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INNOVATION ENGINEERING AS THE INSTRUMENT OF DECISION- MAKING SUPPORT

***Abstract.** The proposed methods of assessment of the innovation project by way of application of innovation engineering as the information-analytical instrument. Methodology of situation modeling has been used for assessment of the innovation project technological decisions effectiveness.*

***Key words:** engineering, financial engineering, innovation project, investment activity, innovation engineering*

Introduction

One of the priority lines of economic policy in the developed nations is introduction and further support of innovations. The process of support of the innovations requires taking into consideration a great number of various factors that have an influence on the effective return of the investments or other expenses for development and introduction of the advanced technologies. Application of the information systems for supporting decision-making becomes evermore topical and the reason of it is the number of the information technologies and the opportunities for their implementation.

The process of creation of a product or a service from the existing and accessible resources is usually called engineering. Within the wide range of already existing brands of engineering there has appeared the need for the engineering of creating innovations, because only every tenth innovation project becomes recognized and is included in the manufacturing process. Application of methodology of innovation engineering gives the opportunity to avoid typical errors in the development of the innovative products. The conceptual foundation of the innovation engineering is the systemic, object-oriented and coordinated interaction of all participants of the innovation process [1].

The life cycle of an innovative product includes the following stages: development of the product, introduction of the product to the market, termination of production and sales in the market. Along with the life cycle of an innovative product for the systemic innovation, there is also the life cycle of the technical system, that is longer in comparison with the life cycle of the innovative product and covers the period from its groundbreaking idea to the removal from operation and utilization [2].

If an innovative product is a certain technical system, the following tasks have to be accomplished for realization of its life cycle:

- carrying out a functional analysis of the original innovative idea and identifying advantages of the proposed innovation over the existing means;
- identifying opportunities for the implementation on the basis of the existing and available resources;
- analysis of the needs that will be satisfied in case of implementation of the proposed innovation; determination of important and potential sales markets for the innovative product;

- determination of economic feasibility of development and production of the innovation;
- carrying out preliminary functional-cost analysis of the market concept of innovation;
- development of a pilot functional system and the system operation algorithm;
- carrying out internal system analysis;
- identifying the existing contradictions on the functional level;
- development of documentary support for the innovative idea;
- assembly, testing and trial of the product;
- preparation of the draft technical specification for the engineering design of the specimens of the innovative product.

1. Preliminary data

Engineering envisages a complete development of the project from the idea to the implementation and further monitoring. Thus, appearance of the financial engineering was facilitated by changes in the domain of banking and investment capitals. Financial engineering is a combination of design, development and implementation of the innovative financial instruments and processes, as well as a creative pursuit of the new approaches to resolving financial problems.

Financial engineering covers a wide range of issues – corporate finances, management of long- and short-term cash investments and the risks involved therewith. In general, the risk is the possibility of occurrence of a certain unfavorable event, entailing various kinds of losses (for example, a physical injury, loss of property, receiving income below the expected level, etc.). In other words, a risk is an activity associated with overcoming an uncertainty in a situation of the inevitable choice, in whose process it is possible to make a qualitative and quantitative assessment of the likelihood of achieving the anticipated result, a failure to achieve and deviation from the goal. The main features of a risk are contradictions, alternativeness and uncertainty. The alternativeness of a risk means the need to make a choice from two or more possible options of decisions, directions, actions. If there is no open options, there is no risk situation and, accordingly, there is no risk [3].

The key task of financial engineering is specialization in advancing and conducting negotiations on simplification and sale of credit lines intended for the construction of manufacturing enterprises.

Thus, in this case, financial engineering is development and monitoring of the project, starting from the intentions to build and obtain material assets, including those from foreign investors, to the completion of construction and repayment of credit already during operation of the enterprises.

Financial instruments are examples of the innovative use and combining existing financial instruments for reducing financial risk, lowering the cost of financing, using some advantages and peculiarities of accounting and tax legislation, or for the use of an ineffective market. There are external and internal factors producing influence on the rapid development of financial engineering [4]. The external factors include, in particular, volatility of prices, general globalization of industrial and financial markets, tax asymmetries, achievements of the financial theory in the sphere of new techniques and technologies, changes in the regulatory, legislation, strengthening of competition and operating costs. As to the internal

factors, it should be noted, that they include especially the need for the liquid funds, reluctance to risk on the part of managers and owners of the company, as well as divergence of their interests.

New financial instruments can be classified as follows:

1. By their designation:

– financial instruments that lower the cost of attraction or increase efficiency of investments;

– financial instruments that redistribute market risks;

– financial instruments that reduce pressure of regulatory, accounting and tax constraints;

– financial instruments designed to use segmented or ineffective markets inefficiently.

2. By types of the instruments:

– financial instruments based on the "technology" of forwards and swaps;

– financial instruments based on the option "technologies";

– debt financial instruments.

3. By the operationally productive principle:

– financial instruments based on consumer products and securities;

– financial instruments based on financial processes;

– financial instruments based on financial strategies and decisions.

The process of support of the innovative decision-making requires taking into consideration a great number of various factors that have an influence on the effective return of the investments or other expenses for development and introduction of advanced technologies.

2. Statement of the problem

Application of innovation engineering from the information-analytical standpoint permits to use the principles of situation modeling for gathering, processing and analysis of the input information for comprehensive assessment and prediction of the innovation projects.

Thus, in order to implement the principles of innovation engineering, the following tasks have to be achieved:

– identification of input and output data components;

– development of the algorithm for a possible postponement of reimbursement of a credit and the bank interest thereon;

– study of the risks of the first year of the investment project implementation;

– elaboration of the conceptual diagram of interaction of the investment process participants analysis of the opportunities for increasing the profitability of the project.

The following output data can be obtained based on the analysis of the state of the innovation project:

1. General preliminary settlement payments.

2. Basic net foreign currency earnings (FCE).

3. Assessment of the results of payments.

4. Structure of payments:

– loan repayment;

– banking interest (k % per annum);

– indebtedness to the bank (z millions of US dollars);

- insurance amount (^q% and postponement of payments).
- 5. Possibility of restructuring payments.
- 6. Project profitability level.

3. Example

Absence of the meaningful state concepts is not an obstacle for establishment of the elements of sustainable development systems at various levels. Thus, according to the UN recommendations, there is a need for the initiative to develop local elements of sustainable development and their further scaling. It is for this purpose that an innovation project was developed for the construction of the system for integrated solid domestic waste processing and organization of the enterprise for the eco-friendly disposal of solid waste with further production of alternative energy and other useful products. Rapid development of industry makes it possible to apply a variety of methods for sorting out and processing solid domestic waste, namely: pre-sorting, sanitary waste landfilling, combustion, biothermal composting and pyrolysis. The objective of this project is to create an environmentally friendly, safe and commercially healthy solid waste management system, but as this project is a pilot project, technical, organizational and economic solutions used in it must ensure their effective use in the construction of waste management systems in other regions with similar reference conditions.

The project envisages commissioning of a production facility for processing 200 tons of solid domestic waste and 100 tons of organic agricultural waste and sludge waste per day. In general, the structure of solid domestic waste in the region is in line with the average statistical data on Ukraine and has the following structure: paper and cardboard – 10-35%, food waste – 20-50%, plastic materials - 4-15%, etc. The main mass of waste is organic components - from 35 to 50 percent with the essential increase of packaging paper and plastic materials in recent years. Compared to housing sector waste, the waste of non-housing sector is characterized by the increased content of unpolluted waste paper, metals and plastic materials.

Preliminary analysis of modern technologies for processing solid domestic waste was conducted when choosing technological solutions with the use of situation modeling methods. Thus, taking into consideration technological, industrial and organizational aspects, comprehensive use of technologies of the companies GTE International Holding (Hungary) and Zorg Biogas (Switzerland) was chosen. Solid domestic waste processing complex of the GTE International company consists of three systems – sorting, gasification of organic waste and depolymerization. Waste paper, metals, glass and some other waste are packed and sold to consumers immediately after sorting. Organic waste products are gasified and produce synthesis gas that is used for generation of electric power. In its turn, the depolymerization system recycles milled and dried plastic waste and polymer film for further production of synthetic fuel (a mixture of about 30% gasoline and 70% diesel fuel.) It should be noted that equipment of the company GTE International complies with all EU requirements, including those presented to diesel fuel synthesized in the result of recycling.

Conclusion

The components of innovation engineering and financial instruments discussed herein are examples of innovative use aiming at reduction of financial risk and at lowering the cost of financing innovation projects. Thus, application of the innovation engineering methodology allows to optimize the flow of financial resources, to assess effectiveness of investment and provides opportunities for elaboration of substantiated recommendations for the effective innovative decision-making.

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