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**SIMULATION OF URBANIZATION PROCESS
OF SHYMKENT CITY**

Annotation. *The article examines the process of urbanization in Shymkent and identifies the factors influencing the process of urbanization in Shymkent. Modern models of studying the process of urbanization are analyzed: the theory of urban settlements, differential urbanization and the theory of central places. The analysis showed that the urbanization system of Kazakhstan is developing in the context of the planned transition to a market economy, which can serve as a platform for testing the functioning of the economy. Also, a mobile application has been developed to track urbanization processes in Shymkent.*

Keywords: *The process of urbanization, migration, population, urban settlement system, differential urbanization, the theory of central places.*

Introduction

Rapid urban growth and urban population growth presents both opportunities and challenges. On the one hand, cities, especially large cities, become centers of economic growth and development, centers of concentration of opportunities for business and people. On the other hand, urban infrastructure does not always keep pace with the rapidly growing needs of enterprises and urban population, which leads to worsening living conditions in cities and such problems as environmental degradation, lack and low quality of public services, increased diseases and risks to human health, as well as many others. This is very clearly seen in the example of large megacities in the Asian region.

The purpose of the work is to track processes through a single mobile application, taking into account the factors affecting the urbanization process.

To achieve this goal, the following tasks were set:

- study of the subject area.
- modeling of the urbanization process.
- Development of a model of urbanization processes in Shymkent based on the model.
- Monitoring the urbanization process in Shymkent.
- Demonstration of control in the mobile application.

Urbanization is becoming a serious challenge for Kazakhstan, which is a dynamically growing region in economic and demographic terms.

This study aims to study the history of urbanization, concepts of urbanization, its aspects and factors, urban land, urban hierarchy, urban priority, over-urbanization, urban space, urbanism as a way of life and factors of urbanization. After a comprehensive literature review, the results of various studies are systematically linked, the results are disclosed and conclusions are drawn.

Shymkent is one of the fastest growing cities with great development potential. In this vein, further promotion of Shymkent as a city with a million population and issues of its development seem to be relevant.

1. Concepts and overview of urbanizations

1.1 The concept of urbanization

Research clearly shows that urbanized societies, in which most people live in cities and towns, are a new and fundamental step in human social evolution. Throughout history, the way in which cities have influenced and shaped social life has led urologists to look deeper into the emergence and development of the urban form. The dimensions of the urbanization are very complex. However, site size was the most widely used criterion in determining the population of a city. In urban areas, there is a high concentration of population in a limited area and, consequently, high population density and social heterogeneity [1].

Urbanization threats:

- Rapid urban development can lead to poverty and local governments cannot serve the entire population.
- Using more energy leads to more air pollution, which has a significant impact on human health.
- Exhaust air from cars causes high levels of lead in the city.
- A large amount of undistributed waste poses a significant health risk.
- Urban development can pose an environmental threat such as environmental flooding.
- Pollution and physical barriers can destroy urban timber.
- Animal populations are devoid of toxic substances, vehicles and habitats.

The benefits of urbanization:

- Fights poverty by promoting economic development and job creation.
- Involvement of the local community in local government and development.
- Reducing air pollution through the use of energy and modernization of alternative transport systems.
- Formation of public-private partnerships to provide services such as waste management and housing.
- Planting trees and maintaining urban greenery as a key element of urban planning [4].

Stages of urbanization

- Developed urbanization – the rapid growth of urban agglomerations and megacities, millionaire cities.

The share of the urban population is 50-75%.

- Advanced urbanization – suburbanization, urbanization, modern urbanization.

The share of the urban population is 75%.

- Emerging urbanization – the growth of the urban population, the rapid growth of large cities, the share of the urban population is about 50% [5].

2. The relevance of the study of the urbanization process

2.1 Factors influencing the urbanization process

Urbanization is a relatively new socio-economic phenomenon in Kazakhstan; The country has a long tradition of dispersed settlements with low population densities. The risks of urbanization (rising inequality, unaffordable housing, crowding and pollution) should be the targets of well-designed policies that benefit the agglomeration (high productivity, economic diversification, new markets, good conditions). At the same time, as people become more concentrated in cities, the economy becomes more productive, efficient and diverse; new forms of production and consumption will appear, knowledge will expand, innovation will increase. Urban areas are also natural laboratories for social transformation and innovation.

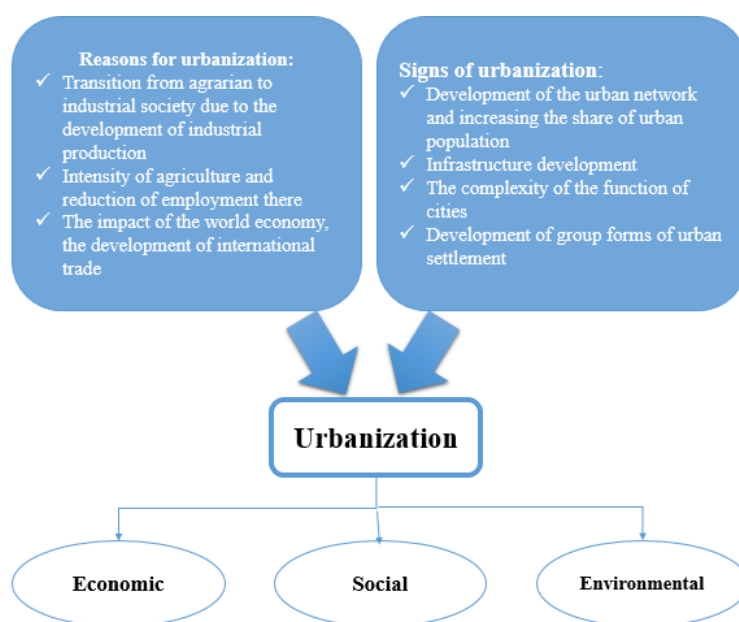


Fig. 1 – Factors influencing the process of urbanization

Work and development issues, among other things, attract people to cities. Already, half of the world's population lives in cities, and by 2050, it is projected that two-thirds of the world's population will live in cities. However, the most pressing problems in cities around the world are environmental degradation and poverty [8].

The conditions that lead to the development and prosperity of a city can be divided into three levels:

- human;
- culture;
- globalization.

People define the current process of urbanization, the quality of urban life. Indicators of the quality of urban life, living standards, housing, health care, transport, education, culture, environmental indicators of the border, employment reflect the factors of urbanization development [6].

These factors are often closely related, and we will find their connection through several analyzes.

Let us study the changes and indicators of factors influencing the urbanization process in Shymkent for 2015-2020 by creating the table below and building a diagram on its basis.

2.2 The urbanization process and the level of development of Shymkent

The demographic decline continued until 2002, and over 10 years the population of the Republic of Kazakhstan decreased by 12.7%. At the same time, Kazakhstan remained the country with the largest urban population in Central Asia - about 55-56% in 1999-2000. Since 2004, the population of Kazakhstan has begun to grow again due to two factors – natural growth and largely due to a positive balance of external migration. Basically, the balance of external migration remains positive in the southern and western regions, in the city of Almaty and the Almaty region. For 20 years, 1,376 thousand people arrived in these regions for permanent residence, of which 810 thousand or 59% of those who arrived were repatriates (about 200 thousand families according to official data) [9].

Today 57.6% of Kazakhstan's population lives in cities. Almaty (more than 1,829 thousand people), Astana (more than 1,047 thousand people), and recently Shymkent (more than 1,005 thousand people) were included in the list of millionaire cities. Shymkent is one of the fastest growing cities with great development potential. In this vein, further promotion of Shymkent as a city with a million population and issues of its development seem to be relevant.

Today Kazakhstan is at the level of industrial development of the economy. Cities play a special role in these processes.

In January 2015, the Shymkent authorities sent a request to UNESCO for recognition of Shymkent as an ancient city.

Until 2018, the administrative center of the South Kazakhstan region was the city of Shymkent. He will be expelled from the South Kazakhstan region on June 19, 2018 and will report directly to the Government of Kazakhstan. Thus, the administrative center of the region was moved to the city of Turkestan, and the region itself was transformed into the Turkestan region [10].

As of 2012, the population of Shymkent: Kazakhs – 64.76%, Russians – 14.52%, Uzbeks – 13.7%, Tatars – 1.54%, Ukrainians – 0.54%, Koreans – 1%, the rest – 3.94% of representatives of other nationalities.

According to statistics, in 2015 the population of Shymkent was 858 147 people. Today, 711 783 people lived in the former district of Shymkent. The population of Shymkent in June 2018 was 1,002,291 people.

Shymkent has a developed infrastructure and is one of the leading industrial and economic centers of the country. There are many enterprises in Shymkent. There are about 69 industrial enterprises in the city. These are non-ferrous metallurgy, mechanical engineering, chemistry, oil refining and food industry, etc.

In 2020, the volume index in the «Transport» sector amounted to 102.9%. The volume of cargo turnover in 2020 compared to the same period last year amounted to

1,078.2 million UAH. tkm and decreased by 8.1%. The volume of passenger traffic amounted to 3619.5 million people. and increased by 8.9%.

The city has commissioned 16.5 thousand square meters of housing, which is 24.3% by 2019.

As of April 1, 2020, the number of operating small and medium-sized businesses amounted to 69,586 units. For the corresponding period of 2019, it amounted to 107.9% [11].

Thus, Shymkent is considered the 3rd megalopolis, which develops economically, socially and culturally from year to year. In 2020, it has the status of the cultural capital of the CIS.

3. Review of modern methods of urbanization research

3.1 System of urban settlement. Auerbach-Zipf's law.

To analyze and evaluate changes in the system of urban settlement of the country, most researchers use the rule of «rank-population» (Auerbach-Zipf law): if you assign each city in the study area a serial number («rank») corresponding to the place that it occupies in terms of population (in order of decreasing population size), then it turns out that the population size of a given point somehow depends on the population size of the largest (first in rank) city. This dependence, which is usually called the «rank-population» rule, can be written in the form of a formula [9]:

$$P_n = P_1/n^q \quad (1)$$

where P_1 – the population of a rank n city,
 aP_1 – the population of the largest city.

This formula simply states that (in the idealized case, when $q = 1$) the population of the «first» city, as can be expected, will be 4 times larger than the fourth most populous city in the given territory. Expressing this ratio in logarithmic form:

$$\ln P_n = \ln P_1 - q \ln n, \quad (2)$$

We can consider it as a logarithmically normal distribution, and on the graph of such a dependence (on the abscissa – the logarithm of the rank, on the ordinate – the population) we get a straight line with a slope – q [12]. This pattern was revealed purely empirically and is in good agreement with data for US cities; however, when it was tested for other countries, a number of significant discrepancies were found. In this regard, a more general form of dependence was proposed, where instead of P_1 a certain constant C was used, and it was also proposed to raise the denominator of the fraction to a certain power q (the formula proposed by B. Mandelbrot) [13]:

– where C and q are some constants (C is a constant, coefficient; q is the coefficient of paired linear regression (the slope of the logarithmic straight line));

– in this case, of course, this equality is understood as a certain theoretical model that only approximately corresponds to empirical data, in particular for $n = 1$, $P_1 = C$ [13].

Coefficients C and q are calculated for a specific area and a specific calculation interval, i.e. are tied to a specific sample. Their values are estimated in the usual technique of econometric analysis, for example, using the least squares method after preliminary logarithm of the original equation [10]:

$$\ln P_n = \ln C - q \ln n. \quad (3)$$

3.2 Stages by J. Gibbs and differential urbanization

The theory of differential urbanization is the development of stages by J. Gibbs, who believed that urbanization is a natural change of stages and transitions. At the first stage, cities begin to appear, but cities are small and lagging behind villages in growth, the rural lifestyle prevails.

This is followed by a period of suburbanization, urbanization slows down, suburban areas develop faster, and the rural population continues to decline. This trend is replaced by the deconcentration of the urban population, the growth of agglomeration (city and suburban area) slows down, the population migrates to villages and small settlements, but its lifestyle is different. J. Gibbs's scheme was expanded into the theory of differential urbanization. Zh. A. Zayonchkovskaya identified the following evolutionary stages: 1) autonomous development of the city and village; 2) concentration of population in cities; 3) integrated settlement around big cities, in agglomerations [15].

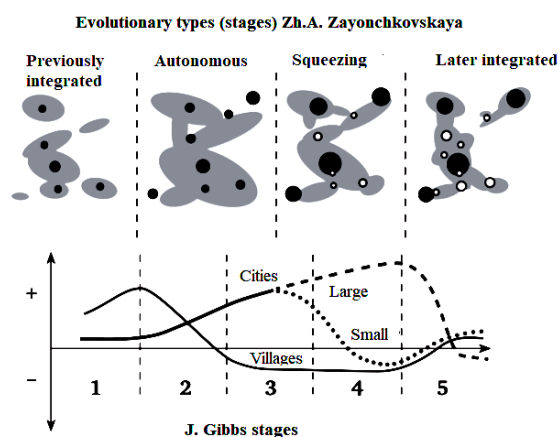


Fig. 3 – Stages of Differential Urbanizations

Differential urbanization according to T. Contouli includes the following stages:

- (I - urbanization-1) growth of large cities at the expense of medium and small;
- ((II, urbanization-2) polar dynamics of large and small cities, medium-sized ones begin to grow;
- (III, polarization reversion - 2) big cities lose their attractiveness, small cities move to growth, medium-sized ones slow down growth;
- (IV, polarization reversion - 2) big cities are losing population, small cities are leading;
- (CU-V, counter-urbanization-1) medium-sized cities are losing population, big cities are moving closer to them;
- (CU-VI, counter-urbanization-2) medium-sized cities lag behind small and large, but not so much and for a long time.

4. Software module for managing the urbanization process in Shymkent

4.1 Information system operation scheme

An information system workflow is a schematic representation of how a project works and what problems it solves.

In our case, that is, when modeling the urbanization process, first of all, an analysis will be carried out, as a result of which statistical indicators will be presented. You can also view, view and download data from stat.gov.kz or other statistical sites. Thus, all the factors influencing the urbanization process of Shymkent will be collected and tracked in one mobile application.

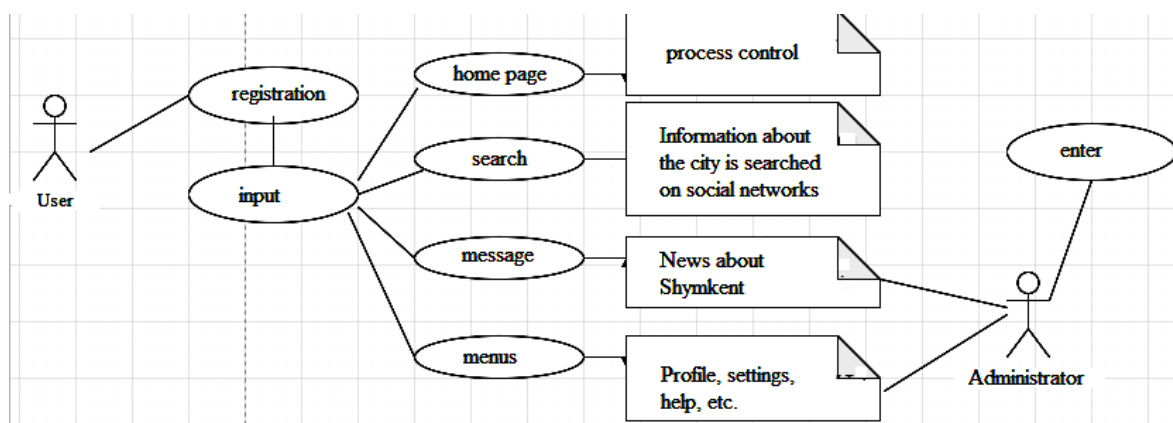


Fig. 5 – UML diagram

4.2 Mobile application for monitoring the urbanization process in Shymkent

In the modern information world, it is very important to stay connected at any time, get access to the necessary information, use and develop mobile applications using mobile devices to inform the general public. The development of information technologies for mobile devices is actively developing.

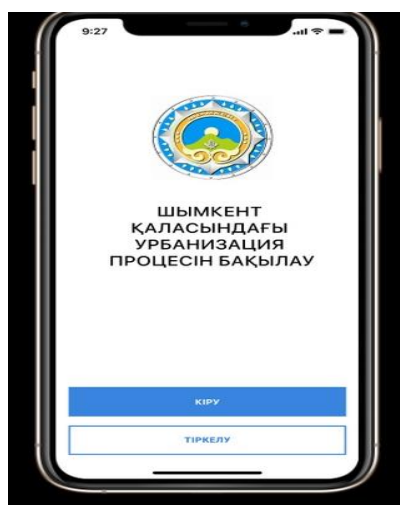


Fig. 6 – Login page

First of all, to control the urbanization process in Shymkent, press the enter button. And if you have not used this mobile application before, you can register by clicking the register button.

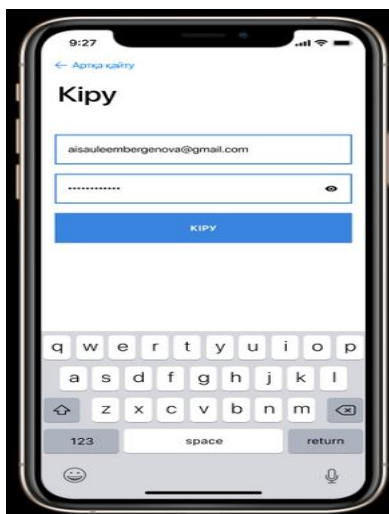


Fig. 7 – Access to mobile application

In general, the mobile application consists of 4 parts. They:

- The main;
- Search;
- Notice;
- Menu.

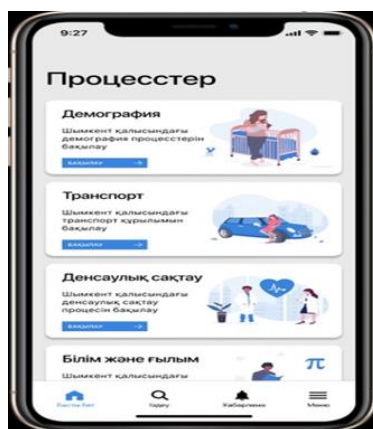


Fig. 8 – Processes

Processes are published on this page. That is, each process will be controlled individually. When you click the «Control» button and go to the next page, you will see the level of this process.

Processes:

- Demographics;
- Transport;
- Health;
- Accommodation;
- Education and Science;
- Tourism;
- Ecology;

- Culture
- IT industry;
- Security.

Each process produces its own statistics. For example, if you click the Demographic Data button, you will see the data for 2020, which is current.

The same is observed in the following processes. For example, if we want to see the process of «housing», then we will look at issues such as the number of people in line for housing in the city, how many houses are being built, and the results are presented in the form of graphs or diagrams.

Conclusion

In conclusion, urbanization is a historical process of increasing the role of cities in the development of society. The process of changing the socio-economic and demographic structure of the population, affecting its culture, lifestyle, psychology and other factors. The main indicator of the urbanization process is the increase in the share of the urban population.

Urban population growth in Kazakhstan is the result of three processes: natural urban population growth, rural-to-urban migration, and rural-to-urban reclassification. Reclassification is the result of natural population growth and migration from rural to urban areas, as well as the rapid expansion of urban areas into adjacent rural areas. This is how medium and large cities appear. However, most cities lack budgetary resources to implement the large investment projects needed to improve governance in growing cities.

Urbanization is a relatively new socio-economic phenomenon in Kazakhstan; The country has a long tradition of dispersed settlements with low population densities. The risks of urbanization (rising inequality, unaffordable housing, crowding and pollution) should be the targets of well-designed policies that benefit the agglomeration (high productivity, economic diversification, new markets, good conditions).

At the same time, as people become more concentrated in cities, the economy becomes more productive, efficient and diverse; new forms of production and consumption will appear, knowledge will expand, innovation will increase. Urban areas are also natural laboratories for social transformation and innovation.

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ШЫМКЕНТ ҚАЛАСЫНЫҢ КЕНТТЕНУ ПРОЦЕСІН МОДЕЛДЕУ

Аңдатпа. Мақалада Шымкент қаласының кенттену үрдісі зерттеледі және де қаланың кенттену үрдісіне әсер ететін факторлар анықталады. Кенттену процесін зерттеудің қазіргі заманғы модельдері: қалалық қоныс аудару жүйесі, дифференциалды урбанизация және орталықты орналастыру теориялары талданады. Талдау нәтижесінде қалыптасқан Қазақстанның кенттену жүйесі жоспарлы және нарықтық экономикаға өту жағдайында дамып келе жатыр, экономиканың қолданылуын тексеретін платформа бола алатындығы анықталды. Сондай-ақ, Шымкенттегі кенттену процесстерін бақылауға арналған мобильді қосымша жасалды.

Түйін сөздер: кенттену үрдісі, миграция, халық саны, қалалық қоныс аудару жүйесі, дифференциалды кенттену, орталықты орналастыру теориясы.

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МОДЕЛИРОВАНИЕ ПРОЦЕССА УРБАНИЗАЦИИ ГОРОДА ШЫМКЕНТ

Аннотация. В статье исследуется процесс урбанизации в Шымкенте и выявляются факторы, влияющие на процесс урбанизации в Шымкенте. Анализируются современные модели изучения процесса урбанизации: теория городского расселения, дифференциальная урбанизация и теория центральных мест. Анализ показал, что система урбанизации Казахстана развивается в контексте планового перехода к рыночной экономике, что может служить платформой для проверки функционирования экономики. Также разработано мобильное приложение для отслеживания процессов урбанизации Шымкента.

Ключевые слова: процесс урбанизации, миграция, население, городская система расселения, дифференциальная урбанизация, теория центральных мест.