

## Model of Investment of Small Enterprise in Industry

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**Abstract.** The need for the development of small enterprises in Russia against the background of stagnation in this segment of the economy in recent years makes studying the problem of investment attractiveness of this market segment relevant to finding opportunities and prospects for the development of small business in Russia. The purpose of the research: the construction of a model for investment decision-making based on a small enterprise in industry. Methodology: methods and models of financing, evaluation of investment attractiveness, modeling. Results: a conceptual model for investment decision making is developed, taking into account the choice of the financing option, the method for assessing the effectiveness of investments and the decision support system in the context of the specifics of a small enterprise in industry. The research is given in the context of analyzing linguistic variables of risk assessment and fuzzy parameters of the main indicators of a project and are supplemented by some elements of scenario analysis.

### 1. Introduction

A small enterprise can develop independently or be integrated into the chains of global companies or follow other options of development, financing of projects could be interesting for regional and local state authorities. Besides, the polymer production has features from ecological point of view, which should be taken into account when assessing the investment attractiveness of projects.

The listed is the basis for criteria for selection of methods and methodic of valuation of investment projects and financing methods and base for investment for small enterprises in industry.

Thereby, the purpose of research is construction of the model of investment decision-making based on small enterprise in industry.

The most complicated part is to optimize the portfolio given the constantly changing conditions whereby the project is being implemented. There is always room for the effect of externalities and internal factors, so decisions are made in the conditions of uncertainty. When investment projects are

chosen, determined data is substituted for probable one, both expert and statistic methods are used and risk premium is considered, so that the uncertainty factor is taken into account.

The authors assume that expressing expert assessments through fuzzy numbers reduces the drawbacks of average weighted values of project input parameters, which may result in considerably shifted point estimates of efficiency and risk indicators. In some situations the theory of probabilities is not effective due to the lack or imprecision of data. In such cases the fuzzy set theory should be used. Fuzzy sets were determined by L. Zadeh in 1965 as a formal apparatus for treating statements of a natural language (Zadeh, 1965). According to this theory, experts may give a specific mathematical sense to the results of expert assessment, after which qualitative expert estimates can be transferred into quantitative ones (Krutikov, 2017). Another positive aspect is to use scenario approach in fuzzy sets: an expert commission suggests several case scenarios: a pessimistic one, an optimistic one and the expected one. The information obtained as a result can be joined as a fuzzy triangular number - for each project - and compared so that the best projects are chosen.

## **2. Model formation of investment**

The construction of the model starts from presentation of expected result of modeling. The result of modeling should include: methods of valuation of investment attractiveness; Methods of financing of investment project and investment decision support system. Therefore, we used various theories and methods in the subject domains. In this case, taking into account the specifics of the object and the uncertainty of the external environment of its functioning, we consider it expedient to use a combination of methods in a unified system.

The existing methods of investment decision-making do not contradict, but complement each other, and, consequently, can be used in the integral methodology. Therefore, we consider the expediency of using the basic method of net present value (NPV) and the accompanying method of calculating the internal rate of return (IRR), method of calculating the payback period (PB) and others in combination with methods of economic value added (EVA) and fuzzy sets (Kalugin, 2017, Balashov, 2014, Brusov, 2014, Rogova, 2011).

The main methods of financing are: self-financing, corporatization, loan financing, leasing, venture financing (Balashov, 2014, Brusov, 2014, Rogova, 2011). We suppose, the using of methods proposed and its combinations should become the base for forming alternative design options for investment.

The formation of alternative investment solutions for a variety of methods for assessing investment projects and methods for their financing is the subject of the theory of fuzzy sets (Zadeh, 1965, Zadeh, 1976, Chernov, 2010, Chernov, 1999).

For information support of investment decisions, considered the creation of a single structured system for monitoring data on each of the possible methods for making investment decisions in the context of macro- and meso-factors of the external environment (Vetrova, 2017). Such a support system should include information, ways of collecting and processing it in the context of the country's social and economic development, regions, municipalities, sectoral and regional complexes, enterprises. In these conditions it is advisable to use the methodology of architecture (Zachman, 1997).

To design an investment decision-making model that we identified with three main components: a unit of methods for evaluating investment efficiency, a block of financing methods, and an information support system for an investment decision, it is necessary to take into account:

- participants in the investment decision-making process;
- a complex of information resources, regulatory legal documents formed at various levels (regional and sectoral strategies, programs, projects, methodological materials ...);
- peculiarities of decision making by Russian and foreign investors;
- the possibility of adjusting investment decisions on the agreement of all participants in the investment process.

The model for making an investment decision in the context of the system and the management process can be presented as:

- A) Methodologies for assessing the effectiveness of investment projects;

B) Methods of financing investment projects, which form the basis for the formation of alternative options;

C) Information support systems for investment decisions.

A conceptual model for making an investment decision is presented at the fig. 1.

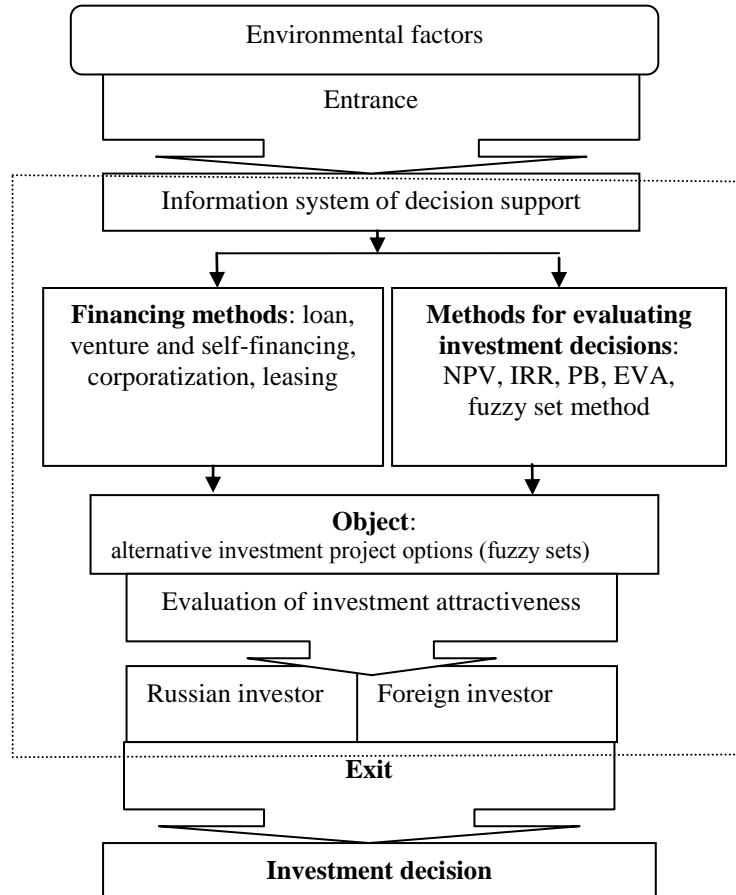


Figure 1. Model of investment.

Creation of a single structured system for monitoring data on each of the possible decision-making methods and methods for evaluating the effectiveness of investment projects in the context of macro- and external factors form a database on socio-economic development, economic indicators, sectoral and regional complexes, monitoring from various sources: federal statistical reporting agencies, departments, offices and enterprises.

Technologically, this stage can be based on the concept of the Data Warehouse (Vetrova, 2017), which will ensure greater efficiency in making decisions by the investor, regardless of the level of his awareness of the region at the initial stage of the investment project evaluation. The main advantage of this system is a single, structured, generalized representation of real, quantifiable indicators or structured fuzzy sets that determine the choice of the method of making an investment decision.

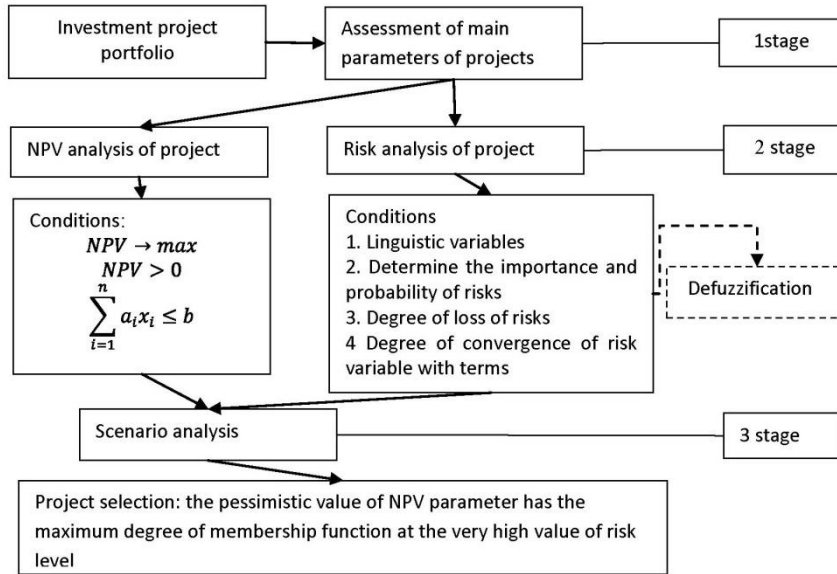
### 3. Portfolio building

The reviewed main publications on the fuzzy set theory used for building an investment project portfolio and assessing project risks prove that the topic is popular both in Russian and foreign sources. The following rules can be distinguish in applying fuzzy sets to optimize a project portfolio.

When the fuzzy set theory is, apply to assess investment projects, it is necessary to decide on the algorithm of actions and methodology of assessment. Thus, for example, when the membership

function is determined, the accuracy of knowledge about a complicated phenomenon is define by estimating the grade of membership of a variable in the fuzzy set. An element can belong to a set within a range of 0 to 1 with a bigger or smaller degree of reliance.

We propose that a project portfolio should be optimize by analyzing fuzzy parameters of risk, which will also allow us to assess the risk level of the projects in the portfolio. To do so we choose two main areas: NPV and risks. Figure 2 shows a scheme for building an investment project portfolio by using an apparatus of fuzzy sets.



**Figure 2.** Scheme for Selecting the Best Investment Projects Using the Apparatus of Fuzzy Sets.

The undoubted advantage of the fuzzy set theory applied to project assessment is the capacity to compare qualitatively different indicators and parameters with various units of measurement.

When a set of investment projects is considered at an enterprise, it is difficult to choose qualitative indicators and to compare and select from the presented alternatives. Net present value is most commonly use to judge the efficiency of a project. An integrated value of a project is hard to define as a whole, but, at the same time, every project is a single scheme, and individual suggestions cannot be use. To analyze and choose a project, it is necessary to determine the main parameters, whereby the decision will be taken to build a portfolio. Therefore, projects are chose if they can be implement with the available amount of initial capital investment and ensure the maximum amount of net present value.

For those projects that have been select for analysis, the investment expenditures and the total amount of available investment funds *b* are determined. To do so it is suggest that the fuzzy set theory, scenario approach and risk assessment should be combine. Calculations are made separately for every project. Both general risks (such as underfunding and strategic risks) and specific risks, inherent to a particular project are determine. It is preferable that the selection of economic indicators should be the same for all projects. Most commonly, it is NPV, IRR and, in rare cases, payback period. NPV is divide into discounted cash flows for big or long projects.

**4. Conclusions**

Since a small enterprise is considered to be a business entity, and investments are considered in the polymer industry, it is necessary to clarify the specifics of all the elements of the investment decision-making process, taking into account the specifics of the subject, object and subject matter.

The investment decision is the result of an integrated assessment of the investment object in terms of the methods of financing and the results of the investment assessment, the opportunities and risks

associated with it, the investment decision support system, taking into account all participants in the investment activity.

Participants of decision-making of small enterprises in polymer industry are:

- Owners, investors, both Russian and foreign;
- Management of the company;
- Partners, incl. resource providers, large companies, in which chains small businesses can be built;
- Regional and / or local government authorities interested in developing the territory;
- Experts, specialized in matters of investment activity and specificity of industry production.

The process of an standard investment decision-making , consists of stages, its content is determined by the specifics of the object and subject:

- Evaluation of the investment case. An important role is played by methods of external analysis, in modern conditions these methods are characterized by a high level of variability and mobility.
- Formulation, initial assessment and selection of investment proposals. At this stage, we pay special attention to methods for evaluating investment decisions, methods of financing and information support system.
- Analysis and decision- making.
- Project implementation and monitoring.
- Post-investment control.

In the last three phases, the defining role is played by the business environment in the territory, including the infrastructure.

We formulate the basic principles for investment decisions for small industrial enterprises in the polymer industry as follows:

- return on investment;
- minimization of potential risks;
- acceptability of deadlines;
- review of the project throughout its life cycle — from pre-investment studies to the termination of the project;
- modeling of cash flows, including all cash receipts and expenses related to the project implementation for the billing period, taking into account the possibility of using different currencies;
- comparability of the conditions for comparing different projects (project options);
- time factor determination;
- the disparity of non-recurring costs and / or outcomes (preference for earlier results and later costs);
- accounting only for future costs and revenues;
- evaluation of previously created resources used in the project, based not on the costs of creation the project, but with an alternative cost;
- comparison "with the project" and "without the project";
- accounting for all the most significant consequences of project implementation (economic, environmental, social, etc.);
- accounting for the availability of various project participants, the discrepancy between their interests and the different estimates of the cost of capital, which is expressed by individual values of the discount rate;
- multi-stage evaluation at the stages of substantiation of capital investments, development of feasibility studies, selection of a financing scheme, monitoring, etc.;
- accounting inflation and risk factors, as well as the possibility of using it in the implementation of multiple currencies for the development of the project;
- accounting for the working capital requirement for the newly created organization.

Since the problems of investment attractiveness of small enterprises in the polymer industry are being investigated for this business segment in order to attract not only domestic but also foreign

investors into the industry, the investment attractiveness of small enterprises in the polymer industry in Russia should be considered taking into account the regional specifics of the current or future location of the enterprise in the industry. At the initial stage of the formation of the algorithm for making an investment decision, the investor needs a structured data system in the context of regions with the possibility of comparison with the purpose of assessing the feasibility of investments, both at the stage of forming a new enterprise and investing in the operating business.

Building an investment project portfolio based on the fuzzy set theory has quite a few advantages, such as versatility, flexibility and a wide coverage of estimates. The fuzzy set theory apparatus implies big preliminary work at the stage of identifying and analyzing risk factors, which contributes to a more exact assessment of risk, accumulation of a risk database and, in prospective, assessment of risk factors in dynamics. The drawbacks include complications in the perception of this theory and difficulties in interpretation of results. A risk criterion depends not only on the assessment, but also on the weight of the criterion, the degree of importance in the complex assessment of a project risk. Combining risk assessment and NPV analysis helps us to determine the best composition of projects in a portfolio. The other considerable advantage of this method is the opportunity to compare qualitatively different elements of a system with various units of measurement.

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