The productivity of a high-tech municipality: basic parameters and factors (based on the material of nuclear cities)

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Abstract. Technological (digital) transformation, the evolution of the socio-demographic structure, profound changes in the economy of cities and the urban environment in the modern world determine the relevance of the search for new approaches to urban development. At the same time, high-tech municipalities, and in particular - Russian nuclear cities, possess significant features against the background of global trends. Using the methodology of systems analysis, expert surveys and comparative case studies, the article analyzes the productivity parameters of a high-tech municipality and approaches to urban development based on the material of Russian nuclear cities.

Key words: Urban development, urban economy, city productivity, city efficiency, social and urban system, development factors.

1. Relevance

The national development goals of Russia have a local projection, since it is on a local, human scale that the achievement of macroeconomic indicators is concretized. By themselves, the national and regional products are created in enterprises and organizations that are directly included in the context of local communities. Thus, it is the product that is the most important source of factors affecting the productivity of cities and territories.

In methodological, state-legal, and sectoral sections, a municipality can be viewed as a subsystem within the national or even global social system.

The research problem or the main research question is the question of what factors influence the productivity (efficiency) of a municipality: a nuclear city, how it is determined at different levels of the regional, national and global systems.

Its relevance is associated with the need to search for new approaches to the development of cities in the nuclear industry under conditions of technological (digital) transformation, the evolution of the socio-demographic structure and profound changes in the economy of cities and the urban environment in the modern world.
2. The degree of elaboration of the problem

There is a significant body of literature on the problems of urban economics and possible management responses to the challenges facing modern cities, but they are just to a limited extent applicable to the phenomenon we are analyzing. Firstly, the trend of globalization of urban economies, which has been widely analyzed in the literature recently [1], has relatively little affected the cities of nuclear energy and industry due to their closed nature, secrecy, and remoteness from the centers of international communications. Secondly, the general issue of “shrinking cities” [2] is also not entirely acceptable for the Russian nuclear industry, which is developing dynamically and is characterized by clear historical optimism. There are also restrictions on the use of the so-called “sharing economy” [3] due to existing security restrictions [4].

At the same time, other developments are not only applicable, but have an undoubted prospect in nuclear cities in particular, the influence of smart city technologies on its "productivity" [5] and the positive effects of cultural clusters (creative spaces) [6]. However, as it will be shown in the study, these directions in Russian practice are done only at the beginning.

There is an obvious need to develop methods of urban development that would rely, on the one hand, on the unique competitive advantages and meaningful features of Russian nuclear cities, and on the other, would be guided by the development goals of Russian industry and economy, and not so much on the post-materialistic values set by Western scientific discourse.

3. Methodology

From the point of view of the principle of hierarchy, the global, national and regional levels are superior to the municipal ones. At the same time, they are the environment or "context" for the activities of the municipality. By definition, any subsystems are open, although the degree of openness and closeness of subsystems and its regulation is a separate topic, in particular, when considering closed administrative-territorial entities. Being open, these subsystems receive resources from the environment and deliver the product in demand. Municipal subsystems have an internal functional structure that can be differentiated according to various parameters. The basic division is between physical and non-physical infrastructure, that is, the spheres of social relations, fixed or not fixed in physical space. According to this criterion, it is possible to single out, on the one hand, all the material functions of the city's life support: security, the economic sphere, housing and communal services, transport and roads, healthcare, education, science, culture, sports, events, territory markers.

On the other hand, there will be such characteristics of the territory as the image of the future, management strategies, systems of social ties, social and human capital, and others. This dichotomous juxtaposition seems somewhat artificial and simplistic. But it makes it possible to remove the naturalistic bias that was formed in the post-Soviet period towards the purely everyday aspects of the municipality development. With this approach, the phenomena of social consciousness regain their significance [but outside the boundaries of Marxist social science, as full-fledged forms of social being]. In addition, the spheres of culture, science and education are more likely to belong to the metaphysical block. However, in modern conditions they have already been reified in specific institutions, establishments and services. The choice of one or another approach to structuring a municipality depends on the tasks of management at a higher, intra-municipal or community level. In the first case, it is formed by the sectoral structure of the federal and regional levels of government. Municipalities are increasingly using an “interdisciplinary” approach, forming, for example, creative-industrial clusters [6], etc. The public level of government focuses on intra-court issues.

From the point of view of our scientific task, it is analytically more convenient to maintain a commitment to the sectoral approach as a way to streamline urban functions. At the same time, we will consider interdisciplinary and other creative approaches of the municipality as management strategies, and social
management projects as an expression of the social capital of the municipality. At the same time, it seems productive to return to some classical schemes of structuring social systems, especially to the model of T. Parsons [7], which distinguishes between political, economic, societal and cultural subsystems. The first is responsible for goal-setting, the second is for reproduction, the third is for the development of the community as a system of social ties, and the fourth is for “maintaining the pattern”. In this typology, only the economy will correspond to the "physical block". First of all, societal (that is, in contrast to sociality, society as a whole: its quality, that is, society, cohesion, solidarity, degree of cooperation), as well as goal-setting and maintaining the best examples of social behavior will acquire special significance. In this approach, however, culture is treated conservatively. In our understanding, it is closely linked with politics and is associated with the creation and broadcasting of the image of the future municipality as a productive context for goal setting. That is, as a working model, we take the sequential division of the municipal subsystem into two (environment and people), four (politics, economics, societal, culture) and more (by sectors and directions) subsystems (sectors).

In this subsystem, described in a first approximation, as a result of a number of processes, on the basis of incoming and internal resources, a certain product is formed that has value. Here municipalities differ very significantly in terms of the “product” set, level and character of the consumer. Therefore, here we need to introduce the concept of a nuclear city and further analyze the problem using the material of nuclear cities, which we will consider representative in a certain aspect for single-industry towns, science cities, high-tech municipalities.

Thus, a nuclear city is a municipality with a population of about several tens to about one hundred thousand people, on which territory an enterprise of the nuclear industry is located, a nuclear power plant, a radiochemical plant, an arms factory or a scientific institute. Obviously, the main product of such a municipality will be the products of the city enterprise. However, in modern conditions, it has diversified enough. If earlier all enterprises and cities were part of certain industries in a unitary state with a planned economy and performed purely sectoral tasks, today they are included in markets, regional economies and political systems, global communications and social processes.

4. Empirical research
In the course of expert interviews (in the form of brainstorming) with more than 40 representatives of municipal authorities of nuclear cities, the primary parameters of the productivity of municipalities of this type were determined. The value of the product for a particular level in the macrosocial system was considered as a criterion for productivity. For comparison, we used the estimates of the productivity of cities in the implementation of the Soviet nuclear project. It was found that in Soviet times, an absolutely decisive 90% or more) indicator of productivity was the contribution to ensuring the interests and security of the USSR. This applied not only to the weapons complex, but also to nuclear power plants, their weight in the country's energy balance was about 20%, but this energy also largely worked for the needs of the military-industrial complex. The construction of nuclear power plants abroad was not carried out for market reasons, but rather for political and even ideological reasons.

That is, economic indicators, including energy efficiency, labor productivity, efficiency, were an order of magnitude less significant than the solution with the help of the industry of strategic geopolitical tasks in the cold war. Nevertheless, advanced nuclear technologies, providing unprecedented efficiency and productivity, were regularly created and implemented in the industry, as well as the system of scientific organization of labor and management that was widely used in it. The productivity of Soviet nuclear cities was to some extent assessed as their ability to act as a showcase of the Soviet way of life and an example of the growth in the level of well-being of the population. However, due to the closed nature of the industry and the secondary nature of socio-humanitarian issues in the face of essentially wartime tasks, this
The parameter of productivity can be expressed only by a few percent. Nevertheless, the ideological significance of the industry was great as an indicator of the advanced character of the Soviet system.

In total, the formula for the productivity of Soviet nuclear cities can be expressed as 90/5/2/3 (where 90 is a contribution to ensuring national security, 5 is to macroeconomic indicators, 2 is the formation of a model of life for a Soviet citizen, and 3 is the formation and maintenance of the ideology of the advanced nature of the socialist system). Bypassing the transition period, when all productivity indicators fell almost to zero, experts described the current situation.

5. Results and discussion

According to the results of the analysis, the very characteristics of the system have changed, the state has ceased to be the only customer, the industry has joined the markets and processes of shaping the markets of the future, the management context (the system of state and municipal governance) and the social environment of the industry have changed (mobility and social communications have become more developed). At the same time, the economic crisis, the expanding post-industrial structure and the change in the structure of the armed forces led to a significant reduction in production capacity and the outflow of the population from many nuclear cities.

Nevertheless, in recent years, especially 6 years after the reunification of Crimea and Sevastopol with the Russian Federation, there has been a crisis of strategic stability systems. Against this background, unique samples of nuclear weapons have been created in our country, which today act as a critically significant product of the industry and the cities of its localization. In a market economy, the importance of the innovation sphere of the nuclear city has radically increased, high-tech municipalities are rightly expected to produce and introduce innovations. The importance of economic indicators has increased: the contribution to the regional domestic product, energy efficiency, electricity cost, labor productivity and lean production have become key indicators of enterprise efficiency, setting requirements for the urban environment. Personnel became a new product of the municipality: if earlier the municipality consumed them on the basis of a centralized distribution of university graduates and attracting the best minds, now it produces well-trained graduates of schools, branches of the Moscow Engineering Physics Institute, engineers, who, unfortunately, for various reasons, are leaving enterprises. In the conditions of a competitive party-political system, the level of support by the population of nuclear cities for regional and federal authorities has become important, which is an indicator of the level of mobilization of nuclear cities for solving state problems and the effectiveness of the corporation as a major player in the state-political system of the Russian Federation.

On these grounds, the experts presented the following weight indicators of the productivity of a modern Russian nuclear city: 70% - contribution to the promotion of national interests and ensuring the national security of Russia. It can be operationalized as the degree of participation of a nuclear city (a city-forming enterprise) in the creation and implementation of technologies that critically affect defense capability and the possibility of influencing other countries of the world in the interests of Russia (the latest nuclear weapons, new types of reactors, discoveries and personnel that make it possible to participate in MegaScience collaborations);
10% - innovation, that is, the creation of new technologies that are sold in the markets and create markets. Indicators are the number of innovations, revenue.
10% - political support (share of votes for the president, governor, ruling party multiplied by the turnout share)
7% - economic indicators (labor productivity, contribution to GDP/GDP)
2% - human capital (the number of people who have left the city employed in high-tech or science-intensive industries in other regions)
1% - the ability to generate meanings and development patterns.
In relation to each of the parameters, in the course of the expert assessment, specific independent variables or influencing factors were formulated. In a first approximation, it was shown, in particular, that the first parameter (contribution to ensuring national interests and security) is influenced by the transfer of Soviet experience through the mentoring system - not only in production, but in science and in the production management system. Moreover, scientific creativity is influenced by complex environmental factors, such as the unique quality of the natural and cultural environment. The innovative potential is decisively influenced by the creation of interdisciplinary teams of scientists, managers and entrepreneurs. The indicators of political support are most significantly influenced by the patriotic agenda, the image of the future and the overcoming of social conflicts of various levels, as well as the quality of political governance in the territory and the organization of public communications have been formed. As to the economic indicators, it is the introduction of efficient production systems and digital (end-to-end) technologies. Human resources maintain the quality of school education and classical (universal and fundamental) engineering training. On the semantic potential, the preservation of the patriotic, scientific and ideological components in school and university education.

The parameters of the urban environment that critically affect productivity were analyzed separately. Thus, a system of hypotheses was formulated, which was initially tested through a series of case studies on 27 nuclear cities.

The experts noted that the most positive effect is the change in management mechanisms in the city including the transition to project management, multilateral strategic planning, the introduction of information, communication and digital technologies in public management, the attraction of additional stakeholders to making management decisions.

In second place there were projects related to the improvement of the urban environment (mainly the creation of public spaces) and projects on public involvement (information and advisory projects). Further on, financial and economic instruments (new approaches to financing and budgeting, the creation of territories of advanced economic development, the opening of new industries). Projects in the field of human capital development ranked only fourth among the best practices. Closing the list are projects for holding mass events, digital transformation and support for certain categories of the population.

6. Conclusions

Currently, the development of municipalities is dominated by approaches aimed at involving the maximum number of participants (stakeholders) and resources in solving urban problems. These approaches are very important in the development of modern high-tech municipalities, primarily from the point of view of the development of the communicative competences of the authorities, the introduction of new public management culture. But at the same time, they carry the threat of populism, consumerism, orientation towards current symptomatic problems. Sometimes they are more similar to “fundraising” rather than finding truly new approaches and productive, innovative economic models. Only a few projects have a positive effect on changes outside the municipality.

In further studies, it is planned to set the frame of the dependent variables more rigidly, focusing on the external productivity of the municipality.

7. References

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