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Article

Development of Small Services in Residential Areas of Nukus City: Institutional Model and Mission of Microservices

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Abstract: The article presents a unified concept of developing microservices and service economy in residential areas of Nukus city. The institutional model of interaction between the city council, neighborhood councils, service providers and the university is described. International experience (Korea, Japan, Singapore, the European Union) and the features of the local context of Uzbekistan are analyzed. The role of microservices as the foundation of the everyday economy and a tool for inclusive development is considered. A presentation of the performance assessment system of subordinate organizations was held, and recommendations were made on the "roadmap" for the implementation of a service ecosystem and the development of mini-services in Nukus.

Keywords: Microservices, service economy, quarterly consulting, KPI, mathematical models, social capital, urbanization

1. Introduction

Nukus, as the cultural and economic center of Karakalpakstan, has the status of the capital and is the main administrative, economic, scientific and cultural center of the Republic of Karakalpakstan within Uzbekistan.

From an economic point of view, modern Nukus is: the administrative and business center of the republic, where government bodies, banks, and large trade and service organizations are located; industrial and processing (food, light, construction materials), agricultural (cotton, rice, melon, livestock) enterprises of the region; Nukus is an important transport hub (Nukus International Airport, railway, highways leading to Tashkent, Khiva, Muynak, etc.). In 2019, the Nukus Free Economic Zone was established for a period of 30 years to attract foreign investment and locate import- substituting and export-oriented production[1].

Nukus is home to almost all major scientific, educational and cultural institutions of Karakalpakstan: higher education institutions and research institutes, including Karakalpak State University, Medical Institute, Pedagogical Institute, Technological University, branches of Tashkent Agrarian and other higher education institutions, and a branch of the Academy of Sciences of Uzbekistan. The population dynamics of the city of Nukus in recent years is as follows:

- 2010 ~265-271 thousand.
- 2015 - ~300-301 thousand.
- 2020 - official price 319-335 thousand soums.
- 2022 - 329-333 thousand people.

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- In 2023-2025 - according to the latest estimates, approximately 345-370 thousand people (in various databases: 344.7 thousand according to state statistics, 370-371 thousand according to demographic models).

Population growth was relatively steady, without sharp declines, accelerating in the post-war decades and growing steadily in the 2000s-2020s due to natural migration and out-migration from rural areas of Karakalpakstan[2]. The age structure of the population looks like this. According to the State Statistics Committee of Uzbekistan (via the citypopulation.de database), in Nukus there are approximately:

- 0-15 years old - 95.5 thousand people (~ 28% of the population)
- 16-64 years old - 229.1 thousand (≈ 66-67%)
- 65+ years old - 20.1 thousand (≈ 5-6%)

The average age of the population is around 24 years old, meaning Nukus is a young city with a predominance of working-age people. A brief description of the age structure is as follows:

- children and adolescents → need for schools, kindergartens, youth infrastructure.
- is made up of people of working age with potential for industry, service , and small businesses[3].
- Relatively low proportion of elderly → the burden on the social protection system is lower than in aging societies, but due to environmental problems, attention to health is increasing (Aral Sea, dust and salt storms.

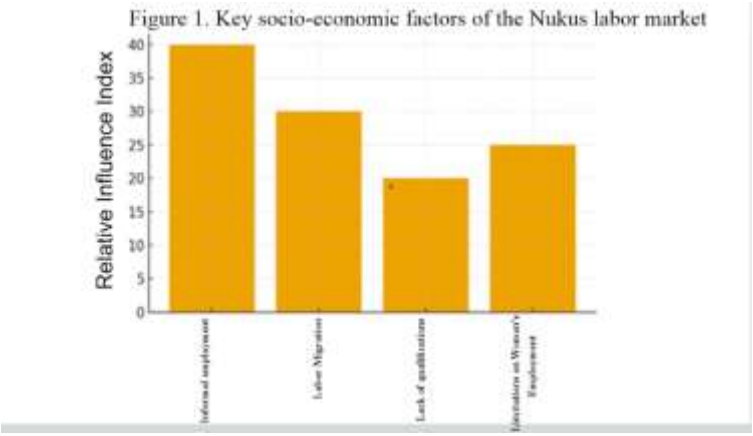
According to data , the population of Karakalpakstan as of January 1, 2024 is approximately 2,002.7 thousand people, of which ~17% of the republic's population lives in the capital.

The contribution of Nukus to the regional economy is as follows:

- A significant number of business entities registered in the city: on June 1, 2025, there are 5,006 business entities in Nukuse.
- The description of the Nukus economy mentions industrial enterprises: a winery, textile, polymer plants, and electrical products.
- is of great importance for the republic's economy from an administrative, industrial and service point of view.

Modern cities are moving from industrial models to service, knowledge, and work economies . For Nukus, which has about 50 quarter councils and a high share of informal employment, the development of local microservices is a strategic necessity. Small services provide employment, improve the quality of life, and contribute to social stability[4]. Socio-economic conditions and key drivers of the labor market: high informal employment, labor migration, skills shortages, and limited female employment. Service infrastructure is underdeveloped in most neighborhoods. are based on the concepts of labor economics, social connections, neighborhood services, and the "nearby cities" approach. Small services are part of the everyday economy and are very important for low-income regions. The main factors of the labor market, based on expert assessments, are presented in Figure 1.

Figure 1. Key socio-economic factors of the Nukus labor market



International experience in the field under consideration includes: **South Korea - Care Communities district centers; Japan - Community Care Stations; Singapore - service centers; Germany, France, Netherlands - neighborhood services and micro-order models.**

2. Materials and Methods

In general, for developing countries, UNCTAD recommends a service-led development strategy that includes the development of modern ICT services, creative industries, logistics, tourism, and financial services in parallel with the modernization of traditional industries[5].

The stages and features of the development of the service sector in the Republic of Uzbekistan are as follows. During the years of independence, a number of programs were implemented in Uzbekistan to develop the service sector and the service sector. Sh. Kh. Otaboyev 's work distinguishes the stages of the formation of the national services market from the 1990s, when the share of services in GDP was around 33-34 percent, to the mid-2010s, when it reached approximately 50 percent.

The program for the development of the services sector for 2012-2016, approved by the resolution of the President of the Republic of Uzbekistan, aimed at increasing the share of services in GDP to 55 percent, developing modern types of services, including in rural areas, and improving the quality of services provided to the population[6].

Subsequent socio-economic development strategies have strengthened the priority of the service sector, along with industry and agriculture. Modern studies by Uzbek authors (ZG'. Kudratov, MABekmirzayev, D. Nasirov, Sh. Sattarov, M. Soy, etc.) show that in 2017-2022, the volume of services in the country significantly increased, their composition was diversified, and the share of modern types of services (ICT, finance, logistics, tourism, education and healthcare) significantly increased.

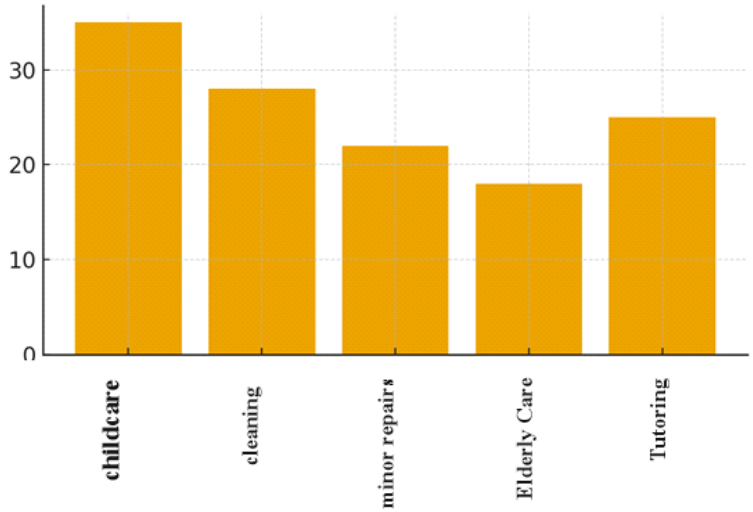
Research shows several key trends in the development of the service sector in Uzbekistan:

- Regulatory reforms and liberalization. Simplification of registration and licensing procedures, tax incentives for small businesses in the service sector, and the development of special economic zones have encouraged private initiative and increased investment flows[7].
- The active introduction of e-government, online government services, payment systems, and e-commerce platforms has led to the emergence of new types of services and increased efficiency.
- The growth of the role of small business. Ya.Sh. Kuchkarova emphasizes that small business in the service sector has become one of the main sources of new jobs, especially in regions and rural areas .

includes the following model : city council - strategic center; quarter councils - operational level; Karakalpak State University - personnel training and analysis center (**Figure 1**). This will form the "Nukus-Service" digital platform.

of small services in residential areas is to provide everyday conveniences close to home, support women and the elderly, create jobs and strengthen the local economy. Local services increase social cohesion and the quality of urban life.

Figure 2. Demand for Basic Microservices



The quarterly council performance evaluation system includes organizational activity, social effectiveness, economic development, service quality, and innovation. An annual rating system is envisaged **[8]**.

The mathematical basis of the microservices model is as follows: to assess the overall economic impact of implementing microservices, the integral performance index formula is used on a quarterly scale:

$$Ie = \Sigma (Ki \times Wi)$$

where Ki is the value of the i- th indicator,

Wi - weight coefficient. Weight coefficients are determined by expert method and sum to 1.0.

Table 1. *Weighting coefficients of indicators*

Indicator	Weight
Organizational activity	0.25
Social impact	0.25
Economic activity	0.20
Quality of services	0.20
Innovation	0.10

The econometric model of demand for microservices looks like this: To analyze the demand for microservices, a linear regression model of the following form is used:

$$D = B_0 + B_1 X_1 + B_2 X_2 + B_3 X_3 + e$$

where D is the demand level;

X_1 - household income;

X_2 - population density;

X_3 - female employment rate. The model allows us to estimate the contribution of each factor to the distribution of demand[9].

To predict the development of service infrastructure, an exponential growth model of the number of microservice providers can be used:

$$N(t) = N_0 e^{kt}$$

where N(t) is the number of performers at time t,
N_0 - initial level,
k - post coefficient
reflects employment growth after the introduction of a digital platform and training.

3. Results

According **In order to effectively develop the above recommendations** , a "Roadmap" has been developed for the development of mini-services in residential areas of the city of Nukus . It is as follows:

PHASE 1. Analysis and preparation (1-2 months)

1. Quarterly demand study Conduct a quarterly analysis[10]. Methods: population surveys (QR-questionnaires, door-to-door surveys); monitoring flows at different times of the day; Analysis of the distance to the nearest services (shops, pharmacies, household services). Identifying the MOST important needs of the population: grocery mini- stores; bread/milk/water; equipment repair; mini - balloon; household services (keys, shoes, tires); mobile coffee shop/fast food; courier services in the quarter; pharmacies and health centers.

2. Competitive environment definition Service map within a radius of 400-800 m . Identifying "blank areas" where services are unavailable. Population density assessment (based on data for 2023-2025).

3. Legal requirements Check the requirements of the administration for the following:
installation of temporary pavilions ; sanitary standards; fire safety requirements;
placement in areas around the house; apende municipal land (not 3-5 let).
List of required licenses: product sales; catering; medical services (if there is a mini-pharmacy);household services.

4. Financial model Cost of opening 1 point (example): 15-25 m2 pavilion: 45-75 million soums; equipment: 20-50 million soums; personnel: 3-6 million/month; Turnover: 200-500 million soums per month (with the right assortment)[11]. Coverage period: 8-16 months.

STAGE 2. Design a mini-service network (1-2 months)

1. The concept of formats

Recommended point types:

Format	Square	Description
Mini-market	20-30 m2	Main products + household goods
Bread/milk-point	8-12 m2	The most necessary goods are within reach
Small pharmacies	10-20 m2	Basic medicines, hygiene products
Coffee/fast food pavilion	6-10 m2	Coffee, samsa, shawarma
Household services	8-15 m2	Repair of phones, shoes, keys
Pick-up point	8-20 m2	Goods delivery points (Uzum, Korzinka, AliExpress)

2. Choosing experimental quarters Criteria:high population density; distance from large shopping facilities; convenient use by the population; support from neighborhood committees[12].

3. Architectural design of pavilions mobile/modular structures; a single company style; energy efficiency (solar panels); video surveillance + fire alarm.

4. Logistics planning Supplement system: 1 central repository → micro points. Arrival graphs. Single accounting IT systems.

STAGE 3. Pilot launch (3-4 months)

1. Start 5-10 experience points
The first recommended locations are high-density and underserved neighborhoods.
2. Staff selection
Local population → social impact. Employee training: cash discipline; working with customers; quality control; fire safety.
3. Motivation system Fixed + percentage of turnover. Monthly bonuses for service quality[13].
4. Marketing Launch in Nukus telegram channels. Installation of signs and bright light banners. Loyalty programs (QR map of each neighborhood's residents). Free products/tastings on opening days
5. Evaluation of pilot results usefulness; attendance; personnel productivity; public opinion.
After 3 months - solution: expand? improve? close weak points?
STAGE 4. Network Expansion (6-18 months) 1. Open another 20-40 points
Priorities: new residential areas; reconstruction and new construction areas; kindergartens, schools, facilities near bases. 2. Network optimization sales automation (scanners, electronic price lists); transition to cashless payments; a single shopping center to reduce the purchase price by 12-25%. 3. Expanding formats for payments /utilities; medical measurement points (blood pressure, sugar - free); mini libraries/social points (increase loyalty)[14].
STAGE 5. Strengthening the ecosystem (2-3 years) 1. Creation of a digital platform "Nukus Servis" with a map of all points; online catalog of goods; Order products within the quarter within 10-15 minutes; of payments via Uzum Bank / Payme / Click . 2. Collaboration Korzinka, Makro, Baraka Market - micro-formats; Pharmacy chains; Uzum Market, Hilton, local cafes; support. 3. Social programs discounts for pensioners;
special prices for families with many children; free drinks in the heat; small points of sorting raw materials.
STAGE 6. Full quality control ("seamless network") Key KPIs: Turnover per point - 25-45 million soums per month (minimum). The level of population satisfaction is 85%+. The delivery time for goods is a maximum of 24 hours. Minimum stock levels - optimize purchases with the AI module[15]. The entire network coverage period is 12-24 months.

4. Conclusion

Microservices current to grow Nukus economic landscape change , quarterly boards , digital tools and performers to teach based on stable service show ecosystem create possible . Service to show institutional model complex expansion this shows that small microservices city employment economy to the foundation rotation possible. The integration of quarterly councils, digital platforms, university learning centers and a system of indicators makes the model sustainable, repeatable and scalable. The use of economic and mathematical methods increases the quality of management and forecasting accuracy, and the use of a roadmap allows for an increase in the quality of implementation of the recommendations presented.

of a network of microservices (mini-services) in the residential areas of the city of Nukus is a strategic direction for the transition of the city's economy to a service-oriented, inclusive and sustainable model. The study shows that the steady growth of the city's population (approximately 345-370 thousand people by 2025), the high share of the young working-age population (66-67%), as well as informal employment and the lack of service infrastructure make the development of microservices an urgent task.

The proposed institutional model is based on effective cooperation between the city government (strategic management), neighborhood (quarterly) councils (operational level), service providers , and Karakalpak State University (training and research center). This model is based on the successful experience of South Korea, Japan, Singapore, and the European Union and is adapted to the local context.

The main scientific and practical results are as follows: microservices network has been developed (analysis → design → pilot launch → expansion → ecosystem strengthening → full quality control).

A KPI system and an integral efficiency index (Ie = Σ(Ki × Wi)) for quarterly evaluation of the councils' activities were proposed.

growth mathematical models of supply and demand for microservices were presented.

The most popular formats in residential areas were identified as mini-markets, bread and milk points, small pharmacies, household services, fast food and delivery points.

The possibility of delivery in 10-15 minutes and integration of payment systems are envisaged through a single digital platform, "Nukus Servis".

As a result, the full implementation of this model:

reduces the distance to services for the population to 100–300 meters, ensuring quality of life and saving time;

300–700 new jobs , especially increasing employment for women and local residents;

reduces the share of informal trade;

that is attractive for small businesses and investments, and pays for itself in 8–16 months .

Thus, the implementation of the institutional model of microservices and the “Roadmap” in the city of Nukus will bring the city's economy to a new stage based on the principles of a service-oriented, socially sustainable and convenient “nearby city”. This will make it possible to turn Nukus into one of the innovative model cities in the service sector not only in Karakalpakstan, but also in the entire Central Asia.

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