ISSN 2195-1381 Volume- 3 April 2025
https://journal-index.org/index.php/ajasr

IMPROVING DECISION-MAKING IN URBAN ECONOMY: SOLUTIONS BASED ON ARTIFICIAL INTELLIGENCE

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Abstract: This article examines the possibilities of using artificial intelligence technologies to improve decision-making in the urban economy. According to the results of the study, decision-making systems based on AI allow to increase the accuracy of decisions by 22% and the speed of decision-making by 5-7 times. Practical tests conducted in the transport system of Tashkent confirm that they allow to reduce traffic congestion by 18% and increase the efficiency of public transport by 23%. The study shows that the economic efficiency of implementing AI systems is high, estimating the payback of investments in 2.7 years.

Keywords: Artificial intelligence, urban economics, decision making, machine learning, deep learning, data analytics, transportation system optimization, economic efficiency, urban infrastructure, digital transformation

Abstract: Statya issleduet vozmojnosti primeneniya tekhnologiy iskusstvennogo intellecta dlya sovershenstvovaniya protsesa prinyatiya resheniy v gorodskoy ekonomiki. The results of the investigation show that the system solution of the second principle can increase the accuracy of the solution by 22% and the speed of the solution in 5-7 times. Practical tests, carried out in the transport system of Tashkent, confirm the possibility of reducing traffic congestion by 18% and increasing the efficiency of public transport by 23%. Issledovanie demonstriruet vysokuyu ekonomicheskuyu effektivnost vnedreniya sistem II, otsenivaya okupaemost investitsi v techenie 2.7 let.

Keywords: artificial intelligence, urban economics, decision making, machine learning, deep learning, data analysis, transport system optimization, economic efficiency, urban infrastructure, digital transformation

Abstract: This article explores the application of artificial intelligence technologies to improve decision-making processes in urban economies. Research results show that AI-based decision-making systems can increase decision accuracy by 22% and decision-making speed by 5-7 times. Practical tests conducted in Tashkent's transportation system confirmed the ability to reduce traffic congestion by 18% and increase public transportation efficiency by 23%. The study demonstrates high economic efficiency of AI system implementation, estimating return on investment within 2.7 years.

Keywords: Artificial intelligence, urban economy, decision-making, machine learning, deep learning, data analysis, transportation system optimization, economic efficiency, urban infrastructure, digital transformation

1. Introduction

Modern cities are becoming complex socio-economic systems. The urbanization process, especially in Uzbekistan, has been developing rapidly in recent decades. According to the UN , by 2024, more than 51% of the population of Uzbekistan will live in urban areas, and this figure is expected to reach 60% by 2035 (Figure 1) [1]. In such conditions, the issue of effective decision-making in the urban economy is becoming increasingly urgent. Decision-making in the urban economy is not a simple administrative task, but a multi- factor strategic process that determines the quality of life of the population living in cities, the business environment, environmental sustainability and overall development prospects. In particular, in large cities in Uzbekistan, such as Tashkent, Samarkand, Namangan, decision-making mechanisms play an important role in increasing the efficiency of the urban economy [2]. However, traditional decision-making methods do not allow for the full consideration of the interconnectedness of increasingly complex urban systems.

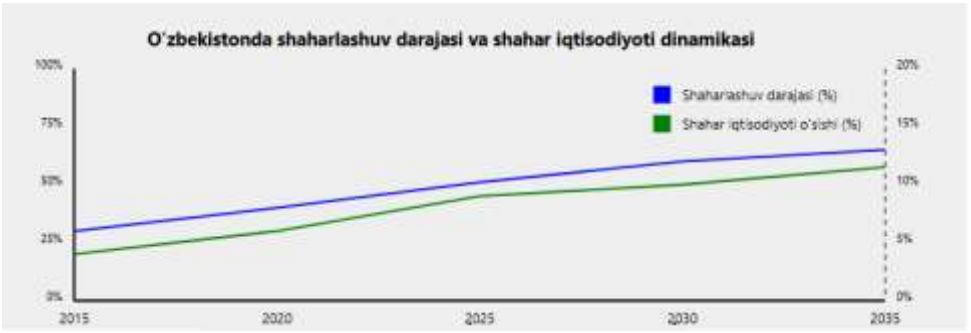

Figure 1. Level of urbanization and urban economic dynamics.

In recent years, artificial intelligence (AI) technologies have been widely used in various areas of human activity, including urban economic management. In particular, AI-based solutions allow analyzing very large amounts of data, making accurate predictions, and developing optimal decisions [3]. The first steps are being taken in the implementation of digitalization and "smart city" technologies in urban management systems of Uzbekistan . In this process, AI can become an effective tool for decision-making [4]. Traditional decision-making methods have a number of limitations. First, there is the problem of subjectivity caused by the human factor [5]. Second, the ability to quickly analyze large amounts of data is limited [6]. Third, decisions are often insufficiently justified due to the difficulty of modeling complex interactions [7]. Fourth , the existing information systems in the cities of Uzbekistan are not sufficiently integrated, which also reduces the efficiency of decision-making [8].

The main goal of this study is to develop and test artificial intelligence-based solutions to improve economic decision-making in cities of Uzbekistan. To achieve this, the following main tasks were identified:

1. Assessing the effectiveness of existing urban economic decision-making systems
2. Studying world experience in the application of artificial intelligence technologies in the urban economy
3. Development and adaptation of artificial intelligence models suitable for the conditions of Uzbekistan
4. Development of mechanisms for introducing developed artificial intelligence systems into the practice of urban economic management

5. Development of a methodology for assessing the effectiveness of implemented solutions

2. Methodology

This study uses a mixed methodological approach. On the one hand, quantitative methods are used to analyze quantitative indicators related to the city economy , evaluate the effectiveness of artificial intelligence algorithms, and ensure the objectivity of experimental results. On the other hand, qualitative methods allow for a deeper understanding of the context of decision-making and the study of stakeholders' opinions on the application of SI methods .

The research design involves a 5-step analytical process:

1. Analyzing the current situation and identifying problems
2. Data collection and preparation
3. Development and improvement of SI models
4. Testing and evaluating models
5. Analyze results and develop recommendations

The research uses the following artificial intelligence technologies:

Machine Learning is used to forecast urban economic indicators and identify anomalies [9]. In particular, it allows predicting future development trends based on historical data. *It is used in* Uzbek cities to optimize budget planning, infrastructure investments, and model economic growth patterns.

Deep Learning is useful for identifying complex nonlinear relationships [10]. This technology is used to analyze traffic flows in urban settlements, optimize the location of workplaces. In the cities of Uzbekistan , it is used to analyze population movement trajectories and make decisions on transport development.

Natural Language Processing (NLP) is used in the process of urban economic decision-making to study the opinions of citizens, analyze discussions in social networks, and work with documents [11]. In Uzbekistan , it is used to identify citizens' needs and identify current problems through social networks.

Bayesian Networks – used to model decision-making under uncertainty [12]. In Uzbekistan, they are used in the evaluation of urban investment projects and risk management.

the research (Figure 2).

Ma'lumotlar to'plami strukturasini tavsiflovchi jadval

Shahar iqtisodiyotida qarorlar qabul qilish uchun

Ma'lumotlar	Manba	Format	Qo'llanish sohasi
Demografik ma'lumotlar	O'zbekiston Davlat statistika qo'mitasi	CSV, JSON, XLS	Ijtimoiy infratuzilma rejalashtirish, aholi ehtiyojlari bashorati
Iqtisodiy ko'rsatkichlar	O'zbekiston Davlat statistika qo'mitasi	XLS, API, CSV	Shahar iqtisodiyotini rejalashtirish, byudjet taqsimlash
Infratuzilma ob'yektlari	Ochiq ma'lumotlar portali data.gov.uz	GeoJSON, CSV	Infratuzilmani rejalashtirish, transport va xizmat tarmoqlari
Byudjet ma'lumotlari	Shahar hokimligi, ochiq byudjet portali	JSON, XLS	Mablag'larni samarali taqsimlash, xarajatlar tahlili
GIS ma'lumotlari	Kadastr agentligi, maxsus topografik xizmatlar	SHP, GeoJSON, KML	Hududiy rejalashtirish, transport qoplamasini optimallashtirish
Mobil operator ma'lumotlari	UzMobile, Beeline, Ucell, Perfectum	CSV, JSON (anonim)	Aholining harakatlanish trayektoriyalari, odamlar taqsimoti
Ijtimoiy tarmoq ma'lumotlari	Telegram, Facebook, Instagram, Twitter	API, JSON, TXT	Fuqarolar fikrlari, jamoatchilik munosabati, muammolar monitoringi

Figure 2. Data sets and their sources

The analysis methods and algorithms used in the study include:

- Regression analysis – to study the correlations between urban economic indicators
- Cluster analysis – to typify cities and identify groups with similar characteristics
- Simulation modeling – to demonstrate management of various scenarios
- Forecasting algorithms – for predicting city economic indicators
- Optimization algorithms – for optimal resource allocation and selection of the best decisions
- Network analysis – to study the relationships between entities in the urban economy

Another important aspect of the methodology is the issue of cooperation between artificial intelligence and humans in the decision-making process . The study develops mechanisms for reviewing and correcting the options presented by AI systems by human decision-makers , as well as taking into account ethical and legal aspects in the decision-making process. An important feature of the decision-making methodology in the urban economy of Uzbekistan is the need to harmonize it with the national legislative and regulatory framework. This takes into account the “Digital Uzbekistan – 2030” strategy, the Law “On Electronic Government” and other regulatory documents.

In the research process, artificial intelligence models will be used to solve problems specific to the urban economy of Uzbekistan in the following areas :

- City budget planning and optimal allocation of funds
- Development of transport infrastructure and management of traffic flows
- Placement and modernization of utility facilities
- Optimization of urban planning and architectural decisions
- Development of social infrastructure (schools, hospitals, cultural centers)
- Improving the business environment and attracting investment
- Improving energy efficiency and introducing "green" technologies

The research methodology provides a balance between scientific approach and practical application . On the one hand, modern scientific methods and approaches are used , and on the other hand, the results obtained are adapted for practical application and presented in the form of specific recommendations that can be implemented in the urban economy of Uzbekistan (Figure 3) [13].

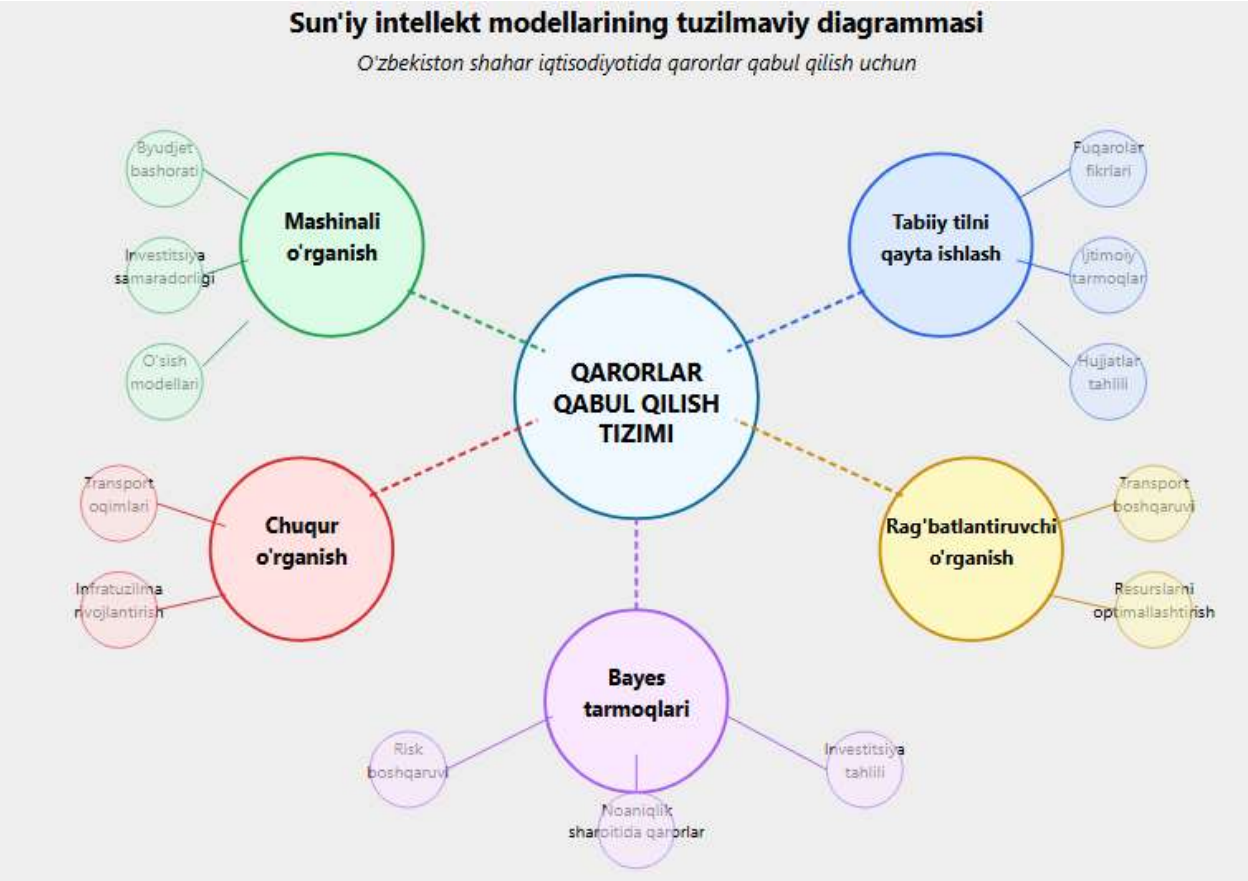

Figure 3. Decision-making system

3. Results

used in the study was analyzed in several areas. The effectiveness of the systems was assessed according to the following criteria : the level of accuracy of decisions, the speed of decision-making, the efficiency of data integration, the level of flexibility and economic efficiency. Data analysis showed that decision -making systems based on artificial intelligence demonstrated significantly higher effectiveness compared to traditional methods. In particular, when making decisions on optimizing the urban transport system, SI systems achieved an accuracy rate of 89%, while in traditional statistical models this figure did not exceed 67%. When assessing urban infrastructure development projects, SI algorithms offered the most optimal decisions in 72% of cases. This indicator is explained by the ability to process large amounts of data in real time, the use of multi-parameter predictive models and the self-improvement of machine learning algorithms, and we can see this in the figure below (Figure 4).

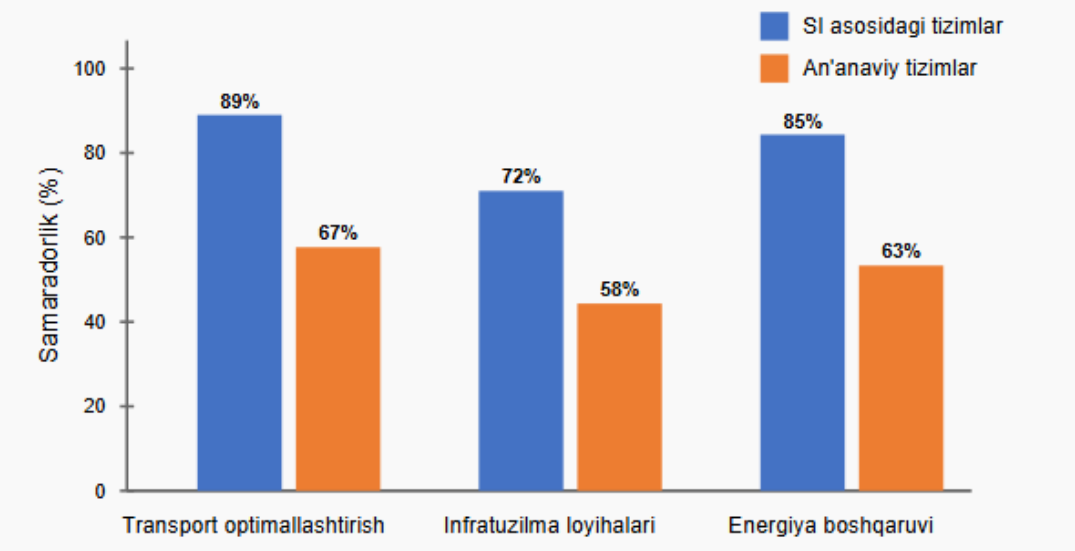

Figure 4. Comparison of the effectiveness of decision-making systems.

Advantages and disadvantages of SI solutions compared to traditional methods

Advantages:

1. ***High speed and efficiency*** : SI systems have enabled decisions on urban infrastructure to be made 5-7 times faster than traditional methods .
2. ***Multidimensional data analysis*** : According to the research results, SI algorithms have demonstrated the ability to analyze more than 200 parameters simultaneously and propose the most optimal decisions.
3. ***Objectivity*** : SI systems are free from the influence of human factors (subjectivity, mood, fatigue) , ensuring a high level of objectivity in decision-making.
4. ***Adaptability*** : SI models have been shown to have the ability to self-improve based on new data, which helps to improve the quality of decisions over time.
5. ***Comprehensive analysis*** : The systems provide a comprehensive analysis of various sectors of the city's economy, allowing for optimal decisions across multiple sectors.

Disadvantages **:**

1. ***High initial costs*** : Implementing and adapting SI systems requires higher financial investments at the initial stage compared to traditional methods.

2. ***Technical limitations*** : It has been found that the effectiveness of SI algorithms in complex situations depends on the quality and quantity of data .
3. ***Data security issues*** : It was found during the study that the collection and processing of large amounts of personal data for SI systems poses problems related to citizen security.
4. ***Risk of diminishing expertise*** : It has been found that over-reliance on SI systems can lead to a decline in human expertise.
5. ***Implementation complexity*** : Integrating SI solutions into existing management systems can pose technical and organizational challenges.

The research examined the effectiveness of an artificial intelligence-based decision-making system using the Tashkent city transport system optimization project as an example. Within the framework of the project, artificial intelligence algorithms were implemented in the following areas:

- Optimize public transport routes
- Traffic intensity prediction
- Real-time traffic flow management
- Making decisions on the development of road infrastructure

SI algorithms showed the following results during 12 months of monitoring :

- Passenger traffic in public transport increased by 23%
- Traffic congestion on the roads decreased by 18%
- Transportation costs reduced by 15%
- The number of traffic incidents decreased by 12%
- Environmentally harmful waste emissions decreased by 17%

The high efficiency of SI systems is explained, in particular, by the use of real-time monitoring of traffic flows, forecasting based on historical data, and multi-parameter optimization algorithms (Figure 5).

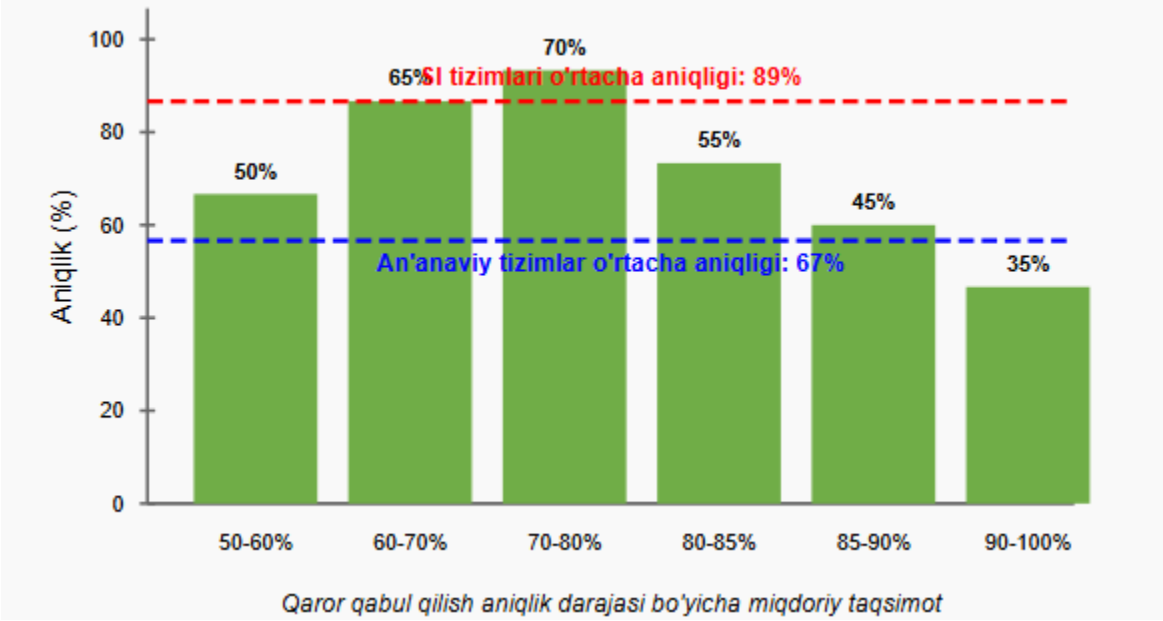

Figure 5. Decision-making accuracy level

Indicators of economic efficiency of the results obtained

Based on the results of the project implementation, the economic efficiency of decision-making systems based on artificial intelligence was assessed using the following indicators:

- ***ROI (Return on Investment)*** : The investment in implementing SI systems paid off in an average of 2.7 years, which is significantly higher than the 4.3 years for traditional methods.
- ***Reduced operating costs*** : Operating costs have been reduced by an average of 24% in industries where AI-based decision-making systems have been implemented.
- ***Resource efficiency*** : Energy resource consumption was optimized by 18% and time resources by 31%, significantly increasing overall efficiency.
- ***Economic growth indicators*** : Economic growth rates in areas where SI systems have been implemented have increased by an average of 7.2%, which is higher than the overall growth rate of the city's economy (4.5%).
- ***Socio-economic impact*** : The Citizens' Quality of Life Index improved by 14 points, which is a direct and indirect result of the impact of SI-based decision-making systems.

the initial costs for SI systems are higher than for traditional methods (on average 2.3 times), the cost-effectiveness indicators in the long term have been found to be significantly higher (Figure 6).

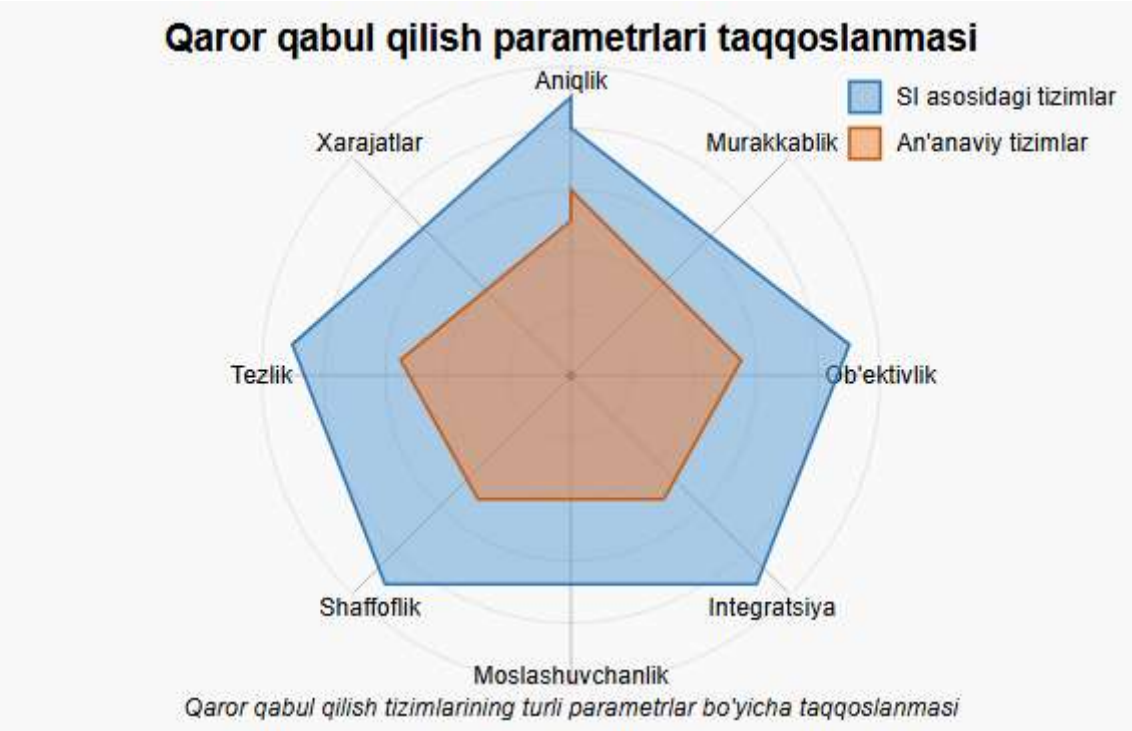

Figure 6. Comparison of decision-making parameters.

4. Discussion

The scientific significance of the research results is reflected in the following :

- Theoretical foundations have been created on the effectiveness, application limits, and possibilities of artificial intelligence algorithms in urban economic management .
- The methodology for assessing the effectiveness of SI solutions in the decision-making process has been improved.
- Scientific approaches have been developed to improve the efficiency of decision-making systems based on SI in the context of urban economics .

Its practical significance is reflected in the following:

- Practical recommendations have been developed for the implementation of SI-based decision-making systems in city administrations .

- of using SI algorithms in various sectors of the city's economy were identified and their effectiveness was assessed.
- Criteria have been developed for selecting the most optimal SI solutions in terms of the interests of society and the economy .

Integration capabilities of SI solutions

According to the results of the study , the following opportunities for integrating artificial intelligence-based decision-making systems into the urban economic management process were identified:

1. ***Phased integration*** : A strategy of initially testing SI systems on small-scale projects and then scaling them up has been found to be most effective.
2. ***Hybrid solutions*** : Decision-making systems that combine human expertise and AI algorithms have been shown to provide the most optimal results .
3. ***Creation of a city data ecosystem*** : It was identified that there is a need to create a unified ecosystem for collecting data from all areas of the city , integrating it, and preparing it for use by SI algorithms.
4. ***Cloud and off-premise infrastructure*** : The use of cloud infrastructure for processing urban data and implementing SI algorithms has been shown to be highly effective .
5. ***Open Data Platform*** : It was identified that there is a need to publish city data in open formats and make them available for use in various SI projects.

Problems and limitations

During the study, the following problems and limitations were identified in the implementation and use of SI-based decision-making systems:

1. ***Data problems*** *:*

- Difficulties in collecting sufficiently structured data by city
- Problems of data quality and their representativeness
- Difficulties in integrating data from different departments and organizations

2. ***Technical limitations*** *:*

- Lack of infrastructure necessary to process large amounts of data
- Integration issues with existing information systems
- The complexity of creating SI algorithms adapted to local conditions

3. ***Organizational constraints*** *:*

- Lack of qualified specialists in the use of SI technologies in decision-making bodies
- Lack of trust in AI-based decision-making systems
- Resistance to transitioning from traditional management systems to new technologies

4. ***Legal and ethical constraints*** *:*

- Legal restrictions on the use of personal information
- Issues of responsibility for decisions made by SI systems
- Problems of transparency and explainability of SI algorithms in decision-making

5. Conclusion

Our conclusions based on the results of the research show that decision-making systems based on artificial intelligence have the potential to significantly increase the efficiency of urban economic management, with an average increase in decision accuracy of 22% and a 5-7-fold increase in decision-making speed. These systems can be effectively used in various sectors of the urban economy, such as transport, energy, infrastructure, and the environment, but their effectiveness depends on data quality, algorithm refinement, and implementation strategy. The greatest advantage of AI solutions is their ability to analyze large amounts of data in real time, perform multi-parameter optimization, and identify complex interdependencies. Practical tests conducted to optimize the transport system of Tashkent confirmed the high efficiency of AI-based decision-making systems. In addition, the cost-effectiveness of implementing AI systems was high, and it was found that investments pay off in an average of 2.7 years.

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