THE CONCEPT OF A PROACTIVE APPROACH TO ANALYZING THE EFFECTIVENESS OF INVESTMENTS IN NATURAL RESOURCES

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ABSTRACT

In the context of analyzing the effectiveness of investments in natural resources, the most important point of the proactive approach is, first of all, to assess the level of adaptation of the investment project to the future conditions of its implementation. It is not possible to adequately implement this by traditional forecasting methods based on the" movement " from the past to the present and further to the future. We need a fundamentally new approach that implements the "movement" from the future to the present. This proactive approach is based on simulation and expertise. To simulate both negative and positive actions of the external environment of investment projects, a homogeneous Markov chain with discrete time is used. In contrast to the scenario approach, in which the state of the economy is assumed to be unchanged throughout the operational period, it assumes a change in the state of the economy at each step of the calculation period, which will allow the inclusion of the factor of economic turbulence in the system of making investment decisions. Implemented the principle of accounting for all consequences of implementation of investment projects both economic and non-economic (externalities, public goods), despite the fact that they allow quantification or some effects can only be assessed qualitatively with the involvement of experts. To do this, all the consequences are abstracted into four categories: "Benefits", "Costs", "Opportunities", and "Risks". The first and second categories include consequences considered as random variables, and the third and fourth categories are random events. Functional-morphological analysis and synthesis are used to build a variety of alternative investment projects, this allows building unusual and unique options in addition to the usual natural alternatives. A hierarchical model for assessing the level of adaptation of investment projects to the future conditions of their implementation is proposed.

Keywords: *proactive adaptation, pro-activity, proactive approach, investment project, methodological principles, homogeneous Markov chain with discrete time, complete consequences system, control hierarchy, value functions*

1. INTRODUCTION

The phenomenon of pre-emptive adaptation was reflected in the work of many scientists, however, the concept of “pre-adaptation” was originally formulated by C. Darwin as an

independent evolutionary phenomenon and "... reflects the fact that organisms have not yet realized their readiness to adapt to the future, and the readiness formed in the old environment "[1]. According to many scientists, the conceptual basis for solving the problem of proactive adaptation can be the idea of anticipatory reflection, which is understood as adaptation to future, not yet arrived events[2].Thanks to the accumulated experience, there is a person's ability to get ahead of the course of external events and "... with the greatest beneflt to adapt to future often dangerous phenomena of the outside world long before these phenomena take place"[3]. Currently, the concepts of "pre-emptive adaptation", "pre-adaptation", "pro-activity", forming a synonymous series, are widely used in various fields of human activity. Proactive (proactive monitoring) is widely spread in the field of information technology. It is considered as the main tool for predicting the behavior of the system, identifying "weak" places and, ultimately, solving problems before they become critical. Recently, it has become widely used in management, since in conditions of limited solvent demand, fierce competition and constantly increasing production of various goods and services, the company's management needs to use qualitatively new management approaches to ensure the stable functioning and effective development of the company. One of these approaches is proactive management. The proactive approach is of particular importance in investment management because it is necessary to determine in advance, at the pre-investment stage, the future effects of each of the considered investment projects in order to prevent the manifestation of negative effects, reduce their importance increases the effect of positive effects. At the same time, the theoretical and, above all, mathematical tools developed to date to support a proactive approach to the analysis of the effectiveness of investment projects cannot be considered satisfactory, because it does not allow, firstly, to take into account all the most signiflcant quantitative and qualitative consequences of their implementation, secondly, inadequate conditions of economic turbulence taking into account risks and opportunities (managerial options). In this regard, studies focused on the development of the mathematical apparatus and methodological tools to support a proactive approach to the analysis of the effectiveness of investment projects should be recognized as relevant.

2. METHODOLOGY

It is generally accepted that the life cycle of an investment project is represented in three stages: pre-investment, investment and operational. At the same time, since the late 1950s, managers from both large and small companies in the countries with highly developed economies have come to the necessity of introducing a new, post-investment phase of the project life cycle. The need for this stage is also indicated by leading Russian experts in the field of investment theory P.L. Vilensky, V.N. Livshits, S.A. Smolyak, adding a stage " at the completion of the project ", on which " a posteriori assessment, an assessment of actual effectiveness "[4]. The authors note that the importance of the " stage at the completion of the project 'stage is not so much to verify the effectiveness of the project after its completion as to develop recommendations for improving the quality of investment decisions at the pre-investment stage for newly initiated investments in natural resources. In world practice, the analysis of investment projects at the pre-investment stage is called pre-investment research, consisting of three stages [5]. At the first stage, called the study of investment opportunities, a pre-investment research program is formed. At the second stage, the customer begins the development of a declaration (application) of intent, in which the most suitable option for investing in the capital investment object is selected, the preliminary conditions and location (area) of the object are located and approximate technical and economic indicators within the investor's financial capabilities (restrictions). At the third stage, the determination of practical actions for investment is carried out.

In domestic practice, in accordance with the Methodological Recommendations for assessing the effectiveness of investment projects (hereinafter referred to as the Recommendations), the pre-investment phase is also carried out in three stages[6]:

- development of an investment proposal and declaration of intent (express assessment of the in vestment proposal);
- development of "Justification of investments";
- development of a feasibility study for the project.

Consequently, the main tasks of both world and domestic practice of pre-investment research are:

1) the formation of a list of potential investment projects at the stage of rapid assessment of the investment proposal;
2) analysis and selection of the most effective project option at the stage of justification of investments;
3) development of a feasibility study for an effective project option.

Moreover, the unsatisfactory theoretical and methodological basis for the analysis and selection of the most effective project option often leads to serious errors. For example, in accordance with the Recommendations, the assessment of the effectiveness of alternative investment projects at the pre-investment stage should be carried out with different depth of study at its various stages (the principle of multi-stage evaluation). At the same time, the volume and nature of the available information at the initial stages of this stage do not allow the use of classical methods for evaluating the effectiveness of investment projects, since their cash flows cannot be reliably predicted; therefore, the integral effect of implementation or other performance indicators cannot be calculated [7]. Some scientists propose to begin the implementation of the pre-investment phase from the moment of thorough elaboration of the project idea, since, in their opinion, only "... a thorough study of the idea often significantly changes the initial idea of its scope, implementation mechanism and possible effectiveness"[8]. Moreover, to describe the project idea, the author introduces the concept of a conceptual project - a document describing the constructive idea of the project, its goals and objectives, novelty, the amount of necessary resources, uniqueness, strengths and weaknesses, and investment attractiveness. The formation of a conceptual project is recognized as an important part of the process of implementation of the pre-investment phase, since the two-stage approach "conceptual project - business plan" avoids the situation when full-scale and costly research leads to a negative conclusion regarding the feasibility and effectiveness of the idea - such a conclusion can usually be made already based on a conceptual design. The idea of using investment projects to assess the effectiveness of investment projects at the pre-investment stage seems to be quite constructive, in our opinion, however, questions remain about what a conceptual project is and how to build it based on the project idea. Other authors [9,10] also note that the need for analysis and evaluation of many alternative project options leads to significant resources and time. To simplify the procedure for the preliminary selection of cost-effective investment projects, the authors propose using simpler practical methods of selection based on economic methods of express analysis. However, the only simplification here is to use equal-sized cash flows that have a uniform distribution. Thus, despite numerous attempts to simplify the procedure for evaluating and selecting an investment project at the pre-investment stage, using the concept of "conceptual project", the question of describing the investment project and evaluating its effectiveness at all stages of the pre-investment stage (from the innovative idea of the project to its implementation) remains open. In addition, the question of using a proactive, proactive approach for the effectiveness of an investment analysis remains unexplored. The use of proactive approaches is now possible due to, as noted above, the ability of a person to make

decisions taking into account the accumulated experience, the development of the mathematical apparatus for modeling possible situations in the future, and also due to the fact that an active transition is being made from traditional forecasting to the principles of the methodology " technological foresight ", or the Foresight methodology.

3. RESEARCH

The methodological principles of the concept of a proactive approach to the analysis of the effectiveness of investments in natural resources are based, firstly, the principles applicable to any types of projects regardless of their technical, technological, financial, sectoral or regional features and formulated in the Recommendations, which are based on the methodology UNIDO, secondly, the principles of the "technological foresight" methodology, or the Foresight methodology. In accordance with the Recommendations, when determinmg the effectiveness of investment projects, we will take into account all the consequences of its implementation throughout the entire life cycle (settlement period). We will divide the calculation period into steps — the segments within which data are aggregated; the calculation steps will be determined by their numbers(0, 1, ..., T). To simulate both negative and positive actions of the external environment of the functioning of mvestment projects, a homogeneous Markov chain with discrete time is used. The state of the economy at each step of the calculation period will be described by the following sequence:(S^1, S^2,…, S^n). Unlike the scenario approach, in which the state of the economy is assumed to be unchanged throughout the entire billing period, it is assumed that the state of the economy will change at each step of the billing period, which will enable the inclusion of economic turbulence in the investment decision-making system. To build a complete system of consequences at each step of the calculation period, we use the methodology of SWOT-analysis, as a key Foresight tool. At the same time, we assume that any consequence of the implementation of the investment project at some step of the billing period can have either a positive or negative effect. The positive effect at a certain step of the calculation period is determined in our ideas, firstly, by cash receipts (B – Benefits), generated by the investment project, secondly, favorable events, or opportunities (O – Opportunities). The negative effect at a certain step of the billing period is determined in our ideas, firstly, by cash payments, or investment costs(C – Costs), necessary for the implementation of IP, secondly, adverse events, or risks(R – Risks). Thus, a conceptual investment project related to natural resources(IP) has the following formal description:

$IP= (\{B, C, O, R\}^1, \ldots, \{B, C, O, R\}^T)$.

We will use the conceptual investment at each stage of the pre-mvestment stage to calculate its effectiveness, while the concept of "various development depths" formally means the degree of certainty of the corresponding sets. In order for this model to be a working tool when making investment decisions, a methodological approach is needed that would allow us to carry out assessments from the perspective of evaluation criteria. In this study, for these purposes, we will use the hierarchical structure analysis methodology, which is based on the rigorous mathematical eigenvector method for processing inverse symmetric matrices (matrices with power calibration) [11,12]. Graphically controlling hierarchy for assessing the integral effectiveness of investment projects will be presented in the form of the following hierarchy (Figure 1)

Figure following on the next page

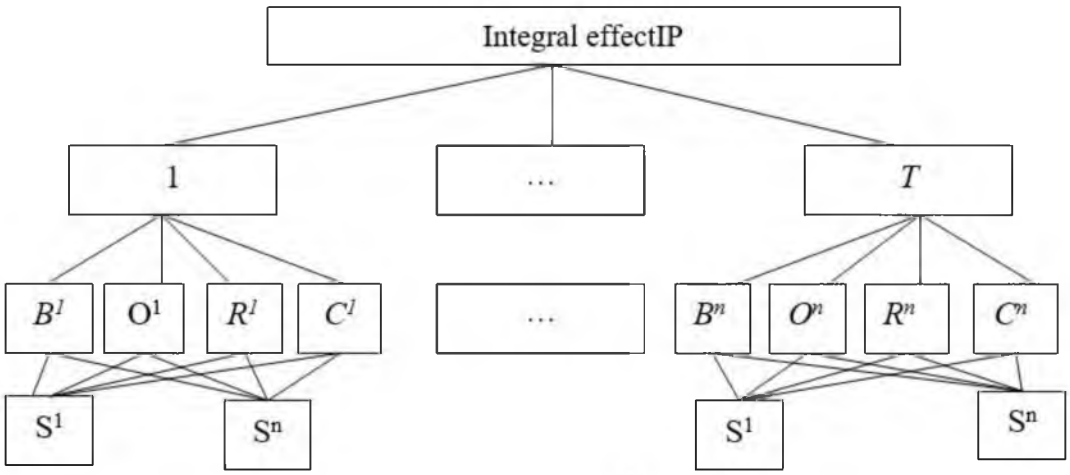

Figure 1: The management hierarchy for assessing the integrated effectiveness of investment projects

Formally, the integrated assessment of the effectiveness of investment projects is calculated according to the following formula:

$$\varphi(ip) = \sum_{t=1}^{t} \varphi_{t}(ip) * w(t)$$

where w (t) - "weight", the significance of the t-th step of the calculation period, φt (ip) - is the value function of the investment project at step t of the billing period.

In turn, the value function of the investment project at step t of the calculation period will be calculated using the following valuation functions, which are constructed in accordance with the hierarchy analysis method[13]:

- $\varphi_t^B(ip)$ — IP assessment function from the position of the criterion "benefits at the t-th step of the calculation period";
- $\varphi_t^C(ip)$ — the function of evaluating the IP from the position of the criterion "costs at the t-th step of the calculation period";
- $\varphi_t^O(ip)$ — IP assessment function from the position of the criterion "opportunities at the t-th step of the calculation period",
- $\varphi_t^R(ip)$ — IP assessment function from the position of the criterion "risks at the t-th step of the calculation period".

By the multiplicative form of aggregation, we finally obtain the value function of the investment project at step t of the calculation period [13]:

$$\varphi_t(ip) = \frac{\left(\varphi_t^B\right)^{w_B}\left(\varphi_t^O\right)^{w_O}}{\left(\varphi_t^C\right)^{w_C}\left(\varphi_t^R\right)^{w_R}},$$

where w^B — " weight ", the priority criterion of "benefits",
w^O— " weight ", priority criterion for "features",
w^C— " weight ", priority criterion "costs",
w^R — " weight ", priority of the criterion "risks".

We note that " weights ", the priorities of the criteria, and also the significance of the t-th step of the calculation period are based on the principles of the hierarchy analysis method.

4. CONSLUSION

The article attempts to introduce a proactive approach to the analysis of the effectiveness of investments in natural resources, the essence of which in the general formulation is to prevent threats before they become relevant. In the context of the analysis of the effectiveness of investment projects, this means, first of all, an assessment of the level of adaptation of each of the analyzed projects to future conditions for their implementation. It is not possible to adequately implement this using traditional forecasting methods based on " movement " from the past to the present and further to the future. A fundamentally new approach is needed that implements " movement " from the future to the present. This proactive approach is based on UNIDO methodological principles applicable to any type of project, regardless of their technical, technological, financial, industry or regional specifics and the principles of "technological foresight" or the Foresight methodology. The implementation of these principles becomes possible due to the ability of a person (expert) to make decisions taking into account the accumulated experience (expert knowledge) and simulation modeling of future events, conditions, situations, actions. To simulate both negative and positive actions of the external environment of the functioning of investment projects, a homogeneous Markov chain with discrete time is used. In contrast to the scenario approach, in which the state of the economy is assumed to be unchanged throughout the entire operational period, it is assumed that the state of the economy changes at each step of the calculation period, which will enable the inclusion of economic turbulence in the investment decision-making system. The principle of taking into account all the consequences of the implementation of investment projects, both directly economic and non-economic (external effects, public goods), is implemented, despite the fact that they allow a quantitative assessment or some consequences can only be assessed qualitatively with the help of experts. To do this, all the consequences are abstracted into four categories: "Benefits", "Costs", "Opportunities" and "Risks". In the first and second category fall consequences considered as random variables, in the third and fourth - random events. A control hierarchy is proposed for assessing the integral effectiveness of investment projects, and corresponding evaluation functions are defined.

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