

Features of the Social Infrastructure Formation of Astana City

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Abstract Social infrastructure can influence the creation of comfortable conditions for society and a sustainable living environment in the planning of an urban area. This article examines the current state of the social infrastructure of the city of Astana using extensive research and the results of sociological research in administrative districts. The article touches upon the process of the formation of social infrastructure in the process of historical development. Currently, the social infrastructure has the power to develop the urban area, improving the living conditions of the population. The data from the social survey shows that the social infrastructure at the district and local levels affects the living conditions of residents. Social infrastructure planning is a process that includes consideration of the existing transport links, buildings and structures, infrastructure investments, and social problems in a complementary way. This article emphasizes the importance of regional features. Considering these features can play a big role in improving the quality of public services and maintaining the well-being and economic prosperity of the population. The development of the city, the economy, and its social infrastructure contribute to the influx of human resources, which determines a socially-oriented approach to planning. The study of the urban area allows us to see the importance of taking regional features into consideration. Based on scientific research, directions for the development of the social infrastructure of Astana are presented.

Keywords Social Infrastructure, System, Structure, Public Centers, Socially-Oriented Architecture, Place of Employment, Regional Features

1. Introduction

The article examines the issue of the impact of social infrastructure on the development of urban areas, and how it improves the living conditions of the population. The history of the formation of the social infrastructure of the city currently developing in new conditions is presented. The purpose of the study is to determine the features of the formation of social infrastructure by defining the basic principles of its organization. The following methods are used to achieve the purpose: the study of the historical features of the formation of social infrastructure in the territory of the city of Astana; the analysis of the current state of the city's social infrastructure.

There are several notions that create the basis for this. Firstly, there is a need to revise the standards of the service system, which is the foundation for the design of social infrastructure facilities. Secondly, socially-oriented approaches based on a development strategy that focuses on the empowerment of the resident population are indicated. Thirdly, it will significantly contribute to the urban area's sustainable development, considering

population growth and the need for new jobs. An important point in the study is the step-by-step service system, which began to develop in the 1950s. In the 1990s, the territory of the city increased significantly and a system with more population-oriented approaches was required. The main part of the article is based on the assessment of this service system and the conditions of its emergence.

The article presents an overview of field studies of the districts. A brief overview of the development of urban areas is described. Previously, the system was focused on consumers of small cities, whereas now it is necessary to develop ideas together with residents and planners of each part of the city. The article discusses modern approaches aimed at stabilizing socioeconomic factors, which can contribute to solving the problems of urban renovation. A summary of the main results and an assessment of approaches that helped to achieve certain goals are presented. The author relies on a number of studies, and assessments of the results of the development of the city. The study includes a time frame from the beginning of the 19th century to the present.

2. Materials and Methodology

The methodological foundation of the study is based on a systematic approach to the issue, as well as a comprehensive analysis of conditions and factors. The conclusions are based on the analysis of literary sources, project materials, archival data, field surveys of the social infrastructure of Astana, and sociological research on the territory of the administrative districts of the city. The field survey provided information on urban planning, compositional, technical, and other data on urban development and the formation of public centers. The statistical method made it possible to identify data on the demographics of the population, and the availability of service facilities. Materials include related data from the city and regional reports, statistical data, archival data, and sources of project organizations. This made it possible to compare goals, implementation, results, and impact, as well as success factors. An integrated approach to the study of the existing situation of social infrastructure requires research of historically developed territories of the city. The study makes it possible to understand the living environment of the urban population, its features, scale, and problems.

Social infrastructure of microdistricts of Astana

In the course of the study of the current state of social

infrastructure, the following points were analyzed: aspects of the historical formation of social infrastructure objects in the structure of the city; the location of the main objects of attraction; the functional purpose of buildings and territories; the results of a population survey, and statistical data. To analyze the complex social infrastructure of the city, data on three main periods correlating with different periods of the city's development was collected. It is important to consider the understanding of dramatic changes in the economic system of the city at all periods of development. Each structural element is connected to the others, forming an urban fabric as a whole. The results show that social infrastructure should take into account events in all areas of society, focusing on all important aspects.

It is important to take into account the results of these studies when discussing and planning master plans of cities, in order to determine the planning of a promising direction for the development of urban areas. This will allow taking into account the mutual influence of social infrastructure and urban areas on each other. It is also important to note the need to survey the population of cities and discuss the development of general plans of urban areas to identify and reflect the needs for objects of social infrastructure. The reflection of these data is necessary to improve the quality of the service sector and ensure favorable conditions for the development of human potential in each city.

3. Results

3.1. The formation of the social infrastructure of Astana is connected to the process of founding the fortress of Akmolinsk in 1830 (now Astana)

According to the statistics of 1836, buildings such as wooden houses, an infirmary, a mill, a forge, and a tower were a part of the fortress. Trade was actively developing in the city until 1916, and along with this, trading shops and small workshops emerged. With the transition from a nomadic lifestyle to a sedentary one, the population of the city has increased significantly. Also, a large influx of population to the cities occurred with the resettlement of peasants in the 1880s. Akmolinsk was divided into parts: a fortress, a settlement, a Cossack village, and a City, dissected by a rectangular grid of streets into small blocks. Social infrastructure facilities, such as an infirmary, a chancellery, a cinema, churches, a city council, a fire tower, and shops for rent appeared in the center of the city. Merchants built their houses in the city (Kubrin's Mansion, Moiseev's Mansion, Koschegulov's house).

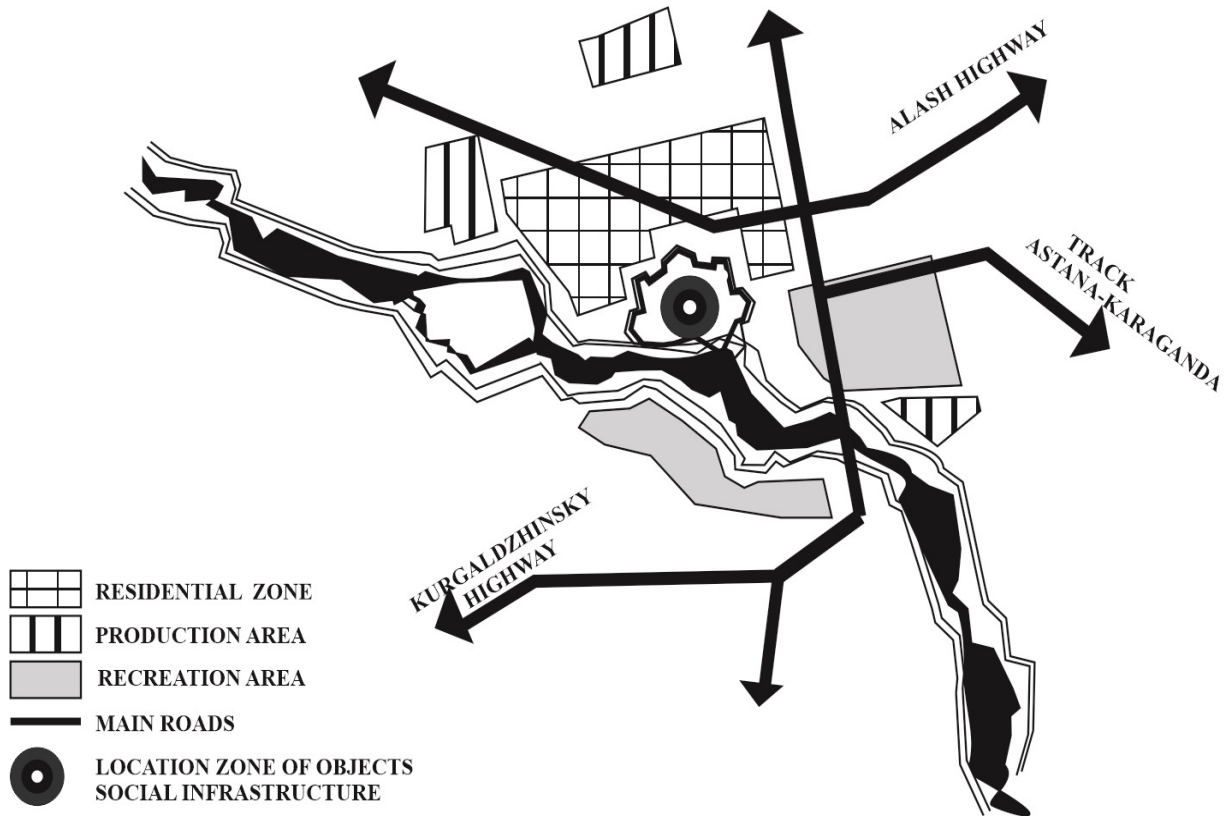


Figure 1. The model of the Akmola fortification (based on the drawing of 1880)

Over time, they initiated the construction of institutions, schools, and hospitals (Koshchegulov madrasah school 1905, Kubrin Hospital, cinemas built by merchants A.I. Skvortsov, D.V. Egorov "Meteor" 1910, "Progress" 1911), a nursery park. These events led to an increase in public service institutions in the fields of trade, education, and medicine. Merchant houses and shops, educational institutions of the village, the Gorky Theater, and the Siberian Bank occupied the territory of the center of the old square of Astana [1, 2, 3]. Attention to the issue of city development is obvious in several general plans.

In 1923, there were also enterprises such as a sheepskin factory, forges, windmills, and mechanical mills with a total number of workers of 208 people, and a mechanical workshop. The composition of social infrastructure facilities has significantly expanded with the increase in population and territorial growth of the city: city council, fire tower, GostinyDvor, shopping malls, bank, church, cinema, post office, gymnasiums, and colleges.

Most of the service institutions in 1830-1916 were located on the territory of the central street of the city (management and trade institutions, churches). They were places of employment. These institutions often coincided in purpose with the place of residence. The layout of the cities was of a quarterly rectangular character with a street width of 60-80 m, with orientation to the main planning axis - the river.

3.2. The Main Aspects of the Formation of Social infrastructure in the Soviet Period (1917-1991)

Settlement on the territory of Kazakhstan changed with the transformation of cities and villages in the image of the village during the new economic policy of 1921, and collectivization of 1927-1932. The increasing role of enterprises in the city has revealed the need for schools, kindergartens, and health clinics. The problems of school education and medicine coverage were considered at illiteracy elimination conferences in 1924 in Orenburg. In 1929, the merchant representative office in the city of Akmolinsk initiated the solution to the problem of transportation of goods – the establishment of the Borovoye-Akmolinsk railway connection, the laying of the Akmolinsk – Kartaly railway section, which significantly revitalized the life of the city. In 1929, the construction of the station was carried out, as well as a village for families of railway workers. The village and the city were connected by a road. These changes affected the formation of social infrastructure facilities (shops, a school, children's institutions, and hospitals) of the transport hub of the station and the village. The settlement was formed by multi-apartment 2-3-storey sectional houses (KarasaiBatyr Street) and typical 2-storey cottages (Goethe Street, Liebknecht). The city began to divide into two parts - the historical center and the village, connected by a railway (Fig.1.).

The railway connection contributed to the development of the city's industry, turning Akmolinsk into a major city in Northern Kazakhstan. In 1929, there were schools, a vocational school, a library, a museum of local lore, a newspaper publishing house, a hospital, a central outpatient clinic, a tuberculosis dispensary, a bacteriological laboratory, a women's consultation clinic, as well as a nursery. Industrialization covered the construction of large cities based on the development of natural resource deposits (1933-1941), creating jobs. Collectivization changed the settlement system of cities, increasing the population of the city at the expense of the deported. The industry was represented by 6 enterprises of national and local significance. There were two health clinics, a maternity hospital, and an ambulance station in the city. Social infrastructure facilities were located in the citywide space, along the main highways, and in the immediate vicinity of places of employment (production). Consequently, objects of social infrastructure and consumers of goods gravitated to places of employment. The population was provided with basic social infrastructure facilities, such as schools, a nursery, and a hospital, which reflected the interest of the leadership in the workforce. This approach has influenced the increase in the pace of industrial and civil construction.

In the war years (1941-1945), with the relocation of factories of national significance ("Kazakhselmash") for the evacuated population, there was an increase in social infrastructure facilities around these places of employment. Residential quarters were built next to enterprises. Mass construction and the development of a standard, prefabricated housing construction has singled out the construction industry as one of the priority areas of activity of the population. Evacuated factories geographically expanded the cities of Northern Kazakhstan.

In the post-war years (1945-1954), housing construction continued. A theater, cinema, and sports facilities were built. Enterprises of defense significance have been reorganized to produce agricultural machinery and consumer goods. The deportation of 1940-1948 Germans from the Volga region, Koreans from the Far East, and Chechens from the North Caucasus significantly increased the population of the city of Akmolinsk from 32 thousand

people to 76 thousand people [4].

The development of lands in 1954-1965 contributed to the emergence of significant amounts of jobs, which led to an increase in population. In a year, 4847 thousand hectares of new land were plowed by collective farms and 3684 thousand hectares by state farms.

Along with the standard construction, large social infrastructure facilities were built with one functional purpose, such as administrative (Palace of Soviets), educational (universities), cultural (theaters, Palaces), leisure (cinemas), etc. The general plans of 1957 and 1963 outlined an approach to the development of social infrastructure in a three-stage service system. The main highways of the city were the primary location of social infrastructure facilities, securing the historical center and new urban planning nodes. Social infrastructure facilities in the perimeter development were located in the buildings of shops, food and consumer services, as well as at the ends of residential buildings, along main streets and highways. As a result, neighborhoods and new microdistricts acquired individual differences. The territory of the city was compact and allowed the population to get services in social infrastructure facilities.

The following 70-80 years are characterized by attention to the problem of reducing the difference in the levels of improvement of the village and the city and the need for their holistic development. The use of prefabricated reinforced concrete structures, panel and block houses is becoming more prominent in construction. The formation of the central squares of the cities of Northern Kazakhstan was influenced by design and construction work to achieve the ensemble of squares and streets. The territory of the city developed in the southeast direction. The microdistricts acquired their individual features due to the construction of buildings with a new functional direction (trade, sports, culture, medicine) [5, 6, 7]. The expansion of borders affected the remoteness of the city center service facilities for remote neighborhoods. The time spent on transportation to them increased. There was a need for social infrastructure within the neighborhood to provide a wide range of services, but the construction of facilities was carried out only on major highways.

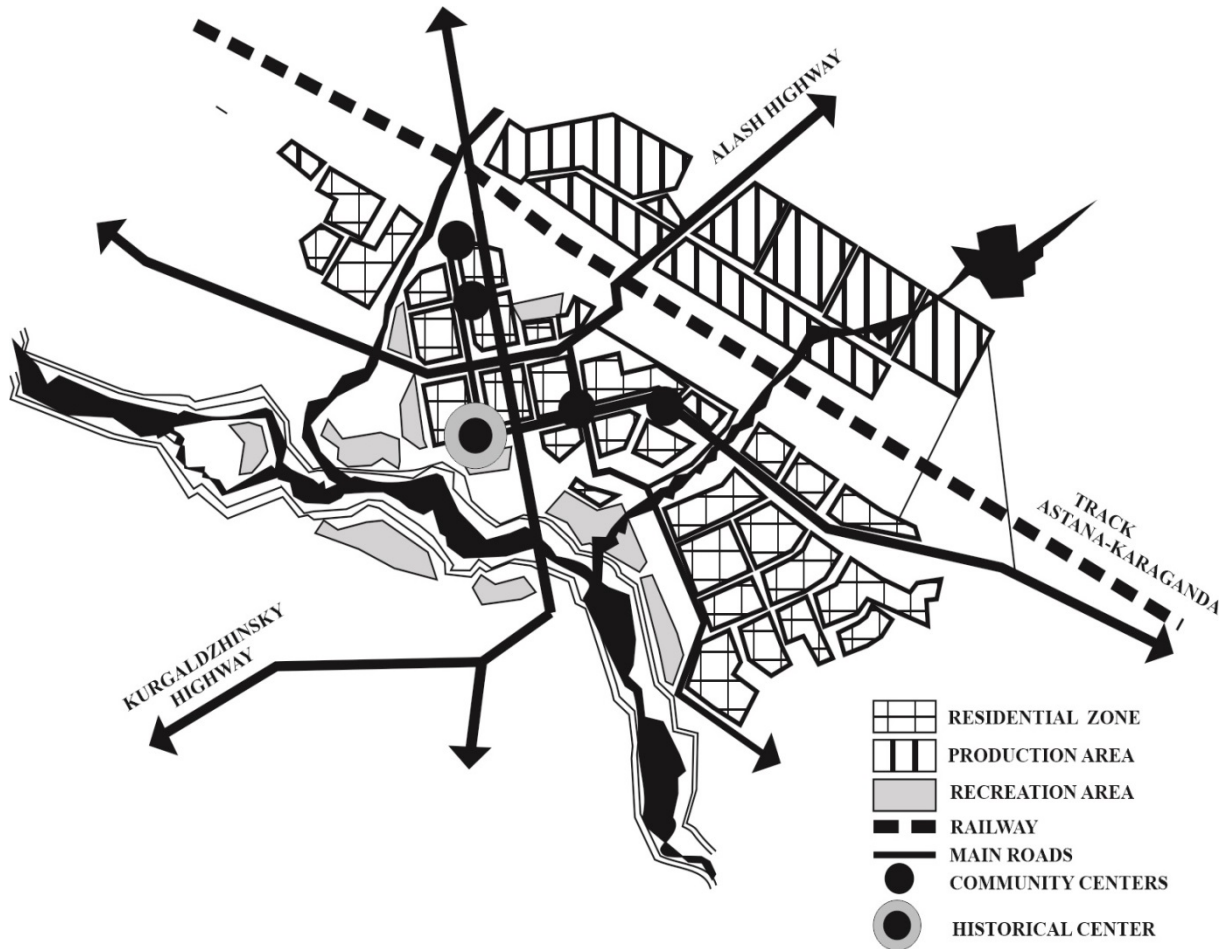


Figure 2. The model of development of the planning structure of the city of Tselinograd (according to the drawings of 1963)

The social infrastructure within the framework of the three-stage service system did not cover the city limits, and did not provide convenience and accessibility for the city's population for the following reasons:

- the growth of the city's territory in the southern direction;
- the growth of the population of Astana in 1960-1989 from 129 thousand people to 281 thousand people;
- increasing urbanization;
- an increase in production facilities in the city;
- development of individualization in the construction of neighborhoods;
- a small number of private social infrastructure facilities;
- service facilities built with a connection to the citywide center (Fig.2.).

In 1985-1991, the development of social infrastructure slowed down, but the facilities continued to operate. As a result of the development of residential housing, the territory of the city expanded without taking into account service objects, increasing the differences between the remote neighborhoods.

3.3. Social Infrastructure of the City at the Present Stage

The development of the social infrastructure of the city at the present stage is distinguished by the changes associated with the process of formation of the independent state of Kazakhstan and the transfer of the capital from Almaty to Astana. 1328535 people live in Astana [8]. The level of urbanization in Kazakhstan is currently approaching 58.2%, which shows the desire of the population to live in cities. In a market economy, a large number of private social infrastructure facilities emerged. The primary difference between these institutions is that they are able to quickly focus on the demand of the population in the service sector [9]. Many trade, food and consumer services are located in the built-in premises of the first floors of residential complexes. The lack of preschool education and medicine institutions determines the placement of kindergartens and health clinics on these premises.

Shopping and entertainment centers have become very popular in the harsh climatic conditions of Northern Kazakhstan. The work of trade, food and consumer services institutions can be substituted with a digital service. The active development of social infrastructure facilities, such as shopping malls, should take into account

the development of a trend for periodically recurring structures in the form of the creation of micro-city centers [10]. One of the successful combinations of building groups is the location of social infrastructure facilities along central streets in high saturation, on pedestrian

streets, which allows increasing the significance of the center, the importance of the pedestrian zone, and the flow of people [11]. Currently, social infrastructure is actively developing at urban planning nodes, creating a problem of traffic congestion, and remoteness (Fig.3.).

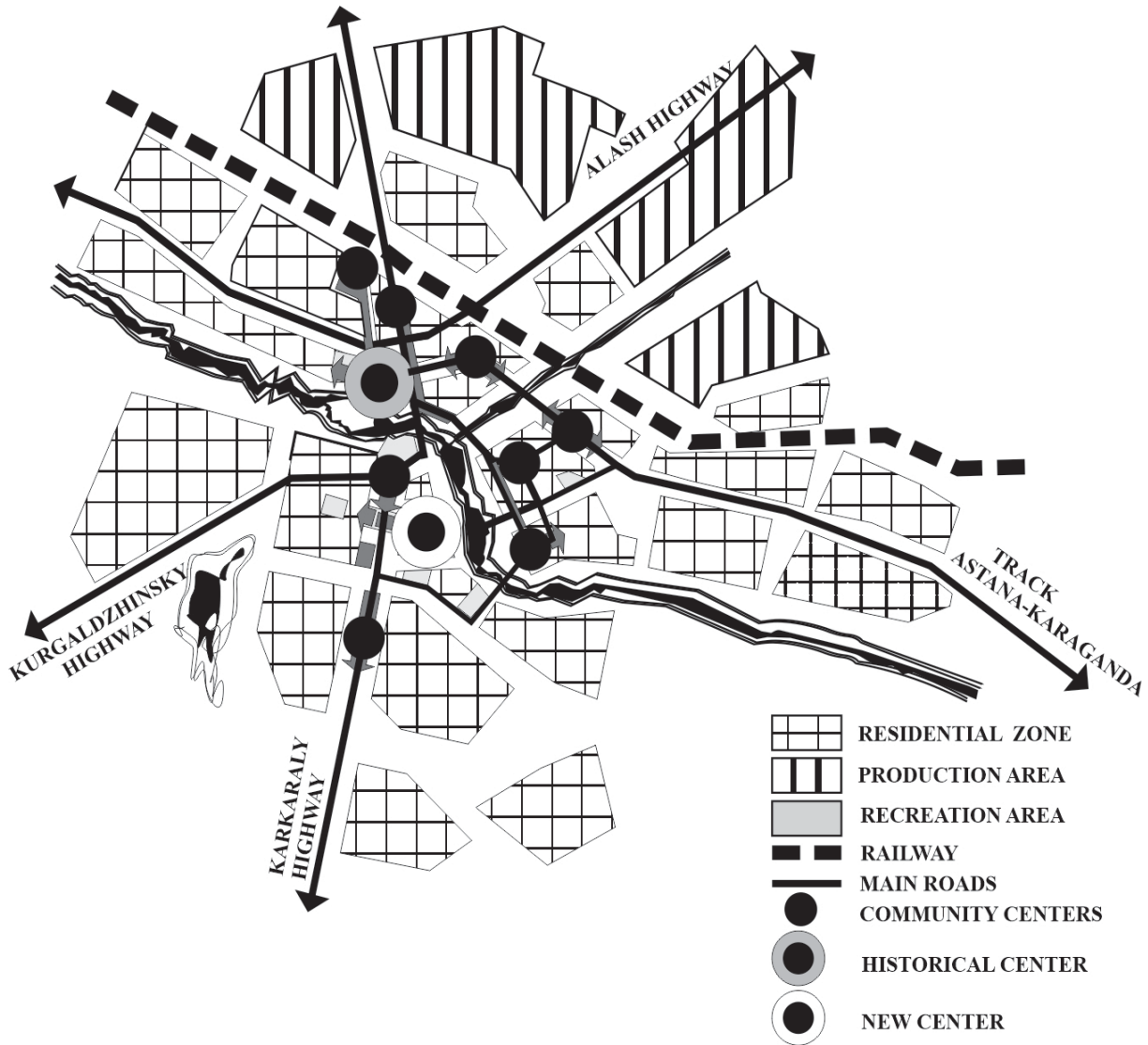


Figure 3. The model of development of the planning structure of Astana (according to the general plans of 2010)

The majority of the population works in administrative, financial, educational, and medical fields. Heavy industry in the city is represented in small numbers. Thus, in Astana, the share of the GRP services sector increased from 72.6% to 87.2% from 2007 to 2013, with trade taking the leading place at 22.2%, other services – at 37.4%, transport – at 9.5%. The creative industry is gaining a steady rise and is often associated with innovative activities. Creative objects of social infrastructure include such areas as industrial and graphic design, advertising, cinematography, architecture, fashion design, music, performing arts, press, software, television and radio, etc. The specific feature of these objects is the presence of a creative environment in lofts, and coworking centers, which can be created in industrial buildings, and garages on the territory of the residential zone. As a result of studying statistical data and conducting a survey, problems were identified. One of them is the remote location of basic social infrastructure facilities and their overload, excessive concentration of the population in the city, lack of employment, as well as lack of social infrastructure. It was revealed that the state of the social infrastructure of cities is affected by the process of migration of the population within the city. The reasons are the obsolescence of social infrastructure facilities, the discrepancy between the level of service and modern requirements, the lack of jobs in cities, and the decline of city-forming enterprises, which increase the pace of internal and external migration of the population. According to statistical data, as well as according to a survey of the population, these are the leading reasons for changing the place of residence. As a result, active migration of the population in the cities of Northern Kazakhstan takes place, linking career prospects with the branches of the post-industrial economy and finding no place not only in the urban economy but also in the current social environment. The main direction of internal migration is the largest cities of republican significance. The outflow comes from urban and rural areas.

Shifting priorities to the development of human capital gives a new idea of a person's lifestyle, where in addition to work, housing and recreation, it is necessary to ensure human development in sports and education. This implies the presence of sports, medical, educational institutions in the structure of the neighborhood.

Socially-oriented programs make it possible to expand the capabilities of the district administration and increase the role of social infrastructure and opportunities for private projects [12, 13, 14]. The advantage of this is that it assumes the participation of the population in urban planning. People can manage resources, social capital, and time in the context of social integration urban programs. People-oriented approaches to urban development should reflect the consideration of social and transport links, opinions, and opportunities of the resident population [15, 16, 17, 18].

The quality of digitalization of city services has an important impact on social infrastructure. In this regard, it

is necessary to note the launch of the online service in the Smart Astana application on June 1, 2017. This application provides the organization of providing services to the public. The availability of public services has also been increased with the help of e-government service (egov.kz), introduced on April 12, 2006. The Smart District project in 2018 in the Zhastar microdistrict made it possible to automatically monitor the security of entrances with cameras, housing and communal services, meters, etc. These projects provide the most comfortable environment for citizens through the organization and installation of elements. The projects also make it possible to expand opportunities and exercise the right of the population to influence the improvement of services [19]. With the socially-oriented approaches, there are more opportunities to improve the living conditions of the population and eliminate the underdevelopment of remote parts of the city, which will also affect the growth of jobs [20, 21, 22, 23, 24].

The development of urban areas is reflected in the constant change of socio-economic, climatic and historical features. At the same time, such changes in the city are a change in the population in the city, the historical reasons for the concentration of social infrastructure facilities in a certain territory, the formed functional purpose of territories, transport remoteness, the sphere of employment of the population. Taking into account these data, it is possible to determine the impact of changes in the urban area on social infrastructure in the future. The study showed that the planning of an urban area with social infrastructure facilities is a constant analysis of socio-economic and historical features.

4. Discussion

An important point in the planning of social infrastructure is the influence of places of employment on the level of development of urban areas. The advantage of the historical service system is that due to the standards, it has become possible to bring a unified order to the service institutions of the cities in a short period of time. Currently, as a result of increased mobility and selectivity, the population of the city chooses service institutions without taking into account the range of a step-by-step service. The remoteness of social infrastructure facilities does not allow the population to receive the full volume of services (Fig.4). The study revealed that it is important to consider the places where the largest flow of population follows on the basis of popular transport and pedestrian paths. The study of *natural and climatic factors* has shown that the sharply continental climate with big temperature changes requires providing pedestrian and transport accessibility of social infrastructure facilities and the strengthening of the role of public centers in all parts of the city. In the course of the study, it was found that among the conditions for the formation of social infrastructure, *socioeconomic factors*

such as the standard of living, and living and working conditions are important. In the course of the study, it was found that there have been changes in the employment of the population. Thus, in 2010-2020, the share of those employed in the production of services in relation to those employed in the production of goods increased from 53% to 66.3% in Kazakhstan, which suggests the need to plan places of employment on the territory of the settlement, near the place of residence. The organization of places of employment in the structural parts of the city on the basis of centers contributes to a greater concentration of social infrastructure facilities, as well as increases the availability of facilities.

As a result of sociological research, it has been established that sports, medicine, and cultural institutions are not sufficiently developed in the structural units of cities. As a result of the survey, it was revealed that the desolation of cities and the change in natural population growth occurs in cities deprived of places of employment and social infrastructure facilities. On the issue of improving living and working conditions, the respondents identified promising areas for the development: cultural and consumer services 40%, landscaping 20%, organization of sports facilities 25%, improvement of transport links. Respondents identified the most necessary institutions: 38% kindergartens, 20% health clinics, 15% schools, 27% - sports, trade and household services.

The results of *field studies* of the social infrastructure of Astana allowed us to establish the uneven placement of service institutions in the city, the remoteness of social

infrastructure facilities, the concentration of institutions in the historical center, and the formation of city limits near old industrial buildings.

A study of the *economic factors* of social infrastructure facilities has shown the positive impact of a combination of *public and private investments* in meeting the needs of the population, such as kindergartens, health clinics, and gyms.

The study of *scientific and technical* factors has shown that improving the quality of service depends on the increase in innovative industries in the residential area and the digitalization of institutions.

As a result of studying the transport components in the formation of the social infrastructure of the city, the need for *pedestrian connection of centers and an increase in the importance of the centers of the microdistricts* was revealed.

As a result of the study, it was determined that the architectural and spatial organization of social infrastructure requires taking into account the following points:

- the need to provide places of employment in the structural units of the city;
- planning of sports and medical institutions in the microdistrict;
- changing the requirements for the placement of institutions;
- the climate of the region implies a combination of walking areas and social infrastructure facilities;
- digitalization of the service sector promotes accessibility regardless of distance.

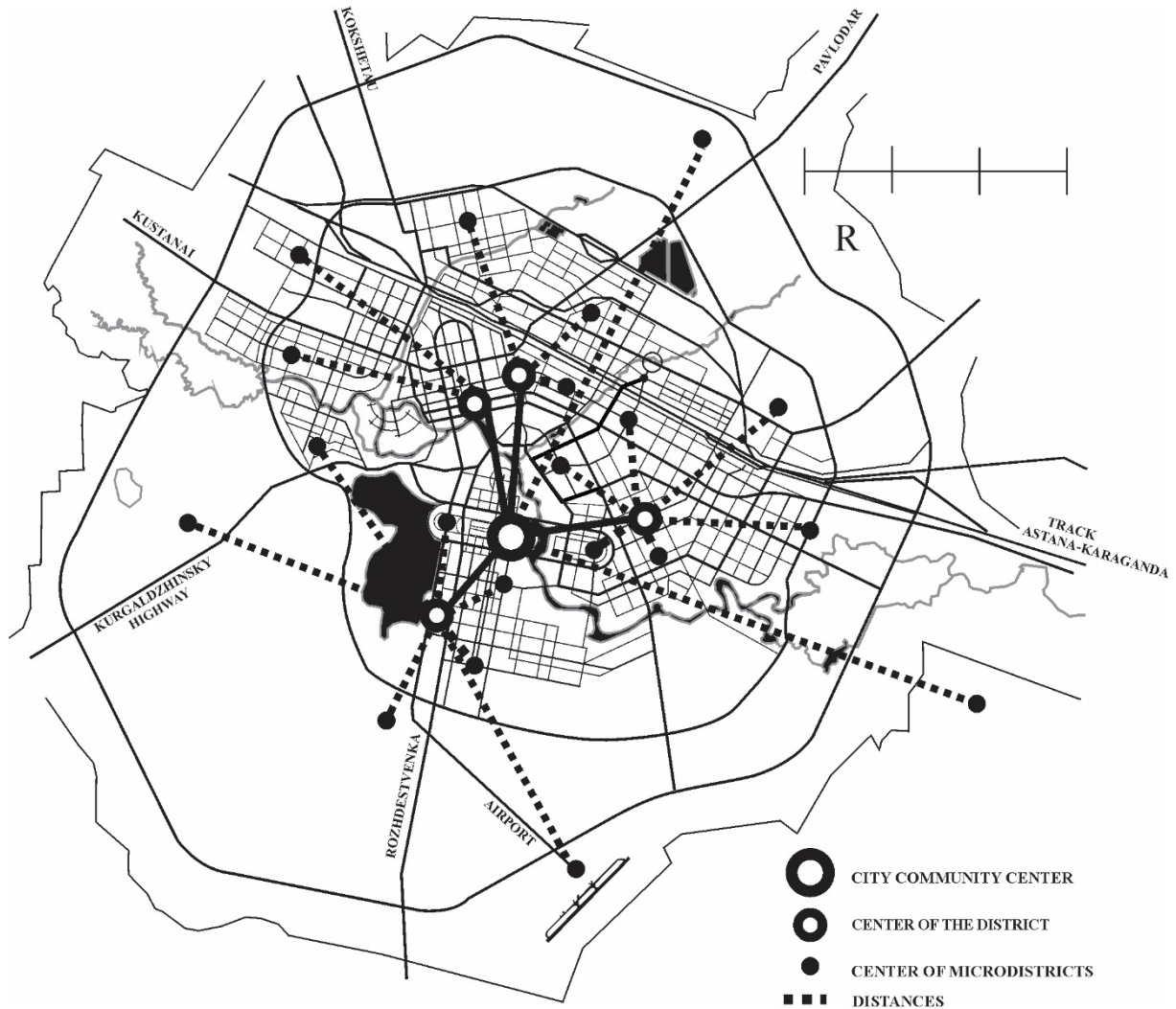


Figure 4. An example of the application of a three-stage service system in the territory of Astana

5. Conclusions

In the course of the conducted research, the features of the formation of social infrastructure, which occupies a central place in ensuring the sustainable development of the city and society, are highlighted.

In conclusion, the following criteria are given for the further development of the social infrastructure of the city of Astana:

1. The study found that the territory of Astana with a low population density, and no sufficiently developed social infrastructure causes the need for urbanization based on employment in the service sector. To support the development of society, it is necessary to consider jobs based on social infrastructure facilities in a multifunctional urban environment.
2. Social infrastructure facilities should be located within walking distance to exclude transport loads and time expenditures of the population. The interconnection of public centers and residential areas guarantees pedestrian accessibility to the necessary facilities and services for the population.
3. A full-scale study of existing social infrastructure facilities confirmed the lack of well-functioning interaction of all service sectors and the need to form a polycentric system of centers.
4. To ensure the quality of well-coordinated work and a high level of services provided, it is necessary to combine recreational areas and a combination of all service areas within the limits of the center of microdistrict significance (education, sports, culture, medicine). These institutions influence the development of human intellectual capital.
5. It is established that the planning of social infrastructure facilities should be conducted with consideration of private investment.
6. The necessity of digitalization of the service sector has been established, increasing the accessibility of institutions.
7. A sociological study has shown that, in general, the organization of medical, sports, and education

facilities in the centers of microdistricts increases the independence of the structural units of the city, which contributes to their sustainable development in the future.

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