Transformation of the regional settlement system and the factors affecting the spatial development in the Ivanovo region

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Abstract. The article deals with the settlement system transformation of the Ivanovo region in modern socio-economic, demographic, spatial and other conditions. The main factors causing impact on the spatial development transformation processes in the conditions of "shrinking" territories are identified on the analysis basis.

Introduction
One of the important issues of urban planning and design, as well as state policy in the field of urban planning and strategic planning, is the determination of the main directions of spatial development of the country and its regions. Determination of the main trends in the processes of spatial transformation of territories requires the collection and analysis of a significant amount of information on various, but interrelated processes in the field of social, demographic, economic, infrastructural and other spheres of the general complex within the urban planning system.

Like most regions of Russia, the Ivanovo region faced a number of processes and problems caused by them, which are a characteristic at the present stage both for the region itself and the central federal district, and for the country development as a whole. The main problems include the rapid processes of depopulation of the territory and spatial "compression" of the territory.

Factors influencing the transformation and development of the territorial spatial system
One of the most important factors in this matter is the socio-demographic situation in the region. The official source for the social and demographic processes’ analysis in the Ivanovo region is the data posted on the public resource of the Territorial body of the Federal State Statistics Service in the Ivanovo region. One of the key indicators are the demographic processes indicators in a given territory, which include - population dynamics, birth and mortality rates, gender and age structure of the population, migration processes and the potential of the territory’s labor resources. The population of the Ivanovo region on the date 01.01.2020, according to the Federal State Statistics Service, was 997,135 people [1]. The maximum size of the region at 1.32 million (Rosstat) was recorded in 1970 and since then the population has been declining almost continuously. Table 1 and Figure 1 present the data on population changes in the region for different time periods [2].
Figure 1. Change in the population of the Ivanovo region during 1970-2019

Table 1 shows these processes in more detail in the context of the last six years.

Table 1. Dynamics of the population in the Ivanovo region for 2015-2020.

| Population / year | 2015   | 2016   | 2017   | 2018   | 2019   | 2020   |
|-------------------|--------|--------|--------|--------|--------|--------|
| Population (thousand people) total | 1036.91 | 1029.84 | 1023.17 | 1014.65 | 1004.18 | 997.14 |
| Urban population   | 842.36 | 837.24 | 832.55 | 826.73 | 819.46 | 814.78 |
| Rural population   | 194.55 | 192.60 | 190.62 | 187.92 | 184.72 | 182.36 |

Thus, the total population decreased by 3.8% over six years, while the urban population share increased from 81% to almost 82%, which indicates a relatively faster decline in the rural population. If to look at demographic processes in the context of municipalities, it is possible to see the different nature and speed of their course. Figure 2 shows a cartogram of changes in the population size by municipalities in the period from 2010 to 2019, which clearly shows the processes not only of changes (%) of the population, but also the processes of population redistribution, and most importantly the processes associated with the so called "compression" of territory, concentration of the population around the main centers and planning nodes [2].

The determining factors include the actual spatial characteristics of the territory that have been developed in the course of historical development: the existing settlement system, the planning structure of the territory, the position of the region in the general federal structure of the settlement.

Figure 2 shows the position of the Ivanovo region in the central federal district [2].

An analysis of the Ivanovo region location in the Central Federal District shows that the region is part of the Central macroregion and is in the zone of strong influence of the largest agglomeration system of the country (the Moscow region, on the territory of which 13% of the country’s population is concentrated), which largely determines labor and migration processes in the region [3]. Negative migration indicators are due, inter alia, to this situation.
To determine the trends in changes in the structure of spatial development and the system of settlement in the region, it is necessary to analyze the existing population density. Fig. 3. shows a cartogram of population density in the context of municipalities, which, to a certain extent, also illustrates the emerging picture of population distribution and the tendency of “territorial compression” around the regional (Ivanovo) and the local (city) settlement centers [2].

Historically, the settlement system of a significant part of the region’s territory was predominantly dispersed (distributed), which also left its mark on the transport network. A large number of small settlements, relatively evenly distributed over the territory, determined the subsequent process of mass migration (in combination with negative population growth) and the "dying" of hundreds of villages and rural settlements.

According to the 2010 census, there were 3,018 rural settlements in the region, in 634 of which no one lived for the census date. In 1040 settlements there were less than 10 people, and in other 781 rural settlements - from 11 to 50 people. For this period, the situation has only worsened. There is a process of further contraction of the population from rural settlements to urban settlements, which in the 2000s caused a wave of the administrative-territorial division optimization (unification and merger of dozens of rural settlements) [4].

The factor of transport infrastructure development is directly related to the spatial characteristics of the territory.

The planning framework of the Ivanovo region is formed by a combination of planning axes of different order, passing in the meridional, latitudinal and intermediate directions. Historically, the formation of the planning frame was primarily influenced by the geographical location of the region, the combination of the large natural planning axes’ location (the Volga River) and the existing settlement system. So, for the most part, the main axes of settlement were the river valleys and the location of transport communications. The basis of the modern planning frame of the territory in the region is the
existing transport frame, represented by the network of highways of federal and regional significance, the railway network, to a lesser extent, the formation of the planning frame was influenced by natural planning axes and elements of engineering infrastructure. In the places of their intersection, as a rule, planning centers are formed - national economic complexes, the largest cities and other organizational and economic centers.

**Figure 3.** The population density of the Ivanovo region in the context of municipalities [2].

The existing transport network in the region is distinguished by good branching, and generally satisfies the internal needs of the region, however, if we take into account the condition and quality of the road surface, especially local and part of inter-municipal roads (the proportion of hard-surface roads in total length of roads does not exceed 63%), then it is possible to see the problems and internal connectivity of the territories. One of the important indicators of the transport road network development is the density of public roads with hard surface (km of tracks per 1000 km² of territory), in the Ivanovo region this figure is 334, which is an average value in comparison with other regions of the Central Federal District [2].

At the same time, the road density in the Ivanovo region itself is not uniform. Figure 4 shows a cartogram showing the distribution of the highways’ density in the context of municipalities.

The main problem is the interregional transport position of the region. A significant part of the territories that make up the Ivanovo region are at a disadvantage, located at the junction of regions, but remaining away from federal highways, large transport corridors, differ in minimal communications with neighboring regions.

Thus, despite the proximity to such centers as Moscow and Nizhny - Novgorod, the region’s transit potential has not been fully explored. The solution to this problem may become one of the growth drivers in the future (especially the gravitation zones of future transport corridors).

The level of engineering support in the territory (gas supply, electricity supply, water supply, etc.) has a significant impact on the economic and social development processes, which can become an additional negative factor or a significant resource of this territory.
Figure 4. Cartogram of the density of the highways of federal and regional significance in the context of municipal districts. Federal and regional road network.

Summary
The transformation of the regional settlement system in the Ivanovo region is currently associated with the predominance of a number of main trends: a decrease in the population of almost all municipalities in the region, the redistribution of the population from the smallest settlements to larger ones (internal migration), the departure of part of the population outside the region (external migration), which in turn reflects the process of territorial "compression". This transformation leads to a change in the settlement system from a distributed state to a more "focal" and point distribution of the population, there is an increase in poorly urbanized territories.

The main factors influencing the transformation of the settlement system in the Ivanovo region are:
- Social and economic processes;
- Demographic and migration processes;
- Position of the territory in the macro-region;
- The existing spatial structure of the region;
- The existing system of settlement;
- Transport frame of the territory and its condition;
- Engineering provision of the territory;
- General trends of urbanization around the main planning units.

The identification of these factors, as well as the determination of their role and level of impact on the spatial development processes in the Ivanovo region will allow finding approaches and developing recommendations for the most optimal and at the same time realistic way of transforming the urban planning system at the regional level. All these factors significantly affect the territorial development, in turn, by influencing them, it is possible to influence these processes. This analysis can become one of the stages in the development of a strategy for spatial development at the regional and federal levels [5].
References

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