[«Smart» concept as a solution to the single-industry towns’ development problems of the northern territorial entities in Russia](#)

Irina Sergeeva,[10000-0003-1955-7055], Evgeniya Voronina,[10000-0002-7296-3363], Nailya Khadasevich,[0000-0002-7908-618X], Nataliya Kaufman,[10000-0002-7385-9276] and Anastasiya Litovchenko,[10000-0002-3692-7030]

1Surgut State University, Surgut, Russia

E-mail: sergeeva_iv86@mail.ru

Abstract. Historically, modern single-industry towns in the north of Western Siberia of Russia are characterized by almost the same set of socio-economic problems. The main of these problems is the retention and growth of human capital as a growth factor of the gross regional product, respectively, and the gross domestic product of the country. The problem of single-industry towns in the Russian North currently remains relevant for such cities, since it leaves the integrated potential vulnerable and risky. The role of the task, which is improving the quality of the population life of these territorial entities under the growing strategic need for the diversification of city economies, timely modernization of enterprises, and the growth of investment attractiveness is increasing, since it is closely related to the development of such an important production factor as human capital. That is why the planning and subsequent implementation of the development strategy of the North of Western Siberia, taking into account the provisions of the concept of a smart city, are becoming the main integral solution in modern conditions.

Key words: Smart single-industry town, Technology, Urban development.

1 Introduction

The modern formation of the territorial formations in the North of Western Siberia is due to the intensive development of unique scale deposits since the mid-60s of the XX century. It was during this period that the “mass urbanization process” of the territory was designated, since “only the shift method could not satisfy the demands of the rapidly developing administrative and technological infrastructure of the oil and gas production complex” [1-6].

In the historical aspect, the industrial potential in the North of Western Siberia evolved as a result of the development of the fuel and energy complex, that was based on the growth and development of those cities, which are usually referred to as single-industry ones [7-10].

The specifics of the formation of the territorial formations in the North consisted in the initial creation of the organizational matrix of the production complex, which was later begun to be filled by people who came from different regions of the country, which eventually became the basis of the population of the new industrial region [11-17].

Further urbanization of the North has accumulated difficulties and contradictions in the development of the social sphere due to the rapid growth of their permanent population. Measures to improve the young towns and villages of oil and gas workers by local administrations were insufficient; many families living in them lacked household and social benefits. This increased staff turnover and social tension [18-23].
Significant changes took place in the highly urbanized northern territories: “new subjects for the development of the territory — corporations extracting resources in the region” [1] appeared, which did not support the development of the territory in the same volume and gradually got rid of social obligations, transferring social facilities to the municipal government during the period from 1990-2000. This negatively affected the functioning of the territories and, in view of the growth in the scale of transmission, was unbearable for municipalities [24-30].

Nevertheless, the collapse of the territories created around large production and processing technological complexes did not seem appropriate based on estimates of the oil and gas fields’ exploitation due to the use of new production technologies and the possible costs of curtailing urban settlements. Therefore, oil companies in the North of Western Siberia abandoned their existing plans for deurbanization [31-35].

Past problems of single-industry territories remain relevant to this day. At the present stage, the functioning and development of territorial entities of the northern regions are based on established contacts between oil enterprises and northern cities.

This article is an attempt to highlight the key problems in terms of the conditions and quality of life of the population, as well as outline the conceptual foundations of the use of smart technologies as one of the tools to retain and increase human capital. The proposed conceptual foundations can become the basis for the development of strategic priorities for territorial entities that have a single-profile nature of existence and development. The basis of this point of view is the publication of a number of authors [2], claiming that the “smart” concept is a powerful approach to sustainable development of increasingly urbanized cities, as well as pointing to the importance of human capital in the development of territories, which is relevant for the North of Western Siberia.

2 Materials and methods

For this article, a bibliographic analysis of literature published in domestic and foreign sources were carried out. Unfortunately, we did not meet foreign studies of single-industry towns and solving the problems of their development, unfortunately. At the same time, we have come across many sources regarding the “smart” concept and its capabilities for solving the problems of the quality of life of the urban population. They were taken into account in the preparation of this article.

In addition, we analyzed many Internet sources, in which there was a mention of the possibilities of using “smart” technologies. In addition, based on the analysis of periodical and historical literature, we formulated a number of problems of urban development of the northern territorial entities and, as a result, tried to formulate probable solutions in the context of a “smart” concept.

3 Results

Many cities located in Western Siberia are not able to fully respond to the request from the residents to improve the quality and convenience of the urban environment. In this regard, the phenomenon of secondary urbanization, which implies the resettlement of residents of small and medium-sized cities to capital cities and large megacities, is becoming increasingly widespread.

As a result, small and medium-sized cities are faced with the problem of a steady decline in the population: according to the Federal State Statistics Service, against the backdrop of an increase in the total number of urban population, the number of residents in cities to 50 thousand people over the past 25 years has decreased from 18.9 million to 16.7 million people (-12%) [23].

This problem is especially acute - very many residents consider their residence in such cities as temporary and set their task - to move to the "big" land.

Improving the quality of the urban environment is one of the conditions for overcoming this negative trend. The task in this case comes down to the need to build effective cooperation between the city authorities as information holders, the business that provides technical solutions, and residents. A particular manifestation of this challenge is the problem of ensuring public safety - we are talking about threats of a natural, manufactured, criminogenic and social nature.
Also, a large number of various administrative barriers caused by the fact that the main initiator of such projects as municipal authorities, which, when working in complex northern territories, are faced with the need to form more complex bureaucratic ones, so they can be attributed to the problems of implementing Smart City projects on the territory of northern cities rules, and they are more regulated and less involved in the implementation of new management technologies in view of the level of protection limits. As a result, there is a slowdown in the formation of official strategic documents, a delay in the issues of their coordination and implementation.

One can also single out another group of problems of introducing smart urban management technologies in the northern territories - the relatively smaller size of the cities located there, which are limited in growth due to a number of natural and socio-economic factors. In such cities, it is more difficult to change urban planning documents, and the implementation of any project related to changes in urban infrastructure requires a large number of approvals and takes a long period.

The problem in the implementation of such science-intensive projects in the territories of northern cities is also the lack of highly qualified personnel in the relevant areas of labor resources.

The next group of problems also includes the relatively worse development of housing and communal services, transport system, ICT infrastructure, mobile network and the Internet.

The problem in the implementation of such science-intensive projects in the territories of northern cities is also the lack of highly qualified personnel in the relevant areas of labor resources.

Thus, despite the ongoing work, currently in Russian cities and especially in most cities of the northern regions, there remains a whole layer of problems associated with improving the quality and safety of the urban environment, which can only be solved in a limited mode by using standard approaches.

The technologies of “smart cities” are significant and in demand for the North, as they ensure the concentration of territorial problems in a single resource center and accelerate their resolution processes.

Let us consider in more detail how exactly the characteristic problems for the northern territories can be solved with the help of smart solutions, components of the “smart city”.

The component “City Administration (Administration)”, which is an information base that collects and accumulates data and is formed because of the functioning of all city services, is determined by unattractiveness for specialists with experience in IT solutions in this field. In our opinion, at the initial stage, it is possible to solve the indicated problem by attracting an outsourcer (concluding an agreement with an organization specializing in this field).

The next component of the smart city system is “Housing and utilities (water supply, electricity, garbage collection, etc.)”, which implies a gradual transition to remote metering and intelligent management of heat, water, electricity in real time by receiving and analyzing data about the status of networks with sensors and sensors.

Problems in the field of housing and communal services are relevant not only for the northern territories, but also for the whole of Russia as a whole. However, the North has a number of its own characteristics. In particular, a long winter with heavy snowfalls and a short summer, respectively, with a short period of repairs of objects in this sphere and preparatory work for the heating season.

A vivid manifestation of the lack of funds to solve the current problems of urban development is the challenge associated with the deterioration of basic urban infrastructures. At the same time, the focus on the intellectualization of the urban ecosystem should imply going beyond maintaining the status quo: the city’s application for the transition to a new quality should be supported by an initiative to form a separate “development budget”. It is logical that today there is a high level of dependence between the indicators of "security" of the city and the level of development of smart urban technologies.

By the end of 2019, it was planned to develop a "Strategy for the development of housing and communal services for the period until 2035". In anticipation of the emergence of a strategy among representatives of the housing and utilities sector [24], it is noted that digitalization should be one of the mechanisms for implementing the future strategy. As a basis, several reasons are indicated:

- the lack of complete, reliable and relevant data on the state of the housing stock, consumers, the volume of services provided and their quality;
- the lack of coordination for the development of IT systems at various levels;
- the lack of built-in mechanisms for the aggregation of information.

As a direction for solving the indicated problems, it is seen in the digitalization of the housing and communal services, which would allow "... to increase the efficiency of management of all enterprises and economic indicators, to ensure transparency and payback of services, as well as attract investment in housing and communal services ..." [23].

In addition, it is important to take into account another aspect - "... consumers [housing and communal services – author’s note] ... turning to the Internet ... ". As shown, "... almost 70% of payments in housing and communal services are made online ...". In this connection, it is noted that the sphere of housing and communal services "needs to be transferred to the digital plane", "new rules of the game on the market of new digital services of housing and communal services are needed."

In the context of digitalization of housing and communal services in the industry, it is planned to introduce “smart” metering devices, robotic routine processes, use artificial intelligence capabilities, as well as big data to analyze and make adequate management decisions based on the National Data Management System [25]. At the initial stage, it is supposed to reduce reporting by 3 times due to digitalization by optimizing the collection of information in this industry.

From the point of view of the following component of a smart city ("Transport"), which should ensure a decrease in the number of traffic jams, to make traffic more convenient and safe for all its participants, there should be:
- a common traffic management strategy has been formed that allows developing the urban transport network based on the processing of data on its congestion generated in real time;
- interactive services for informing road users have been implemented: special screens on the roads should provide drivers with information about changes in the road situation, smart stops should form and display accurate public transport schedules, and urban parking space systems should ensure convenient parking.

It should be noted that the problems of traffic jams and parking for the northern territories are especially relevant. They are influenced by the specifics of urban buildings, namely their density. In this connection, “smart decisions” in this area are especially significant for the territories.

Consider the next component of the smart city system - Health. It involves the introduction of technologies such as mobile devices that provide control, digitalization and transmission of medical indicators online, their storage and processing in cloud services, the use of artificial intelligence in operational decision-making, etc., as well as integration into a single medical space in medical the centers are diagnostic and treatment rooms, operating rooms, intensive care and resuscitation rooms, etc., in order to quickly obtain and process the entire data array of current events.

Note that the problem of a single information center in the medical field of the northern territories is also relevant and smart concept technologies have already been partially implemented. So, in the framework of the Concept of creating a unified state information system in the field of healthcare, a “Regional Medical Information System” was created, where one of the modules is the service “Recording patients for service, managing resource employment and distributing patient flows in a medical organization” (“Patient Portal”). This module was created with the aim of creating a schedule of appointments for medical workers and using them to make an appointment with a doctor to provide primary health care.

The budget institution provides the technical support functions of the portal users.

However, the problems of the availability of information about the patient in medical institutions to which the patient can turn are not resolved. Until now, a paper form has been used to refer patients to specialized specialists, hospitals, and other institutions. This problem, in our opinion, can be solved by introducing the concept of a smart city.

Another important and relevant component of the smart city for the northern territories is Ecology. It is well known that the environmental situation in the northern territories is formed under the influence of an economic factor: oil and gas production complex, electric power industry, pipeline transportation of hydrocarbon raw materials, and timber industry complex.
Because of the negative impact of the hydroelectric power station on the environment, atmospheric air is polluted, thermal pollution of water bodies, noise pollution from operating units, and death of fish entering the water intake facilities occur.

The timber industry complex has a negative impact on forest ecosystems: the soil cover is disturbed, the hydrological regime of rivers and lakes is changing, the territory is polluted with abandoned wood, and the number and species composition of the animal world is changing.

Today it is obvious that the climatic background of the North has also changed. Note that this is a global trend, which the northern territories “did not disregard.” So, during the Climate Conference in Paris on December 12, 2015, the Paris Agreement on Climate Change was adopted by consensus, regulating measures to reduce carbon dioxide emissions in the atmosphere since 2020. The aim of the agreement is to keep the global average temperature from rising to the upper limit of 2 °C, to limit greenhouse gas emissions from industrial human activities from 2050 to 2100, and also to oblige developed countries to allocate funds to a special climate fund to support more poor states in the fight against climate change. [26]

Currently, work is underway to develop a comprehensive plan of measures to improve the environmental situation in the city, which, among other things, involves the implementation of programs to modernize equipment, switch to the best available technologies, reduce emissions at industrial facilities, and improve the monitoring system for air pollution.

Let us consider the last component of the smart city system - “Education”, within the framework of which it is planned to use information technologies aimed at improving the quality of the educational process, by providing ample opportunities to make classes more interesting and diverse, involving students in the educational process, more clearly demonstrating to them the importance and the importance of educational material for practical activities, the simplification of the teacher's work by automating routine operations. An important problem is obvious for the development of the northern territories: there is no single informational integral educational space uniting all levels of education [27].

Solving the problem of integrity and interconnectedness in the field of education is also possible through smart solutions.

4 Discussions

The modern “smart” concept is becoming relevant for an increasing number of Russian cities. Today, the smart city project is a promising area in Russia, formed as part of the digital economy development program.

In accordance with this program, a “smart” city means “... an innovative city that implements a range of technical solutions and organizational measures aimed at achieving the highest possible quality of resource management and the provision of services in order to create sustainable favorable living and staying conditions, business activity of current and future generations ... ” [28].

Under these conditions, the digital transformation of cities has become relevant in Russia, which is based on several “megatrends” in the field of information technology, in particular [28]: mobility, social communications, cloud technologies, big data and predictive analytics, machine learning and artificial intelligence, technologies ensuring cybersecurity, the “Internet of things”.

By the way, by 2024 the Government of the Russian Federation plans to “digitize” 50 cities, including 15 “millionaire” cities, with a total number of 50 million people [29], which makes up almost half the population of the Russian Federation.

Obviously, digitalization is a new quality of life for people, because the introduction of “smart” technologies can improve the quality and level of accessibility of services, ensure the growth of labor productivity, the emergence of new forms of business, and reduce corruption and bureaucratic procedures. In addition, from the point of view of entrepreneurship, the positive impact of digitalization on the development of the economy of the territorial entities of the Federation is noted, since "... business processes are accelerated, costs are reduced, customer feedback improves ..." [29].

As a result, a “smart” city is not just a municipality with a well-developed technological infrastructure, but a place where a person’s life gains new quality thanks to “smart” solutions, since
the use of technologies and digitalization of traditional services allows citizens to use their resources and time more rational and productive [30].

Currently, against the backdrop of an increased need to solve critical urban problems, increase the efficiency of urban systems management, and increase the quality of life of citizens (according to the Center for Strategic Research), a request has already been formed for introducing new generation products [31].

Therefore, in 2018, under the project on digitalization of urban economy “Smart City” of the Ministry of Housing and Communal Services of the Russian Federation, a widespread introduction of advanced digital and engineering solutions in urban and municipal infrastructure began [31]. This project is being implemented as part of the national projects “Housing and Urban Environment” and “Digital Economy”. It aims to increase the competitiveness of Russian cities, the formation of an effective urban management system and the creation of safe and comfortable living conditions for citizens. The project involves about 400 cities [31].

Attention should also be paid to a new trend in the digitalization of cities - the transformation of municipal management using digital technologies for urban management. With this approach, the municipal administration is supposed to automate, optimize and typologize the complex of administration processes, services and procedures.

According to a Skolkovo study, Yekaterinburg, St. Petersburg, Moscow, Kazan, Novosibirsk, Krasnoyarsk, Perm were among the leaders in digitalization among Russian cities.

Despite the steady pace of the introduction of digital technologies in society, there are a number of problems that mediate this process. In particular, the lag of legal regulation in the field of technology from the pace of their development. So, it is noted [32] that the regulatory framework in this area is inert, in particular, the speed of work with innovations does not develop properly, since legislation in the field of state order does not allow it.

In general, modern society is beginning to make increasingly high demands on the quality of the urban environment. The corresponding request is formed both on topics related to the improvement of the urban environment, and on issues of ensuring public safety. A new generation of citizens wants to “smartly” consume, always and everywhere to be in touch, quickly and on optimal routes to move around the city, to be able to quickly find the right place or organization, get to the doctor, enroll a child in school or kindergarten, buy products remotely, Promptly pay for housing and communal services and learn about incidents.

In other words, residents are beginning to perceive the city as a service, which fits well with the general logic of the formation of a digital society and economy in Russia.

The solution of these problems through smart technologies will, in our opinion, solve the most important and key task of the modern development of the Russian North - the retention of highly qualified specialists.

References
[1] Order of the Government of the Khanty-Mansi Autonomous Area – Ugra dated March 22, 2013 No. 101-OG “On the Strategy for the Socio-Economic Development of the Khanty-Mansiysk Autonomous Area – Ugra until 2020 and for the Period Until 2030”.
[2] Tranos E & Gertner D 2012 Smart networked cities. Innovation European Journal of Social Science Research, 5:2, pp 175-190. doi: 10.1080/13511610.2012.660327
[3] Dameri R P 2013 Searching for Smart City definition: a comprehensive proposal International journal of computers & technology, 11 (5), pp 2544-2551. https://doi.org/10.24297/ijct.v11i5.1142 doi: 10.24297/ijct.v11i5.1142
[4] Mora Luca, Deakin Mark, Bolici, Roberto 2017 The First Two Decades of Smart-City Research: A Bibliometric Analysis Journal of Urban Technology. T1. VI 24. doi: 10.1080/10630732.2017.1285123
[5] Johan Colding, Stephan Barthel and Patrik Sörvqvist. Wicked Problems of Smart Cities. Smart Cities 2019, 2(4), pp 512-521. doi: org/10.3390-smartcities2040031
[6] Sonya Frey, Joseph E Kelemen, Caroline Colldahl 2013 Smart Cities: Strategic Sustainable Development for an Urban World. 87 p.

[7] Shapiro J M 2008 ‘Smart cities: quality of life, productivity, and the growth effects of human capital’ Review of Economics and Statistics, 88 (2) pp 324-335. doi: 10.1162/rest.88.2.324

[8] 2018 Revision of World Urbanization Prospects.

[9] 16.05.2018: Access mode: URL: https://www.un.org/development/desa/publications/2018 revision-of-world-urbanization-prospects.html (Access date: 11.11.2018)

[10] Sikora-Fernandez D, Stawasz D 2016 The Concept of Smart City in the Theory and Practice of Urban Development Management Romanian Journal of Regional Science. Access mode: http://www.rrsa.ro/rjsr/V1015.Sikora.pdf Access date: 19.03.2018

[11] IshidaT, Isbister K 2015 (2000), Digital Cities: Technologies, experiences, and future perspectives, Springer-Verlag, Berlin; The Age of Intelligent Cities. Smart environments and innovation-for-all strategies, Routledge, New York. doi: 10.1007/3-540-46422-0

[12] Vanolo A 2014 Smart mentality: The smart city as disciplinary strategy Urban Studies. Vol. 51 iss. 5 pp 883-98. doi: 10.1177/0020854814534564

[13] Söderström O, Paasche T, Klausen F 2014 Smart Cities as corporate storytelling City. Vol. 18 iss. 3 pp 307-320. doi: 10.4324/9781315117433-20

[14] Söderström O, Paasche T, Klausen F 2014 Smart Cities as corporate storytelling City. Vol. 18 iss. 3. pp 307-320. doi: 10.4324/9781315178387-20

[15] Cohen B 2018 The third Generations of Smart Cities Inside the development of the technology driven city Fast Company | the future of business. Electronic data. San Francisco. URL: www.fastcompany.com/3047795/the-3-generations-of-smart-cities (access date: 08.04.2018).

[16] Ranking of European medium-sized cities European Smart Cities. Electronic data. Wien, 2018. URL: www.smart-cities.eu/download/smart_cities_final_report.pdf (access date: 08.04.2018).

[17] Samuel J Palmisano A Smarter Planet: The Next Leadership Agenda Access mode: URL: https://www.ibm.com/ibm/cioleadershipexchange/us/en/pdfs/SJP_Smarter_Planet.pdf (Access date: 08.02.2018).

[18] Greenfield A 2013 Against the smart city (The city is here for you to use Book 1) [S. 1.]: Kindle Edition. 153 p. нет дон

[19] Townsend A 2013 Smart cities: Big data, civic hackers, and the quest for a new utopia. New York: W. W. Norton & Company. 416 p.

[20] Shaw J, Graham M 2017 Our Digital Rights to the City Maidenhead: Meatspace Press. 36 p.

[21] Smart City Expo World Congress 2016. Report Smart City Expo World Congress. Barcelona, 2018. URL: www.smartcityexpo.com/en/the-event/past-editions-2016 (access date: 08.04.2018).

[22] 2016 Smart cities and infrastructure United Nations Economic and Social Council. Access mode: http://unctad.org/meetings/en/SessionalDocuments/ecn162016d2_en.pdf

[23] Smart cities – what is in it for citizens? Access mode: URL: https://newsroom.intel.com/wp-content/uploads/sites/11/2018/03/smart-cities-whats-in-it-for-citizens.pdf. (Access date: 11.11.2018).

[24] Digitalization of cities Access mode: URL: https://www.csr.ru/news/tsifrovizatsiya-gorodov/ (Access date: 20.03.2020).

[25] Digitalization of cities Access mode: URL: https://www.csr.ru/news/tsifrovizatsiya-gorodov/ (Access date: 20.03.2020).

[26] Digital technologies will take housing and communal services to a new level. Access mode: URL: http://ac.gov.ru/events/023411.html (Access date: 21.03.2020).

[27] Paris Agreement on Climate Change. Access mode: http://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_russian_.pdf doi: 10.1201/9781351116589-2

[28] Groshev A R, Kivosheev V V, Kushnikov E I, Pelikhov N V, Reutov Yu I, Rodionova A B
2008 Strategic guidelines for the development of education Khanty-Mansi Autonomous Area - Ugra Bulletin of the Ugra State University. 2 (9). pp. 3-78.

[29] Smart City: prospects for digitalization of the urban environment. Access mode: URL: http://volgaprojects.kommersant.ru/smartcity/1 (Access date: 21.03.2020).

[30] Technologies of smart cities: what affects the choice of citizens? Access mode: URL: https://www.mckinsey.com/ru/-/media/McKinsey/Industries/Public%20Sector/Our%20Insights/Smart%20city%20solutions%20What%20drives%20citizen%20adoption%20around%20the%20globe/smartcitizenbook-rus.ashx (Access date: 20.03.2020).

[31] The system of state and municipal government in the context of digitalization: new approaches and the complicity of citizens. Access mode: URL: http://eisr.ru/projects-and-researches/sistema-gosudarstvennogo-i-munitsipalnogo-upravleniya-v-usloviyah-tsifrovizatsii-novyeh-podkhody-i-s/ (Access date: 20.03.2020).

[32] The National Data Management System is becoming a new philosophy of public administration. Access mode: URL: http://ac.gov.ru/events/022871.html (Access date: 21.03.2020).

[33] The system of state and municipal government in the context of digitalization: new approaches and the complicity of citizens. Access mode: URL: http://eisr.ru/projects-and-researches/sistema-gosudarstvennogo-i-munitsipalnogo-upravleniya-v-usloviyah-tsifrovizatsii-novyeh-podkhody-i-s/ (Access date: 20.03.2020).

[34] Romanova A I, Romanov D S, Maksimchuk O V, Voronin A V 2018 Basic principles of innovation management in the urban economy of smart-city International Journal of Engineering and Technology (UAE). 4 (7), pp 412-415. doi: 10.14419/ijet.v7i4.38.24593

[35] Romanova A I, Berval A V, Dobroserdova E A ea al 2017 The use of “Smart” Technologies in the Field of Municipal Services, International Journal of Economic Research 14(7), pp 23-35.