# Assessment of Cities in Russia According to the Concept of "Smart City" in the Context of the Application of Information and Communication Technologies

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*Abstract*

*The article deals with the "smart city" concept, which is understood as such a model of the city, which provides, on the one hand, the sustainability of its development, and on the other - to stay in the comfort of its occupants. To analyze and assess the state of affairs, we have chosen one of the five "smart city" key elements, namely, the information-communication technologies including the following: new urban technologies, ICT in education, ICT in public health care, in electronic government and public services. The situation in three biggest Volga Federal Region cities (Kazan, Samara and Nizhniy Novgorod) has been analyzed. Recommendations on how to implement the "smart city" concept in other Russia's cities are made.*

**Keywords:** *"smart city" concept, public security, energy consumption control, megacity, environmental protection, intellectual transport system,information– communication technologies.*

## 1. Introduction

The concept of "smart city" and its introduction into Russia's megacities management has been very popular recently. The city infrastructure is becoming more and more complex. New technologies are being introduced, as well as the very habitat of our city dwellers is changing steadily. That is why it is essential to develop innovative approaches to solve numerous urbanization problems and to create new convenient living conditions.

The "smart city" is a uniform system of urban economy management based on the energy saving and energy-efficient technologies, informatization of the production processes and the city infrastructure. The "smart city" concept focuses on the employment of the advanced technologies which enable one to consume rationally the available city resources, first of all, energy supply, as well as to minimize their harmful impact on the city environment. The "smart city" system also deals with new approaches how to organize and run transport infrastructure, electro-power engineering, water supply, and "smart buildings" construction.

A uniform information space accumulating data on the activities of various city municipal facilities is being set up within the framework of the "smart city" concept implementing. It is possible to control the facilities remotely in real time.

## 2. Literature Review

Articles devoted to various urban problems can be arbitrarily divided info 5 big groups. First of all, these are problems connected with the process of social-economical city development management [1]. Secondly, there are articles dedicated to the analysis and comparison of cities competitiveness, as well as to the revealing of possibilities how to intensify the latter [2]. The third group of articles is aimed at analyzing a steady city development in terms of regional economy, as well as at elaborating techniques concerning the selection of city stability indices to assess the city state of affairs and estimate its effectiveness [3].

The fourth group of papers is devoted to cities branding [4]. The articles of the fifth group study various possibilities to build "smart cities". Thus, for instance, Jung Hoon Leea, Marguerite Gong Hancockb, Mei-Chih Huc tend to shed light on the process of effective and efficient construction of a "smart city" with the attraction of state and private investments, employing the experience of San-Francisco and Seul as an example [5]. Sotirios Paroutisa, Mark Bennettb, Loizos Heracleousa use interviews and documents in order to carry out a detailed analysis of various city economic entities' interest in the implementation of the "smart city" concept [6]. Komninos N., Pallot M. and Schaffers H. analyze how highly

developed European cities work out "smart city" development strategies on the basis of net infrastructures and the Internet. At the same time they assign an important role to city dwellers, as well as to the development of new forms and types of collaboration among local authorities, research institutes, universities and businesses [7].

Deakin M., Al Waer H. consider problems connected with the intellectual cities construction, paying special attention to social problems. They suggest carrying out the transition from intellectual cities to smart ones, taking into account the mistakes revealed [8].

In his article, Malek J.A. offers to calculate the information global index of social development (IGC) enabling one to analyze the development of the community located in the intellectual city [9].

## 3. Method

As s whole, the "smart city" concept can be arbitrarily divided into several constituent parts:
1) intellectual transport system
2) public security
3) energy consumption management and control
4) environmental protection
5) information-communication technologies (ICT).

Within the framework of the present investigation we have chosen to examine one of the main elements, or "basics", of the "smart city", namely, information- communication technologies, comprising the following elements: new urban technologies; ICT in education; ICT in public health care, electronic government and state services. The situation in three biggest Volga Federal region cities (Kazan; Samara and Nizhniy Novgorod), has been analyzed. The results obtained are presented in the following tables.

**Table 1:** Employment of advanced urban technologies in the cities of the Volga Federal Region (VFR)

| | | Kazan | Weight | Samara | Weight | Nizhniy Novgorod | Weight |
|---|---|---|---|---|---|---|---|
| 1 | Internet | | | | | | |
| | The number of free Wi-Fi points in public places | 1135 | 0,96 | 1190 | 1 | 1107 | 0,93 |
| | Wireless Internet on public transport (the number of already-equipped transport routes) | 2 | 0,67 | 0 | 0 | 3 | 1 |
| | Wireless Internet in the Underground (the number of stations) | 0 | 0 | 0 | 0 | 1 | 1 |
| | LTE new generation Internet nets available (4G). The number of operators | 3 | 1 | 2 | 0,67 | 0 | 0 |
| 2 | Official city site | | | | | | |
| | The site availability | + | 1 | + | 1 | + | 1 |
| | The number of visits/ attendance (per day) | | | | | | |
| 3 | QR-codes in the city | + | 1 | + | 1 | + | 1 |
| 4 | Electronic tickets | | | | | | |
| | Railway stations | + | 1 | + | 1 | + | 1 |
| | Airports | + | 1 | + | 1 | + | 1 |
| 5 | Universal electronic card of a city-dweller | | | | | | |
| | Availability | | | | | | |
| | The number of cards already issued | 160 | 0,67 | 107 | | 60 | 0,38 |
| 6 | Ministries' official web pages in social nets | - | 0 | + | 1 | - | 0 |
| | Total weight | | 9,28 | | 8,67 | | 8,69 |

The data obtained give evidence considering that, in accordance with the introduction and employment of new technologies, Kazan occupies the top place (9, 28). It results from a rather big number of acting Internet–operators (now in force) of new generation (4 G) and a successfully functioning official city site which is intensively used by the city–dwellers. Two other cities (Samara and Nizhniy Novgorod) are a bit behind Kazan. Each of the two cities has its own strong points and advantages in the sphere above. Samara houses the biggest number of free public Internet points. There are official web-pages of the city top authority in the Twitter, as well as Samara mayor's office video channel in the

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YouTube. It implies that Samara authorities are efficiently employing social net resources to improve their image among the active net users, namely, the young ones. It should be also mentioned that Samara is the only city here which has started introducing the Net in the Underground. Nizhniy Novgorod also tries not to lag behind the rival cities: 3 city routes are equipped with the wireless Internet there and, as the city authorities have already promised, the number of the routes will be increased.

**Table 2:** Cities rating in accordance with the ICT employment in education

|   |                                          | Kazan | Weight | Samara | Weight | Nizhniy Novgorod | Weight |
|---|------------------------------------------|-------|--------|--------|--------|------------------|--------|
| 1 | Pupil's electronic card (the number of schools) | 89 | 0,47 | - | 0 | 189 | 1 |
| 2 | Electronic education                      |       |        |        |        |                  |        |
|   | The availability of trend                 | +     | 1      | -      | 0      | -                | 0      |
|   | Electronic journal/ diary system          | +     | 1      | +      | 1      | +                | 1      |
|   | Distant education                         | +     | 1      | -      | 0      | +                | 1      |
|   | Total weight                              |       | 3,47   |        | 1      |                  | 3      |

Of the three cities, the leader in ICT employment is Kazan (3,47). Nizhniy Novgorod is a bit behind Kazan (3), but Samara lags behind significantly as it is doing practically nothing in this particular sphere.

**Table 3:** Cities rating in accordance with the ICT employment in healthcare

|   |                                                                      | Kazan | Weight | Samara | Weight | Nizhniy Novgorod | Weight |
|---|----------------------------------------------------------------------|-------|--------|--------|--------|------------------|--------|
| 1 | Healthcare unified portal                                            | +     | 1      | +      | 1      | -                | 0      |
| 2 | Convenient way to be put on the list                                 | +     | 1      | +      | 1      | +                | 1      |
| 3 | Mobile application                                                   | +     | 1      | -      | 0      | -                | 0      |
| 4 | Availability of innovative projects in the sphere of public healthcare | +   | 1      | -      | +      | +                | 1      |
| 5 | Innovation centers in the sphere of healthcare                       | +     | 1      | +      | 1      | -                | 0      |
|   | Total weight                                                         |       | 5      |        | 3      |                  | 2      |

Kazan is still the leader in the sphere of healthcare as well. A unified healthcare portal is successfully functioning in the capital of Tatarstan. There are several mobile supplements which help make an appointment with the doctor, as well as get to know the doctors' timetable. Samara occupies the second place as it lacks innovation projects in public healthcare and mobile supplement, but an apparent outsider is Nizhniy Novgorod as from all the enumerated parameters it meets the demand of only two.

**Table 4:** Cities rating in the sphere of the state services and electronic government service employment

|   |                                          | Kazan | Weight | Samara | Weight | Nizhniy Novgorod | Weight |
|---|------------------------------------------|-------|--------|--------|--------|------------------|--------|
| 1 | Online services                          |       |        |        |        |                  |        |
|   | Payment for utility services             | +     | 1      | +      | 1      | +                | 1      |
|   | Paying traffic penalties                 | +     | 1      | +      | 1      | +                | 1      |
|   | TS registration                          | +     | 1      | +      | 1      | +                | 1      |
|   | Registry office services                 | +     | 1      | +      | 1      | +                | 1      |
|   | SP registration                          | -     | 0      | -      | 0      | -                | 0      |
|   | The number of electronic services        | 138   | 1      | 110    | 0,8    | 66               | 0,48   |
| 2 | The number of government services informats | 138 | 1      | 44     | 0,32   | 7                | 0,05   |
| 3 | Mobile supplements                       | +     | 1      | -      | 0      | -                | 0      |
| 4 | Mobile version                           | -     | 0      | +      | 1      | -                | 0      |
| 5 | The Internet-reception room              | +     | 1      | +      | 1      | +                | 1      |
| 6 | The city electronic card                 | +     | 1      | -      | 0      | -                | 0      |
| 7 | Personal account                         | +     | 1      | +      | 1      | -                | 0      |
| 8 | City/ Regional news multicasting         | +     | 1      | +      | 1      | +                | 1      |
|   | Total weight                             |       | 11     |        | 9,12   |                  | 6/53   |

The last criterion is the availability and effectiveness of the "Electronic government" service in the cities. In this context

the situation is the same , i.e. Kazan is a constant leader. Kazan electronic government provides all necessary services including all those making the citizens' access to the state services easier. Samara goes second. Here the electronic government is developed only a bit worse as the city does not possess mobile supplements and city electronic card. However, as a whole, Samara state services fulfill their main function (5) rather effectively and efficiently. The lowest position is occupied by Nizhniy Novgorod. Its poor quality services provided via the Internet and record-breaking low number of "Electronic government" infomats round the city should be specially mentioned. It may be connected with the fact that the service mentioned above is not very popular among the citizens of Nizhniy Novgorod.

Using the data obtained we may produce a summarized cities rating in accordance with the level of their information-communication technologies development.

**Table 5:** Summarized cities rating

|  | Kazan | Samara | Nizhniy Novgorod |
|---|---|---|---|
| New urban technologies | 9,28 | 8,67 | 8,69 |
| Education | 3,47 | 1 | 3 |
| Public healthcare | 5 | 3 | 2 |
| Electronic government | 11 | 9,12 | 6,53 |
| Total weight |  |  |  |

## 4. Results

Thus, the city of Kazan certainly heads the list (28,79) as it has the leading positions according to all the parameters. Then goes Samara (21,79) followed by Nizhniy Novgorod (20,22). In accordance with the analysis carried out the following two conclusions can be drawn.

Firstly, when the key criterion is the introduction of information-communication technologies into the city infrastructure the best city, or the "smartest city", to be more exact, is Kazan as all the innovations here are used more efficiently and, even more, they are in great demand among the city-dwellers in all the spheres under consideration.

Secondly, all the three cities (Kazan, Nizhniy Novgorod and Samara) are actively developing other constituent parts of the "smart city", such as "smart roads", crossroads, innovations in the public utilities sphere and energy-saving technologies, in other words, everything that could be attributed to the smart city" concept.

At the same time it is necessary to admit that despite the already obtained results, it is too early to say that we have achieved the stated goal, i.e. it is too far for Russian cities to become really "smart" ones. The greatest difficulty lies in the fact that the initial and final stages of this process ought to take place simultaneously. For example, the introduction of intellectual systems to the traffic management and control should be carried out immediately along with the construction of new bypasses and bridges. Special large-scale investments as well as highly-qualified specialists are required to make these plans come true.

## 5. Conclusions

Cities normally encounter numerous problems which, in their turn, make it difficult to introduce new urban technologies into the city life, among them:
- city-dwellers, who are ill-informed about the technologies introduced;
- absence of information exchange among the city dwellers, city economic entities and local authorities;
- non-complex introduction of the "smart city" technologies;
- insufficient transport system intellectualization.

Taking info account foreign experience in this field, it is necessary to carry out complex measures to implement the "smart city" model, namely:
- to have citizens informed and trained enough to be ready to accept advanced urban technologies;
- to carry out systematic monitoring of the city environment as the key element of the "smart city";
- to operatively provide "on-line" information for the local authorities about all the faults in the city systems functioning.

Besides the above mentioned principles of the "smart city" actualization, it would be beneficial to introduce step-by-step the following advanced technologies to make the city more convenient and attractive to live in:
1. "smart traffic lights" and "smart crossroad" technologies;

2. "car-sharing" system (short – term car hiring);
3. "smart municipal transport" with on-board computers and without conductors;
4. "smart stations" equipped with anti-vandal security cameras, information indicator boards and bilateral telephone device to contact the police, ambulance or dispatcher;
5. separate waste collection as the first step towards the urban ecological security;
6. special mobile supplements for the citizens to inform the local authorities about various city problems;
7. information of the citizens in advance about new ICT to be introduced into the city infrastructure (via SMS-distribution, the Internet and home address distribution).

All the enumerated elements of the "smart city" are likely to be put into practice in Russia's cities in the nearest future. Moreover, they are to mitigate significantly the citizens' life, making it much more convenient and comfortable. They are expected to relieve pressure on our roads, to reduce the number of traffic jams, to make the every- day life of citizens much safer, as well as to improve the ecological situation in the cities. The state and municipal governmental bodies and businesses are the true driving forces to stimulate and motivate the introduction of the "smart city" model. The "smart city" is the right site for fruitful private-state partnership and collaboration, which are to create new jobs, to ensure ecological problems solving and re-distribution of energy, etc. The "smart city" concept is an effective tool contributing to the development of the city economy and environment. The municipal authorities should understand that the approach presented gives a perfect opportunity for peaceful co-existence of both artificial and natural human "habitats" . In this sense it is the only possible model of our future survival in the technogenic world.

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