



Managing Innovation in Complicatedly Organized Facilities

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Abstract

The purpose of the study is to reveal the features and stages of innovation management in complicatedly organized facilities on the example of the city. The methodological basis of the study is systematic and synergetic approaches that allow considering the development of complicatedly organized facility through the management of innovative transformations. The system-based nature allows to present in detail the structure of the object in the aggregate of all connections, its synergism determines the possibility of multidimensional development of the object and their management in the conditions of not only external but also internal innovations. The essential characteristics of system-based and synergetic approaches are revealed, the set of principles of innovation management in complicatedly organized objects on the example of the city is revealed. A typology of innovation is developed, due to the need to expand the understanding of the social processes affecting the development of the city. The algorithm of innovations' introduction of different types in the current urban planning activity is presented. The results determine new sources and ways of incorporating innovations into the existing system of urban planning, as well as the transformation of the innovation management system itself by taking into account the interests of the city's stakeholders, who form the landscape of bottom-up innovations. This will allow to outline the ways of the new component's development and integration into the urban planning system, as well as to assess the possible consequences of the projects' realization for each stakeholder. The contribution to the theory of innovation management of complicatedly organized facilities is made, which determines the management of the introduction of innovations' range in urban planning.

Keywords: principles, innovation management, complicatedly organized facilities, features, system-based, synergetic

1 Introduction

The priority of modern economic activity is innovation in all spheres of the national economy, positively transforming the organization of effective interaction of the processes' main participants, determining the place, roles and functions of each link in the innovation system, summarizing the sources and mechanisms of innovation financing. In economic terms, innovation is seen as:

– *Change* in order to introduce and use new products, markets, the transition to a new state of the system, the introduction of new elements, ways in different types of human activity to improve the efficiency (4, 6, 25, 27);

– The *process* of creation, dissemination and use of new tool, process improvement, introduction of innovations (2, 7, 14, 16, 17, 18);

– A *new or an improved product* with improved consumer properties, the result of scientific work aimed at the improvement of the previous similar product (8, 20).

Modern economic development is impossible without innovative activity, which is a form of society renewal at all levels. At the same time, it is necessary to develop a new system of innovative processes' interaction in each economic sector and in the economic system as a whole, rather than discrete implementation of innovative projects. The national innovation system is a set of economic entities (enterprises, research organizations, consumers) and institutions (legal, legislative, financial, social), interacting in the process of production, distribution and use of competitive knowledge and technologies aimed at the implementation of the strategic goals of sustainable development of the economic system and contributing to the competitiveness of its entities, including States at the international level. From an industry perspective,

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considering the field of architecture and urban planning, innovation cannot be considered any project that carries new things or changes in the appearance. Here, the concept of innovation is associated with the introduction of products (goods and services) to the market with new consumer properties or a qualitative increase in the efficiency of production systems (1, 5).

The variety of opportunities for the development of the city, multiple innovations in the field considered – in construction, design, external representation, data processing, requires management innovations that are able to exchange diverse information with the external environment in highly dynamic conditions and enter into continuous interaction with the components of the external environment, that is, have a high degree of coherence.

2 Methodological Frameworks

In our opinion, it is necessary to clarify the concept of innovation in the management of urban systems. Innovations in the management of urban planning systems are activities aimed at positive changes in the organization, planning, coordination, control of the processes of creating a comfortable environment for people, based on the preservation of the cultural identity of the territory, environmental friendliness in order to maximize the potential, stable growth of socio-economic indicators of the territory, taking into account the probability of changes in external factors. In such complex dynamic systems with many degrees of freedom, the order parameters that determine its invariance are always determined, and the interaction with the external environment that ensures the emergence of innovations allows preserving its dynamic qualities.

In principle, the control system of any objects is a set of controlling subsystem and controlled subsystem and its dynamic subsystems, elements and multiple organizational cyclic communications, forming a complex multidimensional construct, determined by the system-forming factor.

It is appropriate to consider the city from the perspective of a managed subsystem. The system-forming factor of the city, obviously, is not the development of industrial spheres, but the population (people) as a subject, implying the orientation of innovation on its life activity and long-term development.

Obviously, the city is a system-based, complicatedly organized facility; the source element (system's atom) is the people (population). It is to its life support (accommodation, employment, training, recreation, service) that the city obeys, seeking to optimally generalize all the selected areas. The city as an open system continuously interacts with the external environment, while the interaction has all kinds of forms – information, energy and material transformations, ensuring the integrity of biological and physical natural systems. Important in the study of the city as a system is the allocation of its meta-systems and subsystems (see Figure 1).

The city is fully connected with the external to its meta-systems within all socio-economic and sectoral relations at the regional level and the country level as a whole. On the other hand, the city as a system, in turn, is fundamentally connected with the subsystems that ensure its functioning – sectoral and organizational. And finally, the beginning and

end of the system, its starting and ending point of any cycle of life activity, is a system-forming element – a person (a group of people, community, society), with respect to which the city develops as a system-based complicatedly organized facility.

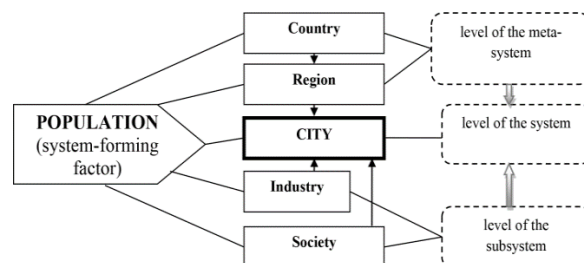


Figure 1: The city as an open dynamic system

Multi-dimensional integrity of the system at each level provides its *goal-setting*, directing and regulating all activities of the system. In a global sense, the purpose of the city is to *meet the human needs in their life support and development*. Decomposition of the goal set involves the following components:

- *ensuring sustainable development of the city* as an optimal increment of its functions, adaptation to the challenges of time, the implementation of new industry technologies while maintaining its identity and functionality;

- *Improving the quality of the urban environment* as a counterweight to industrial urbanization, primarily consisting in the implementation of the Concept of quality of life – the formation of conditions that ensure a decent life and free formation of man. Representation of the urban environment through the availability and quality of trade, communication, food, utilities and entertainment significantly levels the socio-economic contradictions, causing the loyalty of the population;

- *Ensuring the identity of the urban base* associated with the preservation of the existing cultural friendliness, national and regional features of architecture that meet the self-consciousness of the population. The humanistic component of urban planning is to find a balance in the renewal and transformation of urban space, which implies a productive resolution of the contradictions between socio-cultural positions and spatial development of territories;

- *Ensuring the safety of the urban environment*, associated with the peculiarities of new facilities' design and the maintenance of intensive man-made production, transport, energy activities while minimizing the risks of threats to the safety of the population.

The next property of the city, integrating its diversity as a complicatedly organized facility is the *unity and coherence of the elements* that provide the opportunity to achieve the goals. Indeed, the three bases of the city: natural, historical-cultural and urbanized are closely connected with the residential and industrial infrastructure, revealing through the unity of the social space available to each resident. Connectivity is revealed in each urban subsystem – transport, environmental, etc., causing new opportunities of urban environment.

The property of *openness* of the city as a complicatedly organized facility is also logical. The openness of the city with this goal denotes its dynamic growth and evolutionary development, as well as the implementation of the concepts of *dialogue space of the city* (26) as a socially-oriented prerequisite for its development – the productivity of the transport system with the dominance of the pedestrian, the availability of convenient infrastructure with the expansion of green areas, the use of various energy sources and ecologization with reasonable consumption of natural resources, etc., that is, the focus on the consumer of today and future generations.

The hierarchy nature of the city as a system is determined by the levels of management if the balance of stakeholders is maintained. The interaction of the city in the Meta – systems: regional and national economies, its place in the cultural complex of the country, its activity in tourism, etc. - has a predominant connection. The transport network of the city and its place in the meta-systems possess the functional hierarchy. The operational hierarchy is defined by the concept of urban development and is characterized by zones of its predominant influence.

The emergence-based nature of the city as a complicatedly organized facility is manifested in the variety of interactions of its elements forming an integrity, substantially exceeding the sum of its parts. For example, the set of transport and communications form the infrastructure subsystem of the city, while highlighting the person (population) as the *atom* of the city; subordination (or the desire for subordination) to it of all the other subsystems and indicators that characterize the city from different points of view becomes obvious.

The dynamic nature of the city as a complicatedly organized facility is expressed in the continuous growth of the population, and because of the need for predictive design, as well as in the resolution of internal contradictions between the subsystems of the city with the priority of any of the parties. This property determines the need for phased monitoring and correction of any urban plans and tasks as new, initiating changes and events appear.

In General, using the global systems of national economy, ecology and demography, forming the outer boundaries of the city as a system in a multidimensional context, the city connects the territorial, industrial, environmental, socio-economic systems of geographically separated territory through the formation of a sustainable system of human life activity.

Sustainable development of the city presupposes the existence of an innovation management methodology capable of linking together the development strategy, structure, system processes of life support, based on socio-cultural ideas and proclaimed values, new technical and technological capabilities.

The system-based approach serves as the initial philosophical basis for the study of complicatedly organized facilities as systems. The methodology, specificity of the system-based approach is determined by the fact that it focuses the study on the disclosure of the integrity of the object and the mechanisms that provide it, to identify the diverse types of relationships of a complicatedly organized

facility and reducing them into a single theoretical picture, deliberately complicating the object to reveal all potential interactions of the system parts (3, 9, 13). The implementation of the system-based approach through the revealed properties of goal-setting, unity and connectivity, hierarchy and multicomponent nature, emergence and dynamism, allows us to separate the city as a multi-level socio-economic territorial system, within which there are numerous interrelated processes of external and internal life support of the population.

The system theory assumes harmony of interrelation of the city elements as system-based complicatedly organized facility: change of parameters of one of them in a certain way influences change of parameters of other elements and, as a rule, in a nonlinear way. At the same time, the resulting nonlinearity requires certain control restrictions at each time and taking into account the potential *bursts* arising in an unstable environment (11, 15, 22, 23).

Indeed, representing the city in the form of a system of fabric and frame, the territory is structured. Here, the transport network, engineering infrastructure and the green zone (public spaces) create a framework for the *fabric* - buildings, structures, the transformation of which is influenced by management decisions and innovations of different levels. An objective analysis of the Russian cities shows that in connection with changes in the socio-economic conditions their environment becomes chaotic, which actualizes the introduction of the methodology of *synergetic approach*, initiating humanitarian component - the real needs of the residents, the possibilities of transformation, development and improvement of the urban environment (19) in the concept of the city self-development initiated by a variety of factors. The essence of the synergetic approach (10) involves the coordination of States of self-organization processes in complex systems of different nature. Indeed, the city as a natural-anthropological and man-made system includes all the processes of self-regulation at critical moments, forming new structures that emphasize or violate critically the existing state (bifurcation point) *mismatch* of goal setting and surrounding circumstances. Innovations in management can push the system to move from one level of organization to another, thereby changing the system itself. Important in this change is the internal state of the system itself, the rearrangement of its elements and so on, and the target-forming factor. At this point, randomness leads what is left of the system to a new path of development. Once the path is chosen, the system re-exists within the established order until the next bifurcation.

Thus, the system-based approach allows us to study the city as a complex object as a self-organizing integrity, the initiation of development of which is predetermined by planned and managed innovations. Sources of innovation can be planned and spontaneous, allowing you to extrapolate the dependence of spontaneity – organization on the forecast state of the city.

The leading principles of the selected system-based and synergetic approaches are:

- *The principle of iterative cyclic nature* assuming cyclic development with continuous positive increment (change of state) causing local stability, but global instability of the city;

- *The principle of the adequacy of the innovation potential* of the existing development strategy of a complicatedly organized facility, a set of positive factors increases the integral potential of the city development through a variety of endo - and exogenous contradictions, giving acceleration of its development and causing new opportunities to meet the needs of the population;

- *The principle of flexibility of development management*, which is to assess the transparency of innovative initiatives by real resource, natural and cultural friendliness directions of development of complicatedly organized facility and their further implementation;

- *The principle of readiness* of management to the fastest and full development of the created potential of the city development that meets inquiries of stakeholders;

- *The principle of participatory nature of management*, which is responsible participation of each stakeholder in the decision - making process for sustainable development of the city as a complicatedly organized facility;

- *The principle of communicative interaction*, which determines the continuous development of relations between all stakeholders of urban development under specific conditions, circumstances, goals of stakeholders.

The identified principles determine the methodical basis for the implementation of innovation management.

3 Results

It is necessary to consider the content of management innovation as strategically important in today's economy. The productivity of any project aimed at the development of a complicatedly organized object is as higher as the more global synergetic effect of its implementation. According to the typology of A.I. Prigozhin (2003) (24), they include the following types:

1) Technical and technological (new equipment, devices, technological schemes, etc.);

2) Food (new products, materials);

3) Social, which include economic (material incentives, growth indicators, etc.); organizational and managerial (new organizational structures, forms of labor organization, decision-making, etc.); actually social, i.e. changes in intra-collective relations; legal.

Moreover, if the first two types of growth from innovation is obvious, the social contour of innovation, to which we attribute management innovation in the city as a complicatedly organized object, has a long-term implementation and delayed effect. Long periods of search for a suitable management system in urban planning (which lasted about 20-30 years), is accompanied by inhibition or spontaneity in the real construction of cities, a significant loss and de-professionalization of urban planning personnel and methods of urban planning, aggravation of urban problems, degradation and chaotic development of inter-populated areas.

The research of K.S. Klevtsova (2017) (12) emphasizes that among the managerial innovations in the economic sphere *places* are distributed as follows:

(1) New organizational management structure;

(2) The introduction of improved methods of management;

(3) Organization and division of labor.

The initial positions of our study and the system-forming factor of the city – its population to some extent change the approach to determining the typology of management innovation. First, it refers to the source of innovation, which can be *global* (country level of management), *regional* (municipal level of management), *sectoral* (organizational level of management); *bottom-up* (bottom-up innovation) consumer (stakeholder) level of management or participation).

Bottom-up innovations are initiatives that arise in the field, inside or outside of the city and ascending from the users to the formal structures through the effective use of tacit knowledge gained and accumulated in the result of the user experience; it meets the needs of policy of innovation inclusive growth for the interests of the whole society (28). It is bottom-up dynamism that researchers describe as a necessary condition for the development of broad innovations (21).

The nature of bottom-up innovation is dualistic. On the one hand, they are the generator of strategic innovations – as the base of their startup, on the other – the reason for their transformation, arising under the influence of multidirectional local construction intentions, the reason for the *blurring* of the strategic vector of urban planning intentions.

This duality of bottom-up innovation is one of the reasons for the cyclical nature of innovation management, along with, for example, trends in global technological and economic changes (technological structures, *Kondratiev* cycles, etc.) or municipal and regional elections, leading to a change in socio-economic programs and adjustment of urban planning intentions.

The interaction of all types of management innovations is extremely important, because it is the bottom-up innovations that are multidirectional and reflect the interests of business and the population, forming a vector of development, as a clash of multidirectional forces. Strategic innovations accumulate bottom-up innovations, making *action amendments* taking into account the doctrine of urban development, built as a political act of municipal authorities with the help of professional experts in the framework of an integrated urban development strategy.

Then from the position of the city as a complicatedly organized facility, we can give the following examples of management innovation:

- *Personnel innovations* with the formation of a special type of *personnel access* to the design of new facilities within the current historical environment;

- *Organizational and documentary innovation* - toolkit enabling a new package of documents of territorial development of agglomerations;

- *Self-governing innovations* - expansion of administrative powers of territorial public self-government;

- *Communication innovations* - purposeful formation of relations and formats of interaction between society, business and government.

- Management innovations in the urban planning sphere according to the typology allocated by us are planned to be implemented in accordance with the above-mentioned algorithm (Figure 2).



Figure 2: Stages of innovation management in a complicatedly organized facility

As a real example of the algorithm used, one can represent the algorithm for transformation of the existing system of urban development municipal management (range of innovations):

Step 1. Reorganization of the management system and formation of competent human resources. *Introduction of innovations:* organization of coordination of individuals' construction intentions and the business community with the system of events as part of the Executive Committee service.

Step 2. Identification of the territory's resource potential and the organization of systematic maintenance of the duty plan of urban development.

Step 3. Organization of municipal - private partnership.

Implementation of innovations: coordination of activities in the field of urban development of the territory, incorporated in the project planning documentation, and construction intentions of the business community and individual private investors-developers (including bottom-up innovations).

Step 4. Formation of the road map of settlement development based on the activity equality of all local vectors, with their different resource intensity and duration. *Introduction of innovations:* adjustment of resource intensity balance, sequence and necessary chronological duration of the provided actions.

Step 5. Development startup. Maps of local priority transformation of the territory. *Implementation of innovations:* the plan of priority urban planning activities is formed based on the data of urban monitoring, requests of the local population, plans for the implementation of project urban planning documentation and a comprehensive analysis of the resource potential of the studied area (including bottom-up innovations).

Step 6. Formation of positive public opinion in support of urban policy for the development of territories. *Introduction of innovations:* achievement of a high level of public awareness about the plans of municipal government and the degree of public participation directly in the development and coordination of these plans (participatory design, including bottom-up innovations).

Step 7. Attraction of external investors and financial resources.

4 Discussion

Key aspects of interaction between theory and practice of complicatedly organized facilities' development require a thorough analysis of the uncertainty phenomenon. Carrying out numerous reforms, spontaneous interactions, give rise to system-based crises of the world socio-economic systems.

The principal goal of human life support from the state position is to create conditions for his/her development while maintaining cultural and natural identity as possible. From the standpoint of the city as a complicatedly organized facility the goal setting of the development is determined in the design and planning documents' system with the long design period of implementation, during which the environment, circumstances, laws, priorities change. Thus, there is a *mismatch* of goal setting and surrounding circumstances. There is a need to adjust (update) the strategy of urban development management, which encourages the emergence of management innovation. The concept of sustainable urban development assumes that modern urban management practices, meeting the needs of currently living people, does not deprive future generations of the opportunity to meet their own needs.

5 Conclusions

The authors achieved the following results in the course of the study:

1. A complex representation of the city as a complicatedly organized facility with the allocation of system properties is carried out: activities' goal setting, *unity and connectivity of elements*, openness, hierarchy nature, dynamism, and *emergence nature*. The system-forming factor of the city is the population; therefore, there is a serious need to involve the population and other stakeholders in the management of territories' development.

2. The specificity of the city as a system-based object and its representation as an object of management necessitates the involvement of a specific methodology for the implementation of planned and spontaneous innovations. As such a methodology, the authors propose systematic and synergetic approaches that generalize the features of the object under consideration and are implemented through the principles of iterative cyclist nature, adequacy of innovation potential, flexibility of development management, readiness and participative nature of management, communicative interaction.

3. The typology of management innovations is revealed, the distinctive feature of which is the active participation of stakeholders at all stages of urban development – from design to evaluation, and accordingly, the development and accounting of *bottom-up* innovations that have a significant impact on the development of territories and their planned future.

4. A flexible algorithm for the implementation of management innovations of different types (*personnel, organizational and documentary, self-government, communicative*) is developed, which determines their potential productivity and brings to a new level the long-term interests of sustainable development of the city as a complicatedly organized facility.

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