Problems of Research, Projects and Mechanisms for Their Implementation in Chelyabinsk City Agglomeration

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Abstract. The article analyzes the research and design methods of urban agglomerations in the context of the Chelyabinsk agglomeration from the point of view of correctness, objectivity and consistency of the results obtained. The completed and approved project of the Chelyabinsk agglomeration is analysed to provide architectural and planning solutions for sustainable social and economic development according to the theories that have been formed to date. The possibility of effectuation and implementation of the approved project of the Chelyabinsk agglomeration taking in account existing specific natural, historical and socio-economic factors characteristic for the territory under consideration is examined. The authors draw the conclusions the project of the Chelyabinsk agglomeration has been developed in line with the town-planning solutions that do not reflect modern approaches based on the competitive advantages of territories and do not form a space providing transition to a modernized and innovative economy. Specific town-planning decisions have a weak justification and an undeveloped methodology for pre-project analysis and methodology for designing urban agglomerations because of absence of a full study of the phenomenon of urban agglomeration and processes occurring in it today. It is necessary to continue research in the field of development of the Chelyabinsk agglomeration with the use of a logical and objective methodology to analyze the territory and design which can lead to the formation of an urban-planning information model that reflects all the system processes and allows for predicting project solutions.

1. Introduction
The urban agglomeration is a natural form of development of a large and largest city in time against the backdrop of continuing general urbanization, the development of which, according to E.N. Pertsik, "causes intensive processes that can continue and grow: concentration, differentiation and intensification of types of activities (functions), formation of new spatial settlement structures in optimal areas for development, spread of urban lifestyle" [1]. According to G.M. Lappo, the result of many years of research of the problems of urban agglomerations in our country was the conclusion that "agglomerations are the key form of settlement" [2]. This statement is supported by V.Ya. Lyubovny, noting that "the bulk of the country's scientific, production and intellectual potential is concentrated in agglomerations ", therefore they are "the main bases of economic modernization" and "supporting zones for the formation of its innovation-oriented economy" [3]. "The role of agglomerations as leaders in modernizing the country is largely a potential one, to a large extent determined by state policy and emerging trends in socio-economic development" [3]. Thus,
researchers agree that urban agglomerations are a natural evolutionary process of urbanization in general and specific cities in particular, which form the backbone of the country and are the centers of cultural, scientific and industrial activity.

In view of the structural socio-economic changes that occurred in our country, there was a significant redistribution of the population of cities, which led to an imbalance of the country's resettlement system. A striking example are single-industry monocities with narrow production, which were forced to diversify economic activity not only in terms of production, but also in the service sector, in order to curb the emigration of labor resources. In connection with the need to bring Russia to balance and evenly develop the settlement system, the choice of methodology for designing and implementing urban agglomeration projects plays an important role in competition of the largest urban formations of the country.

2. Body
Chelyabinsk city agglomeration has developed as a monocentric agglomeration of the core city, the administrative center of the region and the center of manufacturing, engineering, food and education, and a system of satellite cities based on the mining industry of brown coal basin. Specificity of the planning structure of Chelyabinsk urban agglomeration is typical for this type of economic activity – it is the system of industrial and residential areas of giant plants, large residential areas in pollution-free areas and a complex conurbation system of cities and towns woven into the belt of a coal basin with a large number of disturbed and unsuitable for further economic activity territories [4].

One of the first mentions of Chelyabinsk urban agglomeration in domestic scientific literature arises in the work of G.M. Lappo, "Development of urban agglomerations in the USSR" [5], which provides an example of a methodological approach to determination of boundaries (delimitation) of agglomeration. The basis of this method is the determination of boundaries by a combination of factors: the boundaries of ties (labor, cultural, household, production), the boundaries of transport accessibility (road, railway), supply boundaries (food products from nearby state farms). The choice of factors that influence definition of boundaries is typical for the existing form of the socio-economic system (the command and administrative economy) and can not be objective for the following reasons:

- choice of railways as the basis of the transport frame, which led to the situation that undeveloped lands and unurbanized territories entered agglomeration boundaries, and the time to overcome the distance from the center city to the marginal sub-centers of the metropolitan area is 2 - 2.5 hours, which contradicts comfortable time in natural conditions of life, proved in the studies of C. Marchetti, that is - 1 hour [6];

- forecasting the development of agglomeration based on confidence in constant productive growth and at the same time, a constant increase in the population, which is refuted by a change in socioeconomic organization of the state and by transition to a new form of economy, management and people's livelihoods (from the moment of this scientific work will be less than 15 years that the state organization of the country completely changes);

- lack of attention to administrative and territorial division within the agglomeration as a factor of local self-government, which objectively could not play a role in this specific historical stage, but which objectively works and affects the development of agglomeration in natural conditions of life;

- absence of the object of architectural and planning organization of the agglomeration area as a factor of its development, as a result of which territory planning is reduced to the location of productive forces and places of residence of the population.
Because of the change in socioeconomic organization in Russia and because of transition to a market economy, a number of objective problems of urban agglomeration development appeared, which also affected Chelyabinsk agglomeration:

- a constant increase in the level of motorization of the population, which led to problems in planning of the framework of the transport infrastructure of settlements;
- a change in the nature of internal and external pendulum migration, as a consequence of free choice in places of residence of the population;
- reduction of non-competitive production, which resulted in a change in the functional structure of the city and in conversion of former production areas for new needs;
- the development of service sector that meets the real needs of the population, in contrast to the established system of social, cultural and consumer services centers [4,7,8].

Since the beginning of the 2000s, documents for the territorial planning of municipalities wholly or partly entering the boundaries of Chelyabinsk agglomeration or experiencing influence of the center city have been prepared. Planning organization of development of territories of municipalities did not take into account mutual factors of mutual influence. The suburban zone of Chelyabinsk, consisting mainly of agricultural land and forest fund lands, began to be unjustifiably transferred into the lands of settlements for residential development. As a result of this urban policy, the suburbs of the city-nucleus of the agglomeration began to be unregulatedly built up by settlements of individual residential development and neighborhoods of multi-apartment buildings. The main problems of such development of the territory were shortcomings in the provision of transport, engineering and social infrastructure, because of which a poor-quality and uncomfortable urban development environment for life activity was formed.

In 2008, a number of leading Russian city planners, urbanists and sociologists led by VL Glazychev worked on analyzing the current situation of Chelyabinsk agglomeration and proposing ways to develop it. The researchers proposed exclusive methodology for delimitation of agglomeration, which is based on determining transport accessibility of the territory, on which spatial relationships between Chelyabinsk (the core of the agglomeration area) and surrounding areas are most likely formed. When allocating agglomeration boundaries, the isochrones were correlated with existing boundaries of districts and settlements (municipal formations), that is, borders were tied to the existing administrative-territorial division [9]. This methodology, which connects two main approaches: transport and administrative-territorial, is logical from the point of view of the

Figure 1. Delimitation of Chelyabinsk agglomeration by Buryan L P [5].

Figure 2. Delimitation of Chelyabinsk agglomeration by Glazychev V.L. [9].
management factor in the process of forming the agglomeration, when intermunicipal cooperation on an equal footing becomes the basis for the development of the territory. In view of this, the minimum structural unit should be a municipal formation. However, this method is criticized by a number of researchers [10] regarding lack of a criterion for inclusion of a particular settlement or region in agglomeration boundaries, in view of the fact that in each specific case there may be a territorial specificity when the settlement borders directly on the conditional nucleus of the agglomeration, but is not an urbanized area with a low population density. In general, the work done by Glazychev's team suggested a range of methods for analyzing and forecasting development of the territory of Chelyabinsk agglomeration, emphasized main points of the territory's competitiveness, main problems hindering sustainable development, formed the body of tasks to overcome problems, not only planning organization, but also management and inter-municipal cooperation[9]. Specific design solutions, objectively, were not proposed, since such a task did not initially exist, and this activity requires considerable time and funding for development.

Since 2014, a new stage has begun in design of Chelyabinsk agglomeration. The Ministry of Economic Development of the Russian Federation proposed a program for the formation of pilot projects of urban agglomerations on the territory of the country, in support of the thesis that this form of organization of urban life and economic activity is the backbone of the settlement system. A number of municipal entities of the Chelyabinsk region signed an Agreement on the creation of Chelyabinsk agglomeration [11].

Chelyabinsk agglomeration was included in the number of pilot projects. The regional design institute "Chelyabinskgrazhdanproekt" was engaged in development of the project [12]. In 2016, the work was completed and submitted for discussion, after which it was approved by regional government and is currently a valid town-planning document [13]. This period of preparation for large-scale work, technical specification for the development, of design and final project, revealed the weakness of the methodological base in working with such a town-planning facility as agglomeration, detachment from real demographic processes and inconsistency of economic policy with its urban development.

The proposed technical specification [14] lacks a number of requirements for the project, implementation of which would allow creating a qualitative and objective urban agglomeration project:

- Dividing into the separate stages of formation of graphic and statistical initial data;
- Research of the reasons for already formed structure of the agglomeration, including the study of the phenomenon of pendulum migration;
- Formation of the information model on the basis of synthesis and processing of the assembled case of "big data" and transformation of this model into a dynamic one, for objective forecasting of the influence of specific design decisions on system development.

Delimitation of the Chelyabinsk agglomeration is carried out according to the method of synthesis of two approaches – transport approach and administrative one – the large municipal formations (regions) that make up the suburban zone of the city center where unorganized or weakly urbanized territories, proposed, at the next stage to be developed. Thus, a methodology for studying causes of the existing pendulum migration of Chelyabinsk agglomeration in terms of intensity and direction of the movements of weekly, monthly and seasonal regimes has not been proposed. Such a study, carried out empirically (field measurements and sociological work) and synthesis of the statistical base, could objectively show the real dynamic picture of life in Chelyabinsk agglomeration, would reveal problems and prerequisites for development. However, the research phase remained at the level of cartographic surveys and became one of the same methods that were applied in the periods of Chelyabinsk agglomeration that were already being considered.

The next external problem of the project development context was the lack of a strategy for socio-economic development of Chelyabinsk agglomeration for a long-term period. Existing and approved strategy has a limit of 2020 [15], which practically makes no sense to the work done. In the specified
design conditions, a town-planning model of Chelyabinsk city agglomeration is proposed, depicted in Figure 3.

![Figure 3. Scheme of territorial development of Chelyabinsk region in terms of Chelyabinsk agglomeration. Project plan. Head design Institute "Chelyabinsk Grazhdanproekt" [12].](image)

The subject of the analysis of this design solution is the proposed architectural and planning model and specific urban solutions in relation to specific factors of the territory, both natural and socio-economic, and an analysis of the correlation of the subject, objectives and tasks of the urban agglomeration project to the ones stated in the terms of reference.

According to the stated objective of the project, achievement of a "more balanced socio-economic development" should be realized "as a result of the redistribution of functions between the core and the periphery by unloading a large city, releasing it from non-core functions and transferring them to districts or small towns" [14]. When analyzing the project plan, a supercentralization of the agglomeration is revealed by singling out the only center of "social and business activity" in the central (historical) part of the agglomeration nucleus. Obviously, this planning decision will lead to an increase in pendulum migration and transport infrastructure problems, since the historical center, whose architectural and planning structure was formed in the late 19th and early 20th centuries, [4] has low capacity and a lack of storage space for motor vehicles, which can lead to deterioration of the architectural environment of the city.

Planning development and space organization in terms of industrial sites and new housing construction, the following problems of project solutions are discordant with the stated objectives of "creating a coordinated system of territorial development and land use (including the definition of optimal sites for housing, country construction, industrial and agricultural production taking into account existing and necessary infrastructure for the development) ":

• Preservation of large industrial sites in the central part of Chelyabinsk and in the first ring of existing living area (industrial sites of the times of industrialization [4]), which leads to preservation or deterioration of the ecological situation, formation of an active "brownfield" cutting city area, which hinders its development in northern, eastern and southern directions;
• The imbalance of housing construction, as a consequence of the first problem, based on development of an unurbanized rural area in a large space with destruction of a non-renewable resource of agricultural fields, with absence of any developed infrastructure for social, cultural and consumer services. In the western part of agglomeration on a vast territory, residential construction is assumed, predominantly of an individual residential development. In the current economic conditions, this type of development is provided by a water resource at the expense of individual wells using groundwater and underground water reservoirs. However, when compared with the explored reserves of water resources on the territory of the Chelyabinsk agglomeration, it is found that this area suffers from a shortage of underground sources of water resources, which can lead to its depletion with increasing construction and anthropogenic impact;
• Active development of the watersides and adjoining territories, not only for the purpose of housing construction, but for the formation of new industrial sites, of the only drinking source for the whole agglomeration (for 1.5 million inhabitants) - the Shershnevo reservoir, which already has a serious anthropogenic load, that threatens the existence of the urban agglomeration as a whole.

Modern theory of the economy of spatial development, formulated by creators of "new economic geography" – Paul Krugman (winner of the Nobel Prize in Economics in 2008), Masahisa Fujita, et al. [17,18] proves that development of territories is based on competitive advantages, described by two groups of factors. Factors of the first group include those competitive advantages that are not created by people: availability of territory by natural resources and geographical location. Factors of the second group include: agglomeration effect or use of the advantages of concentration (economies of scale) and diversity; human capital; Institutions that are norms and rules by which society lives; infrastructure. To carry out modernization and innovation policy of territorial development, it is obvious that factors of the second group of competitive advantages should be strengthened [19]. Transition to modernization and innovation economy of cities will be carried out in accordance with the paradigm shift of technological structures [21].

![Figure 4. Scheme for the provision of underground water resources in the territory of Chelyabinsk agglomeration.](image)

![Figure 5. Forecast of the dynamics of the change in the population of Chelyabinsk region at the age of 20-39. Based on the materials of "Chelyabinskstat"[22].](image)
N. V. Zubarevich, a Russian economist-geographer, points out that factors of agglomeration effect and investments in human capital are important for sustainable development of the territory [16]. From the point of view of urban development of these indicators of development, agglomeration effect is achieved by increasing the density of buildings and population in the areas of concentration of public and service centers, manufacturing enterprises; by increase in diversity of development (both in terms of typology and class); by polyfunctional zoning (a variety of functional zones in the territory); by use of economies of scale and concentration to accumulate educational and scientific institutions and create conditions for innovation; by accumulation and production of innovations with subsequent broadcasting to the periphery and suburbs.

An important role is played by investment in human capital, especially young able-bodied population. Now, there is a struggle between cities to attract young qualified population capable of producing innovations in view of the fact that this generation will be significantly reduced over the next 15 years (Figure 5). To increase the attractiveness of the territory, focusing on human capital, it requires a number of architectural and town-planning solutions, such as: improving quality of the urban environment; high aesthetic requirements for architecture; reduction of the level of pollution (decrease in the level of motorization, transition to ecological types of economic activity); constructing architectural objects of all-Russian and international status (development of the city's brand); providing citizens with a wide range of options, services, housing, places of employment, recreation, etc.; proposal of town-planning decisions without prejudice to certain social groups [19]. Unfortunately, these architectural and planning approaches that allow to increase the competitive advantages of Chelyabinsk, are absent in the approved project of Chelyabinsk agglomeration, both in tasks and in design decisions.

3. Conclusions
1. Despite the great attention paid to Chelyabinsk and its agglomeration, over the last 50 years of urban development, only one full-scale urban agglomeration project has been created;
2. This project has developed in line with town-planning solutions that do not reflect modern approaches based on the competitive advantages of territories and do not form a space providing transition to a modernizing and innovative economy;
3. Specific town-planning decisions have a weak justification and an undeveloped methodology for pre-project analysis and methodology for designing urban agglomerations because of absence of a full study of the phenomenon of urban agglomeration and processes occurring in it today;
4. Thus, it is proved that the tasks set and the architectural and planning decisions of the project of Chelyabinsk agglomeration will not lead to proper social and economic effect of sustainable development of the territory
5. It is necessary to continue research in the field of development of Chelyabinsk agglomeration, with the use of logical and objective methodology for analysis of the territory and design, which can lead to formation of a urban-planning information model that reflects all system processes and allows predicting project solutions.

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