AN ASSESSMENT OF REGIONAL SOCIO-ECONOMIC PROJECTS

УДК 519.816:332.145

Vadim A. Lomazov,
Doctorate of Physical and Economic Science, Associate Professor, Professor, the Department of Informatics and information Technologies, Belgorod State Agricultural Academy
E-mail: vlomazov@yandex.ru

Viktoria S. Nehotina,
Assistant of the Department of Information Systems and Technologies, Belgorod University of co-operation, Economics and Law
E-mail: nnviktory@yandex.ru

The problem of development of models and methods for carrying out the assessment of socio-economic projects is examined. The approach to informational simulation of project status on the basis of the determined, statistical and linguistic description of separate indexes is offered. A hierarchical procedure of calculation of project's resulting figure is developed.

Keywords: socio-economic project, information model, project evaluation.

Вадим Александрович Ломазов,
д.ф-м.н., доц., профессор кафедры информатики и информационных технологий, Белгородская государственная сельскохозяйственная академия
Эл. почта: vlomazov@yandex.ru

Виктория Сергеевна Нехотина,
ассистент кафедры информационных систем и технологий, Белгородский университет кооперации, экономики и права
Эл. почта: nnviktory@yandex.ru

ОЦЕНКА РЕГИОНАЛЬНЫХ СОЦИАЛЬНО-ЭКОНОМИЧЕСКИХ ПРОЕКТОВ

Рассмотрена проблема разработки инструментальных средств (моделей и методов) информационной поддержки оценки социально-экономических проектов, реализуемых органами регионального и муниципального управления. Предложен подход к информационному моделированию состояния проекта на основе детерминированного, статистического и лингвистического описания отдельных показателей. Разработана иерархическая процедура расчета результирующего показателя проекта.

Ключевые слова: региональный социально-экономический проект, информационная модель, оценка.

Formulation of the problem and objective of the work

Socio-economic development of regions is one of the priority tasks of state social policy of the Russian Federation and it is carried out, as a rule, on the basis of regional social and economic programs which consist of several projects. The regional social and economic projects corresponding to different spheres (education, health care, culture, sports, employment, social support of people, etc.), certainly have their own peculiarities, however existence of common goal (sequential increase of standard of living) and the general conditions of implementation (regional level) allow to refer these projects to one class.

The problem of evaluation of projects that present themselves as important instruments of regional development is actual not only at the initial stage of choosing of the most effective projects, but also at the subsequent stages of adjustment of earlier made decisions on the basis of project progress monitoring. The accounting and analysis of large number of indexes which characterize regional socio- economic projects are impossible without application of methods of economic-mathematical simulation and the modern information technologies.

Widely-used methods of project evaluation are more oriented on business projects (for example, [1-4]) and don't consider a row of features of the socio- economic sphere connected to existence of not only the quantitative, but also qualitative (linguistic) characteristics of projects that requires an application of artificial intelligence theory approaches.

The General scheme of the procedure of evaluation of projects

The main purpose of the research is a development of theoretical provisions that may become a foundation for information and algorithmic support of an assessment of regional socio-economic projects.

An estimation of regional socio-economic projects within competition of projects is based on an objective data of characteristics of a considered project transformed by means of special evaluation scales to indexes (measured in points) and expert opinions generalized with a using of the relative significance of private indexes. The estimation diagram as procedures of determination of a resultant index of regional socio-economic projects as a result of processing of initial project information is shown in figure 1.

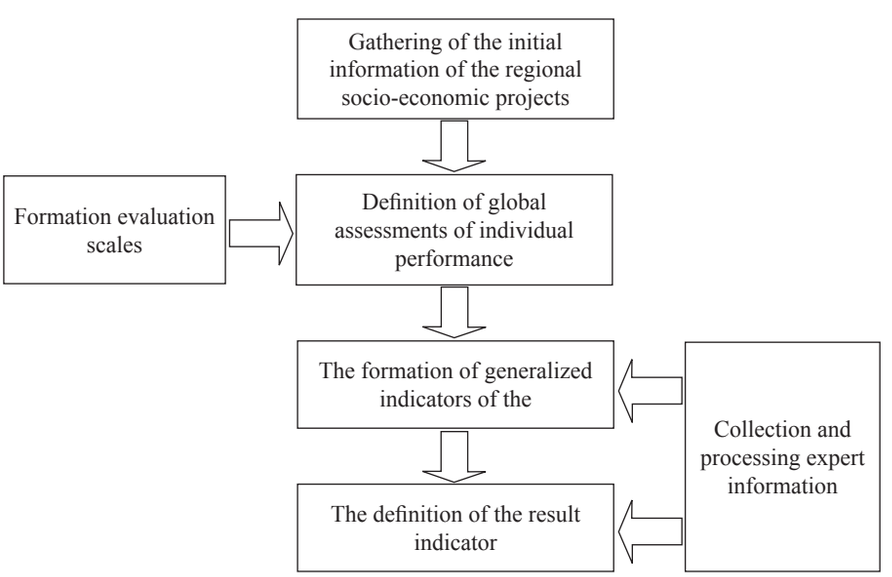

Fig. 1. The General scheme of the procedure of the estimation of regional socio-economic projects

Formation evaluation scales and definition of global assessments of individual performance

A collection of initial information about regional socio-economic projects is carried out on the basis of data that is provided in the request of the organization, implementing the project, and also on the basis of independent sources that the scientific organizations and the certain experts who conduct the audit might be.

Within the initial description of characteristics of regional socio-economic projects we will consider the three types that correspond to different methods of the accounting of uncertainty which is inevitable in the analysis of projects:

1) type D – the determined characteristics that don't consider uncertainty of properties of projects;

2) type S – the statistical characteristics reflecting probable nature of uncertainty;

3) type L – the linguistic characteristics that have verbal values and reflecting unsharpness of concepts, used in case of project evaluation.

A formation of the evaluation scales, that allow to transfer from values of characteristics of the project to their dimensionless point indexes is made by the persons that organize competition of projects, proceeding from the purposes of regional social and economic programs.

Methods of creation of point indexes are various for different types of characteristics of regional social and economic projects. For the determined characteristics the D transition to the discrete (point) $D_x \rightarrow D_b$ values is carried out on the basis of check of accessory of values of the characteristic x to evaluation intervals:

$$D_b = j \quad \text{for} \quad x \in I_j.$$

In that specific case a uniform scale of conversion when evaluation intervals are equal on length, the discrete point value can be calculated by the formula:

$$D_b = \left[\frac{n(x - x_{\min})}{x_{\max} - x_{\min}} \right]$$

where square brackets designate an operation of taking of an integer part of a number, n – the maximum number of points for the considered characteristic; x, $x_{\max}$ and $x_{\min}$ – transformed, maximum value and the minimum value of the characteristic. Value of $x_{\min}$ is set by requirements of conditions of projects' competition and corresponds to the best of theoretically possible (as a rule, almost unrealizable) standart project. In case of achievement by value x its best (in the case the greatest) $x_{\max}$ values ($D_x = x_{\max}$) point value of this characteristic of D_b also accepts the greatest possible value n ($D_b = n$). In case of the minimum value of this characteristic ($D_x = x_{\min}$) D_b also accepts minimum possible value 0 ($D_b = 0$).

Stochastic properties of regional socio-economic projects are connected with an influence of arbitrary factors on results of implementation of regional socio-economic projects and are characterized by mathematical expectation of $M(x)$ and dispersion $\sigma^2(x)$. Possible limits of variation of these quantities are $M_{\min}(x)$, $\sigma^2_{\min}(x)$ and $M_{\max}(x)$, $\sigma^2_{\max}(x)$, as well as they are set earlier by the minimum requirements and the greatest possible reference values. The relative significances of mathematical expectation of $M(x)$ and $Pr(x)$ accuracy (understood as value, reverse $Pr(x)$ dispersions = $(\sigma^2(x)) - 1$) the stochastic characteristic of S are described by weight factors of a_1, a_2:

$$a_1 + a_2 = 1,\ a_1,\ a_2 \geq 0$$

Generally a transition from stochastic characteristics of S to the discrete (point) $S_x \rightarrow S_b$ values is calculated as follows:

$$S_b = j \quad \text{for} \quad (a_1 M(x) + a_2\, Pr(x)) \in I_j$$

In the case of uniform scale transformation, this formula takes the form:

$$S_b = \left[a_1 \frac{n(M(x) - M_{\min}(x))}{M_{\max}(x) - M_{\min}(x)} + a_2 \frac{n(\Pr(x) - \Pr_{\min}(x))}{\Pr_{\max}(x) - \Pr_{\min}(x)} \right]$$

Linguistic description of the particular characteristics of regional socio-economic projects is connected with the specifics of the social sphere where a row of concepts doesn't allow the quantitative measurement. In this case the mathematical tools of the linguistic analysis [5] according to which the linguistic variable is a tuple:

$$L_x = < X,\ G,\ \theta_b(X),\ U,\ M >$$

in which X – the name of a linguistic variable; G – the syntax rule that generates names of verbal (linguistic) values of a linguistic variable; $\theta(X)$ – term set (a set of the verbal values generated by the syntax rule G); $\theta_b(X)$ – basic term set (part of a term set; the remaining terms generated by the syntax rule, are built of the $\theta_b(X)$ elements by means of a finite set of linguistic modifiers and sheaves); U – the universum in which indistinct sets appropriate to terms of a linguistic variable (an indistinct set are defined expresses sense of specific verbal value); M – the semantic rule which is setting sense of each term from $\theta(X)$, i.e. $M{:}\theta(X) \rightarrow Fuzzy(U)$, where $Fuzzy(U)$ – a set of all indistinct subsets of U. To each verbal value of a linguistic variable ($T \in \theta(X)$ term) the semantic rule M puts in compliance the semantic contents expressing it an indistinct set of $M(T)$.

It will be assumed that the verbal linguistic variable values associated with the numerical (U − a segment of the valid straight line $[x_1, x_2]$) and thus limit ourselves by trapezoidal membership functions. In this case, the indistinct set supp $M(T)$ is completely defined by two segments: the bearer of the an indistinct set supp $M(T)$ and its kernel *ker* $M(T)$. Then the transition from linguistic characteristics to discrete (point) $Lx \rightarrow Lb$ values is calculated as follows:

$$L_b = j \quad \text{for} \quad (a_1 Sl(x) + a_2 Sr(x) + a_3 Kl(x) + a_4 Kr(x)) \in I_j$$

where $Sl(x)$, $Sr(x)$ are the left and the right ends of a segment of supp $M(T)$, $Kl(x)$, $Kr(x)$ – the left and the right ends of a segment of *ker* $M(T)$, and a_1, a_2, a_3, a_4 – the normalized non-negative weight factors ($a_1 + a_2 + a_3 + a_4 = 1$, a_1, a_2, a_3, $a_4 \geq 0$), reflecting the relative importance of values $Sl(x)$, $Sr(x)$, $Kl(x)$, $Kr(x)$ for creation of a point assessment of the linguistic characteristic x.

The approach allowed to construct the dimensionless discrete coding of measure of values of regional socio-economic projects that is necessary for the subsequent formation of the generalized indexes of projects.

The formation of generalized and outcome indicators projects

Reduction of number of the considered regional socio-economic policy (RSEP) parameters can be implemented at the expense of combining and eliminating duplication of related characteristics of the project (Figure 2.).

The basis for abbreviation can be:

− the revealed statistical (correlative) dependences between values of characteristics ([1,2]);

− the correlations defined in case of mathematical simulation of processes of change of characteristics ([6-9]);

− opinions of experts ([2,5]).

Thus, if at the next stage of procedure of abbreviation in case of detection of the considerable communication between indexes of one level a certain distinction of their values is marked, it is expedient (without discarding "duplicating" indexes) to integrate these indexes in one generalized index (an additive weighted

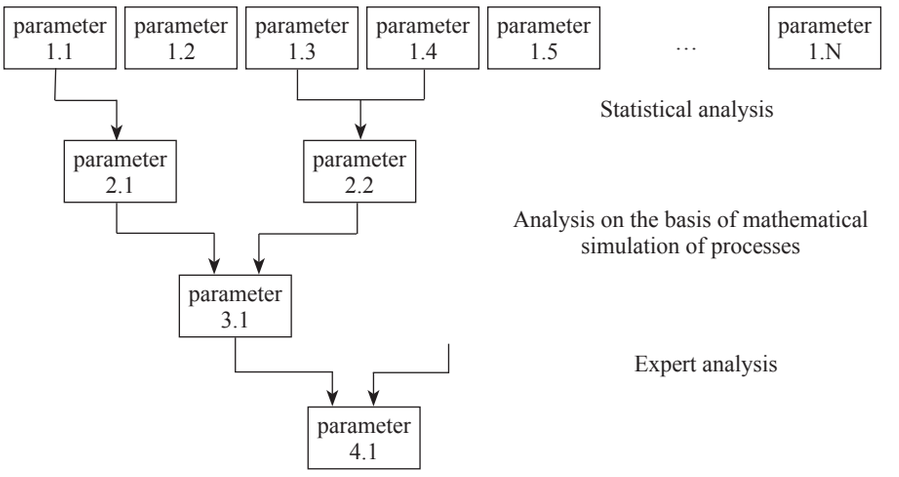

Figure 2. The Diagram of procedure of abbreviation (group) of indexes of regional socio-economic projects

average of private indexes) of a following level. The sequence of stages of abbreviation (group) of indexes of regional socio-economic projects is defined by increase of complexity of the carried-out analysis and increase in a level of involvement of experts.

The subsequent (also hierarchical) procedure of formation of the generalized indexes of projects is based on likeness according to the social (economic) contents and has standard character (for example, [10]). The used weight factors of private indexes can be defined on the basis of methods of expert estimation, for example, by means of Saati's scale and degree calibration of function of preferences. The difference in the formation of intermediate generalized indexes of regional socio-economic projects and a final resultant index is that at the last stage by way of experts in case of determination of weight factors there are not specialists in the subject area of the project, but officials of regional authorities, organizing a design competition.

Hierarchical estimation procedure of regional socio-economic projects is effective not only because of the possibility of providing accounting projects of different characteristics, but also in terms of implementation of the calculating process as it allows to make parallel computings of separate indexes.

Using the results of the evaluation of projects

The main objectives of the evaluation of regional socio-economic projects are:

− a selection of the most appropriate (from a set of options) project for the subsequent implementation [1,2];

− decision-making on adjustment of a course of execution of already implementable project [10].

In the first case it is expedient to select some projects that are close to a resultant index or to construct a set of Pareto-optimal projects on the generalized indexes and to leave a final choice to the persons that make the decisions.

In the second case the estimated data of the project progress represents only a part of information necessary for a decision-making. The second part of necessary information is made by the data on possible diagrams of adjustment. A development of the formalized representation of a combination of these data and procedures of their processing represents the separate task which deserves a special reviewing.

References

1. Lapygin, Y.N. Project management: from planning to efficiency / Y.N assessment. Lapygin. – M: Omega-L, 2008. – 252 pages.

2. Heldman, K. Professional project management. – M: "Bin", 2012. – 517 pages.

3. Lomazov, V.A. Decision support system on the basis of indistinct indexes of an assessment of IT project investment risks/ VA. . Lomazov, V. S. Nekhotina// Information systems and technologies. – 2011, No. 5. – Page 166-170.

4. Lomazov, V.A. informational simulation and computer selection of projects in the mining branch/VA. Lomazov, D. S. Trubavin//Scientific lists of BSU. History, Political science, Economy, Informatics. – 2011 . – No. 1 (96). – Vyp.17/1. – Page 158-162.

5. System analysis and decision-making: Red.by V. N. Volkova, V. N. Kozlov's dictionary-spravochnik/. – M: Vyssh.Shk. 2004 . – 616 pages.

6. Lomazova V. I. The formalization of a choice of mathematical models of the connected fields in case of automation of researches / Century. I.Lomazova, V.A.Lomazov//Information systems and technologies. – 2010 . – No. 3. – Page 79-85.

7. Zhilyakov, E.G. The selection of additive function models of complicated systems / E.G. Zhilyakov, V.I.Lomazova, V.A.Lomazov//Information systems and technologies. 2010 . – No. 6. – Page 66-70.

8. Zhilyakov, E.G. Computer clustering of a set of additive mathematical models of interdependent processes / E.G. Zhilyakov, V.I.Lomazova, V.A.Lomazov//radiotronics Questions. – 2011 . – No. 1. – Page 115-119.

9. Lomazova V. I. The information description of mathematical models of interdependent processes in complicated systems//Scientific lists of BELGU. History, Political science, Economy, Informatics. – 2011 . – No. 1 (96). – Vyp.17/1. – Page 201-208.

10. Lomazov, V.A. The solution of the task of an economic multicriteria choice on the basis of a method of the analysis of hierarchies / Century. A.Lomazov, Y.E.Prokushev//Scientific lists of the Belgorod state university. Series: History. Political science. Economy. Informatics. – 2010 . – No. 7(78). – Vyp.14/1. – Page 128-131.

11. Akupiyan O. S. Models and methods of monitoring of implementation of regional socio-economic projects / Islands of S. Akupiyan, V.A.Lomazov. D.A.Petrosov//the Modern problems of science and education. 2012 . No. 3. Page 270-270.

Литература

1. Лапыгин, Ю.Н. Управление проектами: от планирования до оценки эффективности/ Ю.Н. Лапыгин. – М.: Омега-Л, 2008. – 252 с.

2. Хелдман, К. Профессиональное управление проектами. – М.: «Бином», 2012. – 517 с.

3. Ломазов, В.А. Система поддержки принятия решений на основе нечетких показателей оценки инвестиционных рисков ИТ-проектов/В.А. Ломазов, В.С. Нехотина// Информационные системы и технологии. – 2011, № 5. – С.166-170.

4. Ломазов, В.А. Информационное моделирование и компьютерная селекция проектов в горнодобывающей

отрасли /В.А. Ломазов, Д.С. Трубавин// Научные ведомости БелГУ. Сер. История, Политология, Экономика, Информатика. – 2011. – №1 (96). – Вып.17/1. – С.158-162.

5. Системный анализ и принятие решений: словарь-справочник/ Под ред. В. Н. Волковой, В. Н. Козлова. – М.: Высш.шк., 2004. – 616 с.

6. Ломазова В.И. Формализация выбора математических моделей связанных полей при автоматизации исследований/ В.И. Ломазова, В.А. Ломазов //Информационные системы и технологии. – 2010. – № 3. – С. 79-85.

7. Жиляков, Е.Г. Селекция аддитивных функциональных моделей сложных систем/ Е.Г. Жиляков, В.И. Ломазова, В.А. Ломазов //Информационные системы и технологии. 2010. – № 6. – С. 66-70.

8. Жиляков, Е.Г. Компьютерная кластеризация совокупности аддитивных математических моделей взаимосвязанных процессов/ Е.Г. Жиляков, В.И. Ломазова, В.А. Ломазов // Вопросы радиоэлектроники. – 2011. – № 1. – С. 115-119.

9. Ломазова В.И. Информационное описание математических моделей взаимосвязанных процессов в сложных системах// Научные ведомости БелГУ. Сер. История, Политология, Экономика, Информатика. – 2011. – №1 (96). – Вып.17/1. – С.201-208.

10. Ломазов, В. А Решение задачи экономичного многокритериального выбора на основе метода анализа иерархий/ В. А. Ломазов, Я. Е. Прокушев //Научные ведомости Белгородского государственного университета. Серия: История. Политология. Экономика. Информатика. – 2010. – №. 7(78). – Вып.14/1. – С. 128-131.

11. Акупиян О.С. Модели и методы мониторинга реализации региональных социально-экономических проектов / О.С. Акупиян, В.А. Ломазов., Д.А. Петросов// Современные проблемы науки и образования. 2012. № 3. С. 270-270.