Regional Social Infrastructure: Spatial Aspects of Sustainable Development

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Abstract

The goal of the research is to develop and test the model of the spatial planning of the location of regional social infrastructure, which will help overcome territorial disproportion. In this paper the authors have applied a graph theory approach as an effective method for solving the problem of inequity from the social and economic perspective. The authors suggest a new model, showing a connection between the spatial planning of the location of regional social infrastructure and sustainable development. The social and economic effect of the location of regional social infrastructure is identified using the return on the costs of construction and operation, which are directed from the regional budget. The article presents forecasts of personal income tax as a basis for providing the complex services of social infrastructure to the population of a group. The advantage of the model is focus on the multilateral interaction of territories both between regions and between settlements within the territories.

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1. Introduction

The inequity of social and economic regional development raises a range of problems identified through the interregional competition for human capital. One of the possible ways of overcoming the negative factors of interregional social and economic differentiation is emphasising the development of the social infrastructure of the region.

Economic literature researching social infrastructure has recently paid attention to cooperation between entrepreneurs and authorities (Morrison, 2017). The interests of entrepreneurs here focus on the possibility of using the human capital of the territory, and control over the efficient distribution of budget funds intended for the construction of social infrastructure facilities. The interests of authorities are related to the possibility of involving stakeholders in the development of territories, and thereby creating the conditions for sustainable development. Available social infrastructure can be considered a criterion for harmonizing the interests of entrepreneurs and authorities and establishing a basis for regional sustainable development (Turan, 2016). Analysis of scientific works was revealed a lack of attention on this issue. Naess (2001), in his research, suggests that sustainable development should not be oriented toward the rational use of limited resources. The main idea is to support population groups who can save basic equity. Unfortunately, the author did not connect the two terms "sustainable development" and "social infrastructure" and noted the same problem in the work "Spatial planning for sustainable development" (Ngah et al., 2016). The authors analysed the term "sustainable development" and provided a step-by-step approach to spatial planning, emphasising a balance of the three categories of sustainable development. Sharyn Casey (2005) established standards for social infrastructure. She emphasised the lack of attention on social infrastructure needs and requirements. The word "sustainable" in her research is solely associated with a community that has the ability to maintain and build on its own resources and has the resilience to prevent and/or effectively address problems in the future. We would like to note that considerable attention to the research of social infrastructure has been given by Australian researchers Dodson (2009) and O'Neill (2010). This can be explained by the crisis that has arisen in the urban infrastructure sector in this country.

On the basis of the above, the goal of the research is to develop and test the model of the spatial planning of the location of regional social infrastructure, which will help overcome territorial disproportion. The research question in this study is: How is it possible to stop the inequitable development of territories on the basis of regional social infrastructure?

We identify the term "social infrastructure", formulate the theoretical aspects of the location of social infrastructure, support and test the method of the location of social infrastructure.

The article starts by presenting a detailed literature review of the issues explored. This is followed by developing the theoretical aspects of the territorial planning of the location of social infrastructure locations. The following section proposes a model of the spatial planning of the location of regional social infrastructure. The paper then identifies that the effect of the location of social infrastructure depends on the personal income tax in the regional budget, and conducts scenario forecasting of personal income tax when providing the population group complex social infrastructure services. The last section draws appropriate conclusions.

2. The problem of defining social infrastructure as an economic category

Social infrastructure represents the production relations aimed at creating a set of conditions to provide economic growth and a living for the country's population. The capabilities of social infrastructure in creating such conditions depend on economic potential determined by available reserves and resources. Nowadays, there is no clearly defined interpretation of the "social sphere" as a category. This is connected to the essential content of the category, which has changed in accordance with the level of economic development and public relations. In research or official documents there are various definitions of this concept.

One of the first concepts defines social infrastructure as a complex of conditions contributing to the favourable development of private entrepreneurship in the major sectors of the economy and the population's satisfaction (Rosenstein-Rodan, 1961). In this concept economic agents, such as transport, communications, and so on, are the basic elements of infrastructure. A similar concept can be also found in Nurkce (1955). The genesis of infrastructure theory in economics is discussed at depth by Raenock (2013). The author has presented different approaches to the identification of social infrastructure: as a set of conditions for economic growth; as a set of sectors, ensuring the production of goods and services; as a set of social institutions, servicing economic objectives.

The question of planning social infrastructure can be traced back to the industrial revolution, when the villagers began to move in masses to towns and cities. Interrelations between the development of social infrastructure and the quality of life in rural and urban areas were discussed in a number of studies (Yanitsky, 2010; Teriman et al, 2011; Zhikharevich et al., 2012; Leigh et al., 2016). Most of them emphasize the significant influence of social limitations on economic development and its differentiation.

Nowadays, high quality social infrastructure is seen as a major component of sustainable development (Queensland Government Office of Urban Management, 2006). The formation of sustainable communities implies the integration of the objectives of economic, social and ecological development as a constant process. Social infrastructure is considered the basis for human capital formation (Williams et al., 2010; More et al., 2017). In the opinion of Russian researchers, social infrastructure includes the following indicators: passenger transport; public utilities; health care; education; social benefits; culture and art; physical education and sport; information and communication services; trade; consumer services; catering; tourism and hospitality (Bykovskaya, 2010; Varlamova, 2016).

The term "regional social infrastructure" has distinctive features: its branches function on a national scale as a single system, and at the same time its activity is characterized by a clearly expressed locality. Logacheva (2012) interprets the regional social infrastructure as a "complex of infrastructural branches located in a single territory, which performs different social functions" (Logacheva 2012). In our opinion, the basis for defining social infrastructure is its perception as a set of branches, enterprises and organizations, ensuring the satisfaction of the population. That is why social infrastructure represents an integral system of state, regional enterprises, commercial organizations and branches, located in the territory of a subject of the Russian Federation and provided the services to satisfy the population's (physiological, social, prestigious, spiritual) needs. The system is aimed at improving the quality of the population's life in a region as its major competitive advantage.

The territorial organization of social infrastructure may be seen in economic and social terms. The economic aspects are connected to the formation of the conditions for the

reproduction and inflow of human capital. In this, human capital is a factor of regional advantage. In addition, economic aspects identify the expansion of entrepreneurial activity in the services sector. Moreover, a high level of human capital contributes to growth in innovation activity in a region and national competitiveness, as discussed in a number of studies (Rodionov et al., 2014; Kalinina, 2016; Nikolova et al., 2015).

The social aspects are predetermined by the key role of social infrastructure in the quality of life for the people living in a region. This turns social infrastructure into an object of regional governance. Therefore, the process of social infrastructure development requires the harmonization of national and regional goals of governance with regard to the specific features of the territories in strategic planning.

Nowadays, regional policy focuses on the creation of growth points in regions, which is based on cumulative growth theory and diffusion of innovation theory (Murdal, 1972; Camagni, 2017). The creation of growth points promotes unsustainable development and does not imply integrative strategic planning. This can be explained using the results of applying such a paradigm: intensive urban agglomerations, outflows of population from depressed regions, increasing the lag of innovations from centres to rural areas.

In the framework of the current research we analyse the problem of defining social infrastructure, and identify this term as an integral system of national and regional institutions, commercial organizations and industries, located within the same territory and ensuring the satisfaction of the population (physiological, social etc.) on a gratuitous and reimbursable basis with the target of improving the quality of life for the people living there (as its main competitive advantage).

3. Theoretical aspects of the location of social infrastructure

Under the conditions of globalization, distinctions in the quality of life have become the major driving force for interregional and international migration, which has become one of the main trends in the modern development of regional socioeconomic systems. The results of analysing the interrelations between the development of social infrastructure, migration processes and the competitiveness of the regional economy in the Russian Federation were presented in a previous article by the authors of this research (Zaborovskaya and Gorovoy, 2015). On the basis of statistical information on international and interregional migration, the existence of interregional competition in the national labour market has been proven. This situation explains the differences in the level of satisfaction among the population. In this research, the authors identify statistically significant dependencies between the attractiveness of a region for migration and indicators of the quality of life among the population, which characterize social infrastructure. For this reason, greater differentiation of the quality of life among the population on the basis of region corresponds to more intensive interregional and international labour migration. Young people seek to move to large cities, and migration flows from countries with a low level of human capital development grow and generate social problems. Such situations worsen the quality of life for the indigenous population, increase the need for social infrastructure services, and therefore lead to unsustainable regional development. Therefore, in order to ensure sustainable regional development, reduce migration processes and develop the potential of small and medium-sized settlements, it is necessary to develop a model of spatial planning for social infrastructure objects.

In a number of studies (Matos et al., 2017; Gorovoy, 2015) there are statistically significant interrelations between quality of life, which determines the migration attractiveness of the region, and the region's competitiveness among the subjects of the Federation. Quality of life is ensured by the level of development and availability of social infrastructure services. Based on the above, the authors develop a model of the spatial development of social infrastructure in accordance with following theoretical aspects:

- general access to a range of quality services regardless of the features of the territory (rural or urban settlements, monocentric or polycentric urban agglomerations);
- identification of the influence of location on the availability of highly qualified population, services provision (supply resources), and consumers of such services (consumer services);
- procuring the development of entrepreneurial activity, related to the reduction of administrative and market barriers to entering the market;
- attraction of social entrepreneurs in different social areas in the target to ensure financing for social infrastructure objects;
- identification of modern transport system as a factor for providing access to social infrastructure objects;
- development of integrated complex enterprises providing social infrastructure services as a factor of cost reduction;
- applying the potential of agglomerations;
- harmonization of business, regional authorities and population interests.

The identified principles constitute the advantages of the model, which will be achieved as a result of its implementation. The principles listed above are also a distinctive feature of the model. None of the previously developed models take into account such principles.

The theoretical aspects and revealing of consumer groups' location in region settlements, allow the authors to rationalize the location of social infrastructure and create the conditions for the satisfaction of demand for services of social infrastructure objects. The model of the spatial development of social infrastructure implies the integration of territories as interregional as well as settlements of different sizes, as indicated in Figure 1. The direction of social infrastructure development implies adapting the development to suit different types of settlement. To date, there are 4 types of settlement: rural areas, urban areas, small and medium towns. The specific type of settlement determines the conditions that should be taken into account when modelling. For example, well-developed access to transport exists for urban areas, which is not typical for rural areas. When developing social infrastructure, it is also necessary to take into account the degree of development in neighbouring regions, as well as the possibility of agglomeration effects. For example, a successful integration policy will make it possible to extend the opportunities for service satisfaction achieved in large urban agglomerations to regions with low levels of socio-economic development. The authors mention one of the advantages of the model as being the multilateral nature of the interaction between territories, which ensures a more complex and balanced development of the territories.

Figure 1. The theoretical basis of the model of spatial development of social infrastructure
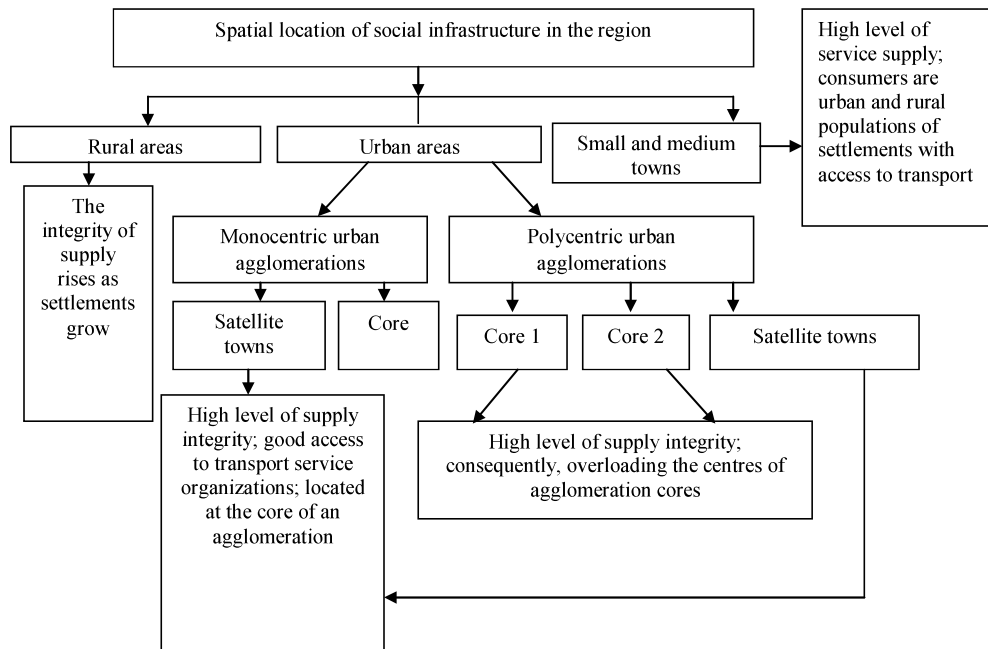
Social infrastructure objects often develop as small businesses organizations, for which instability is common. For this reason, regional government authorities are interested in cooperation with large integrated service enterprises (multi-service) targeting cost-cutting (Jurčík et al., 2015). The authors suppose that the potential integration can be characterized by a number of effects: improved service quality; satisfaction of the needs of the people; and improved possibilities for increased production due to reinvested profits or the attractiveness of workplaces.

From the point of view of the regional government bodies, the spatial location of social infrastructure is characterized by an agglomeration effect. This effect causes the cumulative and incremental increase of incomes for regional authorities due to growth in the output of goods, processes, and services by economic agents compactly located in the territory. Agglomeration (urban and rural) supposes access to transport, a wide range of services and solutions for a spatially distributed urban and rural population. Agglomerations do not coincide with the administrative boundaries. Their populations proceed from consistent availability of transport in the selected territories, levels of service, types of education and so on.

One of the actual problems is the regulation of migration flows, and as a consequence, the problem of increasing demand on social infrastructure objects in urban agglomerations. This additional load results in the depopulation of individual regions, the degradation and reduction of a number of social infrastructure objects and the reduction of the sustainability of the socioeconomic development of the country at the territorial level.

The authors of the current article see agglomeration as a key tool for the integral development of territories today. It creates growth points for entrepreneurship due to high access to transport, and financial and institutional infrastructure. The need for better quality

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service and innovation activities is justified by the high level of competition in the core town, and its growth intensity in the periphery of an agglomeration in proportion to the development of the latter.

Today, the system of population displacement in the Russian Federation is based on the concentration of material, technical, financial, production and social resources in large urban agglomerations, which function as the hubs of the system's framework. It should be expected that the territorial development of the country will become increasingly inconsistent. A framework for settlement structure in the Russian Federation is projected. It will consist of 20 large agglomerations with a total population of over 1 million people. Moreover, conditions will be created for quick migration from mono-profile cities and towns to the periphery of large urban agglomerations due to newly settled areas, which will have a systemically planned resource-saving social infrastructure.

Inter-agglomeration areas with a well-developed transport infrastructure outside agglomerations represent interest for the development of rural agglomerations in locations of agricultural production. It seems reasonable to stimulate the restoration of population uniformity. Access to the entire range of services in social infrastructure objects must be invariant to the size of the population (rural settlement, urban settlement, small and medium towns, urban agglomerations). However, this fundamental principle is not applied in practice.

The low level of the development of social infrastructure in a large number of rural settlements is preconditioned by the following factors (Mishchenko and Mischenko, 2011): the strict centralization of power, budget planning and funding; the high degree of the bureaucratization of the governance of social infrastructure objects; the instability and insufficiency of budget funding; unfavourable entrepreneurial climate in this sphere; and decreasing demand for services due to a shrinking population. The last factor seems to be the most important because in one of the accepted schemes for funding social infrastructure objects, the size of financing depends on the number of inhabitants in rural settlements. Decentralized funding is related to investment attractiveness, which depends a lot on the size of a settlement.

Moreover, one objective to help retain the population in rural areas is connected both to the achievement of competitive advantages in a region and economic and social security. In order to solve this problem a technique has been suggested for determining the location and service area of integrated objects of social infrastructure based on the model of proportional placement (Fig.1) and graph theory tools (Bollobás, 2013).

4. Method for spatial planning of the location of regional social infrastructure

Based on the abovementioned theoretical aspects and principles, the authors of the study propose a method, which includes the following steps:
- select a territory;
- select a location for multi-services on this territory;
- define investors, who can ensure the establishment and operation of a multi-service, and conditions for investment based on public-private partnership;
- assess transport accessibility for the established multi-services;
- develop a long-term regional development plan for passenger transport infrastructure in coordination with federal programmes;

- hierarchical planning of multiservices (consequent expansion in the composition of enterprises of daily, periodical and occasional use, located in the corresponding centres in proportion to the growing population living in the service zones of these centres).

As an efficiency criterion for setting up multi-services, as a means to meet the population's needs, progressive personal income tax is proposed, which, in certain proportions is distributed between regional subjects. Tax growth is caused by stabilizing the population and preventing undesirable migration processes. Support for some steps is reviewed in detail below.

4.1. Location of multi-services

To determine the location for multiservices, it is reasonable to use graph theory (Bollobás, 2013), in particular, an absolute centre definition method. A description of the mathematical apparatus is given in Gorovoy (2015). To find the absolute centre, two stages are realized:

- On each non-oriented arc there are candidate points for placing an absolute centre. The candidate points are points on the arc, the distance from which to the most remote vertices is minimal.
- Among the candidate points and all vertices of the graph, a point or vertex is chosen as the absolute centre, the distance from the most remote vertex of the graph being minimal, in order to select the best candidate point on each edge, it is necessary to construct functions characterizing the point-vertex distances for all f -points.

4.2. Cost estimate for the (re)construction of multi-services

Multiservices are public buildings. The construction and reconstruction of multiservices is regulated by SNIP 31-05-2003 "Public buildings for administrative purposes". The list of costs can be identified based on the goals and objectives of the research. The authors identify the following groups of costs in the framework of the research:

- geological exploration (S1);
- design project development (S2);
- project ratification and approval (S3);
- construction of a building (S4);
- landscaping (S5).

Total costs S will be: $S = S1 + S2 + S3 + S4 + S5$ (1)

4.3. Cost estimate for utilities

Let d_{i,i^*} be the distance from settlement i to a multiservice (graph centre) j^*; c_{i,i^*} the costs of transport infrastructure development; A – one-off costs of vehicle parking. Total costs will be:

$$SC = \sum c_{i,i^*} {}^* d_{i,i^*} + A$$ (2)

Costs for this type of work have to be considered in case they are covered by municipal units.

4.4. Socioeconomic effect of the placement of a multi-service

A socioeconomic effect of the placement of a multi-service is defined, first of all, by the return on the investment in the construction or reconstruction of buildings, and the provision of

utilities. The source of income in such cases includes funds from individuals inhabiting the region. Correspondingly, if the purpose of developing social infrastructure objects is to ensure the satisfaction of the integrated needs of a region's population and the funding is partially or fully carried out from regional and municipal budgets, then the economic effect will depend on personal income tax going to regional and municipal budgets.

$$E = f(N), \tag{3}$$

where N – is personal income tax collected from permanently registered inhabitants of the settlements catered for by a multiservice; E – effect.

The social effect will be determined by the growing attractiveness of the quality of the population's life in a municipal unit, the reduction of the average age of the population due to the comfort of the living conditions for the young.
Given the methodology for estimating NPV (net present value):

$$E = \sum (N_t /(1+r)^t) - (S + SC), \tag{4}$$

where N_t is the personal income tax collected from permanently registered inhabitants of settlements served by a multiservice, in the year t; r is a discount rate.

5. Results: Scenario forecasting for territorial location

Under the conditions of limited financing, the problem exists of selecting priorities for the location of multiservices in the territory of the administrative region. Resolving this can be presented as set of group systems for inhabited places, which according to graph theory have absolute centres in which multiservices are placed. The possibility of expanding service areas by one multiservice are also considered. Accordingly, group systems for inhabited places for the purposes of selecting the location for multiservices (step 1) are combined according to the principle of addition (Mazur, 2014). In this principle, the service area of the projected multiservice is equal to the sum of the areas of two neighbouring group systems of inhabited places. The group systems can also be combined using the same principle. In this situation, it is equal to the sum of the regions of three neighbouring group systems of inhabited places.

The forecast of the total amount of personal income tax is calculated using three scenarios (Sari and Kahraman, 2015).

- realistic, based on the trend of the size of the population in a group system of settlements;
- pessimistic, based on the size of the population in a group system of settlements, smaller than the average by α% (value α is, at the same time, the pessimism characteristic of the project developers);
- optimistic, based on the size of the population in a group system of settlements larger than the average by β% (value β is the optimism characteristic of the project developers).

To develop the scenario forecasting, data from Rosstat (2016) on population employment in the Russian Federation in January 2016 were used, according to which the rate of decline in the number of economically active population in the country was 0.7% per year, and the share of economically active population was 94.36%. This category of citizen is the payer of personal income tax. The share of economically active population in the total population of

the country was 49.1% for the indicated period. These data were used to calculate a realistic forecast. To calculate a realistic forecast, the hypothesis of the invariability of the total population was adopted, the employment structure corresponds to the above average Russian indicators. Thereby forming a matrix of management decisions. The scenario forecast is presented in Table 1.

Table 1. The forecast of personal income tax when providing the complex services of a social infrastructure in a conditional region to the population of group systems of inhabited places

Index	Group system of inhabited places			Two neighbouring group systems of the inhabited places			Three neighbouring group systems of inhabited places		
	1st year	2nd year	3rd year	1st year	2nd year	3rd year	1st year	2nd year	3rd year
Population in region, thousand people (fact)	100	101	102	170	172	174	260	263	266
Realistic forecast									
Population, thousand people	100	101	102	170	172	174	260	263	266
1.2. Number of economically active population, thousand people (1.1*0.491)	49.1	49.6	50.1	83.5	84.5	85.4	127.7	129.1	130.6
1.3. Number of employees in the economy, thousand people (1.2*0.9436)	46.3	46.8	47.3	78.8	79.7	80.6	120.5	121.8	123.2
1.4. Accrued wages, million roubles / year (1.3*29.565* 12)	16436.9	16603.7	16781.1	27977.9	28275.9	28595.3	42736.8	43212.2	43708.9
1.5. Personal income tax, million roubles (1.4*0.13)	2136.8	2154.8	2181.5	3637.1	3675.9	3717.4	5555.8	5617.6	5682.2
Pessimistic forecast									
2.1. Population, thousand people	$100 \times 0.9 = 90$	$90 \times 1.019 = 91.71$	$91.71 \times 1.019 = 93.5$	$170 \times 0.9 = 152$	$153 \times 1.019 = 155.1$	$155.1 \times 1.019 = 158.1$	$260 \times 0.9 = 234$	$234 \times 1.019 = 238.5$	$238.5 \times 1.019 = 243.0$
2.2. Number of economically active population, thousand people	$90 \times 0.491 = 44.91$	$44.91 \times (100-0.61)/ 100 = 44.63$	$44.63 \times (100-0.61)/ 100 = 44.36$	$152 \times 0.491 = 74.6$	$74.6 \times (100-0.61)/ 100 = 74.1$	$74.1 \times (100-0.61)/ 100 = 74.0$	$234 \times 0.491 = 114.9$	$114.9 \times (100-0.61)/ 100 = 114.2$	$114.2 \times (100-0.61)/ 100 = 113.5$
2.3. Number of employees in the economy, thousand people	$44.91 \times 0.9436 = 42.38$	$42.38 \times (100-0.44)/ 100 = 42.2$	$42.2 \times (100-0.44)/ 100 = 42.0$	$74.6 \times 0.9436 = 70.39$	$74.6 \times (100-0.44)/ 100 = 74.3$	$74.3 \times (100-0.44)/ 100 = 73.9$	$234 \times 0.9436 = 220.8$	$220.8 \times (100-0.44)/ 100 = 219.8$	$219.8 \times (100-0.44)/ 100 = 218.9$
2.4. Accrued wages, million roubles / year	15035.5	14971.1	14900.7	24972.9	26360.2	26218.2	78335.4	77980.6	77661.3
2.5. Personal income tax, million roubles	1954.6	1946.2	1937.1	3246.5	3426.8	3408.4	10183.6	10137.5	1008.9
Optimistic forecast									
3.1. Population, thousand people	100	$100 \times 1.021 = 102.1$	$102.1 \times 1.021 = 104.2$	170	$170 \times 1.021 = 173.6$	$173.6 \times 1.021 = 177.2$	260	$260 \times 1.021 = 265.5$	$265.6 \times 1.021 = 271.1$
3.2. Number of economically active population, thousand people	49.1	50.1	51.2	83.5	85.2	87.0	127.7	130.4	133.1
3.3. Number of employees in the economy, thousand people	46.3	49.9	50.9	83.1	84.8	86.6	127.1	129.8	132.5
3.4 Accrued wages, million roubles / year	16426.3	17703.3	18058.3	29482.2	30085.3	30723.9	45095.1	46050.4	47008.35
3.5. Personal income tax, million roubles	2135.4	2301.4	2347.6	3832.7	3911.1	3994.1	5862.4	5986.6	6111.1

To determine parameter α in the pessimistic scenario of the forecast and parameter β, we used the forecast data of the Ministry of Economic Development of the Russian Federation, according to which "the economically active population is expected to decrease by 1.3 million people in three years, from 72.1 million in 2016 to 70.8 million people in 2020. At the same time, the number of employed in the economy will decrease from 67.7 million in 2013 to 66.8 million in 2020" (State Statistics Service Rosstat, 2016); "... by 2020 the population will grow by 0.9 million people from 143.2 million people in 2016 to 144.1 million people in 2020" (State Statistics Service Rosstat, 2016). Therefore, in the model, the average annual relative increase in the number of economically active population is taken as:

$\beta 1 = ((70.8 / 72.1) * 100 - 100) / 3 = - 0.61\%$.

The average annual relative increase in the number of employed in the economy is adopted in the amount of: $\beta 2 = ((66.8 / 67.7 - 100) * 100) / 3 = -0.44\%$; $\alpha = 2\beta$.

The average annual population growth rate in the optimistic forecast corresponds to the data of the forecast of the Ministry of Economic Development of the Russian Federation:

$(100 - (144.1 / 143.2) * 100) / 3 = 0.21\%$, in the pessimistic - is 90% of the actual (0.19%)

To calculate the personal income tax, the average wage of 29.565 thousand roubles was used (in 2016 in Leningradskaia oblast). The term of the construction and commissioning of a multiservice and the creation of transport infrastructure is 3 years. Demand for services on the part of the population in a certain settlement generates relevant supply and determines what objects of social infrastructure are located in this territory. Accessibility of services is ensured by the transport infrastructure, which provides transport services and creates the conditions for the availability of other functionalities for social infrastructure objects. Consequently, social infrastructure can be presented as a territorial hierarchically organized system.

Under the conditions of federalism, the preservation of the territorial and economic unity of the country calls for coordinated objectives at national and regional levels given the role of the regional social infrastructure and its special significance for the strategic planning of territorial development.

With interregional and intra-regional differentiation, and international and interregional migration processes, the level to which social infrastructure is developed can be considered a criterion for the successful coordination of the interests of entrepreneurs and authorities, since it is the capability to satisfy the complete set of needs, which ensures the stability of the number and reproduction of a region's population.

Under the conditions of intensive international and interregional migration, the accessibility of social infrastructure causes growth in the population and, what is more important, creates the conditions for the expanded reproduction of the indigenous population. With the simultaneous implementation of employment programmes, including entrepreneurial activity, the conditions are created for incomes in the national and regional budgets to grow. In this context, the creation of conditions for employment is a limitation that determines whether it is necessary and feasible for social infrastructure to develop in a certain territory. This model corresponds to the strategy of setting up group systems of settlements – the interrelated and interdependent development of neighbouring urban and rural settlements based on a single transport infrastructure and service network. In such cases, the socioeconomic and cultural advantages of large cities related to agglomeration advantages combine with the ecological and territorial potential of the periphery between cities and towns.

6. Discussion and conclusions

This study was aimed at determining the role and place of social infrastructure objects in the provision of the sustainable socioeconomic development of a territory. As the main result of this article, the authors highlight the proposed model of the spatial planning of the location of social infrastructure, oriented towards sustainable development. It can be presented as a set of group systems for inhabited places, which is described using graph theory and uses absolute centres in which multiservices are placed. In the authors' opinion, the development level of social infrastructure, to a large extent, defines the interregional and international migration attractiveness of a territory. Agglomeration processes, common in contemporary socioeconomic systems, creates attractive conditions where social infrastructure objects become concentrated, creating favourable conditions for a better quality of life. Under Russian conditions, these processes are not controlled well enough and generate an excessive inflow of population to towns and cities, worsening the socioeconomic potential of rural areas. The authors find it important to change the current approaches to the spatial positioning of social infrastructure objects, which must use the advantages of agglomerations and present equal access to services for population, independently of the place of living. The funding of social infrastructure objects is limited. Therefore, integrated objects – multiservices – have been considered as a promising form in the research study. Their location must be based on the methodology of the proportional placement of social infrastructure, which implies the accessibility of services, multi-channel funding, public-private partnership, and transport development. The tools of graph theory are productive for the positioning of multiservice objects with the costs related to the creation or reconstruction of multiservices and transport costs serving as parameters.

Although there are a number of studies based on other principles and approaches to those of "social infrastructure". For example, the theory of cumulative growth (Murdal, 2009) is based on the creation of growth points in regions, which trigger the process of accelerated development. Within the framework of this theory, the main factors of regional development are specialization and scale effects. The work of another author (Richardson, 1983) is based on the principle of the limited mobility of resources. The factors of regional economic growth are internal resources that do not possess the property of mobility, and mobile resources (personnel, technology, knowledge, investments) are attracted from outside. The main problem that is not fully resolved within the framework of this theory is the excessive concentration of production, growing unevenness of territorial development, and the vulnerability of a non-diversified economy in the face of economic crises. The development of the theory of growth poles and their influence on the development of regions is associated with Hägerstrand and J-R. Boudeville (Mishchenko et al., 2011) is based on the development of the idea of the diffusion of innovations created in advanced industries in the territories – growth centres in peripheral territories.

The model proposed in the framework of this study is based on previous studies. In the model, as in previously developed models, great attention is paid to the development of peripheral territories. The development of peripheral territories will contribute to a more balanced and sustainable development of the country as a whole. Furthermore, the model takes into account the effects that can occur from interactions with adjacent territories. This model can be used in any other country, since during the research, attention focused on the fact that the division of territories in the model is not connected to the administrative

division. The advantage of the model is its focus on the multilateral interaction of territories both between regions and between settlements within the territories. A clear advantage of the model is its theoretical validity and implementation based on the following principles:

- the principle of equal accessibility of social infrastructure services for residents of different settlements, which is the responsibility of the executive authorities of the constituent entities of the Federation for the opportunity to meet the entire range of needs for the population of the regions, regardless of the type of settlement in which they live;
- the complexity of the offerings of state, municipal and paid services, which consist in the possibility of obtaining services through all possible channels of financing;
- the priority of the transport infrastructure in the socio-economic infrastructure of the region as a means of ensuring the intraregional mobility of the population.

In the opinion of the authors, an essential limitation of the research is the testing of the model based on data from a conditional region. In the future, the model should be implemented using real data. The results of this research may be developed in the following areas:

- The social infrastructure of a region includes various branches. If the specifics of these branches are studied, it is possible to identify those where social entrepreneurship should be developed. Legal standards supporting social entrepreneurship under Russian conditions have not been worked out, virtually. So, the constructive assimilation of foreign experience and its transformation would be useful.
- Funding for social infrastructure objects must be multi-channel. So it is possible to investigate various forms of financing and their efficient use (coordination of financial resources in regions and municipalities, regulating taxes, targeted programming method, funds of transnational and transregional companies, regional entrepreneurs, population). Moreover, efforts can be made to design mechanisms for the participation of economic agents in the social development of a territory, depending on what regional resources are used.

The forms of public-private partnership in the social sphere must also be investigated with the consideration of social infrastructure specifics. Specific focus can be given to the problems of the transport infrastructure in regions in terms of the possible locations of multiservices.

References

Bollobás, B. 2013. *Modern Graph Theory*. Springer Science & Business Media.

Bykovskaya, E.V. 2010. The Role of Social Infrastructure in the Functioning of the Regional Socio-Economic Systems. *The Bulletin of the Adyghe State University, Series "Economics"*, No. 3, pp. 37-43.

Casey, S. 2005. *Establishing Standards for Social Infrastructure*. UQ Boilerhouse, Community Engagement Centre.

Camagni, R. 2017. Regional Competitiveness: Towards a Concept of Territorial Capital. In: R. Capello (Ed.). *Seminal Studies in Regional and Urban Economics*, pp. 115-131. Springer.

Dodson, J. 2009. The 'Infrastructure Turn' in Australian Metropolitan Spatial Planning. *International Planning Studies*, Vol. 14, No. 2, pp. 109-123.

Gorovoy, A.A. 2015. *Methodology of Territorial Organization of Integrated Objects of Social Infrastructure of the Region*. St. Petersburg State Economic University. Saint Petersburg.

Jurčík, R. 2015. Permissible Public Cooperation in the Field of Public Administration–Opportunity for Enterprises. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, Vol. 62, No. 6, pp. 1309-1314.

Kalinina, O.V. 2016. An Innovative Approach to the Formation of a Progressive Taxation Probabilistic Model on Personal Incomes. *International Journal of Economics and Financial Issues*, Vol. 6, No. 3, pp. 995-1002.

Leigh, N.G. and Blakely, E.J. 2016. *Planning Local Economic Development: Theory and Practice*. Sage Publications.

Logacheva, N.M. 2012. *Social Infrastructure and Its Importance to the Socio-Economic Development of Regions of Russia*. Ekaterinburg: Publishing House of the Ural Institute of Economics, Management and Law.

Matos, F., Matos, F., Vairinhos, V.M., Vairinhos, V.M., Dameri, R.P., Dameri, R.P. and Durst, S. 2017. Increasing Smart City Competitiveness and Sustainability through Managing Structural Capital. *Journal of Intellectual Capital*, Vol. 18, No. 3, pp. 693-707.

Mazur, J. 2014. *Enlightening Symbols: A Short History of Mathematical Notation and Its Hidden Powers*. Princeton University Press.

Mishchenko V.V. and Mischenko I.V. 2011. Development of Intraregional Rural Space: a Methodological Aspect. *Issues of State and Municipal Management*, No. 4, pp. 43-49.

More, I. and Aye, G.C. 2017. Effect of Social Infrastructure Investment on Economic Growth and Inequality in South Africa: a SEM Approach. *International Journal of Economics and Business Research*, Vol. 13, No. 2, pp. 95-109.

Morrison, C., Morrison, C., Ramsey, E., Ramsey, E., Bond, D. and Bond, D. 2017. The Role of Social Entrepreneurs in Developing Community Resilience in Remote Areas. *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. 11, No. 1, pp. 95-112.

Murdal G. 1972. *Modern Problems of «Third World». Drama of Asia*. Translation from English. Publishing house «Progress», Moscow.

Murdal G. 2009. Great Economists since Keynes: An Introduction to the Lives & Works of One Hundred Great Economists of the Past. *Economics*, pp. 210-214. St. Petersburg.

Naess, P. 2001. Urban Planning and Sustainable Development. *European Planning Studies*, Vol. 9, No. 4, pp. 503-524

Ngah, I., Ruang, S.N.P. and dan Manajemen, M.K.P. 2016. Spatial Planning for Sustainable Development.

Nikolova, L.V., Kuporov, J.J. and Rodionov, D.G. 2015. Risk Management of Innovation Projects in the context of globalization. *International Journal of Economics and Financial Issues*, Vol. 5, No. 3S, pp. 68-72.

Nurkse, R. 1961. *Problems of Capital Formation in Undeveloped Countries*. New York: Oxford: Oxford University Press.

Queensland Government Office of Urban Management (OUM). 2006. Office of Urban Management Home Page. Retrieved January 12, 2006 from http://www.oum.qld.gov.au/.

O'Neill, P.M. 2010. Infrastructure Financing and Operation in the Contemporary City. *Geographical Research*, Vol. 48, No. 1, pp. 3-12.

Raenock, D.L. 2013. The Genesis of the Theory of Infrastructure in Economic Science, ETAP 3, pp. 92-101. Retrieved September 15, 2017 from http://cyberleninka.ru/article/n/genezis-teorii-infrastruktury-v-ekonomicheskoy-nauke.

Richardson, H.W. 1973. *Regional Growth Theory*. London: Sage Publications.

Rodionov, D., Guzikova, L. and Rudskaya, I. 2014. Innovation Potential of Regions as a Factor of National Economy Competitiveness, *Actual Problems of Economics*, Vol. 158, No. 8, pp. 215-223.

Rosenstein-Rodan, P.N. 1961. Notes on the Theory of the 'Big Push' In: H.S. Ellis (Eds.). *Economic Development for Latin America. International Economic Association Series*, pp. 57-81. London: Palgrave Macmillan.

Sari, I. U. and Kahraman, C. 2015. Interval Type-2 Fuzzy Capital Budgeting. *International Journal of Fuzzy Systems*, Vol. 17, No. 4, pp. 635-646.

State Statistics Service Rosstat. 2016. Retrieved May 11, 2016 from http: // gks. com / wps / wcm / connect / rosstat / rosstatsite / main.

Teriman, S. and Yigitcanlar, T. 2011. Social Infrastructure Planning and Sustainable Communities: Example from South East Queensland, Australia. *World Journal of Social Sciences*, Vol. 1, No. 4, pp. 23-32.

Turan, H.T. 2016. 6 Reconstruction of Regional Development Policies in Turkey through Development Agencies. In: Y. Demirkaya (Ed.). *New Public Management in Turkey. Local Government Reform*, pp. 128-154. New York and London: Routledge.

Varlamova, J., Kotenkova, S. and Larionova, N. 2016. Evaluation of Regional Infrastructure. *Journal of Economics and Economic Education Research*, Vol. 17, No. 2, pp. 317-324.

Williams, P and Pocock, B. 2010. Building 'Community' for Different Stages of Life: Physical and Social Infrastructure in Master Planned Communities. *Community, Work & Family*, Vol. 13, No. 1, pp. 71-87.

Yanitsky, O.N. 2010. Social Modernization of Russia. *Sociological Research*, No. 7, pp. 17-27.

Zaborovskaya, O. and Gorovoy, A. 2015. Allocation of Regional Social Infrastructure Objects as a Factor of Integrated Area Development, *International Scientific Publication: Economy & Business*, Vol. 9, No. 1, pp. 422-432.

Zhikharevich B.S. and Logacheva, N.M. 2012. Social Infrastructure and Human Capital in Russian Regions: the Approach to the Assessment of Interference, *Economics and Management*, Vol. 77, No. 3, pp. 150-156.