

Aleksey F. Rogachev¹, Olga B. Mizyakina², Yana V. Fedorova³
**MODELLING OF MONOTOWNS DEVELOPMENT
 BY MEANS OF COGNITIVE MAPS**

The article determines the prospects of monotowns modernization through modelling of their development by means of cognitive maps. The authors use the method of cognitive modelling which allows on the basis of the existing experience selecting the most successful practices of economic activities and developing measures on their implementation for socioeconomic development of monotowns. A modernization strategy of Russian monotowns based on cognitive modelling is offered.

Keywords: monotowns; socioeconomic development; cognitive maps.

Олексій Ф. Рогачов, Ольга Б. Мізякіна, Яна В. Федорова
**МОДЕЛЮВАННЯ РОЗВИТКУ МОНОМІСТ
 З ВИКОРИСТАННЯМ КОГНІТИВНИХ КАРТ**

У статті визначено перспективи модернізації мономіст через моделювання їх розвитку з використанням когнітивних карт. Застосовано метод когнітивного моделювання, який дозволяє, на основі наявного досвіду, вибрати найбільш успішні практики господарської діяльності і розробити заходи щодо їх впровадження для соціально-економічного розвитку мономіст. Запропоновано стратегію модернізації мономіст Росії на основі когнітивного моделювання.

Ключові слова: мономіста; соціально-економічний розвиток; когнітивні карти.

Табл. 2. Літ. 17.

Алексей Ф. Рогачев, Ольга Б. Мизякина, Яна В. Федорова
**МОДЕЛИРОВАНИЕ РАЗВИТИЯ МОНОГОРОДОВ
 С ИСПОЛЬЗОВАНИЕМ КОГНИТИВНЫХ КАРТ**

В статье определены перспективы модернизации моногородов посредством моделирования их развития с использованием когнитивных карт. Использован метод когнитивного моделирования, позволяющий на основе имеющегося опыта отобрать наиболее успешные практики хозяйственной деятельности и разработать мероприятия по их внедрению для социально-экономического развития моногородов. Предложена стратегия модернизации моногородов России на основе когнитивного моделирования.

Ключевые слова: моногорода; социально-экономическое развитие; когнитивные карты.

Introduction. Today's existence and development of mono-profile municipal entities is critical due to reduction of population which lives on the territories of such monotowns, reduction of production, termination of activities of social institutions, growth of unemployment etc. (Srednii gorod..., 2014).

Thus, there is an urgent problem of monotowns' modernization, the solution of which is to be found in this research, in particular. This article offers a scientific hypothesis that modelling of monotowns development using cognitive maps is a perspective direction of their modernization.

Literature review. Theoretical foundations of this research are comprised of the works of contemporary authors studying the socioeconomic development of monotowns (Kryukova and Makeeva, 2013; Tsvetkova, 2013). The concept of cognitive

¹ Volgograd State Agrarian University, Russia.

² Povolzhsky Cooperative Institute (branch) of Russian University of Cooperation, Engels, Russia.

³ Rostov State University of Economics, Rostov-on-Don, Russia.

modelling has been developed and described in the studies of such authors as (Farrell and Lewandowsky, 2015; Mahieu et al., 2010; Thibeault et al., 2015).

Our work uses a special method of cognitive modelling, which allows selecting on the basis of the available experience the most successful practices of economic activities and developing measures on their implementation for socioeconomic development of monotowns.

One of the ways of solving this research task is the elaboration of the concept strategy for development of towns of the viewed types, including that on the basis of economic-mathematical and cognitive modelling of the investments flows and innovations implementation. Cognitive modelling is the method of analysis which ensures the determination of strength and the influence of factors on transition of management object to a targeted state in the view of similarity and difference in the influence of various factors on the management object (Gagarin and Rogachev, Patent # 2011613921).

Classical ("clear") cognitive map is an oriented graph in which a privileged peak is a certain future (as a rule, targeted) state of the management object, rest of peaks correspond to the factors. The bows which connect factors with the state peak have width and sign that corresponds to strength and direction of influence of this factor on the transition of management object into this state, and bows that connect factors show similarity and difference in the influence of these factors on the management object.

Cognitive modelling under this methodology allows building models which take into account such peculiarities as incompleteness of information, its low quality, influence of the human factor, and sustainability of development under the conditions of bifurcations, which will allow determining the key factors and the level of their mutual influence.

At that, cognitive structuring of subject sphere is used, as determination of future targeted and unwanted states of the management object and the most significant factors of management and external environment which influence transition of the object into these states, and determining at qualitative level the causal relations between them, in view of factors interdependence. The results of cognitive structuring are reflected on a cognitive map (Rogachev, 2015).

Unresolved issues. The main drawbacks of traditional cognitive maps – the limitation of application and impossibility for numerical modelling of systems' behavior – are eliminated in various modifications of fuzzy cognitive maps (FCM). FCM is a causal network $G = (C, W)$, where C – the multitude of concepts, W – the multitude of connections between the concepts $w(c_i, c_j) \in W \rightarrow [-1; 1]$ (Medvedeva and Rogachev, 2012).

The research objective is to verify the hypothesis stated above and to determine the perspectives of monotowns modernization through modelling of their development with the use of cognitive maps.

Key research findings.

1. Measures for monotowns development used in Russia today. In this work, monotowns are treated as municipal entities which conform to the following criteria (Decree of the Government of the Russian Federation, 29.07.2014, # 709):

- municipal entity has the status of a city district or urban settlement;
- constant population of a municipal entity exceeds 3,000 people;

- quantity of employees of one of organizations (branches), which conducts on the territory of a municipal entity the same type of main economic activities, constitutes more than 20% of the average list quantity of employees of all organizations,
- one of the stated organizations' (branches) is conducting activities related to natural resources extraction (except for oil and gas) and (or) production and (or) processing of industrial products.

In order to improve the socioeconomic and investment climate of monotowns, two tools are created and realized at the federal level in Russia: the first – the Fund of Monotowns Development, second – possibility for using local taxes a priority socioeconomic development.

Non-profit organizations "Fund of Monotowns Development" was established by Vneshekonombank in October 2014. The purpose of this Fund is to form necessary conditions for the creation of new jobs and investments attraction into monotowns with the most complex socioeconomic situation. The Fund also serves as a consultant during contracts conclusion with monotowns. It also supports co-financing of the related programs and better managerial decisions (www.frmrus.ru, 2016).

The Federal Law # 473-FZ "On the territories of top-priority socioeconomic development in Russian Federation" was signed by the President of the Russian Federation on December 29, 2014. This law determines the legal status of the territories of top-priority socioeconomic development in Russian Federation, measures of state support and conduct of activities on such territories.

Status of a territory of top-priority development will be granted to selected monotowns for 10 years with a possibility of extension of this period for 5 more years. Monotowns with the special status of the territory of top-priority development will receive the following privileges (Federal Law, 29.12.2014, # 473-FZ):

- standard tax subsidies for corporate tax: federal part is annulled, regional part – no more than 5% during the first 5 years, during the next 5 years – not lower than 10%;
- reduction of tariffs for the residents which receive resident status during the first 3 years of the territory of top-priority development status;
- reduction of insurance fees by 4.5 times – from 34% till 7.6%.

On the territories of top-priority socioeconomic development that will be created in monotowns which work in extracting industries – there will be a reducing scaling for the tax on natural resources extraction with the coefficient 0.2 – during the first 2 years, 0.4 – during the 3rd and 4th years, 0.6 – 5–6 years, 0.8 – for the 7–8 years. Thus, differentiated reducing factors will be applied during ten years – regional taxes, possibilities for tax exemptions for property tax, and other taxes and charges (Federal Law, 29.12.2014, # 473-FZ).

The Ministry of Trade and Economic Development of Russia conducts monitoring of positions in mono-profile municipal entities for more than 70 positions. Russian monotowns are divided into 3 groups: crisis, risk-zone, and relatively stable, based on the dynamics of employment, unemployment rate, market situation, and possibility for materialization of demand limitations (Order of the Ministry of Trade and Economic Development of Russia, 26.12.2014, # 854).

The global practice of monotowns development has large experience in structural reforms of their economies on the basis of state, regional, and primarily municipal

support measures (Rogachev, 2015). The key role belongs to social measures with along the measures increasing investments and social attractiveness which ensure the development of competitive production. At that, the analysis of foreign and domestic experience shows the necessity for differentiated approach to solving the problem of monotowns which would take into account national, territorial, and socioeconomic features of each city.

Sectorial specialization of Russian monotowns covers more than 10 various types of economic activities. It is predominantly machine-building, forest industry, non-ferrous metallurgy, and extraction of fuel and other natural resources (Popkova et al., 2015). The number of monotowns by the federal districts of Russia is shown in Table 1.

Table 1. The number of monotowns by the federal districts of Russian Federation (Srednii gorod..., 2014)

Federal district	Number of monotowns
Central	72
Southern	10
North-Western	41
Far Eastern	25
Siberian	48
Ural	43
Volga	92
North-Caucasus	4
Total	335

Geographical distribution of monotowns shows that the largest share of monotowns is located in the Volga and Central Federal Districts – more than half of all monotowns. As to the indicator of population number, the list of monotowns is dominated by small towns with up to 20,000 people – 254 towns. At that, the main part of population in monotowns (more than 6.5 mln people) is concentrated in towns with population of 20,000–100,000 people (Struktura monogorodov..., 2016).

2. Modernization strategy for monotowns in Russia on the basis of modelling their development by means of cognitive maps. We offer a strategy for modernization of Russia monotowns on the basis of cognitive modelling, i.e., application of successful practices – the most effective means, ways, and tools for improvement of entrepreneurial environment, work with investors, and attraction of investments, used in the municipal entities of Russian Federation.

For this purpose, the authors offer to use proprietary cognitive maps with a list of key successful practices recommended for initial implementation and the list of additional practices which could also be recommended for implementation in the process of activities supporting SME in monotowns.

The authors' recommendations include the list of necessary actions for successful realization based on experience of municipal entities. The basic practices include the following cognitive maps:

1. Inclusion of strategic planning measures for investment activities into the strategy of socioeconomic development of a monotown.
2. Development and open access stationing of the investment passports of monotowns.

3. Approval of normative acts which would set the key directions of investment policy of a monotown and SME development.

4. Organization of support for such investment projects by the "one window" principle.

5. Annual investment message from the monotown mayor.

6. Publication of annually renewed Plan on the creation of infrastructure objects necessary for investors coming to monotown.

7. Organization of a specialized monotown Internet resource providing direct communication channel between local authorities and investors.

8. Formation of the system of information & consultation support and popularization of entrepreneurial activities, including that on the basis of multifunctional centers of state and municipal services.

9. Creation of a public council for investment climate improvement and entrepreneurship development.

10. Creation of a structural division for management of activities related to investment climate improvement.

11. Reduction of the measures duration and of financial expenses on licensing procedures in the areas of land relations and construction.

12. Provision of professional training and re-training for public officials responsible for investments attraction and entrepreneurship support.

Additional practices include the following cognitive maps:

1. Introduction of quality standards on municipal services provision.

2. Establishment of the procedure for projects realization under municipal-private partnership.

3. To add to the list of services, provided by multifunctional centers of state and municipal services, the services related to licensing of entrepreneurial activities and SME support.

4. Measures on the reduction of licensing duration for construction and reconstruction of linear buildings on the "final mile" for the purpose of connecting capital construction objects with the systems of engineering infrastructure.

5. Substantiated effective rates of land tax and rental fee for land plots for top-priority categories of payers.

For illustrative purposes and better understanding of the suggested measures, we offer a graphic example of the cognitive map on the basis of the proposed practices (Table 2).

Discussion. Effectiveness of the above measures and initiatives implementation could be achieved through the provision of control over the process and the results of cognitive maps implementation (into successful practices) and observation of the following principles (Skiter et al., 2015):

- planned nature: implementation is performed on the basis of the plan of measures on implementation of successful practices indicating the responsible for these of measures among local authorities, as well as terms and results of measures realization);

- initiative: pilot municipal entities independently perform planning and execution of measures aimed at implementation of successful practices;

- monitoring and assessment: process and results of practices realization are evaluated by executive bodies of a monotown and by its entrepreneurial society.

Table 2. Cognitive map of Russian monotowns development, authors'

Successful practices for monotowns development	Influence on the improvement of business environment	Influence on the improvement of investment climate
Strategic planning of investment activities	+	+
Public availability of an investment passports	+	+
Coverage of investment policy of a monotown	+	+
Support for investment projects on the basis of "one window"	+++	+++
Annual investment statement by the monotown major	+	+
Creation of infrastructure necessary for investors	+++	+++
Organization of specialized monotown's web resource on investment activities	++	++
Information & consulting support and popularization of business activities	+	++
Creation of public council for improvement of investment climate and entrepreneurship development	+	+
Creation of a structural division for management of activities on investment climate improvement	+	+
Accessible infrastructure for production and investors	++	+++
Availability of the development institutes and infrastructure objects	+	++
Reduction of terms and financial expenses on permits in land relations and construction	+++	+++
Professional training and additional training for public servants	+	+
Introducing quality standards on provision municipal services	+	+
The mechanism of municipal-private partnership	+	+
Provision of services related to licensing of business activities and support for SME subjects	+	+++
Reduction of licensing procedures terms in the construction industry	+++	+++
Substantiated effective rates of land tax and rental fees	++	++

+ – significant positive influence; ++ – strong positive influence; +++ – very strong positive influence.

An important element in evaluation of implementation success is the participation of business representatives which conduct their activities on the territory of its monotown. This will allow receiving fair evaluation of the success from the point of view of consumers and direct targeted audience in monotowns.

Conclusion. It is possible to conclude here that with the development of monotowns, successful experience is accumulated, and it should be distributed and used in other monotowns in order to maximize their economic effectiveness. Successful practices of monotowns' activities form cognitive maps.

This proves the offered hypothesis and confirms that modelling of monotowns development using cognitive maps is a perspective direction of their modernization,

as it reduces the uncertainty and risks in the development of entrepreneurship in monotowns.

Perspectives of monotowns modernization are related to modelling of their development with the use of cognitive maps, which allows using the experience of other monotowns, facilitate information transfer among monotowns, and enables modelling and forecasting monotowns development with higher precision.

The conducted research has a high theoretical value, as it contributes to further elaboration of the theory of cognitive modelling of socioeconomic development. Practical value of this research is fact that the conclusions and recommendations could be used in the process of management of Russian monotowns.

It should be also noted here that social factors play an important role in the activities of monotowns – they stipulate the presence of significant national differences in functioning and development of monotowns. That's why cognitive maps developed on the basis of Russian experience cannot be applied in their unchanged form for monotowns in other countries. Adaptation and universalization of the developed cognitive maps is a perspective direction for further research.

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