INNOVATION PROCESSES MANAGEMENT

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ABSTRACT

The article presents the process of innovation management and modelling. Modelling is an important tool, which enables qualitative and quantitative evaluation of development and implementation of innovation projects. The authors outline the aims of the National Innovation Program of the Republic of Latvia as well as specify the sources of financing the research. The article analyses statistical information on fundamental and applied research projects and financing allocated to the projects in specific branches of national economy. The authors establish an interrelation between investments and innovation stages, as well as present a description of a model for implementing innovations.

In order to develop and optimise innovation projects it is necessary to use econometric methods, which allow to quickly and qualitatively process statistical information. The article describes the model of innovation project management and the stages of implementing the model.

Key words: Innovation, modeling, economic development, optimization

Innovations are the decisive factor of the competitiveness of industry of each country. A relevant feature of innovation is that the owner of the particular innovation gains a considerable competitive edge in the market.

In order to help science to produce specific socially and economically favourable results it is necessary to create a mechanism for promoting innovations, for applying results of scholarly research, and for supporting establishment of innovation-focused enterprises. An innovation-focused and knowledge-based economy is the most effective way to a developed economy and political stability for small countries that are not rich in energy or other relevant natural resources, Latvia being one of them.

Nowadays the dynamics of economic development is no longer determined exclusively by traditional resources, such as natural wealth, labour resources, capital and the classical industrial and agricultural branches, but increasingly by high technology-based industries.

The high-tech component has become a crucial source of competitiveness and value added in practically all the branches of national economy. At the same time, enterprises focusing on high technologies and application of high technologies in enterprises of traditional industries can develop only in an innovations-friendly economic environment supporting innovative efforts, i.e., in a country that is consistently implementing a national policy for developing innovations and having an effectively operating national innovations system.

In 2003, the LR Cabinet of Ministers approved the National Programme for Innovations 2003 – 2006. The goal of the Program is to promote the enhancement of the capacity of national innovations. At the same time, the National Programme highlights the following sub-targets:

- harmonised and coordinated development of an environment fostering innovative activities;
- establishment of sustainable, innovative enterprises and creation of the basis promoting their development;
- promotion of unique and competitive economic structures.

In 2003, in order to assist businessmen to elaborate projects for obtaining co-financing from the structural funds, the LR Ministry of Economics offered small and medium-sized businesses to apply for support within the framework of the national programme "Support Programme for Preparing Projects for the European Regional Development Fund".

The goal of the Programme was to identify innovative project ideas and support development of projects in such areas as:

- development of new products and technologies;
- development of business-related infrastructure;
- human resources development;
- promotion of competitiveness.

An innovations project, viewed as a process of implementation of innovations, is a set of orderly sequenced research, technological, production, organizational, financial and commercial activities that would lead to the required and desired changes.

The main factor that could restrict the possibilities of enterprises to make investments is shortage of financial resources to be invested in the implementation of the project. Therefore, entrepreneurs are frequently faced with the issue of utilising investments in the most optimum way.

Possible sources of investments are:

- own financial assets;
- external financing and loan funds;
- allocations from the state budget;
- direct and indirect foreign investments.

Since 2004, organisations and enterprises of the Republic of Latvia may have access to the co-financing from the EU Structural Funds, which means increased possibilities for financing economic development projects.

The National Innovations Programme is a long-term programme and its implementation envisages utilisation of all sources of financing intended for national programmes:

- state financing (funds from the basic budget or special budgets) or financing from municipal (self-government) budgets,
- loan funds or direct investments,
- financing from special target programmes of international organisations,
- other sources of financing (special target donations by enterprises, organisations and private persons).

In Latvia, two scenarios of the development of national economy have been elaborated (for a medium-term period – until the year of 2010) depending on the fluctuations of external demand:

- a slower growth scenario with smaller possibilities for increasing export (option 1);
- a dynamic development scenario envisaging faster growth of export under a more favourable external market conjuncture (option 2).

The results of the forecast are presented in figure 1.

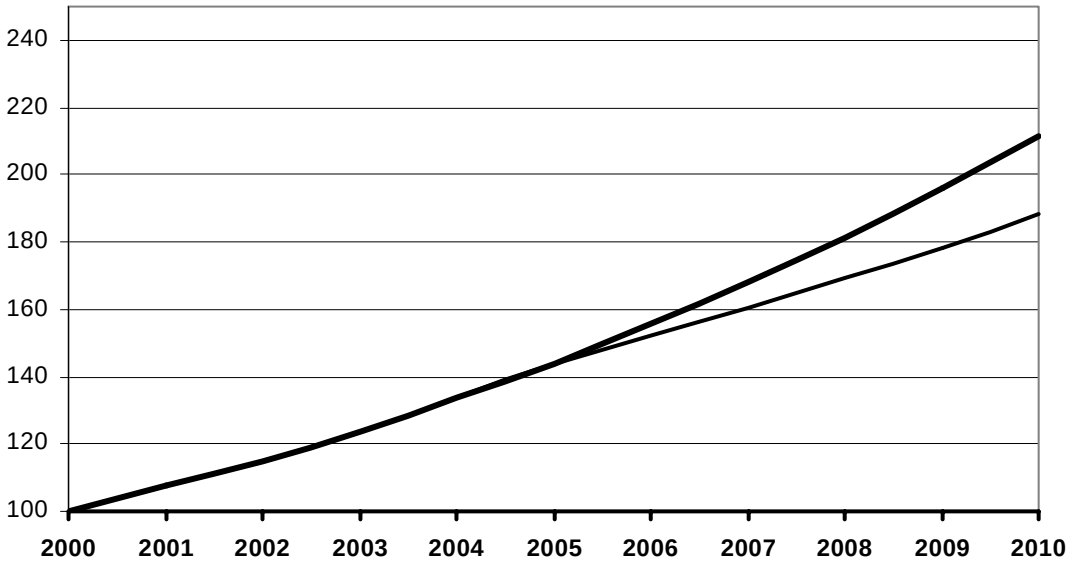

Figure 1. Forecast for the Latvian GDP until 2010 (%, 2000. = 100)

For Latvia priority branches of science are: economics, juridical sciences, chemistry, Latvian Studies, optoelectronics, mechanics, applied mathematics, computer science, communication technology, energetics, biology.

The analysis conducted within the framework of the research shows that in the development of relevant innovative capacities Latvia is lagging behind many EU member states. Which means that, if Latvia wants to be competitive and achieve prosperity on the European as well as global scale, it has to prioritise the objectives and tasks of promptly eliminating the existing drawbacks in the national innovations system.

Enhancement of economic activity in Latvia is to a great extent dependent on the efficient management of innovation processes.

Innovation process management may be expressed as a model (see fig. 2).

The management of innovation projects has to be effected by applying methods of economic and mathematical modelling allowing to assess and analyse the project, and to quickly and qualitatively process statistical and other data.

Imitation modelling is one of the most widespread methods of research of economic objects and systems.

The selection of methods of modelling of the object under consideration depends on a great number of conditions (modelling components), e.g.:

- complexity of the object or system being researched;
- the character of behaviour of the object or system;
- the character of behaviour and the impact of the factors on the changes of the entity or economic

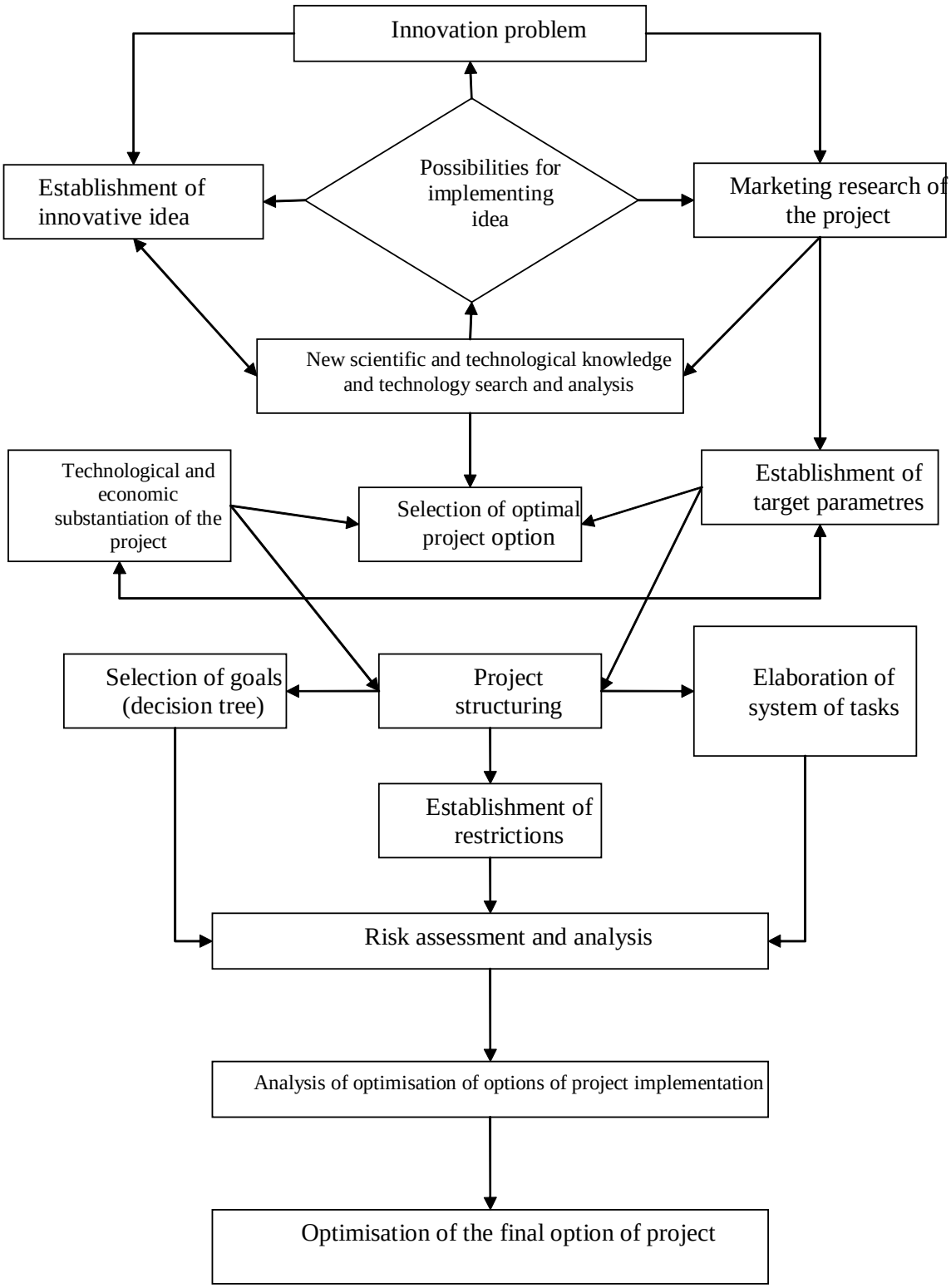

Figure 2. The model of innovation process management

system being investigated;

• other similar conditions.

Fig. 3 presents a process of creation of an imitation model.

Where the relations between separate components forming the model are comparatively simple and can be accurately described, analytical models can be used for obtaining the required information.

However, most of the economic processes and systems are complex entities, consisting of a great number of interrelated sub-systems (which in their turn also are complex objects and require a detailed study), changing their positions in space and time.

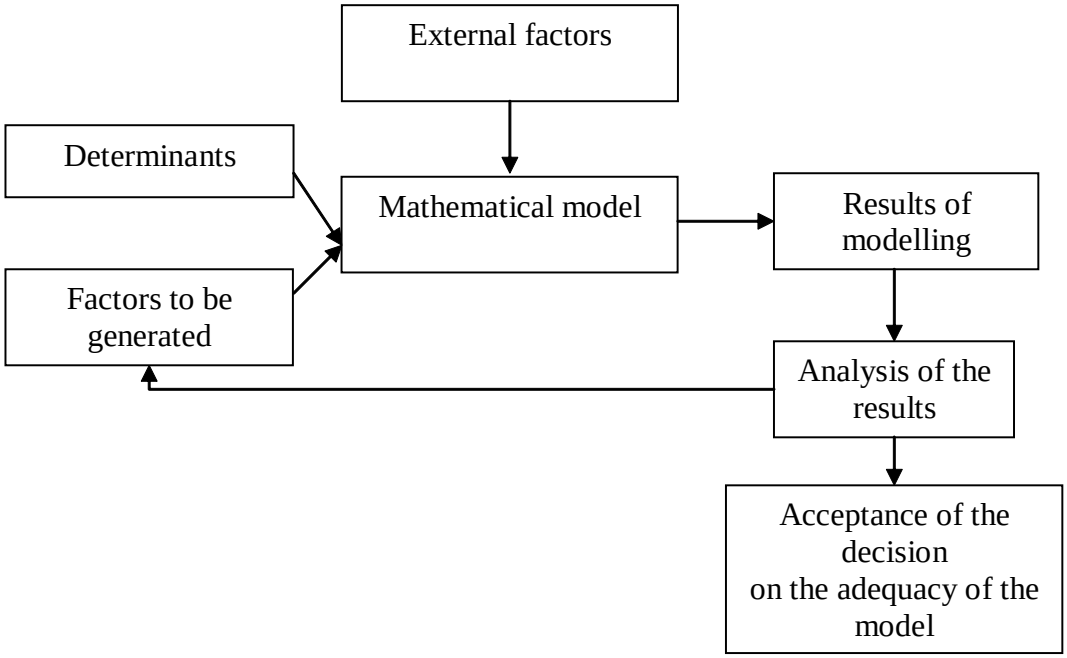

Figure 3. Process of creation of an imitation model

For researching such economic systems it is impossible to create an absolutely accurate effective model by applying analytical methods. In such cases it is necessary to use the methods of imitation modelling.

Imitation modelling is usually applied for researching economic processes and systems. Such factors are called incidental variables or incidental values, and their behaviour is described by means of common probability distribution functions.

Imitation modelling may be used for tackling a wide range of economic problems (design and analysis of industrial systems, stock management, balancing of production capacities, allocation of investment funds, optimisation of investment funds, optimisation of flows of services etc.).

Imitation modelling is frequently associated with the factor of uncertainty, whose description goes outside the confines of the traditional statistical modelling, which, in its turn, complicates the imitation modelling process.

The aim of the research is to find innovative ways of using imitation modelling for investigating economic systems. As a result, it is possible to set the task of creating an efficient procedure for generating incidental parameter values constituting factors of an imitation model, to consider the asymmetric distribution of model factors, to create an adequate model of non-linear dependence between the factors, to effectively use up-to-date information technologies, to ensure continuous control of the behaviour of the specific economic system that is being researched.

The traditional scheme of imitation modelling is the formation (generation) of a mass of incidental parameter values featuring the changes of model factors (see fig. 4).

The algorithm of generation of incidental continuous value X, having continuous distribution function F, can be described in the following steps:

1. Let us generate, within an interval (**0.1**), an evenly distributed incidental parameter $\mathbf{u \sim U(0.1)}$.

2. Let us calculate $\mathbf{X = F^{-1}(u)}$.

The value of $\mathbf{F^{-1}(u)}$ will always be definite, since $0 < u < 1$, but the area of defining the function **F** is the interval [0,1]. The figure below presents the essence of the algorithm graphically; here incidental

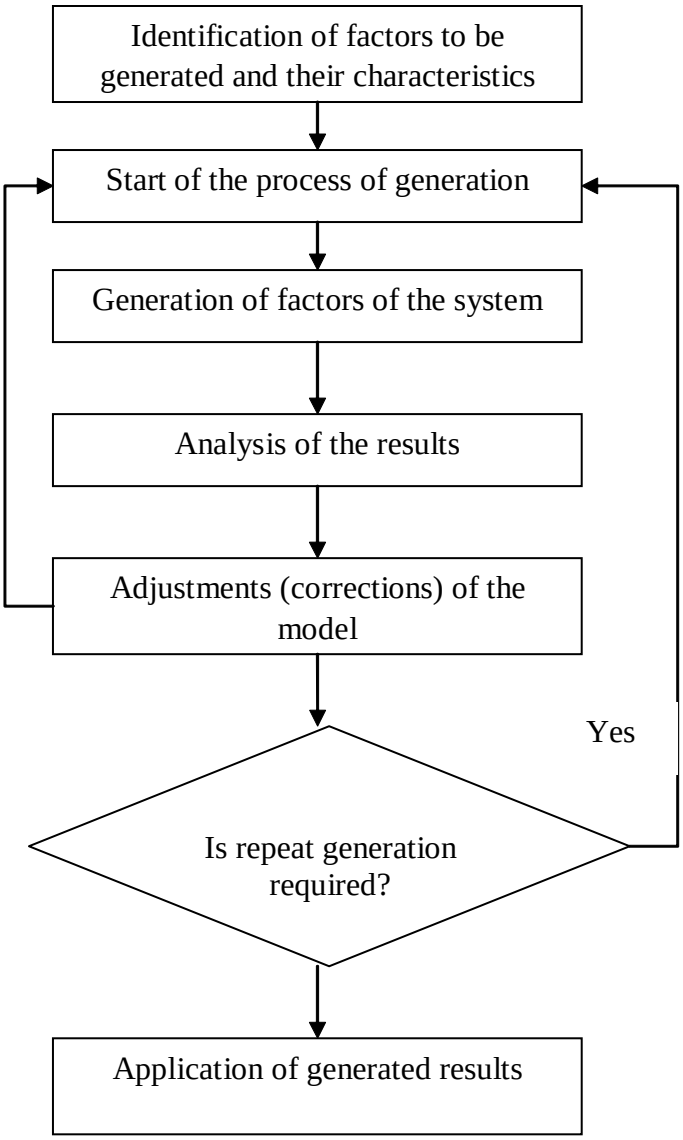

Figure 4. Algorithm of generation of incidental parametres

value may be assumed to be either positive or negative. This depends on the specific value of parameter **u**. In the figure, the value of parameter $\mathbf{u}_1$ produces a negative incidental value $\mathbf{X}_1$, but parameter $\mathbf{u}_2$ yields a positive incidental value $\mathbf{X}_2$.

The method of reverse transformation may be also used if value **X** is discrete. In this case the distribution is as follows:

$$F(x) = P\{X \le x\} = \sum_{x_i \le x} p(x_i) \qquad (1)$$

where $\mathbf{p(x_i)}$ is probability $p(x_i) = P\{X = x_i\}$

It is admitted that incidental parameter **X** may have only such values as $\mathbf{x}_1$, $\mathbf{x}_2$, …, for which

$\mathbf{x}_1 < \mathbf{x}_2 < \ldots$.

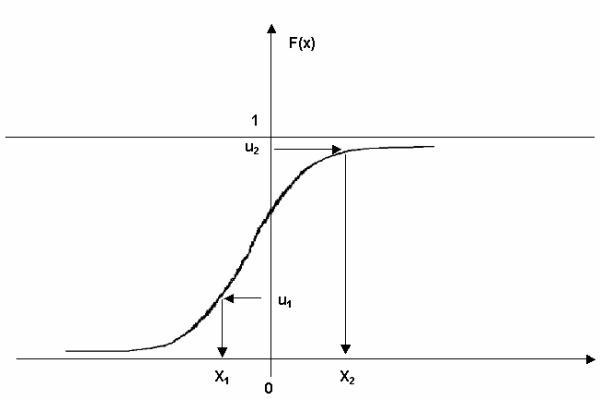

Figure 5. Scheme of reverse transformation

Thus the algorithm of developing the values of incidental parameter **X** will have the following consequences:

• Let us generate, within the interval **(0.1),** evenly distributed incidental parameter **u ~ U (0. 1)**;

• Let us establish the least positive round value **I**, for which **u < F(x_i)**, and assume that **X = x_i**.

Both options of the method of the reverse transformation for continuous and discrete values (at least formally) can be combined in one formula:

$$X = \min P\{x : F(x) \geq U\} \quad (2)$$

which is true also for mixed distributions (i.e., containing both continuous and discrete components).

In contrast to commonly used direct methods of generating incidental values (the method of the reverse transformation composition and implosion), for imitating the factors of the imitation model it is recommended to use the so-called indirect methods, namely, the acceptance-refusal method. This method may turn out to be suitable if due to certain reasons it is impossible to apply direct methods or if these methods are inefficient.

The "acceptance-refusal" principle is rather common. If the aforementioned algorithm is looked upon from a slightly different perspective, it is clear that it may be extended for generating incidental points in areas having higher dimensions – i.e. in multi-dimensional areas.

This is relevant in modelling real economic systems by applying the Monte Carlo method.

When using the MS Excel programme, users usually apply standard functions for modelling incidental parameter values in a dynamic regime. The simplest economic problems may be modelled by means of an installed **Data Analysis** block or **SIMTOOLS**, **POPTOOLS** superstructure in MS Excel, which allows to simultaneously model the required number of incidental parameter values with given factors.

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