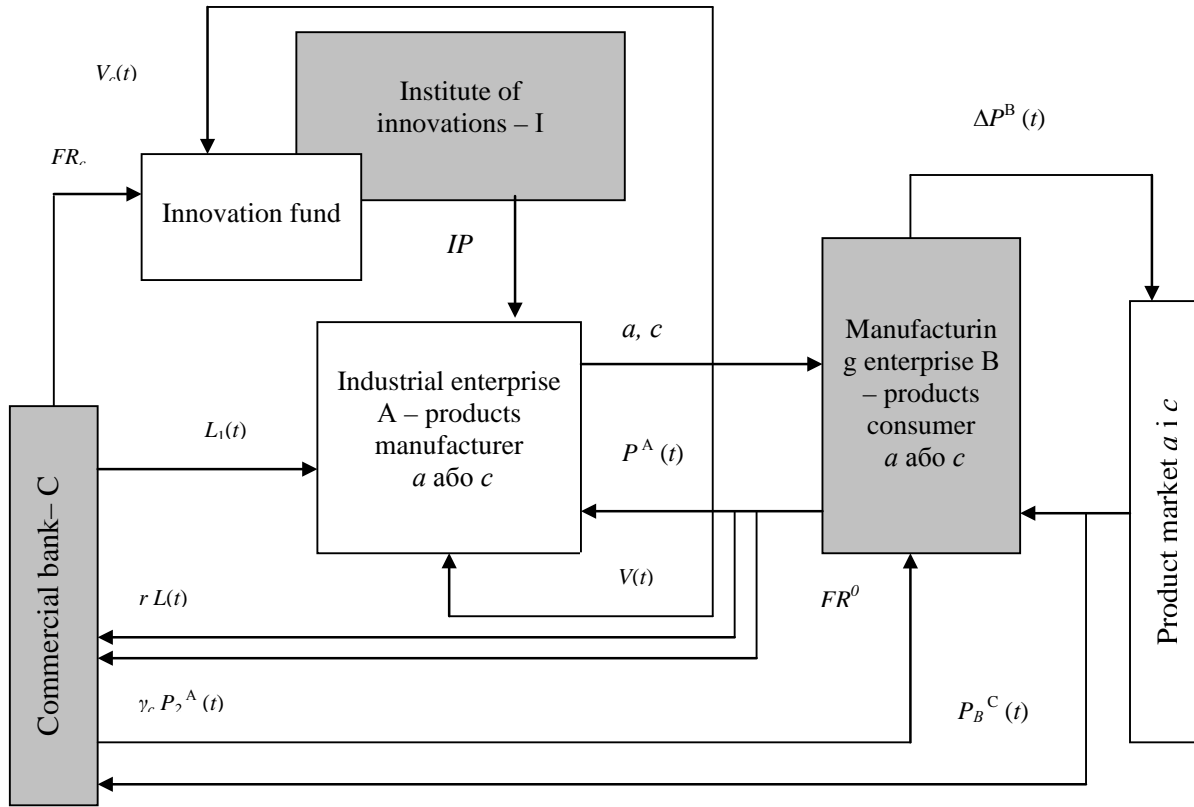
$V_c(t)$

Institute of
innovations – I

FR_c

Innovation fund

IP

$\Delta P^B(t)$

Commercial bank– C

$L_1(t)$

Industrial enterprise
A – products
manufacturer
a або c

a, c

$P^A(t)$

Manufacturing enterprise B
– products
consumer
a або c

Product market a і c

$r L(t)$

$V(t)$

FR^0

$\gamma_c P_2^{\ A}(t)$

$P_B^{\ C}(t)$

Fig. 1. Financing directions of business structures participants that implement anti–crisis innovations
Note: proposed by authors

The legend: IP denotes that the Institute of innovations implements a developed innovation project; $V_c(t)$ denotes the amount of money deducted from the profit of manufacturer A at every moment of time; FR_c denotes that commercial bank deducts a part of its resources (γ_b) in amount of FR_c for innovation project financing; FR^0 denotes that the bank can lend to enterprise A temporarily free funds $FR^0 = (FR - FR_c)$ (loan interest rate r) in order to reduce costs per unit; $L_1(t)$ is the loan granted by the bank to manufacturer A on terms of return (interest rate r) aimed to reduce costs per unit of the output a; $rL(t)$ is the loan repayment with interest rate r; $\gamma_c P_2^{\ A}(t)$ denotes that the bank receives a share of deductions (γ_c) from the profit of the enterprise A in proportion to invested funds in innovations at the first stage; a, c are types of sold products; $P^A(t)$ – profit of the enterprise A; $P_B^{\ C}(t)$ denotes that the bank receives a share of the consumer enterprise's (B) profit (γ_b) in proportion to the invested funds in innovations; $\Delta P^B(t)$ is the profit of the enterprise B; $V(t)$ denotes that the part of the profit V_c is deducted by the enterprise A into the innovation fund, and the other part is directed either to costs per unit reduction, or to the funds accumulations of the enterprise A.

Let's consider the resources consumption dynamics with a constant absolute increase in the form of a linear function $Z(t) = IF_0 + FR_c + V_c(t)$, where $(IF_0 + FR_c)$ is the costs level at the initial moment t_0; V_c denotes the constant absolute growth per unit of time. Then finish period for the innovation project development is: $T^0 = t_0 + (Q_c - FR_c) / V_c$, $V_c = const$.

It is assumed for simplification that only enterprise A and enterprise B participate in joint financing of anti–crisis innovations in the BS, i.e. $IF_0 = 0$, what in turn does not significantly affect the following results and $t_0 = 0$. In this case, these participants' share of financial participation in the innovation project is $Q_c = IF^*$, in particular the share of bank participation is $FR_c = \gamma_c Q_c$. Hence, the equation which connects the parameters γ_c, V_c, T^0 looks like this:

$$T^0 = (1 - \gamma_c) Q_c / V_c, \qquad (1)$$

We introduce the restriction for the accepted model:

$$0 \leq V_c \leq V_{cn}, \; FR < Q_c, \; FR + V_{cn} \, T^0_{pi} > Q_c, \qquad (2)$$

where V_{cn} is the allowable level of deductions from the enterprise's A profit, which corresponds to the minimum amount of the producer's A profit per unit time; T^0_{pi} is the the minimum possible period of the innovation project implementation, $T^0_{pi} = (Q_c - FR) / V_{cn.}$

Considering the finish period T^0 of the project development, it should be noted that by increase of T^0 there is a likelihood that new products' market advantages may be lost under the influence of external factors (moral aging of products, competitors' actions, political and economic changes in the country, etc.). Therefore it is expedient to fix the value T^* in the form of a scheduled term, which determines the maximum allowable finish period of the innovations introduction, while $T^0_{pi} \leq T^* \leq T$.

Thus, there is a correlation between the probability of obtaining one or another profit size and the risk level of the innovative transformations strategy implementation. The lower the profit probability is, the more risky the innovation projects are, and from the other point of view, the higher risk level is expected, the greater project profitability is planned.

Besides the methods for preventing financial crisis risks in activities of integrated group participants it is expedient to foresee some methods for assessing the risk of funds investing in the enterprise with the threat of crisis by BS participants (table 1).

Assessing the risk of funds investing in an enterprise with the threat of crisis by BS participants depends on how uncertainty is taken into account.

An alternative method is the "minimax" method, which generates a list of expected scenarios during the investment process, and two scenarios are selected where the process achieves both maximum and minimum efficiency. Subsequently, the expected effect is estimated by the Hurwitz formula with the constituent of consistency (L). When $L = 0$ (Wald point), the pessimistic assessment of the project's effectiveness is chosen as the basis for decision making, when everything is done to reduce the expected loss in conditions of the unfavorable selected scenario implementation.

Such approach undoubtedly leads to risk minimization of BS participants, who invest their money in updating fixed assets of the enterprise that is facing a crisis situation. However, the use of this approach may have negative consequences concerning business activity reduction of BS participants.

Table 1

Methods for assessing the risk of funds investing in an enterprise with the threat of crisis by BS participants

Methods	Method's essence
"Minimax" method	A list of expected scenarios for the situation development during the process of capital formation should be prepared and two scenarios should be selected from these directions, where the process achieves both maximum and minimum efficiency.
Method for determining the risk level by taking into account enterprise losses	The risk level is determined, taking into account the size of losses and the probability of these losses.
Method for risk assessment using the model of capital assets estimation of the enterprise (CAPM)	The model shows what level of return on assets of the enterprise can be expected within the ideal risk–free and common market rates, taking into account enterprise's opportunities that form the level of riskiness.
Proposed method for determining the risk level	In order to evaluate and analyze an effective new direction of BS enterprise development which requires additional financial resources in an unfavorable (crisis) financial situation, we adopt this strategy as an average weighted estimate, where the occurrence probability of this or that strategy implementation assessment is taken as the base for weighting coefficients and the average expected norm of profitability is calculated.

Note: proposed by authors

The methodology for determining the risk level which takes into account losses amount and the likelihood of these losses may be used:

$$R = L \times P_l / 100\%, \tag{3}$$

where: R is the risk size, hrn.; L denotes losses amount, hrn.; P_l is losses probability, %.

Also the capital asset pricing model (CAPM) is known as a model for risk assessment and mathematically it can be represented in the following way:

$$R_c = R_f + \beta(R_m - R_f), \tag{4}$$

where: R_c is the expected income (discount rate for equity),%; R_f denotes risk–free income rate, %; β is the beta coefficient of the project's risk level; R_m denotes the average market rate of return, %.

In case of unsystematic risk the model looks like this:

$$R_c = R_f + \beta(R_m - R_f) + E, \tag{5}$$

where: E is the increase in discount rate due to unsystematic risk, %.

The model shows what level of return on assets of the enterprise can be expected within the ideal risk–free and common market rates, taking into account the enterprise's opportunities that form the risk level β. The calculation of the rate of return on money directed to the given development strategy implementation in comparison with the profitability of the funds directed to alternative strategies development may be performed for the anti–crisis strategy of the business structure participant. In this regard, it is necessary to indicate the expediency of combining enterprises in the BS, what may also allow analyzing the riskiness of alternative strategies and reduce the risk level due to market positions of such an integrated group.

The probability theory may be used in order to estimate the risk level. Let's suppose that the internal rate of return *(Rv)* of the project implementation concerning the fixed assets renovation of the BS enterprise, which is in a crisis situation, depends on the probabilistic assessment of its realization possibility. Let's consider five probable assessments of the implementation strategy (high, permissible, average, low, unacceptable) in its relationship with the internal rate of return of the project (table 2).

Table 2

The evaluating probability of the development strategy implementation by the participant of business structure

Probabilistic score	The probability value of such an assessment (p_i)	Internal rate of return (R_v),%
High	0,1	45
Permissible	0,2	35
Average	0,4	30
Low	0,2	20
Unacceptable	0,1	10

Note: proposed by authors

To evaluate and analyze an effective new direction of BS enterprise development, which requires additional financial resources because of an unfavorable (crisis) financial situation, we adopt this strategy as an average weighted estimate, where the occurrence probability of this or that strategy implementation assessment is taken as the base for weighting coefficients and the average expected norm of profitability is calculated (R_v^{av}):

$$R_v^{av} = \Sigma p_i \times R_v \tag{6}$$

The average probabilistic estimate for the normal probability distribution law for the enterprise is the highest value, and then the probability values are evenly reduced to one (acceptable and high score) and another (low and inadmissible score) sides.

The root–mean–square deviation σ can be taken as a measure of risk with a high degree of accuracy and calculated by the formula:

$$\sigma = \sqrt{\sum \left(\left(R_v - R_v^{\,av} \right) \times p_i \right)} \tag{7}$$

The lower the value of σ is, the lower the risk while introducing a new strategy development for the BS enterprise is expected.

Consequently, the correct organization of scientific and technical work in the BS may enable favorable conditions creation for the process of updating enterprise production and products marketing implementation at a high level.

Conclusions. In order to clarify scientific approaches to promising research in the field of crisis management, the authors' interpretation of the term "business structure innovation" is presented: new products, new financial and credit services, insurance, investment, trust and leasing services, new favorable conditions for customers, including prices, etc., which make it possible to improve the activity of such integrated associations. At the same time, taking into account the directions of influence, we propose the definition of anti–crisis innovations of the BS: these are technical and technological developments, new products, new financial and credit services, insurance, investment, trust and leasing services, new favorable conditions for customers, including prices, etc., which allow to provide anti–crisis activities of integrated associations.

During the research, it was accepted as the upward idea that proposed theoretical aspects concerning the main tasks and functions of the BS's Institute of innovations actualize the issues of identifying and overcoming the reasons that impede the BS's improvement and, at the same time, these aspects make it possible to clarify study approaches to crisis management of BS's innovation transformations. In order to accumulate the required amount of financial resources in the BS, it is proposed to create the Institute of innovations (perhaps an innovation institute, innovation firm, innovation center, venture capital company, etc.), which is aimed to form an innovation fund to finance anti–crisis innovations.

In order to prevent crisis situations in BS the theoretical and methodological approach to assessing the economic efficiency of business structures' innovation co–financing has been developed, taking into account the principles of innovation risks management in integrated associations.

The substantiated theoretical and methodological approaches to innovations financing in business structures can be used in further research on the appropriate theoretical support development for crisis phenomena prevention, for carrying out work both at the individual entity level and the at the level of business structure as a whole.

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