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FORMATION OF SMART CITY PROJECTS IN AZERBAIJAN AND ANALYSIS OF LOCAL EXPERIENCE

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Abstract.

Modern technological development has led to the emergence of new approaches in urban management, one of which is the smart city concept. This article analyzes the formation, implementation, and local experience of smart city projects in Azerbaijan. The main purpose of the research is to examine the management principles, technological opportunities and socio-economic impacts of smart city projects implemented in the country. Comparative analysis, observation and scientific source review methods were used during the research process. The study found that smart city projects in Azerbaijan play an important role in the development of digital services, optimization of transportation systems, improvement of energy efficiency and ensuring sustainable management. The article also evaluates future development prospects and existing problems of local experience

Keywords: smart city, digitalization, sustainable development, management, urbanization.

1. Introduction

The primary objective of this study is to analyze the development characteristics, application areas, and local experience of smart city projects in Azerbaijan. Within the scope of the research, the theoretical foundations of the smart city concept are examined, smart city initiatives implemented in Azerbaijan are evaluated, and their socio-economic significance is assessed. The study is based on the analysis of scientific literature, comparative analysis, and observational research methods [1].

The application of technology in modern cities is no longer limited to improving administrative efficiency; it also aims to enhance citizens' quality of life, preserve environmental sustainability, and accelerate economic development. From this perspective, smart city projects have emerged as one of the most important models for the future of urban governance. The study and evaluation of smart city initiatives implemented in Azerbaijan are particularly

relevant for identifying future development opportunities and improving urban management practices.

The rapid growth of urban populations has led to numerous social and economic challenges in modern cities. In particular, increasing traffic congestion, inefficient utilization of energy resources, environmental pollution, and difficulties in the provision of public utility services have created a need for new approaches to urban governance. Traditional management models are no longer considered sufficiently effective in addressing these complex urban challenges. Consequently, many countries have accelerated the integration of digital technologies into urban management, leading to the widespread adoption of the smart city approach. The smart city model seeks to optimize urban infrastructure management, improve public services, and enhance citizen satisfaction through the application of advanced information and communication technologies. By integrating digital solutions into various aspects of urban life, smart cities promote greater efficiency, sustainability, and resilience [2].

In Azerbaijan, the expansion of the national digital transformation policy in recent years has created favorable conditions for the development of smart city initiatives. In particular, the reconstruction and redevelopment projects implemented in the liberated territories have provided an important opportunity for the application of both Smart City and Smart Village concepts. The investigation and evaluation of these projects significantly enhance the relevance of the present study.

2.Experimental Section

The main objective of this research is to analyze the characteristics, application areas, and local experience of smart city projects in Azerbaijan. The study focuses on examining the theoretical foundations of the smart city concept, evaluating the smart city initiatives implemented throughout the country, and determining their socio-economic significance.

Furthermore, the research investigates the impact of smart city projects on urban governance, the development of digital public services, and sustainable development. Particular attention is devoted to identifying the existing challenges associated with implementing the smart city model in Azerbaijan and exploring its future development prospects [3-5].

2.1. Main Characteristics of the Smart City Concept

The smart city concept represents a modern approach based on the extensive application of **Information and Communication Technologies (ICT)** in urban management. Its primary

objective is to improve the efficiency of municipal services while enhancing the quality of life of citizens. Through the implementation of advanced technological solutions, the smart city model enables the optimization of urban resource management and supports more sustainable urban development.

One of the defining characteristics of smart cities is the extensive use of digital technologies. In modern urban environments, transportation systems, energy supply networks, public safety services, and municipal utilities are increasingly managed through intelligent technological systems. This approach facilitates more efficient resource utilization while improving the quality, accessibility, and reliability of public services.

In addition, the smart city model plays a significant role in promoting environmental sustainability. Measures aimed at reducing energy consumption, increasing the use of renewable energy sources, and protecting the environment constitute some of the principal components of the smart city concept. For this reason, many countries are placing increasing emphasis on the implementation of smart city projects as part of their sustainable development strategies [6].

2.2. Local Experience with Smart City Projects in Azerbaijan

The expansion of digital transformation policies in Azerbaijan over recent years has significantly contributed to the development of smart city initiatives. Government-led digital transformation programs have created favorable conditions for the integration of innovative technologies into urban management. Among the most important initiatives are the expansion of e-government services, the implementation of digital governance systems, and the development of intelligent urban infrastructure [7].

One of the most significant examples of smart city implementation in Azerbaijan is the large-scale reconstruction of the liberated territories. The Smart City and Smart Village projects being implemented in the Karabakh and East Zangazur Economic Regions are based on the application of modern technologies in both urban and rural governance. These projects prioritize the deployment of smart energy systems, renewable energy sources, digital public services, and advanced communication technologies.

Moreover, Azerbaijan has launched various projects aimed at the digitalization of transportation systems, the modernization of urban security systems, and the improvement of

municipal utility services. These initiatives contribute to more efficient urban governance while increasing the quality of public services and enhancing citizen satisfaction.

2.3. Analysis of the Aghali and Aghdam Projects

Among Azerbaijan's smart city and smart village initiatives, Aghali Village and Aghdam City occupy a particularly important position. Aghali Village is recognized as the country's first Smart Village project. Within the framework of this initiative, renewable energy sources, digital management systems, and advanced agricultural technologies have been successfully implemented. Residential buildings, public services, and infrastructure have all been developed based on modern technological standards, creating an innovative and sustainable rural settlement [8].

The Smart City projects implemented in Aghdam focus on rebuilding the city's infrastructure in accordance with modern international standards. The principal objectives include the introduction of intelligent transportation systems, the promotion of environmental sustainability, and the improvement of energy efficiency. This integrated approach provides a solid foundation for the city's long-term sustainable development and economic revitalization.

The Aghali and Aghdam projects represent important examples of the practical implementation of the smart city concept in Azerbaijan. They demonstrate the effective application of digital technologies in both urban and rural governance and serve as valuable models for the implementation of similar projects in other regions of the country.

3.Result and Discussion

3.1. Advantages and Existing Challenges of Smart City Projects

The implementation of smart city projects offers numerous advantages for urban governance. First and foremost, the use of digital technologies enables public services to be delivered more efficiently, rapidly, and transparently. Furthermore, the efficient utilization of energy resources, the reduction of traffic congestion, and the improvement of environmental conditions are among the most significant benefits associated with smart city initiatives. These projects contribute to the optimization of urban infrastructure while promoting sustainable resource management and enhancing the overall efficiency of municipal services.

Smart city projects also play a crucial role in improving citizens' quality of life. The expansion of digital public services simplifies interactions between citizens and government institutions,

making public administration more accessible and user-oriented. At the same time, the enhancement of intelligent security systems contributes to creating safer urban environments. Moreover, the adoption of advanced technologies stimulates economic growth by encouraging innovation, attracting investment, supporting digital entrepreneurship, and fostering the development of knowledge-based economies.

Despite these advantages, the implementation of smart city projects is accompanied by several significant challenges. One of the primary obstacles is the substantial financial investment required for the development of digital infrastructure and intelligent urban systems. In addition, the incomplete development of technological infrastructure and insufficient levels of digital literacy among both public institutions and citizens remain important barriers to successful implementation. Furthermore, cybersecurity and data protection have emerged as critical concerns within smart city ecosystems. As urban services become increasingly interconnected through digital technologies, ensuring the confidentiality, integrity, and security of data becomes essential for maintaining public trust and protecting critical urban infrastructure.

4. Conclusion

The findings of this study demonstrate that the smart city concept plays a vital role in contemporary urban governance. The integration of Information and Communication Technologies (ICT) into urban management contributes to the more efficient delivery of public services, the sustainable utilization of urban resources, and the improvement of citizens' quality of life. As in many other countries around the world, Azerbaijan has placed increasing emphasis on the development and implementation of smart city initiatives as part of its national digital transformation strategy.

The research examined the smart city projects implemented in Azerbaijan and evaluated the country's practical experience in this field. Particular attention was devoted to the Aghali Smart Village and Aghdam Smart City projects, which have demonstrated considerable potential in the areas of digital governance, energy efficiency, and sustainable development. These initiatives provide valuable examples of how innovative technologies can be successfully integrated into urban and rural planning while establishing a foundation for the implementation of similar projects in other regions of the country.

The study further indicates that the successful implementation of smart city projects requires continuous investment in technological infrastructure, the improvement of digital literacy, and the strengthening of cybersecurity measures. In addition, effective institutional coordination,

public participation, and the adoption of international best practices are essential for ensuring the long-term sustainability of smart city initiatives.

In conclusion, the further expansion of smart city projects has the potential to make a substantial contribution to Azerbaijan's sustainable urban development and ongoing digital transformation. By integrating advanced technologies into urban governance, improving public services, and promoting environmentally sustainable practices, smart city initiatives can enhance economic competitiveness, improve the quality of urban life, and support the country's long-term development objectives.

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