Analysis of Smart Cities Education Needs

V.A. Zhmud [1,2], *A.V. Lyapidevsky*[2], *U.A. Mikhalyova*[3], *O.N. Dolinina*[4]

[1] *Novosibirsk State Technical University, Novosibirsk, Russia*
[2] *Novosibirsk Institute of Software Systems, Novosibirsk, Russia*
[3] *North-West Federal University honored to M.K. Ammosov, Yakutsk, Russia*
[3]*Saratov State University. Gagarina A.Yu., Saratov, Russia.*

Abstract. The study of regional staffing requirements is relevant for planning the development of new and modification of existing educational programs. Currently, universities are forced to take into account regional needs when developing educational programs for the reason that they are responsible for fulfilling the formulated recruitment plan. In addition, the Ministry of Science and Higher Education monitors the placement of university graduates in regional industrial enterprises and business and science enterprises. With insufficient demand for graduates, the opening of a new educational direction may not meet with government support. This means that applicants will be able to enroll in this direction only on a paid basis, therefore, the groups will be small, funds for providing the educational process with equipment may not be sufficient. The higher the recruitment and graduation of students, the better the corresponding educational direction is provided with funds. Many universities plan to open such educational programs as the Smart City and Internet of Things technology program. There is already a department in Novosibirsk with such a direction at the Siberian State University of Telecommunications and Informatics, which increases the responsibility of such an analysis. An analysis of the activities of this department shows that it does not develop fast enough, however, it carries out active innovation and exhibition activities, and also participates in competitions for grants. In addition, the orientation of this department to specific employers as a whole is apparently connected with the Rostelecom corporation, as is the activity of this entire university, therefore other departments of a similar direction compete only for applicants, but not in the field of employment for their graduates. This paper continues the discussion raised in a previous publication [1].

Key Wirds: Smart City, IIoT, IoT

INTRODUCTION

Technologies of a Smart City and the Internet of Things have been especially relevant recently. Novosibirsk State Technical University is located in Novosibirsk, which is the city with more than a million people, with almost two million suburbs. The city has a developed transport structure, including the subway, a developed information structure, almost all residential buildings and enterprises are covered by the Internet, mainly using satellite communications and fiber optic lines. The city is located near the geographical center of the Russian Federation, at the intersection of railway and road transport arteries connecting the most important regions of the Russia, it is one of the most important industrial, scientific and agricultural regions, it has one of the largest airports in the country, connected to almost all major cities of the country and many capitals of Europe and Asia. The rapid industrial development of Novosibirsk and the Novosibirsk Region began during the Second World War as a result of the evacuation of the most important factories from Moscow, Leningrad and other cities of Western Russia to this region. Several technical universities were organized for the staffing of these enterprises, including NSTU, in addition, the Novosibirsk Scientific Center (Academician Town) was established in the southern part of the city, in which there are several dozen scientific institutes, including the Institute of Nuclear Physics, the Institute of Thermophysics, the Institute of Semiconductor Physics, Institute of Automation and Electrometry, Institute of Laser Physics, Institute of Cytology and Genetics, two chemical institutes and many others. Also, Novosibirsk State University was created in Academician Town, which is one of the National Research Universities, which are financed under a separate program, which provides for the accelerated development of research potential. All this creates an extremely favorable environment for the development of the region, especially in the areas of advanced technologies, including information technology, laser, electromechanical, radio electronic, engineering, energy, chemical, biological and many others. The Government of Novosibirsk include Ministry of Digital Development, which proves a significant interest in the development and implementation of digital technologies in the economy of the city and region. The development strategy of Novosibirsk is enshrined in a document presented on the website [2] (Resolution of the Novosibirsk City Hall On the plan of measures to implement the strategy of socio-economic development of the city of Novosibirsk for the period up to 2030 dated 10.07.2019 No. 2515).

SMART GOVERNANCE

Smart Governance is a fundamentally new approach to the management task.

The smart controls include:

- The smooth functioning of the communication system between residents and representatives of the executive branch, information transparency of the city administration;
- The activity of citizens in the management of the city;

- The relevance of strategic planning documentation;
- High traffic to official sites of the city administration.

The governance functions that were previously carried out only by exclusively competent specialists, managers, have now reached such complexity that the training of a sufficiently competent specialist in all areas of knowledge that is required for a sound and at the same time sufficiently operational solution exceeds the capabilities of an individual. Previously, this problem was solved by using expert advice, but this approach is acceptable only for long-term solutions that do not require quick decision-making. If expert advice are convened for operational management, there is a danger that the right decisions will be made so late that their correctness will no longer matter. An intermediate step to solve this problem is to create expert systems that give answers fairly quickly to a variety of complex questions from a wide variety of areas. In this case, the manager still makes the decision independently, and the expert system only provides the necessary information. The next step is to create decision support systems. Such systems not only provide initial information, but are also able to generate possible solutions, as well as simulate the development of a situation in the event that certain decisions are made, that is, make forecasts of the development of the situation depending on the decisions made. In the future, one can discuss the formulation of the problem in such a way that the decision is made exclusively by computer intelligence, without the use of man. In this case, one has to reconsider a person's place in the control loop, which is psychologically very difficult. However, this is not as dangerous as it seems. Firstly, the element of subjectivity is eliminated, the danger that the decision maker does not possess any information is either eliminated, or does not attach the corresponding importance. Secondly, such a system can fundamentally only improve through training, but it is unlikely that it would deteriorate, as it can be with a person due to fatigue, aging, loss of certain skills, illness, excited state, etc.

E SMART ECONOMY

The concept of a smart economy implies significant changes in many industries, as well as in the management of the city as a whole. In particular, such an approach as the "sharing economy" is known. According to the Accenture study, the share of the digital economy in global GDP was 22.8% in 2016 and would grow to 24.7% by 2021 [3].

In this case, several types of global changes in the lifestyle and management of people that are already formed by digital technologies can be distinguished: Labor market, Business models, Logistics, etc. Under the new conditions, company management will have to more frequently review their strategies and operating models so as not to lose to faster competitors. And top managers themselves will have to undergo training more often in order not to lag behind the stream of changes. Sooner or later, profound changes will affect the entire world economy and society. Therefore, it is important to keep abreast of the latest innovations in digital technologies and make them competitive advantages. The advanced urban ecosystem includes qualified specialists and entrepreneurs, specialized investors, large corporations that not only themselves develop new technologies, but are also ready to develop partnerships and invest in startups, as well as infrastructure (accelerators, coworking, consultants, etc.). At the same time, companies operating in the field of digital technologies have to consider the ethical requirements generated by their work.

Many megacities make sense to analyze the experience of the capital of Great Britain, so as not to be "provincial" in the world of digital economies [4]. A smart economy also requires high data security, so the government of the Russian Federation relies on Blockchain technology in this matter [5].

The main tasks of the economy of urban management include:

1. The population growth of the city of Novosibirsk
2. The growth of the humanitarian potential of the city
3. Sustainable economic growth
4. Ensuring safe life in the city
5. Improving the quality of the urban environment [6].

"Smart finance" also refers to a smart housekeeper, that is, 1) the availability of ATMs and cashless payments in stores, via the Internet, from a mobile phone, etc .; 2) accessibility and transparency of employment systems, systems for the provision of services and goods, state tenders and other sources of income; 3) the reliability and accessibility of the payment system from the largest purchases to the smallest calculations, like travel in public transport.

SMART MOBILITY

Smart mobility involves solving the following tasks

- Smart communication tools that allow employees to always be in touch and have all the means to work fully, regardless of their actual location, the ability to participate in webinars, co-edit documents of all types, take part in experiments, in production management, and so on.
- Smart means of finding organizational opportunities for mobility for the purpose of personal professional and career growth - advanced training, job change, additional earnings, educational and industrial mobility, educational tours, mobility for the purpose of recreation, language mobility and so on.

- Smart means of recruiting assistants for any time periods.
- Smart means of feedback on mobility programs and means of finding financial support for mobility.
- Smart tools for organizing summer and winter schools, for organizing hybrid learning spaces with mobility elements, and so on.
- Smart tools for arranging transfers (transfers) and to make a traveler in any country feel as comfortable as at home - a system of booking hotels, transport, buying tickets for all the events that interest the traveler, means of drawing up the best route and managing transfers (as well as acquiring tickets), including in countries whose language is not known to the traveler, and much more [7], [8].

To facilitate mobility, it is very important to provide the “anywhere at home” service for traveling citizens, which increases their integration in a new place of residence, facilitates adaptation, and promotes continuous awareness of all important events that are necessary for taking notes for organizing and improving life (weather forecast, transport information, smart geolocation, etc.) and to perform professional tasks (professional news, high-speed Internet, high-speed Wi-Fi).

SMART ENVIRONMENT

The concept of a smart environment is closely related to two concepts - the Internet and wireless. The continuous coverage of the territory of the subject’s stay with a wireless connection that has Internet access makes it possible to connect to anything and anytime, if at the same time the traffic speed is sufficient and the traffic payment is not significant, then the issue can be considered resolved. For different segments of the population, the concepts of a negligible fee are, of course, different, therefore, you should focus on the average working citizen with an average income level, while you should assume an allowable amount of traffic that significantly exceeds current needs (the so-called unlimited), otherwise there is no need to talk about a smart environment. If the user has to take into account the amount of information transmitted on traffic, he will be engaged in savings, which means that there will be no “smart environment”. The smart environment is incompatible with weak Internet or weak wireless connection, or with such an expensive connection that the user has to save the amount of information transmitted. This problem is almost completely solved in most developed enterprises, as well as in many public places, such as cafes, restaurants, conference venues, and some airports. In some cases, individual units of public transport are equipped with free Wi-Fi access - metro, buses, fixed-route taxis. However, this is far from widespread, in particular, there is as yet no free Wi-Fi at public transport stops, in any shops, in parks, in taxis, at railway stations, in bus stations, in intercity buses, etc. Such a network should cover the entire city as a whole, without gaps, continuously, or this task should be solved through mobile communications, while ensuring an insignificant cost and high speed with unlimited traffic. I would like to name the highest level of the smart environment, first of all, the production process, since for every employed citizen the highest priority is his ability to perform his professional functions not only directly at the workplace, but also at other points of his whereabouts - on the way to work and home, home, even on vacation, because the rhythm of modern work is such that satisfactory salaries are paid only to those who have a certain level of responsibility, which suggests The ability to receive urgent tasks not only during working hours, but also outside of it, as well as the prompt execution of some urgent work (including processing and transmission of information) outside the permanent workplace. To this end, people in creative, pedagogical, and scientific and technical professions do not part with computers or gadgets; for the same purpose, modern phones acquire more and more functions of a handheld computer - the ability to view and edit files of all traditional types, effective browsers, etc. Thus, the highest level should recognize the ability to perform professional tasks from anywhere in the "smart" city as effectively as from your workplace. This feature can be called “mobile office” or “smart office”.

SMART PEOPLE

Research in the field of psychology has shown that for people with a high level of intelligence, they have habits that annoy others. This is due to unconventional behavior, with a quicker response to irritating environmental factors, including social factors. These people react more actively to disturbing public order, more acutely feel changes in working conditions, enter various public organizations to protect their rights, or are completely immersed in professional activities or hobbies, ignoring in some cases those norms that seem insignificant to them, whereas to other people they are seen as immutable [9]. Apparently, smart people are called those people who more quickly and efficiently master the new opportunities provided by the development of smart city technology and the Internet of things, however, this connection is far from straightforward. Some natural caution may hinder the development of new services and capabilities too quickly, in particular the transition to new platforms too fast, new information opportunities in the area where security is not obviously sufficient. In particular, cautious people are in no hurry with switching to a card system, to a payment system using a mobile phone, are in no hurry to purchase bitcoins for settlement of transactions, etc. The caution of smart people is not an obstacle to the development of technologies of a smart city, smart home and the Internet of

things, because if the security of the proposed technologies is proved, it is these people who will first of all switch to new technologies. At the same time, natural or acquired caution will save them from a new type of hacking, which can be called social and technological hacking of security systems. Its essence is that partially information is obtained by hackers due to abuse of user confidence, and part of the information is obtained by hacking, together this information is sufficient for illegal access, withdrawal of funds and other illegal actions. In this regard, methods and means of information protection should be sufficient to ensure complete information security, but their essence should not be disclosed even to the user.

SMART LIVING

Modern technical solutions offer a new vision of what constitutes a "smart life". This problem involves overcoming the threats of the energy crisis caused by the depletion of resources, preserving and restoring the environment, improving all spheres of human quality of life, expanding the number of people covered by these benefits of civilization, and not by destroying the remaining islands of untouched nature, but rather by their careful protection, including expansion and restoration. Vivid examples of effective environmental programs are the restoration of the jungle in Vietnam, the rescue of pandas in China, the organization of reserves and wildlife sanctuaries on all continents, the special zone of Antarctica and the North Pole, etc. At the same time, there are examples of adversity, such as a large garbage spot in the center of the Pacific Ocean, ruthless extermination of whales by Japanese whalers in spite of the worldwide ban on catching whales, destruction of the unique forests of Indonesia, Madagascar, clogging of natural species in Australia, New Zealand, invasive species, etc. .P. Each city, even the smallest, contributes to the destruction of nature and environmental pollution, even if the city itself is relatively clean, its waste, as a rule, poisons and destroys nature in the place where it is dumped, even if they are partially cleaned beforehand, what does not always happen. The most serious threats to the future "smart life" are the most massive processes that are associated with the nutrition of mankind, the supply of its raw materials, fuel, the solution of transport problems, the pollution of natural areas by creating tourist zones in them. In some cases, insufficiently competent authors mistakenly believe that the problems of safe energy, for example, are easily solved by creating solar panels, by using hydrogen as a fuel, by using renewable energy sources, such as growing special fuel crops (see, for example, [10]). In fact, the statement is true that if the car is powered by electric drive or by burning hydrogen, it is environmentally friendly only in the place of its work, since the environment is not polluted near it. But it should be taken into account that in order to obtain this energy, for the manufacture of solar batteries, batteries, engines, the car as a whole, to create all the necessary prerequisites for the operation of this car, somewhere else there are plants that, perhaps, pollute the environment is much stronger than it would be polluted, for example, by some other types of fuel, maybe not looking as environmentally friendly. On the one hand, of course, the emission of exhaust gases from too many cars in a city with a large population can create an environment that is simply dangerous for living. But on the other hand, the need to create a "clean car" should not lead to the creation of environmental disaster zones in other territories. Removing an exhaust site to another territory is not a solution to the problem. In this regard, it is necessary to understand that planet Earth is our common home, only those types that lead to the least pollution of the environment not only at the place of their use, but also at the places of their creation, as well as places of generation or creation of consumables for them - fuel, lubricants, including electricity.

ANALYTICAL OVERVIEW OF THE PROBLEM STATUS IN THE PARTNER REGIONS (NOVOSIBIRSK REGION): GENERAL CONSIDERATIONS

There are many initiative groups in Novosibirsk involved in the development and implementation of the concept of a smart city. In particular, the ComNews Information Group will organize on November 28 a business forum "Smart City & Region: Digital Technologies on the Way to a Smart Country". Venue: November 28, 2019, Hotel DoubleTree by Hilton Novosibirsk (Novosibirsk, Kamenskaya St., 7/1), information about the event on the website [11]. In 2019, the ComNews Information Group will hold a series of regional events under the general title "Smart City & Region: Digital Technologies on the Way to a Smart Country". The events will take place in cities where the Smart City or Smart Region projects have already been launched: St. Petersburg, Vladivostok, Sochi, Sevastopol, Yekaterinburg, Nizhny Novgorod, Novosibirsk, Moscow. The objective of the events is a dialogue between the federal authorities and the national project management structures "Digital Economy of the Russian Federation", on the one hand, and regional / municipal authorities, on the other, as well as the exchange of best practices and agreements on replication of successful regional projects to other subjects of the federation, the study of advanced experience of cities and countries of the world, the formulation of the needs and objectives of regions / cities for the IT and telecommunications community. An important part of the events will be the search for new opportunities for creating public-private partnerships in the interests of regions and cities (including taking into account changes in 115-ФЗ on concession agreements and 224-ФЗ on

PPP introduced in June 2018). The penultimate event of the series took place in Novosibirsk and was devoted to the issues of building a digital information infrastructure for the creation of the Smart City in the Siberian Federal District. An agreement on the inclusion of Siberian cities in the implementation of the Smart City project was signed in March this year. It included Novosibirsk, Krasnoyarsk Territory and the city of Krasnoyarsk, Zheleznogorsk and Zelenogorsk, as well as the Kemerovo Region and Mezhdurechensk. Active introduction of projects has already been started in all the regions and cities represented. In particular, such projects as the municipal portal "My Novosibirsk", the unique information system "Ritual", "smart" stops, which are planned to be made more multilingual, have been introduced and are working in Novosibirsk, and it is planned to install modern information boards at metro stations.

ANALYTICAL ESSENCE OF "APPROACH OR PHILOSOPHY" OF SMART CITIES

Smart City - is one of the key urban trends of our time. The essence of a "smart" city includes many elements - from caring intelligent traffic lights that redirect traffic to reduce congestion, to regulate waste, water systems, monitoring urban transport, through current communication channels. Urban infrastructure programs can have a large number of authors-developers, caring citizens or municipal authorities, but for all initiatives to work together, be used by the maximum number of citizens and provide convenience to all groups of the population, rather than worries and concerns, they must go through various stages testing. The degree of development of the "smart city" can be determined by the number of management sectors covered by intelligent technologies, by the complexity of technologies and the totality of their use. The implementation of the concept of a "smart city" usually begins with the introduction of technologies in some areas that are not interconnected, including e-government systems that improve communication between the city administration, various institutions and residents. This helps to improve the collection and processing of data about the city. Based on the experience of leading countries, two main approaches to implementing the concept are identified. The first approach includes the introduction of Smart City technologies, through the design and construction of new cities. This helps to think through the infrastructure of the future city and ensure maximum unification of all urban systems. Examples of this approach are the projects being developed or being implemented in cities in South Korea, the United Arab Emirates, and China. In most cases, these are relatively small, compact settlements, where the infrastructure is built from the very beginning according to previously developed, usually quite strict standards. Often, the improvement of such a city is seen as a single megaproject, which is detailed on some projects and component fragmentary projects, and its effectiveness is initially regarded in terms of economic effects. The second, most common approach, provides for the implementation of the concept of a "smart city" in existing cities, where, based on the existing infrastructure, local or comprehensive programs for the implementation of intelligent technologies are implemented, which are further integrated into systems. The leaders in this area - Amsterdam, Stockholm, Barcelona, Singapore - have connected significant areas of urban economy with the help of intelligent technologies, many times increasing the effectiveness of urban systems and the quality of life of the population.

ANALYSIS OF EDUCATION NEEDS

The rapid growth of the educational needs of the region led, inter alia, to the opening of the Smart City department at the Siberian State University of Telecommunications and Informatics. The administration of the Novosibirsk region also supported the idea of creating the triangle "science - education - production". When this link emerges, universities begin to work closely with innovative companies, and a strong synergistic effect is obtained. Most of the graduates who come to work in the IT company were not sufficiently prepared for the modern needs of employers - this is the head of this new department. He claims that their skill does not meet the needs for quality and level of development of the necessary competencies. In his opinion, companies had to train young professionals for an average of six months. It is much more profitable when companies, in cooperation with the university, prepare students for their own needs with subsequent employment. In addition to the opening of such a department, it is planned to open a specialized programming school, where not only students, but also everyone will be accepted. The project is being developed, included in the regional program "Digital Economy", and most likely it will be implemented. The department invited several companies to participate in the project, together we will adapt existing professions, qualifications and competencies to the requirements of the business. A national platform for industrial automation (NPPA) has been created, which supports and promotes the Smart Region project through scientific and human resources assistance, NSTU is also a member of this association, and NSTU is a permanent representative in this association. V.A. Zhmud, head of the Department of Automation. The word "platform" in the name of this association is key. It would be a mistake to believe that the concept of a smart city can be reduced to a heap of some local solutions, such as a smart stop, a smart traffic light, and a smart trash can. A smart city and smart region is primarily a platform that implements the key principle of smart city - the reuse of data and

infrastructure. For example, thanks to an integrating system, the same surveillance camera can be used by a variety of services and departments for their purposes: to monitor road traffic, to ensure public safety, to control the quality of street cleaning, etc. In the same way, different services can use data from each other's information systems for their needs. This is what brings real efficiency, ensures the availability of information and reduces duplication of costs. Such an integrating platform was developed on the basis of the NPPA Association, it has already been tested in several constituent entities of the Russian Federation, and has every chance of becoming the basis of the "smart region" in our Novosibirsk region. It must be understood that smart city is such a thing that, firstly, cannot be implemented "from above", and secondly, it cannot be realized without involving business and the public in the project, as well as without the collaboration of a large number of very different specialists. That is why initiative companies and universities have created a working group for the Smart Region of Novosibirsk Region project. Professionals from various fields and sectors — housing and communal services, transport, telecommunications, education, ecology, safety, etc. will be invited to participate in it. The authors of the project rely on the response of companies, experts, public organizations and are ready to offer promising projects of the "smart region" in many industries [12].

TRENDS IN INDUSTRIAL DEVELOPMENT

The theme of smart cities has been actively developed in recent years. In Novosibirsk, regional authorities and enterprises developing technical solutions pay special attention not only to theoretical research in this direction, but also to practical steps to implement elements of this concept to directly improve the living standards of city residents. Elements of this concept are realized: smart schools, smart stops, smart traffic lights, smart lighting and many others. In particular, smart schools are introducing food systems for schoolchildren with payment on the student's name cards, these cards also serve as passes to the school, which provides more effective protection of school institutions in order to counter terrorism. Food with a credit card eliminates the need to supply children with cash, which eliminates the possibility of their weaning or loss, since in many cases (in particular, at physical education classes) children leave some of their belongings unattended, this creates conditions for minor thefts, in all cases guarantees the absence of such incidents. Also, in this case, the use of pocket money for other purposes not related to school lunches is also excluded. When using bank cards with special functions, parents can receive SMS alerts about what the child bought for lunch, what time he had lunch, when he arrived at school and when he left school and so on. In the future, it is planned to expand the functions of these cards, including to pay for travel and so on. This technical solution has been successfully implemented by the Novosibirsk Institute of Software Systems (NIPS) in the Irkutsk region, it is also fully ready for implementation in schools in the city of Novosibirsk. The concept of smart stops involves not only notifying passengers about the public transport schedule and the actual waiting time for the nearest vehicles, but also ensuring comfortable waiting, including the ability to charge smartphones, providing Wi-Fi, tracking all public transport units on the city map, display of the current situation on traffic jams on the road and the degree of danger of one or another part of the road due to icing, etc. The concept of smart traffic lights involves changing the duration of the opening for travel of different directions depending on the different traffic load of different directions, it is also possible to use the concept of reverse lanes. Push-button traffic lights for pedestrians can have additional functions of an increased interval of traffic obstruction when using the transition by an invalid or an elderly pedestrian, for these purposes such pedestrians can have special cards or tokens that are attached to the traffic light control panel. All these elements of a smart city constitute separate solutions, their combination requires a common concept, common standards and a single software platform, as well as standard hardware. The complex application of all technical solutions within the framework of a single concept is difficult, therefore pilot projects are being implemented in small cities. However, small cities do not have sufficient funding, so pilot projects are financed centrally from the state budget and from the regional budget. In particular, pilot projects in the cities of Linevo and Koltsovo, which are part of the Novosibirsk Region, are financed in this way.

FACTORS THAT ENHANCE THE CREATION OF SMART CITIES IDEAS

The rapid growth of managerial tasks of the city authorities leaves no choice, a comprehensive solution to these tasks can be carried out only within the framework of a single concept. Many small private solutions are a way that will not allow us to achieve our goals in the shortest possible time, since they will not be hardware and software compatible, there will be unreasonable duplication, while a single and complex solution through standard software, hardware and platform solutions, on the contrary will make it easy to replicate and build up ready-made and well-proven solutions. The most important thing here is that the areas of automation of many city managements functions and the areas of decision-making with fully computer intelligence without human participation can expand gradually, starting with the least significant. In particular, the transfer of traffic control switching functions does not seem dangerous. When they were created, they were programmed extremely primitively, based on the

simplest relay circuit with fixed intervals, regardless of the actual situation on the roads, traffic lights are now almost universally implemented, controlled depending on the intensity of intersecting roads, and even more intelligent algorithms for controlling them are being gradually introduced. Improving these management features is efficient and safe. A higher level is the switching of traffic flows at the level of strategic urban traffic management. But the operator's intelligence can be replaced by computer intelligence with the obvious superiority of computer intelligence, since it can analyze more factors faster and more efficiently, its operation algorithm can be relatively simple, but it can also be more flexible, intelligent, based on heuristic methods, fuzzy logic, neural networks. Managing train schedules, city transport, etc., managing taxi calls and other tasks that are close in functional complexity are already tasks that computer intelligence can do better than human today, since multi-agent optimization can solve such problems, which human consciousness cannot embrace. The next step of the day is more complex tasks, such as driving a separate car and so on. At the same time, there is no doubt that, for example, the management of subway trains can long be completely shifted to computer intelligence. Therefore, the transition to computer management is risky, you only need to competently build a sequence of actions for the transfer of individual functions, that is, to develop a reasonable roadmap for solving these problems. Certainly, there remain areas in which the transfer of control to computer intelligence seems categorically impossible at the present stage, however, the development of this approach and success at certain stages can change the alignment of forces and expert opinions on this issue. This section is filled out based on interviews with experts from the Novosibirsk Region published on open sites.

CRITERIA FOR IDEAS SELECTION

City and regional authorities organize competitions to support research in order to create and implement smart city technologies and the Internet of things in the city and region. Competitive conditions involve the development of a business plan for the implementation of the proposed technologies. One of the most important aspects is the quick payback of the proposed projects. Priority for financing are projects that involve the phased implementation of the proposed solutions, with a return on the implementation of technical solutions at each stage, but, of course, a solution is needed that focuses on understanding the full range of tasks to be solved in the future, which requires not only a vision of the nearest steps, but also a vision of the whole perspective. The most obvious solutions are those in the areas of traffic management, public transport, taxi, housing and communal services, kindergartens and schools. Also promising are the introduction of smart solutions at the airport, at the railway station, at the bus station, in museums, theaters, cinemas, in the subway, in large department stores, restaurants, canteens, and sports facilities. A fortunate coincidence for the implementation of these projects is the planned large-scale sporting events for which the construction of a new stadium (Ice Palace) is underway. In order to best meet the needs of citizens, smart stops are already being introduced in Novosibirsk. Students of Novosibirsk State Technical University have developed and implemented "smart price tags" in stores. At the competition of initiative projects, the authors of the development received a cash prize of 100 thousand rubles. Smart price tags allow customers to read the code combination and find out all the necessary information about the product. This is especially valuable, because in the practice of commodity producers there is an increasing tendency to place information about the product, including the composition, release date and expiration date of food products, in small print on the package, in some cases, the choice of the background color and inscription is such that it makes reading this information even more difficult. while the smart price tag allows you to read information on a large font phone. In the future, these technical solutions should not be implemented using the Internet connection received from mobile operators (which is connected with the payment of traffic), and stores using these price tags are expected to provide free Wi-Fi protected traffic without logins and passwords. In addition, it should be noted that not all buyers have modern phones, there is also a certain percentage of buyers, mostly older, who are not advanced users of modern gadgets. For them, in large stores special barcode readers are installed, which also allow you to find out all the necessary information about the product, also find out its cost or two costs, if there is a bonus card and if it is absent (or the usual price and value of the stock). Along with the criteria of actual payback for an organization introducing a new technical solution, the criteria of indirect payback or indirect usefulness of an innovation can be used, for example, improving the quality of services for citizens, improving social security of citizens, simplifying the procedure for commercial or other activities, and so on.

TECHNICAL-ECONOMIC DEPENDENCIES IN SMART CITIES CONCEPTS

Technical and economic characteristics of the proposed innovative solutions are evaluated in conjunction with the stages of the product life cycle. The life cycle includes the costs of scientific research, the production of prototypes, the preparation of mass production of goods, the production and sale of new products, their introduction and use, and it is also necessary to determine in advance the life time (period of use) of the product, the cost of its removal from production

and disposal in the future with a more modern technical solution. Accounting for expenses at all expense stages of the life cycle allows you to more correctly plan expenses at the income stages and calculate profitability, taking into account all types of costs, both past and future. A typical example of such an innovative solution is the replacement of water, heat, electricity flow sensors of the types that are currently the most common, requiring visual reading of the readings and transferring them to organizations providing these services personally by users with sensors that can be read remotely by these organizations themselves. In this case, for example, an organization providing water supply, instead of waiting for users to enter the readings of these sensors in their personal account, after which it will be possible to bill for this service, will be able to independently read off the readings of these sensors programmatically via Internet networks , automatically. In addition, invoices will be automatically issued, and in case of delays in their payment, interest will be automatically charged. This will reduce the percentage of debt from users of these utilities, which will improve the activities of organizations that provide these services. Currently, as a result of debts from users, organizations are forced to raise tariffs above economically justified ones, which affects conscious users who pay for these utilities on time. In other words, those citizens who pay regularly are forced to overpay so that suppliers have sufficient funds that they receive due to the irregular payments from other citizens who are not so responsible about the obligations of timely payment. Therefore, responsible technical citizens and service providers are interested in such technical solutions, and only those who currently live on debt due to the irregularity of their payments are not interested.

ANALYSIS OF BUSINESS ENVIRONMENT

Since we are talking about technologies for the Internet of things, the equipment is divided into two components - software and hardware, moreover, the hardware solution may be less expensive than software. However, the software solution does not wear out and lasts longer, although it also has a limited life cycle due to obsolescence. Some ideologists of these technologies favor the development of standards, however, experts indicate that such standards are already available and are international, so you should only stick to them. All software and hardware solutions that do not fit into these standards are doomed to failure, at best they will be used locally and temporarily, in the worst case they will not be implemented anywhere. Of particular importance is the task of ensuring information security, which, in the case of a smart city, develops into a comprehensive security task. Recently, distributed registry systems are considered the most effective means of ensuring information security. Data protection in this way is provided by a large number of computer users. The program “Digital Economy of the Russian Federation” has been launched in Russia, six roadmaps for implementing this program until 2024 have been approved, including a program for the development of distributed registry technologies. Roadmaps were approved by the Prime Minister of the Russian Federation Dmitry Medvedev in the fall of 2019. On the territory of Novosibirsk, a competence center will be organized on the basis of the organization, which is the leading research center in this area. The absolute territorial leader in this area is the Public Joint-Stock Company Novosibirsk Institute of Software Systems, which has prepared an application for recognition as the leading research center of the consortium based on this organization, the Technopark of the Novosibirsk Scientific Center (Academpark), Novosibirsk State Technical University, and Novosibirsk National Research State University and a number of other organizations that are regional leaders in software environments stv and systems.

TRENDS IN INNOVATIVE DEVELOPMENT OF SMART CITIES CONCEPTS

A significant part of the development of any economic activity is currently based on digital technology. For example, with the development of the Internet, new business sectors appeared on its basis, for example, in the gaming industry alone, revenues are measured in millions of dollars per day. Digitalization with its competent application, firstly, increases efficiency, and secondly, creates new services and content that are widely in demand and bring added value. All this is created mainly by the efforts of enthusiasts who carry out their projects at the expense of borrowed funds, grants or from their own savings at their own peril and risk. Some participants in innovative initiatives do not stand the competition or are not sufficiently prepared for the difficulties of market relations, but nevertheless, as a result, the best solutions win, provided that they are implemented using sufficiently effective technology. Certainly, it may turn out that a brilliant idea is realized by insufficiently effective managers and is defeated only for this reason, it rarely happens when an insufficiently effective idea is realized by effective managers, since truly effective executors do not undertake the implementation of those projects in which they do not believe in effectiveness. For the implementation of promising ideas, therefore, assistance is required to entrepreneurs seeking to implement their innovative ideas. Funds for supporting innovative initiatives exist for these purposes, and the Academpark, among other things, facilitates these processes by accumulating teams of young and initiative entrepreneurs, helping them to solve routine tasks, assisting in legal, informational areas, offering technical support, and facilitating the resolution of issues by providing production

facilities and infrastructure . The amount of added value from the implementation of innovative ideas is determined by the human factor, talent and enthusiasm of entrepreneurs. Soon, the basis for competition between different territories will be the struggle for such talents who, on the one hand, are the creators of smart services and added value, and, on the other, are active users of these services. This is an avalanche-like process that feeds itself, therefore it is important not only to equip the region with digital technologies where it is profitable and possible, but also to create a comfortable environment for talented people so that it is convenient, environmentally friendly, safe. That is, smart city, in fact, is a tool for the competition of territories for the minds.

FOURTH INDUSTRIAL REVOLUTION INDUSTRY 4 0 AND IMPACT ON INTELLIGENT CITIES

The fourth industrial revolution and direction Smart city, Internet of things, Industrial Internet of things, Wireless communications, Computer intelligence, Big data, Quantum technologies, Heuristic methods - all these are interconnected end-to-end technologies that are impossible and inefficient to develop separately. They should be developed jointly, and all this area is now called the Digital Economy, it is a universally recognized multifaceted international project. This definition was born in those countries where the main decisions are made by the municipalities, since it is in them that most of the funds are concentrated. There, the system is built in such a way that the money is owned mainly by the municipalities, therefore the municipality is the foundation for the implementation of these programs. Therefore, we are talking about a smart city. In our country, a three-level budgeting model, where the municipal level is at a lower position than the regional one. Therefore, if we take into account the Russian and regional specifics and geography, the “Smart Region” may be the more correct wording. On the one hand, the project is financed mainly from the regional budget; on the other hand, it would probably be fair to give municipalities full access to all smart city services. In this regard, it is impossible to draw a line between the conditional "village" and "city", where all development is given to the "city". Therefore, Russia needs precisely the “Smart Region”. The concepts of the city of Novosibirsk and the Novosibirsk Region are inextricable; there is the Government of the Novosibirsk Region under which the Ministry of Digital Development has been created (see [13]). The development and implementation of a digitalization program without the participation of this Ministry is impossible, and one must think and care not only about the city, but also about the region as a whole, such is the regional specificity. In this matter, the Novosibirsk region does not lag behind other regions of Russia, but is among the leaders. This region has two huge competitive advantages. An important aspect of the economy of the future is human resources. Today in Novosibirsk about two thousand graduates of IT specialties are published every year. These two factors give the region a huge advantage. However, the need for graduates of IT specialties is estimated at ten thousand a year, which is five times more than the existing indicators, therefore, in order to meet the future needs of the region, it is necessary to promptly increase the amount of training in this area by five times, and Of course, improving the quality of this training and the competitiveness of trained specialists is required. It is also necessary to take into account that if trained specialists are in demand in the labor market of the Novosibirsk Region, then they will inevitably be in demand in other regions as well, which will cause an outflow of personnel, therefore, with the indicated needs, the actual output growth should not be five times more, but even higher than that indicator.

PARTNERS SPECIFIC STRATEGIES OF SMART CITIES: EXISTING INFRASTRUCTURE ON PARTNERS REGION

The most important component of creating a smart city is infrastructure. The regional government began to create its own data centers (DPC), communication channels and the necessary infrastructure in a very timely manner. The two Data Processing Centers currently created have a huge reserve that is several years ahead of the region’s needs. There is also a structure of communication channels: channels of operators, channels of administration. Many channels are laid with optical fiber, which has undeniable advantages over other communication channels. This distributed environment guarantees the possibility of providing traffic to all users at affordable prices. Novosibirsk Academic Park (Technopark of the Novosibirsk Scientific Center of the Russian Academy of Sciences) is the most important link in the creation and improvement of the region’s infrastructure for the creation and development of innovative potential. Academpark regularly organizes forums, seminars, exhibitions, promotes the creation of consortia, and provides its sites for various events in the field of innovation. For teams of young businessmen in the field of technical innovations, preferential conditions are provided for obtaining space, and these are not just empty rooms, but ready-made offices equipped with computer equipment connected to high-speed Internet networks, you can also get the necessary legal advice at preferential prices on the territory of the technopark, or even free of charge, there are also resolved all the issues of nutrition and other infrastructure problems. Another important aspect is the regular holding of summer and winter schools on the innovative development of the region. The exchange of ideas, opinions, technical

achievements, their publication on a single site of the technopark creates a certain synergistic effect, contributing to the acceleration and improvement of the implementation of innovative ideas. An important factor is the possibility of receiving serious critical comments from more experienced colleagues, which avoids the elementary errors of the growth of small enterprises. Thus, technology parks are a key link in the development of regions. They contribute to the creation of small innovative enterprises, carry out their incubation guardianship, promote the popularization and introduction of products, and establish horizontal and vertical ties [14], [15].

CYBER SECURITY

Cybersecurity issues are key in solving smart city tasks, since it is assumed that so many functions are transferred to computers and a computer network. Apparently, there are no and cannot be final technical solutions in this area, because two opposing processes are constantly taking place: while some developers are creating more and more new methods of protection against hacker threats, others are working tirelessly and developing more sophisticated methods of implementation hacker attacks. Apparently, the most dangerous period for any gap in information security is the period when it was not detected by the creators, and the most dangerous period of the action of viruses and virus-like programs is the period of their incubation spread, when they only penetrate various computing devices, but still Do not start to harm. These tasks are not being solved at the regional level, but at the federal level. Since there are some legislative restrictions on the storage, for example, of personalized data on personal computers that have physical access to the Internet, this at least indicates that the legislative bodies that have adopted such documents do not trust software protection against hacks, therefore, insurance requires the hardware impossibility of leakage of this data on any network. Of course, if the computer is not connected to the Internet, information from it theoretically cannot be removed, but one should take into account the fact that, for example, a laptop, it has all the software and hardware capabilities for connecting to the Internet via wireless lines, so if Such a computer acts as such a storage, then theoretically it can, without the knowledge of the user, contact the wireless communication line and transfer information there, provided that the corresponding malicious software component has penetrated into it and installed t, performing such actions without user consent and no indication of these actions. In addition, such information protection tools cannot be used in any way in technical means and systems that ensure the implementation of the smart city concept, since this concept is inseparable from the transfer of data from various devices to various recipients, including purely hardware that a person does not control in principle, instead, they should work completely autonomously and automatically. Perhaps the best solution would be a total rejection of technical equipment that is susceptible to viruses and virus-like programs, just as it is impossible, for example, to infect reptile with some specific diseases of mammals, or even, perhaps, like it is impossible, for example, to infect a machine flu intelligence. But such an idealized approach is impossible, since smart city technologies are already being implemented on software and hardware that are not sufficiently protected from hacking. The situation is further complicated by the fact that, for example, if a particular technical device is immune, for example, a Macintosh computer is not susceptible to attacks targeting Intel computers, but if data centers use Intel computers, and the Macintosh computer is connected to such a center, then it may be exposed to danger, and it would seem to be a technical tool immune to such problems. Cybersecurity issues are seriously discussed on many open sites, for example, [16].

Currently, these problems remain extremely relevant and there is no ready-made solution for them, especially at the regional level.

PRIVACY CONCERNS

Confidentiality consists in the need to preserve information without disclosure and without transmitting it without coordination with all owners of this information to third parties, even if there is a visible need. Information can be transmitted only if there are two prerequisites, the first of which is that it is advisable, and the second that it is unsafe and allowed by all owners (authors) or confidents.

Thus, Confidentiality is the need to prevent disclosure, leakage of any information.

With the development of information technology, the problem of confidentiality and confidential information is becoming increasingly important. And in different areas and different countries, confidentiality and confidential information is defined differently.

In the countries of the European Union, confidentiality of information is regulated through a number of agreements and directives, such as EU Directive 95/46 / EC, 2002/58 / EC and ETS 108, ETS 181, ETS 185, ETS 189.

Thus, the Convention on Crime in the Field of Computer Information (ETS N 185) is aimed at deterring, inter alia, actions against the confidentiality of computer data and computer networks, systems. Under this convention, in order to counter crimes against the confidentiality of the availability and integrity of computer data and systems, each party takes the legislative and other measures necessary to qualify it as a criminal offense in accordance with its domestic law:

- Unlawful access
- Illegal interception
- Impact on data
- Impact on the functioning of the system

• Unlawful use of devices.

According to the Convention on the Protection of Individuals with Automatic Processing of Personal Data (ETS N 108), parties must maintain confidentiality or confidentiality in the processing of personal data, as well as with respect to information accompanying a request for help.

The Directive "On the protection of individuals in the processing of personal data and on the free circulation of such data" (N 95/46 / EC) addresses the issue of confidentiality in their field. According to this directive, an "operator" is an individual or legal entity, a state body, an agency, or any other body that independently or together with others determines the goals and methods of processing personal data; when the purposes and methods of processing are defined by law or by-laws at the national or Community level, the operator or specific criteria for its appointment may be established by national or Community law. A "processor" is an individual or legal entity, a government agency, agency, or any other agency that processes personal data on behalf of the operator. To ensure confidentiality, any person acting under the direction of the operator or processor, including the processor itself, who has access to personal data, cannot process them, except on behalf of the operator, if he is not required to do so by law.

According to the supplement to the directive N 95/46 / EC, directive 2002/58 / EC, confidentiality regarding the processing of personal data and the protection of privacy in the electronic communication sector consists in the prohibition of viewing, recording or storage, as well as other ways to intervene or monitor messages and related traffic data carried out by persons or other users without the consent of the user.

In the Anglo-American tradition, there are two main types of confidentiality: voluntary (privacy) and forced (secrecy). (See Edward Shills - The Torment of Secrecy: The Background & Consequences Of American Security Policies (Chicago: Dee 1956) In the first case, this refers to the prerogatives of the individual, in the second case, information for official use, available to a limited circle of officials a firm, corporation, government agency, social or political organization. Although privacy and secrecy are similar in meaning, in practice they usually contradict each other: reinforcing secrecy leads to violation and reduction of privacy. In totalitarian and authoritarian states, under confidentiality, as a rule Lo, I mean only secrecy.

At present, Russian legislation does not clearly define the concept of "confidential information". The Federal Law No. 24 "On Information, Informatization, and Information Protection", which has expired, states that confidential information is documented information, access to which is limited in accordance with the legislation of the Russian Federation.

The current Federal Law "On Information, Information Technologies and Information Protection" (hereinafter "On Information") does not contain the term "confidential information". However, it describes the concept of "confidentiality". "Confidentiality of information is a requirement for a person who has gained access to certain information to not transfer such information to third parties without the consent of its owner." According to the same law, "information is information (messages, data) regardless of the form of their presentation".

In the Decree of the President of the Russian Federation "On approval of the list of information of a confidential nature" to information of a confidential nature include:

• Information about facts, events and circumstances of a citizen's private life, allowing him to identify his personality (personal data), with the exception of information to be disseminated in the media in cases established by federal laws.

• Information constituting the secret of the investigation and legal proceedings, as well as information on the protected persons and state protection measures.

• Official information, access to which is limited by public authorities in accordance with the Civil Code of the Russian Federation and federal laws (official secrets).

• Information related to professional activities, access to which is limited in accordance with the Constitution of the Russian Federation and federal laws (medical, notarial, lawyer's confidentiality, confidentiality of correspondence, telephone conversations, mail, telegraphic or other messages and so on).

• Information related to commercial activities, access to which is limited in accordance with the Civil Code of the Russian Federation and federal laws (trade secrets).

• Information about the essence of the invention, utility model or industrial design before the official publication of information about them.

Thus, in the Russian Federation, confidentiality is defined as binding upon a person who has gained access to certain information (messages, data), regardless of the form of presentation, the requirement not to transfer it to third parties, without the consent of the person who independently created the information or received on the basis of law or agreement the right to permit or restrict access to information determined by any grounds. Above was a list of information that is classified as confidential. But the law "On Information" allows the owner of the information to give it the status of confidentiality independently. Therefore, the list in the Decree of the President of the Russian Federation "On approval of the list of information of a confidential nature" is approximate [17].

INTEROPERABILITY

There are great difficulties in the process of creating and implementing intelligent technologies, as a result of which barriers are formed for "smart cities". Among the main obstacles are the low priority of the topic on the agenda at all levels of government, the lack of obvious incentives (including economic) to reduce the costs of introducing innovations, the lack of benefits with significant initial costs and expenses, and the slow exchange of information in this area. In addition, among the barriers there is low coordination and fragmentation of infrastructure management systems, heterogeneous interests of various departments, and limited demand for innovations by the population due to low knowledge of technology potentials. These problems lead to the fact that there is a narrow introduction of technology in large cities with fairly capacious markets, where the concentration of high-income people creates a sufficient demand for innovation, while only local tasks in limited areas are solved. In cities with low economic potential, the introduction of intelligent technologies is even more difficult, which leads to the lag of these cities, their further loss of competitiveness and a decrease in attractiveness. Overcoming these barriers could partly be facilitated by large complex projects that provide for a radical change in the paradigm of development of urban systems. In order to overcome the above barriers, it is the authorities that must formulate long-term goals and create conditions for their achievement. The development of the necessary infrastructure can be ensured through the use of various models of public-private partnerships, and the financing of key projects can be carried out through the provision of preferences, budget funds, banks and funds. As a result, it should be noted that the development and implementation of intelligent systems should be accompanied by the involvement of all parties interested in the sustainable development of the city. The state should act as a coordinator of similar interactions, ensuring the identification of opinions and interests of all these parties, as well as providing access to the process of managing and using data, services and infrastructure. Together with infrastructure modernization, new technologies solve the main task of eliminating the technological backwardness of cities, and the use of intelligent systems creates the potential for future sustainable development. Thus, we can say that at present, state structures are the operator in solving the problems of creating smart cities. Funding mechanisms for these tasks exist and various can be applied. One of the most real mechanisms, apparently, is associated with the Digital Economy of the Russian Federation program, where the volume of one project is determined in the amount of up to 200 million rubles, the period from receiving financing to the start of implementation is no more than a year, which imposes very strict restrictions on who can be the recipient of such funding. In addition, the contractor must seek and attract third-party extra budgetary funding in the amount not less than state funding, that is, the same 200 million rubles, and the cost of one project in this case reaches 400 million rubles. in year [18], [19].

BENEFITS OF SMART CITIES IN THE PARTNER REGIONS

The commercial interest in the Smart City methodology is associated with the possibility of acquiring many positive effects (economic, social, environmental). The use of information and communication infrastructure and technologies allows us to adapt the work of urban systems to real needs and loads, resulting in lower costs, by reducing resource consumption, increasing the quality of services, creating new points of economic growth. The introduction of intelligent technology affects almost all areas. For the transport sector, this means an increase in mobility, a decrease in time costs, for healthcare, a reduction in costs due to better diagnosis of diseases, the least burden on institutions, easier access to medical care, quality control of services, improving public health, for education - checking the learning process, personalization programs, improving access to knowledge, for finance - reducing costs, increasing transparency, security and simplifying transactions, promoting crowdfunding, new payment systems, increased targeting in budget management, for the environment - quality control of the environment and buildings, the introduction of new effective materials, for production and construction - optimization of production processes, verification of resource costs. Accordingly, the Smart City concept enhances the overall level of safety, including environmental, reduces emissions and resource consumption. The acquisition of significant effects is confirmed by the experience of cities, for a long time, working on the implementation of Smart City. The use of intelligent technologies has contributed to achieving a reduction in energy consumption - by 30%, street crime - by 30%, traffic - by 20%, water loss - by 20%. Indirect effects achieved as a result of the adoption of best management decisions and the development of a better urban environment are expressed in the form of progressive economic and social activity, economic growth, increased incomes of the population and budgetary funds. The economic effects of the introduction of intelligent technologies consist of a reduction in the expenses of city residents and budget expenditures, as well as in the growth of income of local enterprises. At the same time, released financial resources can be returned to the economy by expenses of households and companies in other areas, by investments in improving services, which, taking into account the multiplier effects, will have an additional impact on economic growth. Stimulation of growth is also

achieved through more efficient use of the city budget or reduction of local taxes for companies in priority sectors of the economy. In practice, the development of intelligent technologies primarily affects cities with significant economic potential, the budgetary security of which allows for the implementation of such projects, and the authorities are quite well aware of the advantages of a "smart city". Areas where the benefits of their use are undeniable are particularly attractive for the implementation of intelligent technologies. These include energy, the modernization of which allows companies to achieve a large effect of saving resources and costs. And also, the introduction of intelligent transport systems that allow you to achieve complex effects - from optimizing traffic flows in the city, reducing the load on the road network, to improving road safety and improving the environmental situation in the city. Potentially promising experts believe such areas as education, medicine, and the provision of social services. The introduction of smart city technologies in these areas allows us to individualize services and control their quality, adjusting them according to customer needs, increase security and at the same time exercise oversight of budget expenditures in these areas [20].

COLLABORATION BETWEEN INDUSTRY AND UNIVERSITIES IN SMART CITIES CONCEPTS

Strengthening the interaction between universities and regional industrial enterprises is one of the priority tasks of universities, which were created to provide the largest industrial enterprises of the city with highly qualified technical personnel. During the USSR period, trained students were distributed mainly at the request of enterprises, while preference was given to enterprises in the city. The distributed student was required to work for at least three years in the enterprise to which he was sent. The right to choose distribution places depended on the student's academic performance, the higher the academic performance, the more choice he had for his further job. In the post-Soviet state, the distribution institute was initially completely eliminated, however, practice has shown that certain elements of such targeted training of specialists are also needed in a market economy, which does not infringe on the rights of the student and employee, but simply optimizes their opportunities for further employment. In the region, as in the whole country, the institute of targeted training of specialists is functioning. It affects all levels - undergraduate, graduate, postgraduate studies. In graduate school, for example, the practice is such that all budget places for the training of graduate students can be converted into target ones on the basis of the presence of a large number of applications from regional industrial enterprises. Undergraduate studies in targeted training programs allow students to receive additional scholarships for the Presidential program. In this case, the organization, which is the customer for the training of this specialist, must provide co-financing in the process of its preparation. This additional financing does not have to be in the form of direct payments, it can be offset in the form of depreciation of equipment, the cost of services provided to guide student practice, the cost of utilities and other expenses associated with undergoing student training at the enterprise. The advantage of this method is that the student does not come to the enterprise as an expert with only general competencies and ideas about future work, but as an established specialist with positive practical experience. The company also gets the advantage in that the specialist hired for permanent work has already been tried and tested, its value and usefulness for future work has been proven. At the same time, by mutual agreement, the labor contract may be terminated, however, experience shows that enterprises providing a sufficient social package and a sufficiently high level of wages do not fear that the specialist trained with their help will not work at this enterprise, sufficient motivation ensures that personnel in the workplace. Two years ago, Novosibirsk State Technical University achieved the status of regional support universities, which means that in the territory of Novosibirsk and the Novosibirsk Region this university is the most significant university that trains personnel for industrial enterprises in this region.

ROLE OF THE UNIVERSITIES IN SMART CITIES CONCEPTS

All the technical universities of Novosibirsk (NSTU, SibGUTI) and the classical university - NSU are involved in the development of Smart City concepts. The development of this idea requires the creation of consortia and the further optimization of innovative infrastructure aimed at this task. Representatives of the institutes of the Siberian Branch of the Russian Academy of Sciences and high-tech enterprises, administrations of universities and authorities recently discussed the formation of the innovation infrastructure of the Novosibirsk Region in the context of the implementation of the Strategy for Scientific and Technological Development of the Russian Federation. "The Novosibirsk region is one of the leaders in terms of quantity and diversification of innovative infrastructures not only in Siberia and the Far East, but also throughout Russia. However, generalizing statistical indicators indicate that the level of innovative activity of enterprises in the Novosibirsk region, unfortunately, amounts to a little more than a third of the same indicator in the Tomsk region, which, apparently, is determined by a large number of technical universities in Tomsk.

The representative of the business community, the general director of ZAO Radio and Microelectronics Evgeny Bukreev, for example,

noted that small and medium-sized enterprises primarily need a single center representing the interests of the entire industry of Novosibirsk. On behalf of such an organization, it will be possible to conduct a dialogue with state corporations, to protect small companies from being absorbed by larger ones at the moment when the first have formed a new profitable market. As the Vice-Rector of Novosibirsk State University, Doctor of Physics and Mathematics Sergey Kuzmich Golushko, notes, the university chose as one of the vectors for the development of innovative activity the search for interesting developments within the university and converting them into large applications for funding, for example, as part of the National Technological Initiative. There are two centers of innovation infrastructure in NSU; three more are planned to be created. “The center for technology transfer and commercialization that is currently working is creating an innovative, entrepreneurial environment at the university, working with students, employees, and researchers to form teams for technological entrepreneurship. In 2018, together with the institutes of the SB RAS and other organizations, we completed the Aerotomography project to create a complex for geophysical exploration using unmanned aerial vehicles. The global market for Aerotomography is estimated at $ 100 billion, and the budget at 400 million rubles,” - commented Sergey Golushko. Speaking about the role of the authorities in the development of scientific and engineering infrastructure, creating a territory with a high concentration of research and development, the Minister of Science and Innovation Policy of the Novosibirsk Region, candidate of physical and mathematical sciences Aleksei Vladimirovich Vasiliev noted that the task is to create a comfortable environment: both for researchers and and for technological entrepreneurs, engineers, business, and consists of several components. “Firstly, world-class infrastructure should be created here, that’s exactly what the Institute of Nuclear Physics im. G. I. Budker SB RAS and the Institute of Catalysis named after G. K. Boreskova SB RAS during the construction of the synchrotron. Secondly, we need flexibility and representativeness of educational trajectories, which will increase the competitiveness of our educational organizations, the minister said. - Thirdly, in the transition to innovation, it is necessary to offer not what can be done, but what there is a need for. It is necessary to competently analyze the needs now existing, their dynamics and predict, and maybe form those ones that will be relevant in a year, five or ten years. Equally important is modern competitive specialization. Finally, it is necessary to form a set of services and competencies that will make our territory as attractive as possible so that promising technology entrepreneurs do not leave us” [21].

REGIONAL POLICIES FOR SMART CITIES ECOSYSTEMS

The Novosibirsk administration pays great attention to the problem of creating a smart city. In particular, on regular forms of the Novosibirsk Expocenter, organized events are organized, including the International Forum Urban Technologies. It is designed so that developers of innovative solutions can find and implement new developments, scientific technologies in order to improve the quality of life of Novosibirsk citizens. The format of the event is a business program that includes 26 different sections. The key event of the forum is the plenary session “Cities of the 21st Century: Creation of Modern Infrastructure”, at which representatives of various countries, including the representative of Indonesia and the director of the Russian-Singaporean Council, speak. Also, within the framework of "Gortech" a competition was held for best practitioners in the direction of "Smart City". Technological tours, excursions to city and regional enterprises and visits to scientific centers are carried out. During the forum, agreements are signed with large corporations offering projects for the implementation of smart technologies. So, within the framework of the forum, the proposals of the Joint Stock Company “United Rocket Engineering Corporation” for replenishing the city electric transport fleet were considered and generally approved. Softline holding company Schwabe (Rostec) presented its developments in smart lighting and traffic flow regulation. JSC Sitronics, which is a subsidiary of AFK Sistema. They made proposals to the project on smart housing and communal services. The management of this company, headed by the General Director and his deputy, visited Novosibirsk and carried out a series of consultations and meetings on the implementation of the smart city concept in Novosibirsk. A large exhibition was organized at the forum, including all areas of the municipal economy. According to the press service of the Novosibirsk Expo Center International Exhibition Complex, companies and organizations from different parts of Russia became participants in the exhibition. Also, within the framework of the forum, the official speech of Novosibirsk Mayor Anatoly Lokty “On the socio-economic development of the city of Novosibirsk until 2025” was held. The forum was organized by the mayor's office of the city of Novosibirsk and the Siberian Branch of the Russian Academy of Sciences [21].

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Vadim Zhmud – Head of the Department of Automation in NSTU, Professor, Doctor of Technical Sciences.
E-mail: oao_nips@bk.ru
630073, Novosibirsk,
str. Prosp. K. Marksa, h. 20

Alexander V. Liapidevskiy,
PhD in Economics, director of the Novosibirsk Institute of Program (Software) Systems, the author of about 100 scientific articles. Area of scientific interests and competences - software systems and tools, innovative technologies.
E-mail: nips@nips.ru
Russia, Novosibirsk, 630090, prosp. Ak. Lavrentieva 6/1. NIPS.

Ulyana Anatolyevna Mikhaleva - Head of the Department of MTS TI FSAEI of NEFU named after M.K. Ammosov.
E-mail: uamikhaleva@mail.ru

Olga Dolinina - Director of the Institute of Applied Information Technologies (InPIT), Saratov State Technical University named after Yu.A. Gagarin, Dr. of Techn. Sciences, Professor.
E-mail: olga@sstu.ru
410054, Saratov, Polytechnicheskaya str., 77

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