





Chapter 3

Innovative Technologies as a Factor in Ensuring Inclusive Growth in the Unified Ecosystem of Urban and Rural Areas



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Abstract The chapter describes innovative technologies as a factor in the development of the urban environment and rural areas in modern Russia. It reveals the proportion of implemented technologies of various technological stages in Russia. Also, it compares the dynamics of innovation activity in the regions and territories under consideration, the movement in a standard of living criteria of the population in these territories, the level of migration, and natural population decline. The work reveals the reasons for different conditions for inclusive economic growth in urban and rural ecosystems. The concept of inclusive growth is considered in relation to the technological integration of urban and rural areas. The authors reveal principles of building a unified ecosystem, including large urban agglomerations, medium and small cities, as well as rural settlements. The work examines the peculiarities of the use of innovative technologies of the sixth technological stage for economic growth in rural areas of Russia, the growth of living standards of the population in them, as well as inclusive growth in the unified urban–rural ecosystem.

3.1 Introduction

The importance of innovative technologies in the development of society is now becoming more and more obvious. Despite the current situation associated with the increase of coronavirus infection in the world [1], they are considered as an integral

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part of scientific and technological progress and modern science. Considering the complex transition of the national economy to the sixth technological stage, it is becoming obvious that there is a need for better support for innovations for the even and systematic development of urban and rural areas in our country.

The introduction of new technologies contributes to the integration of economic space and provides conditions for the sustainable development of cities and towns, as well as rural settlements. At the same time, an important aspect in the implementation of the concept of sustainable development on the territories of various types and different geographic locations is the achievement of inclusiveness of this development, which manifests itself in increasing the availability of economic and social benefits for the general population, regardless of their living conditions.

The difficulty of the solution to this problem in the near future for Russia is connected, on the one hand, with the complex geographic location of cities and rural settlements. At the same time, historically, there are disparities in the standard of living of the population in large cities and rural areas. On the other hand, today Russia still lags behind economically developed countries in terms of the rate of advanced technologies adoption in the growth of urban environment and rural areas. At the same time, the relatively stable position of Russia in the GII rating allows drawing conclusions about unused opportunities for the development of the innovation sphere, also in the context of the natural, cultural, industrial, and agricultural potential of its urban and rural areas.

3.2 Methods

Many domestic and foreign scientists pay attention to the problem of the development of innovative technologies in modern economy [2, 3]. Actual issues are related to innovations within the framework of the sixth technological stage, which is currently very problematic due to the uneven location of scientific and production potential in modern Russia and the dominance of the centrist configuration of the national innovation system. The main peculiarity of this model is the attenuation of innovation processes in the direction from the center to the periphery where rural areas suffer first of all, because they cannot compete with megacities in terms of scientific and industrial development [4–9].

We had investigated the specificity of urban and rural areas, their need for innovative development, and introduction of innovative technologies into production processes, and this was reflected in a number of scientific works [10–13]. Methods of statistic and comparative analyses, expert assessments, predictive models, etc. were used in our study [1, 14–16]. On the basis of the conducted research and analysis of statistical empirical data, the conclusions were drawn and given in the results of the work [17–19]. Also, the actual regulatory legal acts are used in this chapter [20].

3.3 Results

The formation of the sixth technological stage based on the NBIC-convergence (nano-, bio-, information, and cognitive technology convergence) [21] implies the creation of products of nanotechnology and biotechnology, as well as nuclear, molecular, cellular technologies, etc. In the world economy, in general and in Russia in particular, it has long been relevant. It is obvious that for a full-fledged transition from one technological stage to another, large-scale investments are required in the sphere of the key factor of the technological stage on which, first of all, scientific research and development work will be carried out. In this regard, the transition to the sixth technological stage should presuppose large-scale investments in digital and nanotechnology [22], as key ones within the framework of this stage.

It should be noted that in recent years, these technologies have been successfully developing in the Russian economy. However, it is too early to talk about a full-fledged transition to the sixth technological stage, which responds to a range of challenges.

Firstly, this is the absence of federal authority, whose powers would include a technological policy of the state as a whole (development of scientific and technological tasks, inventions, and their control).

Secondly, many researchers recognize the fact that, compared with the level of science development in Russia, during the transition to the fourth stage, there was a significant decline in applied science as a whole, since there previously had existed a greater number of research and design institutes that had been engaged in various scientific, experimental, and design developments.

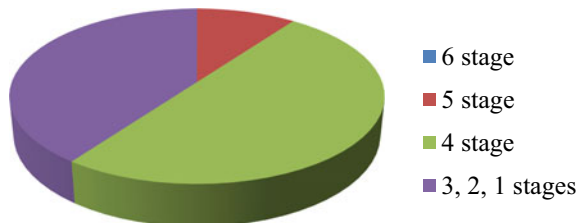
Thirdly, there is no required number of highly qualified personnel interested in the development of science in our country.

Fourthly, for many reasons it is confirmed that the demand of Russian manufacturers for innovative technologies is not as great as in foreign countries. And finally, there are limited resources [5].

As a result, the share of technologies of the sixth technological stage in the structure of the Russian economy remains insignificant. In particular, according to the studies of domestic scientists, technologies of the fourth stage in the Russian economy account for about 50%, the fifth technological stage—only 10%, while the remaining 40% contain technologies of the earlier stages.

As shown in Fig. 3.1, the share of the sixth stage in the Russian economy is

Fig. 3.1 Share of technologies of various technological stages in the structure of Russian economy, %. Source [6]



actually less than one percent. This fact confirms the existence of a significant technological gap between the world and domestic economies, which adversely affects the assessment of the global prospects for Russia's entry into the sixth technological stage.

However, as it was noted, this does not mean that the development of these technologies will not have prospects in the near future. Today, they are already being actively implemented and soon they may become dominant. In addition to the growth of activity on the part of business, the transition to the sixth technological stage is facilitated by the implementation of a number of national projects of our state [23].

Indeed, today Russia has sufficient potential for the growth of innovation activity of the main economic agents. If we talk about the place of the Russian Federation in the ranking of countries according to the Global Innovation Index GII, it ranks 47th out of 131 countries, wherein having prospects for further growth [17].

We may note that the Global Innovation Index is calculated as the average value of innovation resources and innovation results. The resources of innovations include institutions, human capital and science, infrastructure, the level of market, and business development, and the results of innovation imply the development of technologies and knowledge economy, the output of creative activity. These components of the index can be used to trace the dynamics of Russia's positions in the GII during 2015–2020 (Table 3.1).

Based on Russia's position in the GII 2020 compared to the GII 2019, we can draw a conclusion about the advantages and disadvantages of the innovation system in Russia, including the context of urban and rural areas [4].

Thus, the strengths of the Russian innovation system imply a high number of graduates of natural science and engineering specialties who can be employed both in industrial enterprises and in enterprises of the agro-industrial complex; the number of people employed in knowledge-intensive industries, allowing the development of industry and agriculture, etc. The weaknesses include small environmental sustainability and low energy efficiency; the lack of rapid development of clusters, despite the large number of studies in this area, etc.

In turn, the growth of innovative activity and the transition to the sixth technological stage, in our opinion, can contribute to the implementation of the model of inclusive economic growth in cities and rural settlements, as well as promote their integration into a single ecosystem.

Table 3.1 The Place of Russia in the ranking according to the Global Innovation Index (GII) during 2015–2020

Indicator	2015	2016	2017	2018	2019	2020
GII value	48	43	45	46	46	47
Innovation resources	52	44	43	43	41	42
Innovation results	49	47	51	56	59	58

Source Compiled by the authors based on [4]

At present, as it was noted, the development of modern cities in Russia and rural areas is extremely uneven. One of these problems is the underdevelopment of rural areas and their lag behind urban areas in many respects, including the level of innovation. As statistics shows, the population of cities of less than 100 thousand people is steadily declining. The number of citizens living in rural settlements is also decreasing at a faster rate.

Over the past decade, the percentage of the rural population in the country total has decreased from 26.5 to 25.26% [19]. If we talk about the regions of the Southern Federal District, it is worth noting that, for example, in the Rostov region, the share of the rural population in the total of the region has decreased from 32.1% in 2015 to 31.8% in 2021. For comparison, in Krasnodar Territory this indicator has decreased from 47.1% in 2011 to 44.4% in 2021 [19]. A similar trend is observed in the Volgograd region (Table 3.2).

Taking into account the fact that the share of the rural population of the Volgograd region in recent decades has fluctuated within a quarter of the total population of the region [24], it should be noted that this share always remains below the all-Russian level (Table 3.3).

Analyzing this dynamics, it should be noted that this is a reflection of the living standard differentiation of the population in cities and rural areas. This is manifested both in the differentiation of per capita income and in the availability of public goods, education, medicine, cultural facilities, and transportation.

Comparing urban and rural areas in terms of innovative development, as noted, the former are significantly ahead of the latter. This is due to a large number of problems in rural areas that need to be solved before the introduction of innovative technologies.

Of course, when the issue concerns the integrated development of villages, one should resort to a comparative analysis of the advantages of specific territories. Such advantages need to be used and developed, and look for points of growth. If we try to develop an unpromising industry in a particular territory, there is a high probability of wasting time and resources. Therefore, priority areas of development should be specifically identified and supported, and there is also a need to resort to improving the existing support mechanisms, including financial, for the development of municipalities' own revenue base to ensure inclusive development.

Comprehensive development of rural areas implies that it is not necessary to be limited only to one sphere of life in the village; it is important to develop all spheres. One cannot but agree with this, but it is extremely important to find an individual approach in the policy of rural development. For the optimally fast finding approach, it is proposed to divide the regions where particular rural areas are located, into 4 types in accordance with their specific problems and advantages.

Firstly, these are predominantly rural areas with agricultural specialization. Such territories also have a rather favorable climate and natural conditions for such activities. Here, social circles are also important. They will make it possible to use a certain set of universal measures in relation to such territories, allowing focusing the attention on the development of the rural economy. We can here list such measures:

Table 3.2 Dynamics of the urban and rural population of the Volgograd region from 2011 to 2021

Population, thousand people	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Urban	2607,5	2594,8	2583,0	2569,1	2557,4	2545,9	2535,2	2521,3	2507,5	2491,0	2474,6
Rural	1982,1	1975,4	1970,5	1963,0	1957,2	1951,8	1947,2	1940,3	1933,7	1925,2	1915,8
	625,4	619,4	612,5	606,1	600,2	594,1	588,0	581,0	573,8	565,8	558,8

Source Compiled by the authors based on [18]

Table 3.3 Dynamics of the share of the rural population in the total of the Volgograd region from 2010 to 2021

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Share, %	24,25	23,98	23,87	23,71	23,59	23,47	23,34	23,19	23,04	22,88	22,70	22,59

Source Compiled by the authors based on [18]

- diversification of the rural economy of specific territories, which subsequently makes it possible to support various types of business in the villages. Such businesses can create a great number of jobs in the village, but one should not forget about self-employment, as well as rural tourism and social development, the promotion of crafts in the particular area;
- social services should become more accessible for rural residents. Due to this, in future, the living standard of citizens and housing affordability may also increase;
- in rural areas, their own market system should be developed, allowing rural producers to have unrestricted access to the agricultural sales market, both in their own region and in other territories of the country.

Secondly, these are areas where multifunctional rural economy prevails. Typically, these rural regions are characterized by suburban agriculture. They have a fairly high population density, moderate migration outflow, and upcoming construction of housing facilities. Here, social infrastructure is developed as much as necessary, depending on the particular distance from the city. A policy in the field of development of such rural areas should take into account the already established highly productive agriculture and be developed in certain directions:

- the main feature of such territories, as already mentioned, is their close location to cities, therefore, the authorities should provide an opportunity for outdoor recreation for the townspeople and the villagers themselves. But it is essential that such a development direction should not harm the ecosystem. On the contrary, in these areas, special attention should be paid to the preservation and restoration of natural and agrarian rural landscapes. There is also an opportunity to promote sustainable agriculture, which could increase ecosystem sustainability in future;
- there is a need to stop the development of such a trend as irrational transfer of agricultural land to totally different categories. It is necessary to improve the mechanisms for regulating land relations in this area and support industrial and infrastructural suburbanization at the legislative level. It will help to diversify the rural economy, as well as create jobs for rural residents;
- it is worth paying attention to the promotion of population migration from city to village, including temporary migration, for example, recreational. If the construction of new private houses is also encouraged, it will put the suburbanization process on the path to prosperity. The growth of migration to rural areas, the qualitative and quantitative strengthening of the service sector will undoubtedly lead to the creation of new jobs for the villagers and to the development of rural entrepreneurship.

Thirdly, these are regions with unfavorable social conditions for the villages' development. In such rural areas, first of all, the main problem is depopulation. There is a set of measures for a solution to this issue:

- one cannot do without a strengthened state policy, namely a demographic one, which is carried out with an increase in the share of families with public support.

Special additional state assistance in rural areas is needed for families that can be categorized as socially vulnerable. We mean families with disabled children, incomplete, low-income, and very large ones. Single-parent families and, of course, orphans should be under state protection. For them, special complexes of measures should be developed to form and motivate a healthy lifestyle, to strengthen and maintain health, and to reduce the mortality rate in villages. A special factor for such citizens is the promotion of their employment;

- despite the depopulation in these territories, it is important to preserve people's access to social institutions, including health care and education. Of course, the development of social infrastructure should not only be supported, but also developed, and transport accessibility to villages should be improved. Problems with gasification, water supply networks, and sewerage systems should also be resolved;
- in the villages that are characterized by depopulation, agriculture is not the emphasis. However, there should be opportunities for its development; therefore, special state support for agriculture is necessary. It may imply a transition to more extensive, but less intensive, branches of agriculture in peripheral areas, where we mean crop production, grazing, etc. Access to getting credits should also be facilitated, whereby assistance will be provided in the renewal of technological facilities and the purchase of animal feed;
- to solve the problems of such territories, it seems possible to develop such a phenomenon as seasonal dacha settlement of remote villages, when at least during the warm season the villages will be filled with city dwellers for gardening and recreation on rural land.

Fourth, these are regions with poor local development of villages, partly due to unfavorable natural and climatic conditions. Here, we should pay attention to such measures:

- development and implementation of a program of unhindered access to basic life-supporting social benefits and services for villagers as healthcare and pharmaceutical organizations, cultural and educational institutions, food and non-food stores, access to the Internet, and cellular communications. It is also worth noting here the development of transport connecting with the city, both motor and water, emergency air transport;
- given the fact that focal settlements of villages rarely allow preserving their culture, an important factor is the need to stimulate the activity of rural communities in various ways and to allocate grants or other subsidies for the development of folk art and activities.

Taking into account the current state of Russian regions, it may be difficult to determine their type, since sometimes in one region there may be rural areas that require comprehensive measures for their development, belonging simultaneously to two or more types of regions. Then the question arises about the necessity to divide all rural areas into types, depending on their advantages and problems. It would also make it possible to implement integrated rural development more efficiently.

Therefore, when today we mention economic growth in Russia, the GDP growth, it should be noted that it most often concerns large cities—megapolises, as well as oil-producing regions. In the peripheral regions, especially in rural areas negative economic growth is most often observed. In this regard, the existing model of economic growth in Russia today cannot be fully called inclusive, since the results of this growth are distributed and become available to a limited circle of economic agents.

The centric model of the geographical location of settlements in Russia is due to the processes of urbanization, which have recently tended to intensify. Along with the growth of natural population decline in rural areas, its migration to large urban agglomerations is observed. The introduction of digital technologies and elements of nanoindustry makes it possible to observe the reverse process, deurbanization, which was especially manifested during the period of the pandemic and the need for remote work of a great part of the employed.

Even if it is too early to talk about long-term deurbanization in the country at this stage, it is possible to gradually maintain this trend and limit the growth of urban agglomerations. This will also be facilitated by many disadvantages of living in large cities, which citizens often pay attention to. These are, for example, environmental degradation in cities, traffic jams on highways and long city roads, and a change in consumer preferences in favor of natural and organic food. A trend to the values of rural lifestyle began to appear, which is manifested in the less intense rhythm of life, in the possibility of living in a private house with a backyard, etc. [1].

It is worth noting that deurbanization can manifest itself in various forms: the move of urban residents to a permanent place of living in the countryside, and the construction or purchase of a “second housing” in the suburban areas, and even agritourism, which has become more and more popular since 2015. Taking into account the proposed measures, development of rural areas and introduction of deurbanization trend will be a significant step toward stabilizing the socio-economic situation in the post-pandemic period, upon condition of the introduction of innovative technologies into the aspects of living of rural areas citizens [14].

These tendencies are aimed at the integration of economic and social processes taking place separately in urban agglomerations and rural settlements. This integration is an important condition for the implementation of the concept of inclusive economic growth in our country.

Indeed, at present, large urban agglomerations, medium and small cities, as well as rural settlements in Russia can be considered as isolated ecosystems. Of course, there are forward and backward linkages between these systems, but today it is not necessary to talk about a single ecosystem, which organically includes cities of various sizes and geographic locations, as well as rural areas. As a result, economic

growth is extremely uneven. Many resources are not fully used, which significantly affects the GDP growth rates of the Russian economy as a whole in the near future.

Large-scale introduction of technologies of the sixth technological stage creates conditions for the growth of integration processes between urban and rural areas within a single ecosystem.

As shown in Fig. 3.2, a single ecosystem includes large urban agglomerations, small and medium-sized cities (C), and rural settlements (V), the interaction between which is mediated by the use of technologies of the sixth technological stage (T).

Within this single ecosystem, economic growth, on the one hand, becomes more sustainable due to the possibilities of using a diversified portfolio of resources. On the other hand, it is possible to achieve the inclusiveness of economic growth, which will make its results available to a wide range of economic agents, final consumers, regardless of the territorial location of their residence.

Thus, the balanced development of urban and rural areas can be ensured through the diffusion of innovations within the framework of the transition to the sixth technological stage. Development of a single ecosystem that includes both cities of various sizes and rural settlements will make economic growth more sustainable in the long term and make it inclusive.

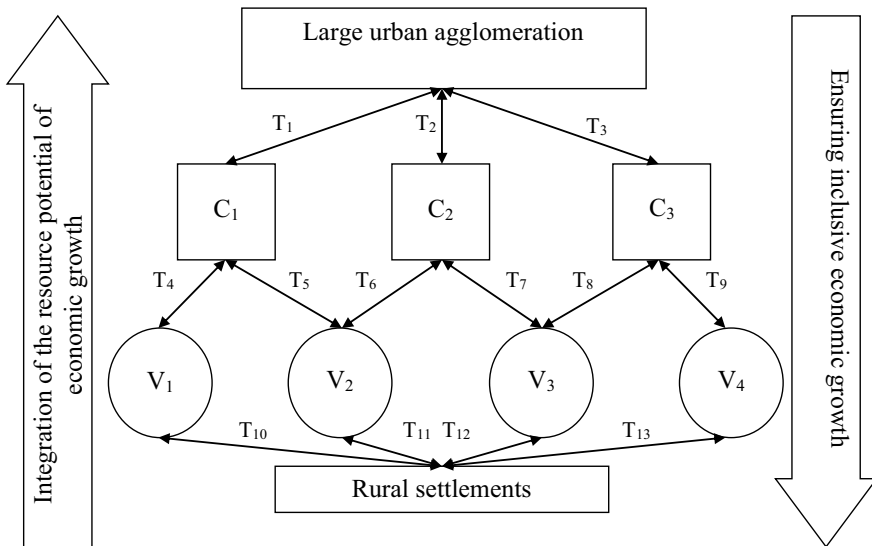


Fig. 3.2 An integrated ecosystem of urban and rural areas in the context of inclusive economic growth. *Source* Developed by the authors

3.4 Conclusion

Summing up the conducted research, some conclusions and generalizations can be drawn. Currently, economic growth in Russia is unstable and uneven. This is due to commodity dependence of the country's economy, uneven distribution of production structures, and insufficient level of technological development of the productive forces. In this regard, for many years, there has been a slight increase in the GDP, a high-level inflation, occasional crisis phenomena in the economy. In addition, the results of economic growth are distributed extremely unevenly toward large urban agglomerations, while rural areas are stagnating. This gives rise to unidirectional migration flows from villages to large cities, intensification of urbanization processes, and growing differences in the living standards of the urban and rural populations.

In the struggle for world leadership in new technologies, Russia needs to move to the new sixth technological stage, the core of which is information-, nano- and biotechnology. The introduction of these technologies will allow large-scale diffusion of innovations in all key elements of the integrated ecosystem in urban and rural areas. This will lead, on the one hand, to economic growth acceleration by mobilizing new resources, and on the other hand, it will make the processes associated with this growth more inclusive.

Consequently, at present, the state faces the most important strategic objective of establishing a roadmap for the development of innovative technologies as a factor of urban and rural area growth, taking into account the difficulties of transition to the sixth technological stage and the specific features of these territories.

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