Modeling of the integrated interaction of the innovation process subjects

Tatyana Valerievna Balabanova, Marina Valentinovna Vladika, Oksana Valerievna Vaganova, Svetlana Alekseevna Kucheryavenko

Belgorod State University, Pobeda Street, 85, Belgorod, 308015, Russian Federation

Abstract. During the research problems related to integrated relationship modeling, it seems to be the most advisable using complex approach to "integration" concept consideration. Within the scope of the presented article, the category "integration" is used as development process, leading to a new type of innovative process subject interaction with the purpose of growth in competitiveness, uncertainty reduction of innovative product commercialization, cost reduction. In connection with that, in the article, there are suggested network modeling algorithm of integrated integration of subjects and evaluation method improvement of integrated relationship efficiency, used for prediction of implemented innovative process efficiency or its inefficiency for suggested model.
[Balabanova T.V., Vladika M.V., Vaganova O.V., Kucheryavenko S.A. **Modeling of the integrated interaction of the innovation process subjects.** *Life Sci J* 2014;11(11):610-613] (ISSN:1097-8135). http://www.lifesciencesite.com. 111

Keywords: integration, innovative way of development, subjects of innovative process, evaluation methods of subjects' interest

Introduction

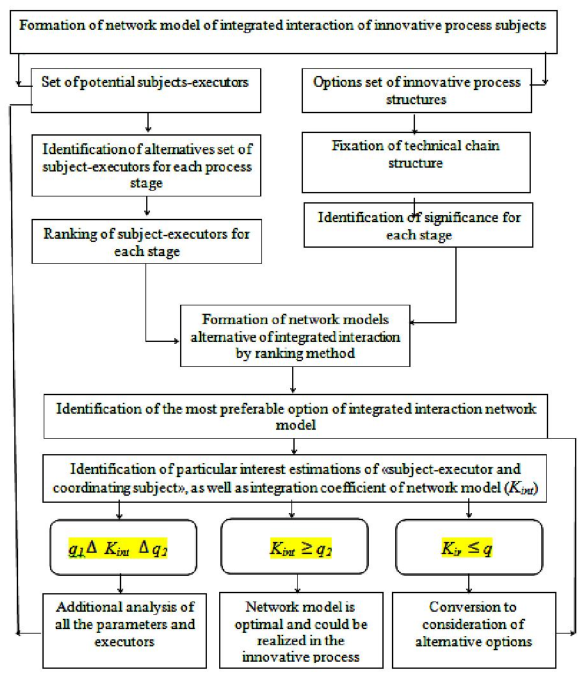
Purposive integration favors opening of some capabilities for process intensification of innovative process (IP) subjects convergence, creating conditions for growth of economic agencies cohesiveness and their more organized changeover to intensive way of economic modernization [1]. From our point of view, one such demonstration of integrated relationship modeling can become forming of network models [2]. Network model of integrated relationship can differ in figure and IP subjects functions, done by them work content, ways of inter-industry linkage formalization and conduction of interdisciplinary scientific researches [3].

Main part

Network model of integrated relationships is formed on the basis of some variety of organizations, where it is allocated subset of potential IP subjects, namely, subset of organizations having required competences [4].

The distinctive feature is the presence of some executors for each competence, being differentiated by particular indicators having value for effective IP execution [5]. It is appeared a problem for a particular project selecting an optimal executors composition by the set criteria (or the most preferable by the set criteria) [6].

In the current article, it is being considered two tasks: forming of network model and effectiveness estimation of integrated interaction of IP subjects (pic. 1) taking into account some criteria in the risk situation. The main aim on the initial stage of integrated relationship network model forming is formation of alternative structures options and their ordering by preference.



Pic 1. Algorithm construction of network model of IP integrated interaction subjects

On the first stage, the task of coordinating subject is to divide the whole process by separate stages and describe it with the most rational level of detail.

From one side, with possible growth of stages number, it is possible to take into account features of the project and the problem of subject-executors selection makes easier, from the other side, possible uncertainty is formed while planning and the quality control level is decreasing. Separate stages in difficult IP can have ambiguous values for decision making about necessity of particular actions execution with the purpose of final result achievement. That is why it is necessary to consider and evaluate level of each stage importance while forming of integrated relationship model.

In the suggested methodology, the main point is that during two-stage ranking usage of initial set of objects [7], on the initial stage by two chosen indexes or criteria, Pareto subsets are allocated sequentially, e.g. estimations being ranked in compliance with given rank [8].

Let it was given certain set of subject-executors $A = \{a_1, a_2, ..., a_n\}$ *for* j-stage of project, being alternative. Any subject-executor a_n is evaluated by the set of parameters: $(p_n\ C_n)$, where p_n – probability index of certain stage successful realization by certain subject-executor; C_n – contract price, offered by subject-executor during analysis conduction [9].

In the very beginning of the ranking procedure, it is advisable to describe relation of coordinating subject toward set selection problem, not taking into account any evaluations presented to alternatives selection [5]. The coordinating subject is to be set a subjective estimate and indicate minimum acceptable value of probability p_{min} for favorable result of alternative selection. That value will be criteria of suggested alternatives portion elimination by the rule which lies in the following: if $p_j<p_{min,}$ then alternative j is excluded from the following consideration. Space of characteristics (p, C) to all alternatives allocation and their comparison analysis conduction becomes "prepared" for all the presented options.

Pareto subset of optimal options stands out on the first step of comparison analysis by criteria $C \to max$ and $p \to max$. The options not included in that subset are excluded. As a result of current stage conduction one network model of integrated relations is being formed between IP participants, being the most preferred for the coordinating subject [10].

Then, the coordinating subject is required to conduct analysis of the obtained model. In the article, it is suggested an approach toward evaluation of model reliability by means of mutual interest index of the coordinating subject and the subject-executors in the teamwork. Such evaluation, presented in the quantitative form, can be called integration coefficient of model (K_{int}) and used as one of the criteria while searching of the best structure option.

Methodology

For current index value identification it is required to conduct several procedures, which lie in analysis of some participants' inters indexes of innovative process [11].

1. *Interest evaluation of coordinating subject in i subject-executor.*

Let us take that i subject-executor is described by means of parameters vector $p_i = (p_{i1}, p_{i2}, ..., p_{in})$. Let us include utility meaning of i subject-executor and will suppose that the utility index additively depends on the values characterizing its parameters:

$$P_i = \lambda_1\, p_{i1} + \lambda_2\, p_{i2} + \ldots + \lambda_n\, p_{in}, \quad (1)$$

where P_i – utility function of i subject-executor;

$p_{i1}, p_{i2},..., p_{in}$ – i executor's parameters, standardized by certain rule;

$\lambda_1, \lambda_2, \lambda_n$ – coefficient of parameters significance, set by the coordinating subject.

Let us suppose that coordinating subject points out some values of parameters which he wanted to be identified from subjects-executors. Those could be even unachievable values (for example, 100% reliability), therefor, vector of such values we will call "absolute" and designate p^c. In connection with that we can calculate absolute value of utility function P_i^c. For convenience of scale standardization of parameters value [0, 1] the final value of i executor utility vector we will identify in the following way:

$$P_i = min\ \{P_i, P_i^c\}. \quad (2)$$

U_i interest evaluation of the coordinating subject in i subject-executor we will identify by the rule:

$$U_i = \frac{P_i}{P_i^{\tilde{n}}}, \text{ where } i = 1, 2, ..., n. \quad (3)$$

Values of those evaluations, obviously, are in the interval [0, 1].

2. *Estimation by coordinating subjects of i subject-executor interest in innovative process realization.*

From the coordinating subject's point of view, subject-executor interest in participation of project realization is identified by two factors: powers loading level (M_{Mi}, changes from 0 to 1) and expected profit (C_i) equals to contract price offered by subject-executor while agreement on work conduction.

S_i utility for i subject-executor's participation in the project (from coordinating subject's point of view) we will evaluate by the formula:

$$S_i = \lambda_c \cdot C_i + \lambda_k \cdot M_{Mi}, , \quad (4)$$

where λ_c and λ_k — coefficients of parameters significance, which are set by coordinating subject.

By analogy with *P* utility estimation we identify vector of absolute parameters values *C* and *M* and, accordingly, S_i^c utility absolute value set for the occasion with maximum loading of free productive potential of enterprise ($M_{Mi}=1$) and obtaining of profit by the subject-executor which equals to certain "regulatory" value ($C_i=C_{norm}$.).

The final value of *i* executor's utility participation in the project we will identify by analogy with the formula (2) in the following way:

$$S_i = min \{S_i, S_i^c\}. \quad (5)$$

The estimation by *Zi* coordinating subjects of *i* subject-executor's interest in participation of certain innovative process we will identify by the rule:

$$Z_i = \frac{S_i}{S_i^{\tilde{n}}}. \quad (6)$$

3. *Estimation of parties' mutual inters in the pair "coordinating subject – i subject-executor".*

It is possible to assess partners' mutual interest in the pair "coordinating subject – *i* subject-executor" by minimum value of two estimations Z_i and U_i:

$$U_{0i} = min\ (U_i, Z_i),\ i = 1, 2, ..., n. \quad (7)$$

The obtained estimations are related to individual subjects of the innovative process, therefor could be called particulars. On the bases of the particular estimations it is possible to suggest integral estimation of interest level of innovative process subjects in collaboration that is to calculate coefficient value of integration.

4. *Identification of integration coefficient.*

Integral estimation of interest level seems advisable to conduct in the following order:

1) Plotting «radar» chart, comparing each semiaxis going from the center with certain subject-executor.

2) On the semiaxes we will set the scale in such a way that their units will reflect relative significance of appropriate competence for realization of considered project.

3) On the semiaxes we will mark unit value of the interest index of the appropriate executors in innovative process realization and connect points together.

4) The area of the obtained polygon F_{max} we will take as conditional measure of maximum mutual collaboration interest of innovative process subjects. Value F_{max} reflects «absolute» situation when network model of integrated relations is absolutely «connected».

5) On the semiaxes we will mark values of interest estimations, calculated by the formula (7), as well connect points together.

The area of the obtained polygon *F* characterizes the actual level of innovative process subjects' mutual interest. Let us take relation of two areas in the function of required integration coefficient:

$$K_{\text{int}} = \frac{F}{F_{\text{max}}}. \quad (8)$$

Conclusion

The intensive integration of subjects by IP creation in terms of network model lets obtain positive effect at the expense of complex factors activities: resources concentration of particular IP subjects; great opportunities by their interests realization; personnel development and education system.

Summary

The main reasons confirming necessity of integrated interaction network model forming lie in the following:

necessity of certain advantages and benefits obtaining from enhancement of financial, scientific and technological and personnel potential, costs reduction, science intensive product release;

extension of manufacturing field and accordingly, variety of alternatives and possible options of strategic decision making, enhancement of scientific and research activities.

Acknowledgements

The article has been done in the scope of state task of SIU "BelGU", project code #315.

Corresponding Author:
Dr.Balabanova Tatyana Valerievna
Belgorod State University
Pobeda Street, 85, Belgorod, 308015, Russian Federation

References

1. Vladika, M.V. and I.O. Malykhina, 2013. Scientific and Methodical Bases of Formations of Indicator System of Innovative Potential Assessment of Higher Educational Institutions. World Applied Sciences Journal, 25(12): 1722-1728.
2. Dezhina, I. and L. Graham, 2001. Is Russia Developing a Commercial Culture for High Technology? Research Technology Management, pp: 68.

3. Arkhipov, A.B. and B.E. Tolkacheva, 2007. Problem of Formation of Factory Area Network in the Innovative Forms of Manufacturing Process Management. Innovations, 7: 105.
4. Bork, R.H., 1954. Vertikal integration and the Sherman Act: The legal history of economic misconception. University of Chicago Law Review, 22: 157-201.
5. Kalugin, B.A., 2006. Criteria and Expert Estimation of Investment Projects. Management Theory and Practices Problems, 7: 84.
6. Arkhipov, A.B. and B.E. Tolkacheva, 2006. Formation and Estimation of Stability of Factory Area Networks in the System of subcontracting. Industry, 5.
7. Hritonenko, N., 2008. Modeling of optimal investment in science and technology. Nonlinear Analysis: Hybrid Systems, 2(2): 220-230.
8. Hague, R., M. Harrop and S. Breslin, 2005. Comparative government and politics. An introduction. 4-th edition haundmills: Macmillan, pp: 318.
9. Glagolev, S.N. and O.V. Vaganova, 2013. The Financial Mechanism to Ensure the Innovation Process. World Applied Sciences Journal, 25 (12): 1729-1734.
10. Blanchet-Scalliet, C., N.El. Karoui, M. Jeanblanc, убрали and L. Martellini, 2008. Optimal investment decisions when time-horizon is uncertain. Journal of Mathematical Economics, 44(11): 1100-1113.
11. Brockhoff, K., 1994. Forschung und Entwicklung. Planung und kontrolle, 4. Aufl., München, pp: 135.

7/13/2014