https://doi.org/10.51176/1997-9967-2021-2-188-196
МРНТИ 06.61.33
JEL: O30, O32, R1

Development of the smart city on the example of aqkol project: concepts and main trends[1]

M.T. Urdabayev [1], I.D. Turgel'[2]
[1] Al-Farabi Kazakh National University, [2] Ural Federal University

Abstract

The purpose of this research work is to analyze the concept of the "smart city" and its characteristics in literature, to assess the application of the concept in Kazakhstan using the example of the "Smart Aqkol" project in order to identify a number of advantages and disadvantages, problems and trends of innovative technologies in the cities of Kazakhstan. In the course of the research, the author carried out a literary review of the concept of "smart city" by domestic and foreign authors, and also considered the experience of implementing "Smart Aqkol" in Akkol. The methodology of the work is to systematize indicators and approaches to the analysis of smart cities projects using the example of "Smart Aqkol". The author carried out a SWOT analysis to evaluate this project and form recommendations for future projects of smart cities in Kazakhstan. In conclusion of the study, conclusions were formulated about the feasibility of using the experience of "Smart Aqkol", which can be used as an example for other cities of Kazakhstan in the implementation of similar projects. The study identified the advantages of the implemented experience based on "Smart Aqkol" and provided statistical evidence of the success of this project, which showed a clear example of the fact that in Kazakhstan there are prerequisites for the effective development of smart cities, similar to "Smart Aqkol".

Key words: city, smart city, innovation , SWOT-analysis, Kazakhstan, Aqkol

«Smart aqkol» жобасы үлгісінде ақылды қаланы дамыту: тұжырымдамалар мен негізгі бағыттар

Түйін

Осы ғылыми-зерттеу жұмысының мақсаты – «ақылды қала» тұжырымдамасын әдеби талдау жасап, Қазақстанда «ақылды қала» тұжырымдамасын «Smart Aqkol» жобасы негізінде қолдануын бағалай отырып, бірқатар проблемалар мен даму тенденцияларын анықтау. Зерттеу барысында автор отандық және шетелдік авторлардың «ақылды қала» тұжырымдамасына әдеби шолу жасап, сонымен қатар Аққөл қаласында «Smart Aqkol» бағдарламасын енгізу тәжірибесін қарастырды. Жұмыстың әдістемесі - « Smart Aqkol» мысалын қолдана отырып, ақылды қала жобаларын талдаудың индикаторлары мен тәсілдерін жүйелеу. Автор осы жобаны бағалау және Қазақстандағы ақылды қалалардың болашақ жобаларына ұсыныстар қалыптастыру үшін SWOT-талдау жүргізген. Зерттеудің қорытындылары бойынша осыған ұқсас жобаларды Қазақстанның басқа қалаларында жүзеге асыруға мысал ретінде қарастыра отырып «Smart Aqkol» тәжірибесін қолданудың орындылығы туралы тұжырымдар жасалды. Зерттеу барысында «Smart Aqkol» негізінде енгізілген тәжірибенің артықшылықтары анықталды және Қазақстанда «Smart Aqkol» -ке ұқсас ақылды қалаларды тиімді дамытудың алғышарттары бар екендігінің айқын мысалы ретінде бұл жобаның сәттілігінің статистикалық дәлелдері келтірілген.

Түйін сөздер: қала, ақылды қала, инновация, SWOT-талдау, Қазақстан, Аққөл.

Развитие умного города на примере проекта «smart aqkol»: концепции и основные направления

Анотация

Цель настоящего исследования заключается в литературном анализе концепции «умного города» и его характеристик, оценка применения концепции «умный город» в Казахстане на примере проекта «Smart Aqkol», чтобы выявить актуальные, современные проблемы и тенденции развития. В ходе исследования автором проведен литературный обзор концепции «умный город» отечественных и зарубежных авторов, а также рассмотрен опыт внедрения «Smart Aqkol» в г. Акколь. Методология работы заключается в систематизации показателей и подходов к анализу проектов умных городов на примере «Smart Aqkol». Автором проведен SWOT-анализ для оценки данного проекта и формирования рекомендаций для будущих проектов умных городов в Казахстане. В заключении исследования сформулированы выводы о целесообразности применения опыта «Smart Aqkol», который может быть использован в качестве примера для других городов Казахстана при реализации подобных проектов. В ходе исследования были выявлены преимущества внедренного опыта на базе «Smart Aqkol» и приведены статистические подтверждения успеха этого проекта, которые показали наглядный пример того, что в Казахстане существуют предпосылки для эффективного развития умных городов, схожих со «Smart Aqkol».

Ключевые слова: город, умный город, инновация, SWOT-анализ, Казахстан, Акколь

1 This research is funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (targeted funding program «Developing the concept and mechanisms of balanced territorial development of the economy and society of Kazakhstan»).

Introduction

The COVID-19 pandemic has become the most influential cause of economic change in Kazakhstan in the last twenty years. Today, pandemic consequences are undermining its growth trends. In January 2020, various international organizations and analysts predicted that the world economy would begin to recover from the global financial crisis and the lowest growth rates. As a result, many developed and developing countries are struggling with the social and economic consequences of coronavirus infection. Moreover, the massive negative impact of COVID-19 on the global economy has drastically changed the lives of many citizens in ways that could not have been imagined before.

That is why Kazakhstan should be in the trend of global changes, such as global informatization of society, urbanization, increasing the role of new "smart type" cities with a science-intensive economy, reducing socio-economic imbalances. This applies to every other nation. However, the peculiarities of the raw material regions of Kazakhstan do not contribute to the transition to new technological systems, make it difficult to system "science - education – state" realization. The fragmented nature of the existing institutional environment, infrastructure provision, and innovative development cannot be overcome. In 2016, Kazakhstan approved a system of national standards for smart city projects [1]. It included common requirements for the ability to urban property centrally manage, including maintaining a high level of security, such as using innovations in housing, urban transport, public health, information technologies, law enforcement agencies, and public organizations [1].

In the current context of small cities of Kazakhstan development, it is already possible to estimate prospective trends of the "smart city" realization. Therefore, there were made attempts to describe and show the advantages of implementing the "smart city" model on the example of the "Smart Aqkol" in Aqkol city. Many cities of Kazakhstan are already covered by GPON optical networks and indeed more than 30 thousand Kazakhstan apartment buildings, 100000 entrances, and 1.5 million apartments. More than 47000 modern video cameras have been installed, which carry out round-the-clock surveillance and monitoring of traffic; M2M network has also been implemented based on the LoRa project in such cities of Kazakhstan as Almaty, Nur-Sultan, Shymkent, etc. [2]. This indicates that there is a primary infrastructure for the realization of "smart cities".

In this context, the basic premise of this scientific research is, on the one hand, the necessity of smart technologies using, on the other hand, the necessity of social and economic inequalities reducing, connecting with a population in the regions of the country establishing. This can be handled by effective response measures through the "smart city initiatives" formation and development that can provide comfort and safety. Moreover, the concept of "smart city" formation implies the creation of a coherent system of income life support, including effective interaction of authority with the population in various spheres of the economy, such as finance, education, science, medicine, and business. All this requires justification of new principles and mechanisms of "smart cities" formation in the post-epidemic period.

That is why the question of conducting an analytical literature review of existing concepts for managing the "smart city" or "smart cities" development, as well as assessing the experience of applying the "smart city" concept on the example of the implemented "Smart Aqkol", for the main problems and trends of innovative technologies, which is the purpose of this study.

Current research, described the positive experience of the "smart city" concept on the example of "Smart Aqkol", which can be used as an example for other cities of Kazakhstan in the development and realization of the "smart city" project.

The major results achieved by applying the selected methods to the available information are: 1) evaluation of the project based on "Smart Aqkol" according to SWOT-analysis methodology and a number of indicators; 2) identification of several advantages of the project, which allowed us to reach conclusions on successful realization of "Smart Aqkol"; 3) Assessed the risks of implementing the smart city project; 4) Formed recommendations on the development of smart city in other cities of Kazakhstan.

Literature review

It is necessary to investigate concepts, models, and existing views on the management of "smart city initiatives" development, and after that to give the author's vision of "smart city". General economic theories, economic geography, and, more recently, interdisciplinary theories of spatial development have had an important influence on the essence and content of the concept of "smart city" formation. The most important components of the theory of "smart cities" formation in the field of scientific and technological development intersect with many special sections of spatial development. Thus, the concepts of the formation and development of the city's smart space were based on the transformation of various neoclassical theories of regional growth and development.

The "smart city" concept was inherent in the process of integrating several ICT to manage their activities. The term "smart city" has become actively used not only in the context of the city but

also in a variety of management strategies to improve the competitiveness and standard of living of the city. Most economists interpret the definition of "smart city" to accommodate the info-communication infrastructure, which is logical. Due to this system, the management of the internal processes of the city is simplified and the standard of living of the population is improved. The 1990s are precisely the period in which this concept was formed. This period also coincided with a period of the wide availability of ICT in Europe and the United States.

Thus, for the first time, the "smart city" term was used in the 1990s in the period between XX and XXI centuries, at a time when Singapore became known as an "intellectual island" and Toronto as a "smart city". Initially, this concept determined the methods of introducing innovative technologies for the development of the virtual spatial expansion of the city and its transition to the information field. The term "housing classes" introduced in the 1960s by two researchers, such as R. Moore and D. Rex is of particular interest in this research. This concept became an alternative to economic stratification to reflect the factor of residence as one of the most significant in the context of the characteristic of a city [3].

E. Burgess proposed a so-called spatial differentiation of the city, consistent with a theory based on concentric circles [4]. He considered business districts to be centers of urban development. These areas are surrounded by mixed zones of ethnic neighborhoods and slums, followed by industrial zones and labor estates. Burgess noted that the next layer was middle-class housing. The final concentric circle, in his opinion, is the elite's suburban property. However, despite the traditions and foundations, such generally accepted approaches have recently lost their relevance.

M. Ablamaiko noted in their work that the "smart city" term originally appeared in the 1990s in mass media when journalists started the topic of ICT. It was during this period that there was a necessity to develop the "smart city" concept to improve the quality of life of the population of foreign countries [5].

According to N.Y. Pivkina, the influence of the "smart city" concept has been researched by many authors, but there is currently no single agreement in the scientific community about what its advantage is, about what components should include the "smart city" concept to ensure a high standard of living for the population [6]. M.V. Argunova in her "Smart city model as a manifestation of technological system" noted that smart city is defined as ensuring the quality of life of the population by using modern tools, which has become necessary for the economic application of urban systems of life of the population of countries. She highlighted, the "smart city" model consists of several sections, such as "smart economy", "smart mobility", "smart management", "smart environment", "smart living" [7].

A.S. Perelozova identified several main elements of the "smart city" model in her "On the problem of public administration in the smart cities concept" [8]. Thus, she presented in territorial location, infrastructure, city population, city government. M.F. Sharifyanov, in his scientific research "Smart City is a new round of territorial digital inequality" described the model of a smart city differently [9]. According to his point of view, "smart city" can be described as a "smart, digital, sustainable or prosperous city". Sharifyanov believed that an intellectual city is a city with different capabilities that allow organizing an innovative intellectual resource. The author noted that a smart city is a city with high energy efficiency and high-quality ecology. Further, under the digital city, the author understands the city, which faces the main task-to improve the quality of life of the population of the country [9]. E. Pakhomov considered the basic model of the city and claims that the term "smart city" was introduced by the founder of the council of smart cities by J. Burst, who emphasized that "smart city" is, first, a model in which the necessary data is collected, analyzed, and stored for the exchange of information between urban subsystems [10].

Based on literature review, it is needed to note that many scientific studies have studied the concept of forming a "smart city" model. However, in various literary sources, the "smart city" concept is ambiguous. There are many definitions of smart cities, all of which are interpreted differently. And as the analysis of the literature review showed, the terminology of the "smart city" is multilateral but is not clear. According to literature review, several main characteristics of a "smart city" can also be identified, it has a virtual spatial expansion of the city and its transition to the information field, is closely related to ICT, and is based on the collection, analysis, and storage of the necessary data. Besides, as far as we know, there are no scientific studies aimed at assessing the experience of the "smart city" project forming in Kazakhstan. Therefore, we undertook to consider the experience of the "smart city" concept using the example of the experience of Aqkol.

Methodology

The study will be conducted based on a structural and functional approach using the methods we have chosen. In this scientific study, we plan to collect relevant information and data to focus on the purpose of the study, and as a result, the results obtained will help solve the research problem. Ac-

cording to recent experience, many analysts and economists used SWOT analysis method[11-13]. We need systemic economic knowledge, experience, and intuition. SWOT analysis is one of the most common analytical methods, which to assess the strengths and weaknesses, as well as the opportunities and threats that affect it. The classical method of SWOT analysis is described in the works by H. Weihrich, K. Fleischer and J. M. Bryson[14-16]. In the scientific literature, the content of SWOT analysis assumes two above-mentioned points (internal and external environment), and the compilation of a SWOT analysis matrix. SWOT analysis method has many modifications, including target development and analysis. SWOT analysis is versatile, and it makes this analysis be used not only as a study tool but also as a method of forming the situation as an initial structuring factor.

The main advantages of SWOT analysis as a research methodology are [17]:

- This is a universal method that is applicable in a wide variety of areas of economics and management. It can be adapted to a research object of any level.
- This is a flexible method with a free choice of the analyzed elements, depending on the goals set.
- It can be used for both operational assessment and strategic planning for a long period.

However, the task of SWOT analysis is to provide a structured description of the situation that needs to be resolved. For a more complete efficiency of the method, the construction of options for actions based on the intersection of fields is also used. To that end, different combinations of environmental and internal characteristics of the company are considered consistently. All possible pairs of combinations are considered and those that should be considered in developing the strategy [18].

However, the objects of SWOT analysis can also be, for example, economic sectors, cities, industry, non-profit organizations, and another [19-20]. Thus, SWOT analysis is applicable to objects of different scales and not only in areas where there is a focus on increasing profits. But it can be used in areas where the goals are complex social or socio-economic in nature. In other words, the object of modern SWOT analysis in a broad sense is a socio-economic object. In our research, we decided to choose a city as the object.

Thus, we attempted to evaluate one of Kazakhstan's projects named "Smart Aqkol", which has been introduced in 2018 and is being actively implemented. To assess it, we collected data and formalized it into a SWOT analysis. Today, there is no unified standard for evaluating "smart cities" projects. Therefore, we propose to evaluate and analyze smart systems through SWOT analysis. The maturity model method can also be used to evaluate smart city projects, which can be applied to evaluate a specific city or project.

Unlike the SWOT analysis, the maturity model is not suitable enough to evaluate the project, as this method will not identify the weaknesses and threats of the project to identify the various issues associated with smart city projects. That is why we chose a SWOT analysis to identify the advantages and disadvantages of project realization instead of a maturity model.

We have identified the advantages of "Smart Aqkol" realization, which allows us to think about its effective experience. The analysis of the study made it possible to see its current state and projections scenarios for other cities of the Republic of Kazakhstan in terms of the socio-economic development of the whole country.

Results and discussion

The spread occurrence of coronaviruses infection has led to the pandemic announcement. For Kazakhstan COVID-19 has become the greatest challenge. In the result, many regions, and cities of Kazakhstan were isolated. High level of uncertainty in terms of the future development and the probability of repeated administration of restrictive measures in the future will slow down the recovery after isolation. According to our estimates, in 2020, the level of gross regional product (GRP) per capita in Kazakhstan will significantly decrease due to domestic spending and external demand, which will increase inflation and social differentiation. In view of this, it is important for Kazakhstan to minimize negative impact of the pandemic, and to assess the level of development of enterprises.

The basic factor of innovational productivity is the firm size, sector, and structure, which have wide major influence on innovation activity. Therefore, current low rate of economy development and enterprises development level in the country have complex set of problems. Kazakhstan has the lowest level of expenses on scientific research and developments - 0,12% of GDP (82333.1 million tenge), and in addition, the number of employees performing R&D has decreased. Moreover, according to the results of global innovation index for 2019 Kazakhstan has taken the 79th place, having declined for 5 positions compared with previous year.

Today, five cities have been included in the concept of smart cities creation and development - Nur-Sultan, Karaganda, Shymkent, Aktobe, and Almaty [1]. Subsequently, the project is planned to be realized in other cities of Kazakhstan. Kazakhstan is in the early stages of innovative technologies assimilation. It is technologies related to the "smart cities" concept compared to developed countries,

as evidenced by the rating of smart cities of Kazakhstan for 2020. The most common practice in Kazakhstan is the introduction of smart services into the urban environment, which is most often proactive. For example, in Almaty and Nur-Sultan, projects for the introduction of intelligent systems in the field of traffic safety were implemented. In several cities, such as Karaganda and Shymkent, it is planned to implement pilot projects for the development of smart management of housing and communal services. The presented list of planned implementations of the elements of the "smart city" concept indicates the need for research and the effectiveness of the implementation of such projects.

The most attractive areas are those where the advantages of using them are obvious for the introduction of intelligent technologies in Kazakhstan. These include transport and green energy systems that allow to implement complex tasks-from optimizing traffic to improving road safety and improving the environmental situation in the city.

Currently, there is a growing interest in the concept of a "smart city" in Kazakhstan, but there are relatively few examples of the development and implementation of projects in this direction. Considerable experience has been gained in this area based on the Aqkol project. Smart Aqkol project was implemented as part of one of the main directions of the state program "Digital Kazakhstan" for the introduction of the concepts of smart cities in Kazakhstan. We will give a brief description of the features of the implementation of the "smart city" concept in Aqkol. For example, Smart Aqkol is an example of creating a smart city from scratch for Kazakhstan. Due to this we decided to choose the "Smart Aqkol" project to evaluate the project using the author's methodology. It has been considered one of the first large projects realized in a small town with 14 thousand residents. It is a city named Aqkol, which is already equipped with many smart sensors and meters [21]. The main reason for the realization of the "Smart Aqkol" is that place is located near the capital of the Republic of Kazakhstan and has the full-fledged infrastructure and is characterized by a high level of protection of communication channels, where there are many data centers [21].

This project was implemented by the administration of the Akmola region and partners: Kazakhtelecom, the Eurasian Group (ERG), AEDC, and Tengrilab together with the Akimats of the Akmola region. An analytical system was created in the city to manage communal institutions [22]. Information is collected from the center screen and analyzed by employees. In case of any changes to the system, they quickly make decisions and send data to the government, utilities, etc. The city's apartment buildings are equipped with more than 6 thousand counters, which data is transferred automatically to a smart system [22]. The streets of Aqkol are equipped with smart lamps with an option to reduce the brightness of the light, all of them are switched on and off using the installed system [1]. Moreover, there are more than 10 LoRaWAN stations in the city, all of which provide a quick collection of cold-water supply indicators. On the streets of the city, in particular, in public places (hospitals, schools, pedestrian crossings), video surveillance is installed. It is monitoring the place of observation and facial recognition of offenders 24 hours a day [22].

The smart system monitors the level of urban air pollution: every 10 minutes it collects data on the state of atmospheric air and sends them to a single tracking system. The system monitors temperature conditions, humidity, road surface temperature, wind speed and direction, precipitation, etc. All relevant information is promptly sent to a single center "Smart Aqkol" [9]. Thus, «Smart Aqkol» collects, analyzes, and stores information, which provides improvement of the population life quality in terms of medical and general education services, environmental ecology, housing, and communal services, and the safety of life of the city population are built. It is noted that the system has reduced criminal activity in Aqkol [21].

According to estimates by the law enforcement agencies of the Internal Affairs Department of Internal Affairs of Aqkol city, in 2020, during the realization of the smart system, the number of offenses in public places decreased by 35 percent, theft by 15 percent, violence by 71 percent, and alcohol-related offenses by 61 percent, which allows us to conclude the positive effect of the introduction of the smart system [23].

We collected information about the implemented project and evaluated it according to the SWOT methodology (Table 1).

We emphasized the usefulness of "Smart Aqkol". According to the Akmola Administration and the results of the survey of city respondents, there are several advantages to its use [22]:

- reduction of crimes (40%);
- increasing of response to emergency rapidity (response to an emergency);
- decrease in the incidence of the population (15%);
- reduction in water consumption (30%);
- reduction of power supply costs (60%).

Table 1 – **SWOT-analysis of "Smart Aqkol"**

Strengths (S)	Weaknesses (W)
1. Location: Aqkol city with 14,000 inhabitants near Nur-Sultan, the capital of Kazakhstan, because it is close to the capital, has the necessary infrastructure.	1. High cost of the implemented project due to expensive software.
2. The city has a full infrastructure.	2. Long realization period of the project.
3. It has a high level of protection of communication channels and a large number of data centers.	3. Long payback period of the project.
4. The city is equipped with many smart sensors and meters.	4. Lack of awareness among the population, during which there are obstacles to the quick implementation of the project.
5. Good state of the city's environment.	5. Lack of finances.
Opportunities (O)	Threats (T)
1. Use multiple systems and manage the intellectual system of the urban environment.	1. Lack of highly qualified specialists to implement projects.
2. Using energy-saving tools.	2. Lack of suitable software.
3. Improvement of work of city facilities.	3. Reluctance of the population of Kazakhstan to change their way of life.
4. Rapid data accumulation and analysis for the management of the city.	4. Issues in attracting investment.
5. A modern digital environment.	5. The system is difficult to integrate due to suboptimal information sharing.
6. Application of an integrated system that is characterized by simple activation and deactivation.	6. The complexity and ambiguity of a project, which channels can be blocked shortly.
7. High level of safety and fault tolerance.	7. Due to the synchronization of the data exchange system, it can be overloaded and not run promptly.
Note - Compiled by the authors according to the source [21].	

The cities of the Republic of Kazakhstan have many problems for the implementation of smart projects, in the solution of which the experience of the city of Aqkol could help. The most acute issue, in our opinion, in the cities of Kazakhstan is the lack of financing of smart projects or insufficient experience of the population and understanding that it is necessary to make a transition to innovation and digitization "smart city" [24].

Here it is necessary to mark a few issues, since many cities (such as Nur-Sultan, Almaty, Shymkent, and others) may face a whole range of problems because of the advantages of smart cities and the existing prerequisites of the implementation of a similar project as "Smart Aqkol".

1. The necessity of preparing a plan for the integrated service of the "smart city" project.

Aqkol's experience has shown that it is necessary to develop a general project with an exact scope of work and projections scenarios of the necessary investments in a time of project realization. The solution for this is the involvement of highly qualified specialists who understand and know the basics of work, the features of smart equipment, who will develop a smart project scheme with all mounting points, connection, and monitoring methods.

2. The necessity of highly qualified group specialists creating that include external experts in terms of planning and development of the "smart city" project.

Highly qualified specialists and external experts were involved in the realization of the "Smart Aqkol". To implement the project in Aqkol, the Akmola Electric Grid Company, IT-company Tengri Lab, Kazakhtelecom, and other partners, the Akimat of Akmola region were involved.

3. The lack of modern software products, which today are considered expensive.

This issue requires a large number of financial expenditures from the state and business. Private investors were engaged in purchasing expensive equipment for the "Smart Aqkol" realization. They invested in this project, which functioning is effective because of means of participants, without the interference of the state. Therefore, the best solution is organizing a public-private partnership, which demonstrates the "Smart Aqkol" success, which was implemented through the investments of project participants, without government funding. Aqkol's experience has demonstrated that the development of the city is possible together with business and the scientific community on mutually beneficial partnership terms.

Therefore, the best solution for the realization of similar projects in other cities can serve the Aqkol experience. Other cities can invite cooperate companies that develop and promote smart equipment.

4. The lack of awareness of the benefits of implementing such projects.

Information on the benefits of the project can be a way of solving the lack of public awareness. The administration of Aqkol sought to inform people of the possibilities and advantages of the smart system. This is why it is necessary to actively inform the population about all the advantages of the implemented project in the media, through social networks. Potential consumers of a smart system need to explain how they will benefit from its implementation. In the immediate future, other cities of Kazakhstan will be able to adopt the effective experience of the "Smart Aqkol" and implement a similar project.

Further, we have suggested the main trends of formation and development of "smart city" in Kazakhstan (Table 2).

Table 2 - **Main trends of a smart city development**

Smart environment (natural resources) • Energy efficiency • Renewable energy • Environmental protection • Saving resources	Smart lifestyle (quality of life) • Sustainable consumption • Ergonomic layout • Social interaction • Healthy lifestyle
Smart people (social and human assets) • Advanced ICT users • Accessible education • Participation in public life and resourcefulness	Smart economy (competitiveness) • Productivity • New products, services and business models • International collaboration • Responsiveness
Smart mobility (transport and ICT) • Integrated transportation systems • Environmentally recommended transport modes • Healthy lifestyle	Smart management (involvement) • Citizens' engagement in policy-making • Useful services • Public data
Note - Compiled by the authors according to the source [25]	

In particular, the central principle lies in integrated development. This list of trends is not exhaustive. It should be noted that "smart cities" should be viewed as a response to the fight against excessive pollution of the environment, overpopulation, and rational use of resources. Cities of this format are becoming strategic locations based on which the issues and threats of unemployment, inequality, and increasing prosperity are solved. Consequently, the "smart city" concept is considered from the prism of the long period of formation concerning perspective trends. In terms of its structural and substantive content, the new format of cities concept is an indicator of the actual processes in the context of the formation of a new space.

Conclusions

Many scientific kinds of research have studied the concept of "smart city" model formation. This is evidenced by the review of literary sources. Researches that were described in this study formed the methodological basis for the scientific topic. This is why a rethinking of the "smart city" concept emerged from the scientific perspective. Perspective, such as the fusion of cultural heritage with electronic and technological structures; urban design based on the needs of residents; the impact of the outside world on the awareness and experience of people; the significance of the process in globalization and the economic component. However, in various literary sources the concept of "smart city" is ambiguous. There are many definitions of smart cities, all of which are interpreted differently. And as the analysis of the literature review showed, the "smart city" terminology is multilateral, but so far there is no clear definition of it.

It should be noted that "Smart Aqkol" is an effective experience of realization of smart city projects in Kazakhstan. After the "Smart Aqkol" launch Kazakhstan has become fully aware of changes in the quality of life of the Aqkol city population. A smart city project helped to reduce criminal activity, improve the state of the ecology of the city's environment, improve the quality of educational services, housing, and public utilities, and the health sector. Nevertheless, based on the conducted research, we highlighted the following most common problems that should be considered by the public authorities when developing and implementing the concept of "smart city" in Kazakhstan:

- organizational barriers, lack of coordination and communication between participants in the de-

velopment and implementation of the "smart city" concept, lack of appropriate labor resources, low level of popularization of the "smart city" concept;

- financial barriers associated with insufficient financial resources and caused by the lack of business models that determine the return on investment in projects;

- infrastructure barriers that reflect the lack of integration of the "smart city" concept into existing urban planning plans, the lack of development of housing and communal services, and the transport system.

The "smart city" model was worth the money spent, as it helps to identify the peak of danger, any threat to the city. With the help of the system, the specialists of the center promptly react to any changes and take effective measures to eliminate accidents, emergencies, and other similar situations.

According to the experience of Aqkol city modern information and communication infrastructure is needed to reach the new level of the urban system in Kazakhstan, so that all implemented systems can function correctly. Therefore, there is a need for the full participation of businesses, institutions, and research centers that work together on such projects. We believe that for the effective formation and development of the "smart city" concept in Kazakhstan, it is necessary to create and introduce fresh innovative technologies; rationally use the urban infrastructure; integrated development of the innovation structure; establishing close ties between local governments and the population of the city; organize and apply an intensive process in related industries and large technology corporations.

References

1. V Kazahstane utverzhdeny nacional'nye standarty v oblasti SmartCity URL: https://www.inform.kz/ru/v-kazahstane-utverzhdeny-nacional-nye-standarty-v-oblasti-smartcity_a2975010 (date accessed: 27.02.2021)

2. Smart-city: umnye tehnologii uluchshajut zhizn' kazahstancev. URL: https://strategy2050.kz/ru/news/52068/ (date accessed: 28.02.2021)

3. Rex J., Moore R. Race, Community and Conflict: A Study of Sparkbrook// Oxford University Press – 1967 - Volume 46 - 304 p.

4. Berdzhess Je. Rost goroda: vvedenie v issledovatel'skij proekt / Jernst Berdzhess // Lichnost'. Kul'tura. Obshhestvo. - 2002. - C. 168-181.

5. Ablajmejko M.S, Ablajmejko S.V. Umnyj gorod»: ot teorii k praktike // Nauka i innovacii. – 2018. - № 6 (184). – C. 1-7.

6. Pivkina N.Ju. Umnye goroda kak novyj standart kachestva zhizni naselenija // Gumanitarnye nauki. Vestnik Finansovogo universiteta. – 2019. – № 9 (4). C. 120-125.

7. Argunova M.V. Model› «Umnogo» goroda kak projavlenie novogo tehnologicheskogo uklada // Nauka i shkola. – 2016. - № 3. – C. 14 – 23.

8. Perelozova S. O probleme publichnogo upravlenija v koncepcii umnyh gorodov // Politicheskaja jekspertiza: POLITJeKS. - 2015. – № 2. – C. 1-13.

9. Sharif›janov T.F., Gajnanov D.A. Modeli preodolenija cifrovogo neravenstva v malyh udalennyh naselennyh punktah na osnove gosudarstvenno-chastnogo partnerstva // Regional›naja jekonomika: teorija i praktika. - 2016. - № 8. - C. 19-32.

10. Pahomov E.V. Bazovaja model› umnogo goroda // Inzhenernyj vestnik Dona. – 2018. - №4 (51). - C. 96.

11. Filippova T.A. Vyjavlenie problem razvitija malyh gorodov s primeneniem SWOT-analiza // Vestnik Altajskogo gosudarstvennogo agrarnogo universiteta. – 2017. -№7 (153). - C. 186-191

12. Senichenko V.E. Ocenka social›no-jekonomicheskogo razvitija malogo goroda s omoshh›ju metoda SWOT-analiza (na primere g. Ahtubinska Astrahanskoj oblasti) // Pskovskij regionologicheskij zhurnal. – 2013. - № 16. – C. 55-60.

13. Kovtunenko M.G., Kobjakin V.I. Ob#edinenie metodiki SWOT-analiza i kvalimetricheskogo podhoda dlja prinjatija investicionnyh reshenii pri upravlenii razvitiem territorii goroda // Evrazijskij Sojuz Uchenyh. – 2020. - №8(77). – C. 28-32.

14. Weihrich H. The TOWS Matrix – A Tool for Situational Analysis // Long Range Planning. – 1982. – Volume. 15, № 2. – P. 54–66.

15. Fljajsher K. Strategicheskij i konkurentnyj analiz. Metody i sredstva konkurentnogo analiza v biznese / K. Fljajsher, B. Bensussan. – Moskva : BINOM, 2005. – 541 c.

16. Bryson J.M. A Strategic Planning Process for Public and Non-profit Organizations / J. M. Bryson // Long Range Planning. – 1988. – Volume. 21, № 1. – P. 73–81.

17. Grishina S.V. Preimushhestva i ogranichenija SWOT-analiza // Aktual›nye voprosy jekonomicheskih nauk. № 5-5. – 2009. – C. 37- 41.

18. Suharev P.N., Grigorenko A.S. Metod SWOT-analiza: ego preimushhestva i nedostatki // Jekonomicheskie nauki Marketing i menedzhment - 2010. - № 6 - C 25-28

19. Cottrell S. Skills for Success / S. Cottrell. – Palgrave Macmillan, 2003. – 312 p.

20. Lees-Marshment J. Political Marketing and British Political Parties: The Party's Just Begun / J. Lees-Marshment. – Manchester University Press, 2001. – 250 p.

21. Umnyj gorod Akkol› URL: https://rodestech.com/Aqkol/ (date accessed: 24.03.2021)

22. Iskusstvennyj intellekt — jadro «umnogo» goroda Akkol› URL: https://profit.kz/news/51989/Iskusstvennij-intellekt-yadro-umnogo-goroda-Akkol/ (date accessed: 25.03.2021)

23. Aqkol: pervyj otechestvennyj smart city i kraj sakral›nyh mest. URL: https://astana.citypass.kz/ru/2020/11/05/aqkol-pervyi-otechestvenyi-smart-city/ (date accessed: 26.03.2021)

24. Konysbaeva A.A. Sovremennoe sostojanie i perspektivy vnedrenija koncepcii umnogo goroda v Respublike Kazahstan // Social›nye i jekonomicheskie sistemy. - № 1. – 2018. – C. 148- 156.

25. A. Kirimtat, O. Krejcar, A. Kertesz and M. F. Tasgetiren, «Future Trends and Current State of Smart City Concepts: A Survey, // IEEE Access – 2020. - Volume 8. - P. 86448-86467.

Information about the authors

Urdabayev Marat Tagaybekovich - corresponding author, PhD student, Al-Farabi Kazakh National University, 71 al-Farabi Avenue, Almaty city, 050040, tel: +7 727 377-33-30, marat.ordas@mail.ru, ORCID 0000-0001-8270-6821

Turgel' -Irina Dmitrievna - Vice Director for Research, DSc in Economics, Professor, Ural Federal University named after the first President of Russia B.N.Yeltsin , 19 Mira street, Ekaterinburg city, Russian Federation. 620002, tel: +7 (343) 375-44-44, Email: i.d.turgel@urfu.ru, ORCID 0000-0001-8647-7739

Авторлар туралы мәліметтер

Урдабаев Марат Тағайбекұлы - хат-хабаршы авторы, PhD докторант, әл-Фараби атындағы Қазақ ұлттық университеті, әл-Фараби даңғылы, 71, Алматы қаласы, 050040, тел: +7 727 377-33-30, marat.ordas@mail.ru, ORCID 0000-0001-8270-6821

Тургель Ирина Дмитриевна - директордың ғылым жөніндегі орынбасары, экономика ғылымдарының докторы, профессор, Экономика және менеджмент жоғары мектебі, Орал федералды университеті, Мира көшесі 19, Екатеринбург қаласы, Ресей, 620002, tel: +7 (343) 375-44-44, Email: i.d.turgel@urfu.ru, ORCID 0000-0001-8647-7739

Дата поступления: 28.04.2021.
Прошла рецензирование: 10.05.2021.
Принято решение о публикации: 04.06.2021.

Received: 28.04.2021.
Reviewed: 10.05..2021.
Accepted: 04.06.2021.

Қарастыруға қабылданды: 28.04.2021.
Рецензиялауды өтті: 10.05.2021.
Жариялауға қабылданды: 04.06.2021.