Analysis of tools and data sources for assessment of digital city development

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Abstract. The relevance of the work is due to the search for opportunities and tools for obtaining analytical information to assess the quality of life of the population of the digital city. The heterogeneity and constant complication of human activity in modern cities, as well as the unique economic, cultural and managerial specifics of various countries and cities determine complexity of the problem under consideration. The transformation of urban life and citizens' activities entails the need for a qualitatively new construction of the relevant organizational, managerial, information and communication structures, which must fulfill their functions with sufficient efficiency, minimal resources, and at the same time, have the flexibility and adapt to fast-paced development of cities. The development and evaluation of indicators of the quality of life of the population in the “digital city” seems to be a necessary component of the effective social and technological progress of the Russian society.

1. Introduction

The problems associated with improving the quality of life of the population and factors determining the dynamics of such indicators become very important at the present stage of society development. Despite the restrictions associated with the external economic situation, the state policy in Russia is aimed at accelerating the development of information and digital technologies, on which largely depends political and economic stability in society. The idea of a smart city based on the infrastructure of information and communication technologies (ICT) and the continuous development of the city has a special focus on people.

The key prerequisite for a digital economy is digital management, whereas the transition from a “smart city” to a “digital one” is based on the achievement of a qualitatively new level of management technologies. In many ways, a “digital city” is not a real object, but a “horizon”, an ideal for the development of urban society, the movement to which is intended, in particular, to improve the quality of life of its citizens through the organic daily use of ICT, artificial intelligence technologies, big data, etc. [1, 2, 3].

Holistic approach to the problem results from the heterogeneity and continued complication of human activities in modern cities, as well as from unique, country- and city-specific dimensions of the economy, culture and management. The transformation of urban life and citizens' activities calls for a qualitatively new set-up of relevant structures to conduct activities in the spheres of management,
organization, information and communication. Such structures must perform their functions with sufficient efficiency, minimal resources, and at the same time should be flexible and adaptable to rapid urban development.

2. Materials and methods
In a narrow sense, the population’s quality of life is an indicator of the distribution efficiency of limited resources by the state. More broadly, it reflects the success of political governance of the state as a whole [4, 5, 6].

Today, the “quality of life” can be recognized as one of the key concepts in studies of socio-economic processes, which require the understanding of the potential of existing methods for assessing the quality of life of the population and determining the basic methodological requirements for the contents of relevant methods. However, despite the experience gained in modern theory and practice, even the most reliable and proven indicator systems tend to become obsolete over time. Therefore, there is a need for continuous work on the development of up-to-date approaches for assessing the quality of life level, relevant to the needs of the contemporary society.

Today, most of the existing indicators are taken from official government sources. The source of these indicators is determined by the official state statistics website: www.gks.ru, many indicators can be found in open form on the websites of various departments: www.roskazna.ru, минобрнауки.рф, www.rosminzdrav.ru

For a competent and rational introduction of a “digital city” concept into the existing infrastructure, there are not enough indicators presented only in official resources. There is a need to study how information technologies are used in the management of urban resources. Because of the lack of such an information in the official state statistics, there is a need to attract additional information from unofficial sources, such as news sites, geographic information systems, social networks, various specialized websites, etc.

For the rational and high-quality implementation of the “digital city” concept, we have developed a system of quality indicators for urban services, equally evaluating each area of city management, both in terms of smart indicators and traditional indicators characterizing the effectiveness of urban infrastructure. The authors proposed the quality of life indicators of the population in the future “digital city” on the basis of surveys and questioning both the city population and specialists in the areas of “smart education”, “smart medicine”, “smart environment”, “smart transport”, “smart management” and others.

3. Results

3.1. Quality of Life Indicators in a Digital City
One of the main problems in developing a system of indicators for the life in a digital city is the necessity of developing indicators not previously used for keeping any statistics. This situation is especially evident in relation to indicators concerning aspects of urban resource management using information technologies.

The authors developed a system of indicators of urban services and quality of life, equally evaluating each area of city management, both in terms of development trends and traditional indicators (Fig. 1).
A set of indicators of the quality of life of citizens must be adapted to the specifics of the development of a “Smart City”. For each of these areas the digital city has developed its own system of indicators.

For example, the following indicators are proposed for discussion and selection for the Smart Healthcare subsystem:

- The number of electronic medical records per 1000 people;
- The number of patients receiving medical services with the help of embedded intelligent devices “connected patient” per 1000 people;
- The share of telemedicine in the total volume of medical services;
- The share of online counseling in the total volume of medical services;
- The number of specialists provided to the patient for selection in counseling;
- Number of “family doctors” per 1000 households;
- The share of medical services aimed at the prevention of diseases and healthy lifestyle;
- The share of feedback to assess the quality of medical services in the total volume of services;
- Number of responsible persons for the quantity and quality of medical services rendered to the total number of leaders of medical organizations;
- The speed of obtaining new information about services, treatment technologies, specialists;
- Number of cases of remote selection of medical services provided;
- Number of sites in the Internet space for discussion of health problems by patients and health professionals.

As a second example, let us consider the Smart Management group of indicators – these indicators reflect how close is the interaction of government bodies and information technologies. A smart management system automates the processes of providing state and municipal services, as well as the implementation of state functions, such as automatic tax collection. The basis of smart systems in this area is electronic document circulation and electronic signature technologies, whereas digitization and automation of data collection ensure efficient and repeated information usage [7-10].

Table 1 presents the indicators of the quality of life of the population for the Smart Management subsystem of a digital city, marked as important. These data were obtained as a result of expert evaluation by specialists of government bodies and the population of the city; about 100 people took part in the survey.
Table 1. Proposed indicators for assessing the quality of life for the subsystem Smart Management

| Indicators of the quality of life of the population (subsystem Smart Management digital city) | Indicator considered as important (%) |
|-------------------------------------------------------------------------------------------|---------------------------------------|
| 1. Information awareness of population about the tax collection and distribution           | 0.10                                  |
| 2. Traffic of city administration sites                                                   | 0.44                                  |
| 3. Electronic public services                                                              | 0.78                                  |
| 4. The number of open data sets published on the portals by the city administration        | 0.22                                  |
| 5. The level of development of strategic planning documents                               | 0.56                                  |
| 6. The level of public procurement transparency                                           | 0.44                                  |
| 7. Development of the “E-democracy” system                                                | 0.22                                  |
| 8. Getting public services                                                                 | 0.78                                  |
| 9. Ratio of automated and non-automated inter-agency requests.                            | 0.22                                  |
| 10. The number of areas of e-government                                                    | 0.56                                  |
| 11. The share of citizens using the mechanism of obtaining state and municipal services in electronic form | 0.78                                  |
| 12. Share of population having electronic signature                                        | 0.22                                  |
| 13. Level of citizens’ involvement in city management                                      | 0.22                                  |
| 14. Ratio of entered and processed messages on the E-democracy portal                      | 0.22                                  |
| 15. Percentage of people using mobile apps that provide citizens’ participation in city management | 0.34                                  |
| 16. The number of citizens’ electronic petitions brought to court and reviewed by the court | 0.34                                  |
| 17. Number of online systems for public discussion of the development of the urban environment and infrastructure | 0.56                                  |
| 18. The number of mobile applications and services provided by the city administration     | 0.56                                  |
| 19. Number of legislative information storage-and- retrieval systems                       | 0.56                                  |
| 20. Percentage of legislative bodies using interdepartmental electronic document circulation | 0.22                                  |
| 21. The number of mobile applications for citizen participation in city management         | 0.22                                  |

Monitoring indicators of the quality of life of the population will quickly assess the effectiveness and efficiency of development of all subsystems of a digital city and, which is equally important, ensure uniform development and distribution of investments.

3.2. Analysis of Unofficial Sources for Information Gathering

For a full assessment of the level of development of the infrastructure of the “digital city”, indicators presented only on official resources are clearly not enough. Part of the indicators concerning the use of high technology in the management of the city and urban resources can be found from unofficial sources, for example, through news sites:

- “The share of the regions in which the system of contactless payment for public transport is implemented” is taken from a source on the website of the newspaper “Arguments and Facts” - www.nsk.aif.ru;
- "The number of clinics that can perform complex heart operations" is taken from a source on the website of the newspaper Novye Izvestia - www.newizv.ru;
- "Percentage of Internet banks of the total number of banks” is taken from a source on an independent news website - www.tadviser.ru;
- “The share of garbage cans design according to the “Smart garbage can” principle” is taken from a source on the news site in the field of smart technologies – www.worldiot.ru.

Many indicators can be determined using highly specialized thematic sites, for example:
• “Number of used battery collection stations” is determined on the interactive map of the site www.punkty-priema.ru;
• “The number of hotels where rooms can be booked through the Internet-booking system” is determined on the website of online hotel reservation www.booking.com;
• “The share of regions that have joined Medesk” is determined directly on the site of this system www.medesk.ru;
• “The Cyber Security Index” found on the website of the Markswebb agency, which is specializing in investigating, auditing and consulting in the development in the field of effective Internet products - www.markswebb.ru.
• The authors have evaluated the existing software products that are capable to perform functions of collecting and processing information from unofficial sources, sites and various text resources:
  • TargetHunter designed to analyze various social, networks with the aim of collecting an audience for marketing research.
  • CompareR is a powerful site analysis tool. However, the result of the activity of this tool relates only to the study of the technical component of the site, namely, its indexing, as well as the presence of errors.
  • AftParser is a convenient tool for collecting various content from any sites, but the purpose of this tool is to collect information for publication on some information resource.
  • Grep is a command line utility that allows searching for keywords or phrases on files in the computer file system. Text Finder tool, like Grep, does also perform searching on files in computer database. However, it differs from the utility by the presence of a clear interface and the ability to display the context in which the desired phrase or word is used.

The analysis showed that the existing software could not completely solve the problem of search and retrieval the necessary information to assess the indicators of the quality of life in the "digital city" [11]. In order to computerize this process, one should plan to create an information system for collecting and processing unofficial information, the source of which is news sites.

4. Conclusion
The transition to a digital economy model in the world economy is accompanied by fundamentally new qualitative changes in the socio-economic relations at the state level and also at the level of business structures. In order to measure the effectiveness of digital economy it is necessary to have generally accepted and unambiguous methods, which are not available today. It is obvious that the results should be assessed based on the goals and objectives set and should be anticipated and interpreted subject to the criterion of socio-economic feasibility. A digital economy strategy can not be developed solely for the sake of testing a new idea.

In the course of the study, we have analysed possible information sources, both official, intended for collecting and processing statistical information, and those obtained from various information platforms and sites.

The performed study takes into account both newly and previously developed quality indicators for subsystems or aspects of digital city. As the result, the authors added quality of life indicators according to their perception of digital economy, and chose the data analytics systems that are suitable for selecting or finding the values of the designed indicators. It is to note that various departments monitor ICT usage in a digital city”, while neither fully taking into account foreign experience, no providing uniform methodological, terminological and conceptual approaches. The study revealed the absence of a unified database of official information on the digital economy, which would represent the entire set of available indicators calculated taking into account international and national standards.

The authors have developed indicators of quality of life for the subsystems or components of the “digital city”, and assessed the capabilities of existing information analytical systems, with which one can find the values of the proposed indicators.
Acknowledgments
The reported study was funded by RFBR according to the research project No. 17-32-01087 a2 OGN.

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