
The effectiveness of technology use based on “Smart city” concept

Abstract. Having introduced in the XX century, fast industrialization, emergence of intellectual technologies and the leap to mass digitalization have given an impetus to global urbanization. In turn, this process has changed city life. In order to maintain the connection and stability between the human and the environment, big data, information and communication technologies (ICT), sensory and innovation technologies, tools based on Internet of Things (IoT) and place of production has led new products and services to expand. The industrialization and urbanization processes required cities to be flexible for innovation technologies called “smart cities”.

The article is devoted to study “smart city” phenomenon in the Republic of Kazakhstan. Number of approaches towards definitions of “smart city” has been analyzed, and the definition of “smart cities” has been proposed on 3 parameters. The purpose of the work is to identify the technology introduction and technology use peculiarities to solve city problems in Astana city. The result of innovation technology introduction is becoming more predictable, i.e. technology availability is not a key to become “the smart” city. The much more significant issue is whether the citizens use “technological and smart solution”, or it remains unnecessary. Consequences of technology introduction have been analyzed. In addition, the effectiveness of ICT use has been considered.

Keywords: urbanization, “smart city” concept, information and communication technologies, effectiveness of technology.

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Introduction

Cities cover only 3% of terra firma of the whole globe (149,4 million square kilometers), but more than half of the population of the earth inhabits this proportion especially. The proportion of urbanized population was 55% in 2018, the same index increased up to 58,9% in 2019 (+3,9%), and there is a prediction that it will reach 66% in 2050. Additionally, cities are center of economic development and cover 80% of global GDP. It is connected with the fact that locations of production places, enterprises and plants are in the cities and around them.

Cities around the world is moving and developing. In spite of dangerous ecological problems (vehicle exhaust emissions, production scrap, contamination of water resources, deforestation), urban population is growing. Figure 1 illustrates overall population and urban population in the Republic of Kazakhstan between 2000 and 2022. It could be noticed that there is a growth of overall population in 2020 in comparison with 2000 by 25%, whereas urban population increased by 30,2%. Comparing 2022 and 2020, overall population rose by 4,6% while urban population grew by 9,6%

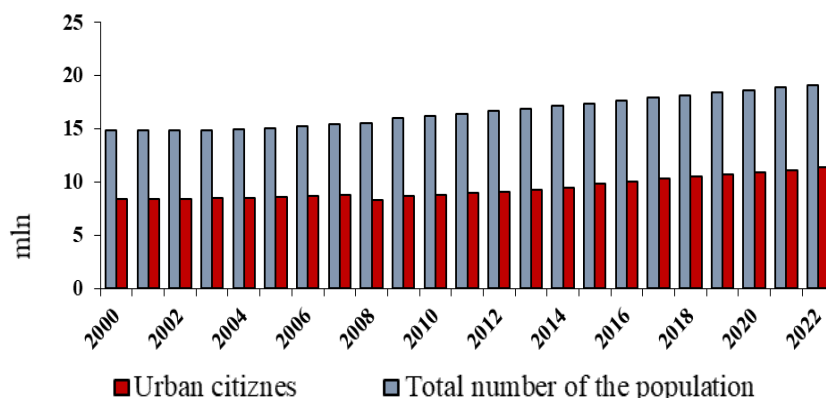


Figure 1. The dynamics of overall population and urban population in the RK

Topicality of the study is explained by the fact that global urbanization level has significantly increased in recent years. The growth of urban population has led to traffic collapse in cities. The pressure on all city services such as healthcare, education, housing and utility, culture, etc. has increased. These issues formed in city metropolitan areas are being solved by the help of human capital creativity, bright scientific ideas, and partnerships, briefly by the help of "smart" solutions. Thus, products based on ICT undoubtedly change city life. City is sensible, if the investment in human and social capital along with investment in ICT infrastructure facilitate the sustained economic growth and high-quality life in context of the sensible management of natural resources on the basis of population's extended participation, the effective promotion of innovation product of the territory and high availability of provided services.

Along with accelerated pace of life and innovative technology development, the concept of smart city is getting more popular. The philosophy of smart city concept is a simple aspiration to increase city quality by making urban residents' life more comfortable.

Literature review

The first explanations about cities where technology use widely spreads were mentioned at the end of 1980s. Global nets were forming at that period of time [1]. The term "smart city" was firstly employed by R. Hall in his article called "The vision of a Smart city" in 2000. He pointed out that that concept of "smart cities" is not limited with ICT, but it takes into account the needs of people and society [2]. A city, which controls and integrates work of all its crucial infrastructures, including roads, bridges, tunnels, railways, metro, communication systems, even enormous buildings, that are able to optimize their resources, to plan preventive activities and control security as well as maximize utility services for their citizens.

Regarding the meaning of the word "smart", every academician defines the notion of "smart cities" in their own ways. Giffinger et al. determine the technology use in infrastructure as search and match of smart solutions [3, p.11].

Technology and ICT are not considered as an only integral part of effective functioning of smart cities, but it should be considered as one integral whole to provide opportunities [4]. Nam & Pardo [5] state that: a smarter city infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions, deploy resources effectively, and share data to enable collaboration across entities and domains.

According to Boyd Cohen [6] a city must use ICT to gain "smart city" status. Moreover, measurable indices of effectiveness should be set up. Meijer & Rodríguez Bolívar [7] promotes socio-techno synergy driven by collaboration of smart people and smart partnership apart from smart technologies.

According to Cocchia [8, p. 17, 29, 35-36], "smart city" takes part in a number of aspects of city life. It

should be available and open for all residents. The most significant peculiarity of the smart city is the technology use. The opinion was claimed by Buhalis & Amaranggana [9, p.553–557]: “the basis of the smart city is mainly formed by technology, that is why all local organizations, ICT and interactive services are interconnected. The current actions in the smart city play an important role. This information is accumulated by Internet of Things”.

Boes [10, p. 393], Kanter & Litow [11] underline that “smart city” is able to be perceived as “the organic whole” and people, tourists and citizens are important aspects of the interrelated system. Researchers claim that the smart city gives an opportunity to increase citizen’s quality of life. Thus, Boes [10, p. 393] states that smart cities should not be directed to citizens only. Smart cities are able to adapt the customer’s needs and to provide the individual services.

Research methods

The researchers such as Nam & Pardo [5] who define three main characteristics or parameters and Albino et al. [12, pp.4-6] who explain the full definition of smart cities are presented in the list.

Table 1. “Smart city” parameters

Technology dimension	Human dimension	Institutional dimension
Technological revolution, intelligent solutions, intelligent computing technology, data analysis, programming, ICT, intelligent networks and remote transducers	Creativity, knowledge, skill, gift	Management system, state, enterprises, academic institutions, local authorities and bodies
Hall (2000), Giffinger (2007), Eger (2009), Washburn et al. (2010), Chen (2010), Harrison et al. (2010), Caragliu et al. (2011), Komninos (2011), Nam and Pardo (2011), Gartner (2011), Thuzar (2011), Cretu (2012), Bakici et al. (2012), Barrionuevo et al. (2012), Kourtit and Nijkamp (2012), IDA (2012), Lazaroiu and Roscia (2012), Lombardi et al. (2012), Zygiaris (2013), Towsend (2013), Marsal-Llacuna et al. (2014)	Eger (2010), Harrison et. al (2010), Caragliu et al. (2011), Komninos (2011), Thite (2011), Nam and Pardo (2011), Gartner (2011), Thuzar (2011), Guan (2012), Barrionuevo et.al (2012), Kourtit and Nijkamp (2012), Kourtit et al. (2012), Lombardi et al. (2012), Zygiaris (2013), Towsend (2013)	Caragliu (2011), Komninos (2011), Thite (2011), Nam and Pardo (2011), Gartner (2011)6 Thuzar (2011), Cretu (2012), Guan (2012), Barrionuevo et al. (2012), Kourtit and Nijkamp (2012), Kourtit et al. (2012), IDA (2012), Marsal-Llacuna et al. (2014)
Note – Compiled by the authors based on data from the literature [12].		

Based on researchers’ suggestion three parameters describing a smart city are offered as follows:

Technological parameter is to intellectualize information and communication technology integration and physical infrastructure to control and effectively use city resources (to increase life quality, service quality and effectiveness, to use resources and to reduce wastes).

Social parameter is a main subject of a smart city – human capital (highly qualified labor power, well-educated citizens, workplaces that need research, creative activities and initiatives which are directed to sustainable development).

Institutional parameter is information openness of town hall, citizens' participation in city control work, information exchange between city control system and citizens and to produce solutions.

Smart city today is a well-functioning system with numerous interactive high technological units and networks that cover literally all spheres of person's life living in a such city. Smart infrastructure deals with the questions of security, finance, education, transport, medicine, trade, social services, housing and public utilities, tourism, that makes it an integral part of digital age. Thus, in order to be a participant of such a system it is only necessary to have a smartphone with internet connection. More and more cities on the map applying "smart city" philosophy as a main concept. Kazakhstan has been applying actively the most advanced directions of urban infrastructures for several years.

Although some investigators are trying to understand how to reorganize urban system [13], there has not been a specific methodology allowing to integrate all subsystems of SC system yet. A number of conceptual models were suggested to accomplish the objective: [14] it is claimed that suggested approaches in literature were frequently not complete, integrated, and informative. They pointed out the absence of uniformity in designing and defining SC concept as well as the absence of designed model assessment methodology. The Republic of Kazakhstan applied as a basis six directions of "Smart city" development proposed in investigation by Regional research center by Vienna University of Technology in 2007. "SMART city" concept was designed in Kazakshstan to apply smart technologies (Figure 1). In the center of SMART city mission is humans and their needs.

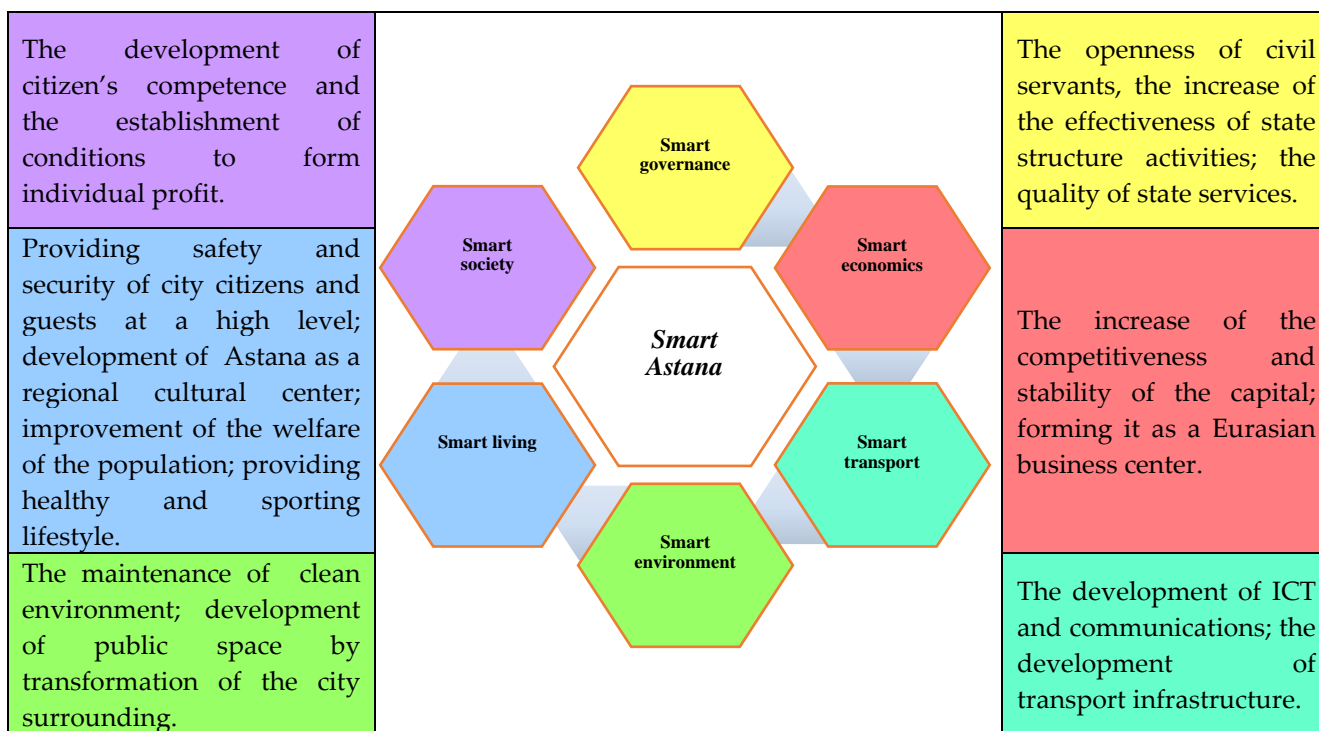


Figure 1. "SMART city" concept in Kazakshstan

Digitalization of main republic city is carried out by "Astana Innovations" company. Its plan is further promotion of mobile application payment services which is used by over 2,000 people, by the way [15]. Initially, it is supposed to develop 5 large cities – Smart Astana, Smart Karaganda, Smart Shymkent, Smart Almaty, Smart Aktobe. Currently the projects are implementing in the rest districts of Kazakhstan. In 2017 the following key spheres were defined for each region according to development peculiarities:

Table 2. Regions of Kazakhstan and their priority areas

No.	Region	Priority areas
1	Astana city	Security, Housing and Public Utilities
2	Almaty city	Transport, Smart Management
3	Akmola Region	Tourism, Ecology
4	Aktobe Region	Social sphere, Healthcare
5	Almaty Region	Transport
6	Atyrau Region	Smart Management
7	East Kazakhstan Region	Ecology, Housing and Public Utilities
8	Zhambyl Region	Security
9	West Kazakhstan Region	Housing and Public Utilities, Healthcare
10	Karaganda Region	Healthcare
11	Kostanay Region	Agriculture
12	Kyzylorda Region	Smart Management
13	Mangystau Region	Education
14	Pavlodar Region	Education, Business (Industry)
15	North Kazakhstan Region	Agriculture , Housing and Public Utilities
16	Turkistan Region (former South Kazakhstan Region)	Education, Construction

Note – Compiled by the authors based on data from the literature [16].

Kazakhstan's capital digital development concept is the use of successful world experience in "smart cities" development. Based on solutions such ultramodern megacities as Singapore and Shanghai, Astana established an individual model appropriate for its economic, social and cultural context. There are several significant indicators which are aspirations for a young city on the way to smart concept. It tend to include three indicators: intelligent systems of city electricity consumption, residents' service quality and transport system based on information and communication technologies. Together with it practice shows that each city must have its own individual criteria to achieve these indicators.

Astana is the first city in Kazakhstan starting to apply smart technologies in its infrastructures. We have got used to intellectual means of transport and security control on city streets, to smart bus stops with information display boards, to plastic boarding passes for public transports and electronic journals. However, work on city service digitalization is continuing.

The aim of "Smart Astana" project (hereinafter – the Concept): to develop an approach that will create advantageous and comfortable conditions for citizens and guests based on "smart city" solutions.

The objectives of the Concept:

- complex modernization of urban digital infrastructure
- increase of regional investment attraction
- development of regional innovation system of urban surrounding
- optimization of processes to have solutions by town hall
- modernization of management style
- improvement of urban population's life quality, including creation of comfortable conditions for work, study and rest
- informatization of the population
- increase of public security level

According to the Concept, three approaches to develop "smart city" are proposed:

Table 3. Three approaches to smart city development

Approaches	Advantages	Disadvantages
Anchor	<ul style="list-style-type: none"> • fast start to implement initiatives of smart city; • achievement of specific targets; • ability to assess investment profitability; • sensibility to use resources. 	<ul style="list-style-type: none"> • difficulty to integrate anchor projects with other smart projects; • absence of interconnection among projects.
Platform	<ul style="list-style-type: none"> • interconnection of projects; • ability to integrate projects; • flexibility of the approach; • possibility to attract third party (by application and use of open data); • possibility to program platform quality. 	<ul style="list-style-type: none"> • absence of "immature" adjusted standards for city in an initial step; • blocking risk; • necessity of capital investment without opportunity to return on investment in an initial step.
Beta city	<ul style="list-style-type: none"> • involvement of citizens and political figures; • access to financing pilot projects and researches; • ability to involve start-ups and small innovation companies; • possibility to use services aimed at consumer (e.g. social networks) 	<ul style="list-style-type: none"> • difficulty to overcome pilot project step and to transfer to a unified operation activity; • unclear goals.
Note – Compiled by the authors based on data from the literature [17].		

Anchor is to apply separate technologies in various spheres of city functioning with following integration in a unified intellectual platform.

Platform is to apply ICT infrastructure with following integration of existing and new services.

Beta city is to apply numerous pilot projects in different spheres of city functioning with following effect assessment in short-term and medium term perspective to take a decision about further expansion.

The big city digitalization starts with its streets and districts. Thus, the project called "Smart district" has been carrying out in Astana since 2018. One of the districts in the capital became pilot. Its infrastructure experienced changes based on the principle "all new and advanced with "smart" mark will be here". Smart houses, traffic lights, paths, pavements with LED screens, benches and even bins. Such a district will determine trends for other city districts. It is definite that security is the most significant thing in smart districts. Therefore, it was refused to use typical "blind" doorbells, instead special doorbells were established in apartments which could be controlled by the help of applications on the smartphones. This function is called "Face Recognition", it allows a home's host to control the security of a flat, even not being inside it. Special sensors detect and present information about who rings the doorbell and send the information directly to the smartphone. There are emergency functions such as "emergency situation" or "SOS" signal. By activating these functions, signals are automatically directed to police and fire service. The district also considered the saving. For this case new generation smart meters to record water, gas and electricity which allowed residents to economize. Such meters collect information and send it directly to public utilities. In addition, green and energy-saving technologies are introducing in Astana, in other words smart district is a large testing platform for various know-how not only in ICT area [15].

Results

Throughout the period from 2018 to 2022 security, public utilities, transport, state services, education and healthcare were being automatized. Most of the work achieved high results. the following consider them [18]:

First objective, which was taken into account in Astana, was security on roads and streets of the city. It was suggested to resolve the issues by the project "Safe city", which considered CCTV setting and along with other means of data transmission. Introduction of the new project "Safe city" started in 2017, which has already been working as an integral part of the megacity.

"Sergek" CCTV system on road security has been completely implemented. By the help of the system, capital roads are considered as the safest in the country.

According to 2020 reports, there is the following dynamics on road security in comparison with the period before the project (2017):

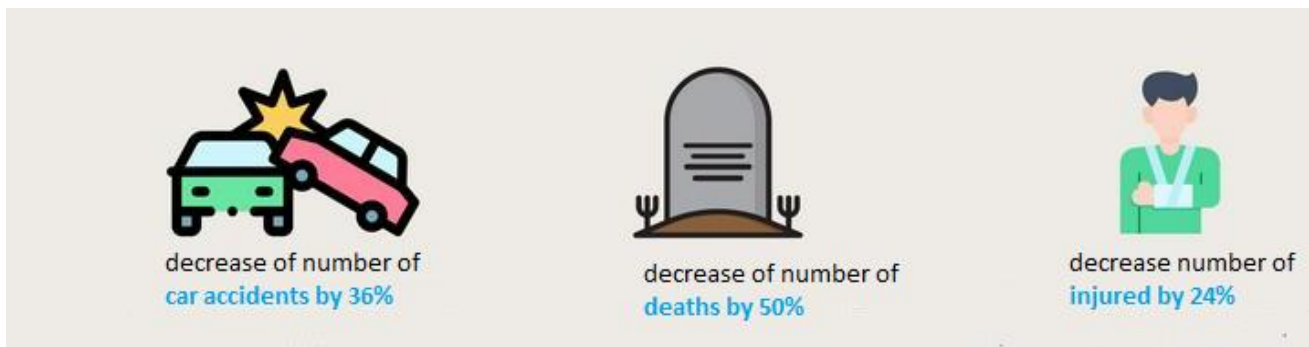


Figure 2. "Safe city" – road security
Note – Compiled by the authors based on data from the literature [18].

CCTV implementation allowed to solve issues of public security as well. Nowadays 100% of healthcare and education buildings are equipped with CCTV cameras.

As a result, in 2021 the following indicators took place in comparison with 2018:



Figure 3. "Safe city" – public security
Note – Compiled by the authors based on data from the literature [18].

Introduction of "Safe city" project has influenced the increase of driving culture, the quality of city traffic management, the effectiveness of police actions to prevent offences and provide immediate assistance to citizens. The project has improved information support of city alert units to collect and fix information

about situations in the streets and public places. It has allowed to reinforce the control over city operational situations in public and political, sport and other mass events, in the streets, in main squares, in crowded places, transport and playgrounds.

In general, project data processing system allow to organize the efficient work as much as possible in different conditions. This automates most part of operations for city life analysis that make it possible to take more accurate solutions.

iQala project has helped to obviate the need of unnecessary trips to authorities in housing and public utilities. By the help of the project people are able to get services of housing and public utilities organization according to the principle "one window". Consequently, it has allowed to save time on forming and receiving documents. Earlier a resident had to go through several authorities and there was no regulation for public service provision.

For instance, after buying an apartment, a resident had to go through all monopolists and to conclude an agreement with each of them separately, to phone regularly in order to understand whether documents were ready. All of this took up to a month. Now an applicant submits an application online on iqala.kz website. In a few days he/she receives an SMS notification about his/her document readiness.

Today "iQala" center provides 152 services round the clock directly. Earlier the services used to provide with different monopolists and state authorities. Since project introduction over 230,000 services have been provided, including 144,500 services in 2021.

100% of state services has been digitalized completely in the capital. Automatization allowed to increase their accessibility and reduce time and labor expenses for citizens. This was extremely necessary during the pandemic.

The accessibility increase was significant in healthcare. All capital's healthcare organizations provide QR on doctors' doors. Having scanned it, you can leave a review in "Smart Astana" application.

"Damumed" application is one of the projects which is introduced in healthcare. It accelerates the process of appointment. Citizens can get online consultation, make an appointment with doctors, and find necessary medicine along with information about pharmacies that sell it. In the account of the application there is an opportunity to look at laboratory results, prescriptions, and electronic sick leaves.

By "Astana is an honesty platform" project, information service for checking legitimacy of sick leave forms in healthcare organizations has been designed. Each given medical certificate together with a sheet of temporary disability, a medical certificate in the form 073, 075, 036, or 03 has QR code which authenticity can be checked by scanning it.

Additionally, by the help of special sensors which allow to turn on green in "smart" traffic lights, ambulance in capital has reduced arrival time by 20%.

The whole ambulance station has also been completely digitalized. 40 workplaces for operators, call center for 10 operators with three digital telephony streams for 90 voice communication lines have been organized. Now 80 station units have been equipped with communicators and GPS-trackers. The system allowed to automate emergency call out service. Response time has reduced by 30% and decreased by almost half.

One of the obstacle even in current capital's digitalization and state service management is weak communication among existing systems, i.e. there is a difficulty in integration. Definitely, not all systems has problems, but the issues is acute.

Regarding the integration, one of the examples is "Smart Astana" mobile application. It includes all existing city services in one application interface – "Th whole city in your smartphone".

By the help of the application, you can see news feed, receive push-notifications from emergency services, send readings of water meter, control bus tracking, get information about educational and sport institutions, you can also pay for state services.

Moreover, user feedback can actively be organized. Residents write reviews, write what services they need, and which services do not function correctly. Monitoring of social networks on residents' applications and comments about implemented projects has been carrying out regularly. In case of questions, feedback is

always given, and if it is necessary meeting with application is held. Main principle of project activities is to take into account city residents' needs to plan work.

In addition, citizens can leave reviews via city monitoring and rapid response system "iKomek109".

"Digital twin of the capital" helps to define where to build a school or a clinic. Another example of a successful integration is "Digital twin of the capital" or city's geoinformation center. It is possible to test opportunities of "digital twin", for example, when it is needed to know who owns the land. The program allows to know about a land everything in real time: information from cadastral number to commercial ownership.

Digital model of local land and terrain model of the capital have already been completely designed, 3D-models of built-up parts of the capital has been completely constructed. It required tremendous work, namely over 16,000 km of engineering networks and 100% of main engineering networks was digitalized. In addition, approximately 205,000 wells of main and intra-quarter networks have been digitalized. By the help such an integration of all objects, it is possible to work out logistics of the city as effective as possible and to solve other city problems.

The system also helps to model natural and man-made disasters and to predict the city's infrastructure behavior. For example, 2D and 3D technologies clearly show engineering network load.

Furthermore, "digital twin of the capital" is an investment map where business society can see what and where to open. State bodies also can predict where it is necessary to build schools or clinics taking into consideration number of population.

Currently the project is employed by Department of Architecture and Urban Planning and Land Relations, Department of Environmental Protection and Environmental Management along with districts of Akimat.

Capital's "geoinformation center" integrates with a system of central state bodies, city's housing and public utility services and other systems as well. "Sergek" project interacts with Single administrative offense register.

With this integration, the procedure of drafting an administrative offense protocol lessens, transmission of data on violation automates, an offender's data is issued with the checking them in a wanted database, committing other administrative offenses, a car for passing a mandatory technical inspection and having an insurance policy on third policy liability is checked.

Transport capacity has increased by 40%. Intelligent transport system of Astana city (ITS) has been implementing in transport sector which includes adaptive management of traffic light objects, electronic fare payment system in public transport, public transport dispatching.

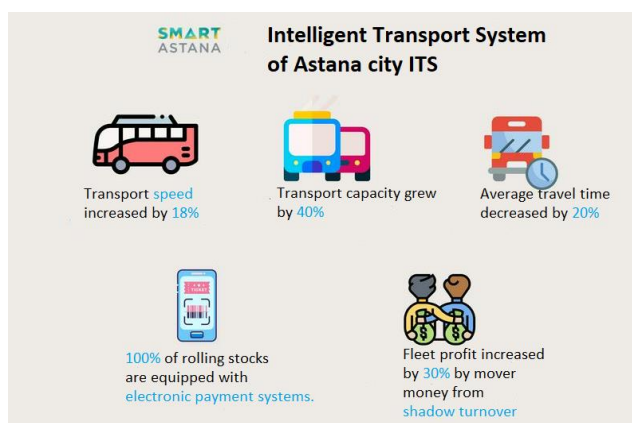


Figure 4. Intelligent Transport System of Astana city ITS

Note – Compiled by the authors based on data from the literature [18].

School meals on "BalaPay" system. The "cashless payment system" has been introduced in 83 schools of the city. The system allows parents to control their children's meals at school. By the system school students make cashless purchases in school canteen; parents fill up their accounts, control cashflow, parents also can set day limit and limits for unsuitable food for their children.

The payment is made by CTS smart card. CTS company issues cards at no cost. Parents and school do not pay, there is no interest rate for school students.

Generally, to develop innovative city eco-systems, IT activities are implemented on "Smart city" development: city IT council under akim's (mayor's) supervision, STEM competitions, hackathons, start-up weekends.

Since the creation of IT council several tasks have been set and smart projects on them have been introduced. IT community participants include representatives of leading digital companies, science, and state bodies. During IT community meeting they represent their projects and demonstrate the consequences of implementation. Around 50 IT projects has been considered.

ROQED Science educational program is a software to study Science subjects in 3D. It is applied in 21 schools in the capital. The project is planned to be represented in all schools of the city. Moreover, it is widely used in other regions of our country.

Smart Recirculation Control SRC Automatic Air Ionizer has been set at the bus stop around School No.65 and Special School No.2. By the help of UV antibacterial lamp, it can eliminate disease-causing bacteria. Moreover, there are a smoke detector and CCTV at the bus station.

BIRGE platform also functions in the city. It is a platform for common ideas which allows citizens to suggest ideas to solve issues on city activity and vote on the offers selected by qualified experts.

Conclusion

In order to increase competitiveness in its economic policy, Kazakhstan defined choice of competitive economics model with key priority areas. Prerequisites for SMART city formation based on modern requirements along with new and fast technologies capable to satisfy consumer demands have appeared.

The city's potential and possibility to be smart and constant will be improved overtime. Developing city as a smart city does not only update it, but it also improves social environment culture, increases life quality, and grows a number of workplaces.

On the basis of "SMART city concept", innovation technologies that are directed to development resources optimization, life constancy and quality improvement, are supported to be evolved. The concept also updates national tourism industry. This is due to the fact that rapid industrialization has given an impetus to global urbanization. City scale has extended, and it has become a large production center. Thus, as an effective solution of social issues and because of the need of quality life rural population moved to cities. This destroyed the environment sustainability and was a reason of different ecological problems.

Technologies play an important role in city transformation and they are one of the major factor facilitating economics development. Smart city concept is based on the information which main peculiarities are information technologies (IT) and comprehensive use of information resources. Smart city uses intelligent information systems to achieve sustained city development – the definition which considers information as a main factor of smart city concept.

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«Smart city» тұжырымдамасы негізінде технологияларды қолданудың тиімділігі

Аннотация. XX ғасырдан басталған жылдам индустриаландыру мен интеллектуалды технологиялардың пайда болуы және жаппай цифрландыру дәуіріне аяқ басу жаһандық урбандалуға үлкен серпін берді. Бұл үрдіс өз кезегінде қала өмірін өзгертті. Адам мен қоршаған орта арасындағы байланыс пен тұрақтылықты сақтау мақсатында үлкен ақпарат, ақпараттық-коммуникациялық технологиялар (АКТ) және сенсорлық, инновационды технологиялар, заттардағы интернет (IoT)

негізінде жасалған құралдар, өндіріс орындары жаңа өнімдер мен қызметтер аясын кеңейтуге жол ашты. Индустрияландыру мен урбандалу процесі қалалардың инновационды технологияларға икемді «ақылды қала» болуын талап етті.

Мақала Қазақстан Республикасындағы «ақылды қалалар» феноменін зерттеуге арналған. «Ақылды қала» түсінігіне анықтама берудің түрлі тәсілдері талданады және үш параметр бойынша анықтама ұсынылады. Жұмыстың мақсаты – Астана қаласындағы қалалық мәселелерді шешуде технологияларды қолданысқа енгізу және оларды қолдану ерекшеліктерін анықтау. Инновациялық технологияларды қолданысқа енгізу нәтижелерін болжау мүмкін емес, яғни, технологиялардың болуы қаланың «ақылды» болып қалыптасуының кілті болып табылмайды. Ең маңыздысы – қала тұрғындарының «технологиялар мен ақылды шешімдерді» қолданатындығы, әлде, олар қажет етілмейді ме? Технологияларды қолданысқа енгізудің нәтижелері талданып, АКТ қолданудың тиімділігі қарастырылды.

Түйін сөздер: кенттену, «smart city» тұжырымдамасы, ақпараттық-коммуникациялық технологиялар, технологиялар тиімділігі

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Эффективность использования технологий на основе концепции «Smart city»

Аннотация. Появление быстрой индустриализации и интеллектуальных технологий в XX веке и вступление в эру массовой цифровизации дали большой импульс глобальной урбанизации. Эта тенденция, в свою очередь, изменила жизнь города. Большие объемы информации, информационно-коммуникационных технологий (ИКТ) и сенсорных, инновационных технологий, инструментов, созданных на основе интернета вещей (IoT), производственных мощностей, задействованные в целях поддержания связи и стабильности между человеком и окружающей средой, позволили расширить спектр новых продуктов и услуг. Процесс индустриализации и урбанизации требовал, чтобы города были «умными», гибкими в отношении инновационных технологий.

Статья посвящена изучению феномена «умных городов» в Республике Казахстан. Анализируется ряд подходов к определению «умный город», и по трем параметрам «умных городов» предложены определения. Цель работы – выявление особенностей внедрения и использования технологий в решении городских проблем г.Астаны. Результат внедрения инновационных технологий становится все более непредсказуемым, то есть наличие технологий не является ключом к становлению города «умным». Гораздо важнее – пользуются ли горожане «технологическим и умным решением» или оно остается невостребованным. Проанализированы последствия внедрения технологий, рассмотрена эффективность использования ИКТ.

Ключевые слова: урбанизация, концепция «smart city», информационно-коммуникационные технологии, эффективность технологий.

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