International Journal of Economic Research

ISSN : 0972-9380

available at http: www.serialsjournal.com

Volume 14 • Number 7 • 2017

The use of "Smart" Technologies in the Field of Municipal Services

Andrei Vladimirovich Berval[1] Anna Ilyinichna Romanova[1] Elena Aleksandrovna Dobroserdova[1] Tatiana Aleksandrovna Elokhova[2] and Alexander Vladimirovich Voronin[3]

[1]*Kazan State University of Architecture and Engineering Russian Federation, Republic Tatarstan, 420043, Kazan, Zelenaya str., 1*

[2]*West Ural Institute of Economics and Law, Russian Federation, 614000, Perm, Siberian str., 35D*

[3]*Industrial university of Tyumen, 625003, Tyumen, str. Volodarsky, 38*

ABSTRACT

This article covers the use of "smart" technologies to develop ways to control the infrastructure of the city, showing the prospects of a significant increase in performance and efficiency of the activities of institutions and organizations of the urban center, subject to the proper application of such technologies in economic activity. The issues raised in the paper today are highly relevant to both public authorities and institutions and organizations of the urban center. The article analyzes the main aspects and the basic directions of the use and development of these innovative ways of management.

Russian and foreign experience dealing with the use of "smart" technologies to manage traffic, housing and communal services of cities is studied.

The use of "smart" technologies to develop ways to control the infrastructure of the city is essential in order to maintain a competitive advantage, which is important especially in times of economic crisis, when local budgets lack economic resources. International practice of using "smart" technologies to manage the city's infrastructure also reveals a significant increase in performance and efficiency of the activities of institutions and organizations of the urban center.

Keywords: Automation, smart technology, urban management, economic policy, city development.

1. INTRODUCTION

1.1. Recovery of municipal infrastructure

Methodological issues of organizing and conducting the overhaul are passed by the Housing Code of the Russian Federation at grass-roots levels, where they are often solved without adequate scientific justification. A few research suggestions for ways of improving the methodology of overhaul planning can be divided into two groups:

First, when formulating the problem building operation process seems to be completely deterministic.

Second, when the object of repair may include several options for repair and reconstruction works, which differ in structure and scope.

As for their development, the first group is based on the methodological principles similar to the principles of the functioning of the system of preventive maintenance. In addition, this method assumes that the remaining defects below the plan will allow the building to operate normally, and inadequate repair will be eliminated in the next planning period. Summarizing the above, we can conclude, that the first group is characterized by the repetition of methodological shortcomings of the system of preventive maintenance.

It seems to be more rational, when it is provided to choose the best option among a certain number of objects planned to repair, each of which permitted a number of different options for the repair work.

Methods of planning of a less rigid approach to the process of operation of the building, allowing certain deviations from the regulatory scheme of operation of the building, to a greater extent reflect the real conditions. More widely advanced mathematical techniques can be applied in such models. The presence of several admissible strategies of repair service stimulates the search for the optimal variant. On this basis a transition to optimal planning of the overhaul and reconstruction of residential buildings can be provided. In one of the first attempts to develop a model of an optimal plan of repairs a set of buildings with a certain degree of physical deterioration is considered (Assanova, 2015; Berval, 2015; Box, 1970; Jiang, 2012; Romanova, 2010; Romanova, 2015; Zagidullina, 2013a; Zagidullina, 2013b).

It is assumed that the cost of major repairs of 1 m2 of living space, depending on the degree of wear and permanent buildings is known. On the basis of these dependencies for all buildings, potentially subject to repair, repair is defined by the performance indicator, which characterizes the reduced wear of the building at a cost of one ruble per square meter of a living space. It is assumed that, taking into account the performance indicator of repair, one can choose from all potentially repairable buildings a set of buildings, repair of which will provide under specified allocations the maximum reduction in the average depreciation of the total housing stock of the city.

According to this approach, it is doubtful to plan an optimality criterion, that is, the maximum reduction in the average wear of all the stock. It is well known that the dependence of the repair of 1 m^2 of living space on the building wear is not linear, that is, an investment of 1 ruble in the repair of 1 m^2 of buildings of varying degrees of wear and tear gives different efficiency in the sense of eliminating physical deterioration. Thus, among the objects that are potentially to be repaired, the objects will be more or less "profitable". It goes without saying that in the optimization plan according to the accepted criteria and restrictions less "profitable" objects remain left out.

The new Housing Code provides owners with the right to choose the timing and volumes of repair work in the house, *i.e.*, to make for them a convenient schedule of complex overhauls. This fact complicates the classical model of optimization, moving the terms of repairs to the terms agreed with the tenants. Approval of economically and socially sound timing inevitably causes the problem of early replacement of some not old objects of a building, which leads to economic losses.

Obviously, one must seek to minimize these losses. To do this, from the diversity of modern building materials it is necessary to select those ones durability of which will be most synchronized with the longevity of the main types of materials used in the repair.

All kinds of fixed assets of housing and communal services are in the process of reproduction, which is implemented through the overhaul, modernization, renovation and new construction.

The overhaul plays a crucial role in the simple reproduction of fixed assets, and it is a complete or partial replacement of constructive elements of objects. The overhaul aims at reducing physical depreciation of housing and communal services.

The overhaul, as a form of reproduction, does not compensate for the functional deterioration of the building and only increases the level of cost parameters. Representing a range of works on the full or partial replacement of structural components and engineering systems of objects, it leads to physical deterioration compensation and allows carrying out reconstruction and strengthening of existing structures, improving their strength and performance.

In general, overhaul planning of the common property of apartment buildings is a managerial activity aimed at developing the goals and management tasks to control reproduction of multi-family residential buildings, as well as determining ways to implement the planned solutions to achieve their goals (Bakhareva, 2015; Bakhareva, 2016; Cho, 2014; Xie, 2011).

As you know, the possibility of performing such activities by territorial and municipal authorities appeared in 2012 after some changes were made to the Housing Code, these changes are related to norms of load redistribution for the financing of capital repairs of the common property of the apartment building from the state to the population and the mechanism of the organization of works on capital repair based on formation of regional programs and major repairs funds.

A mandatory monthly fee for the overhaul was introduced, payable by all owners of premises of apartment buildings, including public institutions with non-privatized apartments. Thus, there was created a guaranteed source of costs financing related to the overhaul of the common property of the apartment building, as well as ensuring the loans repayment for this purpose. Terms of repayment and maturity in this model do not require an exact match of the terms of use for the repair of concrete apartment funds from contributions by the owners of a particular house. In fact, there is a recurrence by introducing a fee (contribution) that must be paid for the overhaul. Thus, the conditions of certain dates for overhaul cannot be complied with, as the fee is paid in parts and is of unlimited duration.

Essentially, the model of formation and use of the overhaul fund presupposes an interest-free "loan" for the repair of a specific fund. Under the condition of equality of the inflation correction of a mandatory payment for the overhaul and construction costs, the risk of depreciation of savings in the capital repair fund is eliminated.

The general meeting of owners of apartment buildings can only come to the decision on the list of works on capital repair of common property within the given parameters of a given sum of money on major repairs or on the collection of additional funds for work that are not envisaged by law, but required to be done, for example, in order to increase energy efficiency of the building.

Thus, this decision has provided financial and organizational basis for carrying out capital repair of common property of an apartment house, various architectural and planning decisions and years of construction within a significant differentiation of incomes of citizens, providing them with decent and comfortable living conditions in apartment buildings.

To implement the proposed mechanisms for organizing and carrying out major repairs in each region of the Russian Federation there is a regional operator (the regional capital repair fund) and a long-term program (up to 30 years) and the current overhaul plans are developed.

That is, state and municipal authorities are taking on significant organizational, financial, administrative and other risks in connection with the overhaul of the common property of the apartment house on the territory under their jurisdiction.

Development of programs of capital repair of the common property of the apartment house aims at restoring the residential buildings resources, if necessary, at replacing their structural elements and engineering systems. The amount of work will depend on the life of the building and the kinds of materials and designs, from which they were built.

Nevertheless, taking into account that every apartment house has its own unique history of construction and operation, the level of comfort and the construction period, the tradition of living and communication between its people, there is an opportunity for Russian federation authorities and local authorities to focus on "dysfunctional" apartment buildings from the objective point of view.

Using their administrative power, it allows taking under control any bad case scenario in apartment building in their area which can happen due to the transition of apartment buildings in the category of old and dilapidated.

At the same time such program should be one of the elements of the plan of territory development, the "road map" of concrete actions, this program forms the motion vector of the overhaul of the common property of the apartment building in the region and takes into account the dynamics of property reproduction, corresponding to modern energy requirements and comfort level on the basis of demographic factors and the evolution of housing, in particular:

1. Rate of new housing.
2. Mechanisms of housing ageing (in a state of dilapidation).
3. Transfer of residential buildings in the non-residential ones and non-residential buildings into residential ones.

To do this, the law provides that the competent authorities of the executive power of the Russian Federation subject of local self-government at least once a year update the regional program of the overhaul.

In the planning process in addition to the organizational measures and long-term plans there are elements of the current planning, due to which the regional program is supposed to include the changes in the technical condition of the apartment building that have occurred over time, also houses that pose safety hazards should be excluded, apartment buildings that are in operation again are included, the results of monitoring of the technical condition of the apartment building are taken into account, changes in the amount and types of work are made in the case when certain types of overhaul work have been already performed by the decision of owners of premises (Bakri, 2012; Efimenko, 2015; Efimenko, 2016; Gollay, 2014; Krivtsov, 2015).

Current planning of overhaul work of common property of the apartment building is connected with terms and stages of the overhaul, a refinement plan of the types of services and (or) work, the definition of types and amount of state and municipal support of the overhaul.

It is much more complicated to deal with the issue of improvement and renovation of road economy of the city.

The use of "smart" technologies to manage the urban infrastructure, in our opinion, is essential to maintain a competitive advantage. This is especially true in conditions of an economic crisis, when local budgets try to save their resources. Also, international practice of using "smart" technologies in managing the city's infrastructure shows a significant increase in performance and efficiency of the activities of institutions and organizations of the urban center.

In the authors' opinion, the main objectives in developing "smart" technologies in housing and communal services of the city of Kazan are:

1. Optimization of expenditures of local budgets.
2. Increasing the performance and efficiency of the activities of institutions and organizations of the urban center.
3. Integration of existing intelligent systems and information resources of the city.

Tasks that are to be solved in the process of achieving these objectives:

1. Collection and analysis of data on operational tasks, infrastructure and transport utilities;
2. Process optimization of task performance taking into account specific features of the activities of institutions and organizations of the urban center;
3. Support of decision-making dealing with management in the framework of control over the technology managing municipal objects;
4. Improving the data efficiency and reliability on the amount and quality of service of housing and public utilities;
5. Implementation and operation of advanced technical solutions in different areas of the city economy;
6. Operational cooperation with the relevant services in crisis and emergency situations.

As examples of successful projects implemented today in Russia there is the Integrated situation-monitoring centre of Moscow (hereinafter referred to as "ISMC"), founded at the end of 2013, and geo information system of the State Public institution "the General Directorate of public road and transport system of Tatarstan in the Ministry of Transport and Roads of the Republic of Tatarstan "(hereinafter referred to as "Glavtatdortrans"), operating since 2011.

The main idea of Moscow ISMC is to receive requests from the authorities and population, including "People's Control" system that deals with patching, maintenance of roadside territory, the purpose of ISMC also consists of redirection of tasks to contractors and getting the report about some work that is done, confirmed with the use of photographic images using a specially designed software for mobile devices. All information is received in real-time and is accumulated on the ISMC servers and then automatically added to the interactive map available for viewing via the Internet. (Assanova, 2015; Bakri, 2012; Khasanov, 2014; Romanova, 2010; Rumaizah, 2012)

1.2. Latest research and publications analysis

Problems of optimization of business activity in the sphere of housing and communal services, including "smart" technologies in communal services, are in the basis of research areas of many modern scientists. Significant influence on the formation of a theoretical model of realizing the potential of housing and communal services, as an essential function of state economic management subsystem is described by G. Zagidullina (Zagidullina et al., 2013). Regulatory issues and housing administration are considered by A. Romanova (Romanova et al., 2015). Problems of reforming and housing development in the regions and municipalities are studied by A. Berval (Berval, Yelokhova, 2015). Applied enterprise management concepts based on housing and communal services were disclosed by I. Khasanov (Khasanov, 2014), A. Krivtsov (Krivtsov, 2014).

International experience of management of municipal services considered by Rumaizah Mohd Nordin (Rumaizah et al., 2012), Fengguang Jiang (Jiang, 2012). In particular the research of such scientists and economists as Bakri (Bakri et al., 2012) underlies the problem of effective management, operation and studying the characteristics of housing and communal services. A significant contribution to the development of the question is made by such scholars as Ying Xie (Xie, 2011), Cho (Cho, 2014).

At the same time, currently strategy development and implementation of regional housing policy is still in the early stages of its development and does not have the support based on understanding the importance of this strategy for the improvement of living standards (Assanova, 2015).

Thus, the analysis of domestic and international publications on optimization of business activity in the sphere of housing and communal services, including "smart" technologies shows that the issues regarding the use of "smart" technologies currently is under-researched, as well as cost-effectiveness of the use of such technologies in the sector of housing and communal services. Insufficient elaboration of themes of using "smart" technologies in the field of municipal services lies in this study.

1.3. Formulation of the problem

It should be noted that today more than 70 enterprises of Moscow public road and housing and municipal services work with ISMC. One of the major systems of ISMC is the state-financed institution "Highways", the system of the largest housing and municipal service enterprises in Moscow currently serving more than 30 million sq meters of Moscow roads. Geo Information System of the State-financed institution "Highways" allows to store spatial data of road facilities that are approved by public cleansing vehicle routes and warranty repair routes. In case of poor quality of the road bed the State-financed institution "Highways" can file a valid claim against the contractor. There is also other information which could be useful for daily operation of an enterprise. Also, similar to the ISMC of Moscow there are 2 situation-monitoring centers in administrative districts (Central Administrative District and the North-Eastern Administrative District). According to the residents' claims to dispatching services the centers also solve problems of housing services (hereinafter referred to as CDS).

Geo Information System of the "Glavtatdortrans" consists of two modules. The first module is a website accessed by login and password. As you enter the website you will find the map of the Republic of Tatarstan with the updated information of regional roads. The map has the layered structure of data organization. Each layer has homogeneous and thematic data that include the accurate coordinates, attributive data of the object, pictures and schemes. The data provided by the "Glavtatdortrans" Geo Information System can be used by all logged-in employees, as well as public authorities and contractors. If you have constant Internet access, you can look through the information on desktop computers, as well as on your mobile devices: smartphones, tablets. If you don't have the Internet access but you need to make an on-site geolocation using the standard features of today's mobile devices, all the map data can be downloaded to your device and viewed off-line which allows the user easily find the location of pavement repair, which was pre-recorded on the map.

"Glavtatdortrans" Geo Information System is developed by building network of partner organizations. In particular, on a quarterly basis the traffic police of the Republic of Tatarstan provide data to the system of the traffic accident situation from the Federal Information System GLONASS 112. Also, the geo information system collects data provided by weather stations installed on highways. A real-time data includes video, weather characteristics such as air temperature and road surface, wind speed, precipitation and road adherence coefficient. The second module is a monitoring system which supervises contractor's transport maintenance work on road facilities under the jurisdiction of "Glavtatdortrans". This monitoring system combines the other monitoring systems of 9 contractors servicing regional roads. Contractor actions are monitored by specialists from "Glavtatdortrans" by providing reports of specialized machinery run-on operation on each road. Also, the location of all specialized machinery is the system in real time and is available for authorized users.

Currently, Kazan has all the prerequisites for substantial improvements in the automation control over public roads, housing and municipal services of the city. The experience of regional offices (Assanova, 2015), as well as the experience of Kazan city municipality of the use of intelligent control systems in local economy (Bakhareva, 2015), is necessary to be incorporated in the other sectors related to public roads system control, housing and municipal services for their further automation and intensification.

2. METHOD

The author argues that the first step in the use of "smart" technologies in public roads, housing and municipal services of Kazan city is to create a Unified Dispatching Center (UDC) of Kazan, by analogy with the ISMC of Moscow.

In the first phase of UDC of Kazan, housing maintenance of the residents' claims should be created (Bakhareva, 2016). In this article it should be called a subsystem of claim control and satisfaction. The following existing services can prove the necessity and advantage of the system:

1. "People's Control" on the website of the electronic government – state services of the Republic of Tatarstan;
2. "People's Inventory" on the website of the Executive Committee of Kazan;
3. Independent Internet project "Open Kazan".

Based on the experience of using "smart" technologies in public roads system, housing and municipal services (Bakri, 2012; Berval, 2015) in this article, the author offers a detailed algorithm for receipt, processing, use, accomplishment of claim applications as shown in figure 3.1. The proposed scheme of UDC of Kazan city is following:

1. Specialists from the Unified Dispatching Centre (UDC) of Kazan receive applications from *e*-government, municipal government bodies, their own departments and population.
2. The UDC managers record claim application on the map according to its address or preliminary data, provided by photo fixation from mobile app with the accurate GPS or GLONASS coordinates, redirect the application to the contracting organization or to the own department;
3. The contractor's manager finds a new application in his software module installed on a computer and assigns the task to a performer.
4. The performer receives a claim application on his mobile device: smartphone, tablet or camera with GPS and GSM modules.
5. The performer goes to the place of work, guided by the mobile map application, which works like any tracking software, the only difference is that the starting point defines the actual location of the performer, and the destination point is the location of the object indicated on the map.

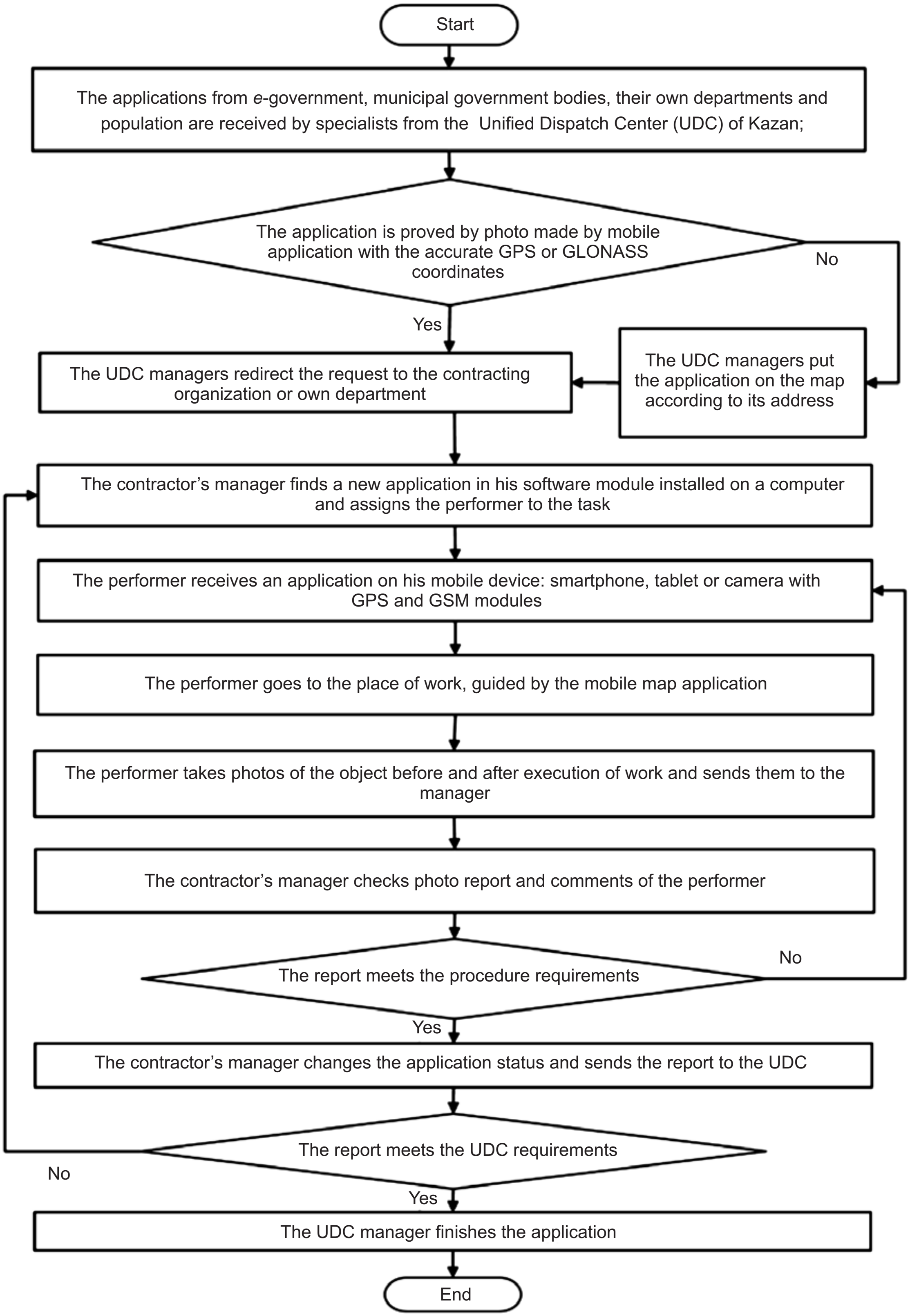

Figure 3.1: Authoring diagram of the UDC of Kazan city (Box, 1970)

6. The performer takes photos of the object before and after work performance.
7. The contractor's manager checks the performer's photo report and comments and if it meets the contractor's requirements, the manager changes the application status from "In process" to "Done", or returns the claim application for rework.
8. The UDC manager checks the contractor's report for compliance with the UDC requirements and if everything is made correct the manager finishes the application, its status is changed in real-time and a person who created the application is notified that the work is done.

By means of the UDC in Kazan all the information flows associated with urban management will be redirected, without disturbing the existing structure of the modern interagency cooperation of companies involved in public road system, housing and municipal services of Kazan. The author's scheme of interagency cooperation in the UDC of Kazan as part of the applications tracking subsystem is shown in Figure 3.2.

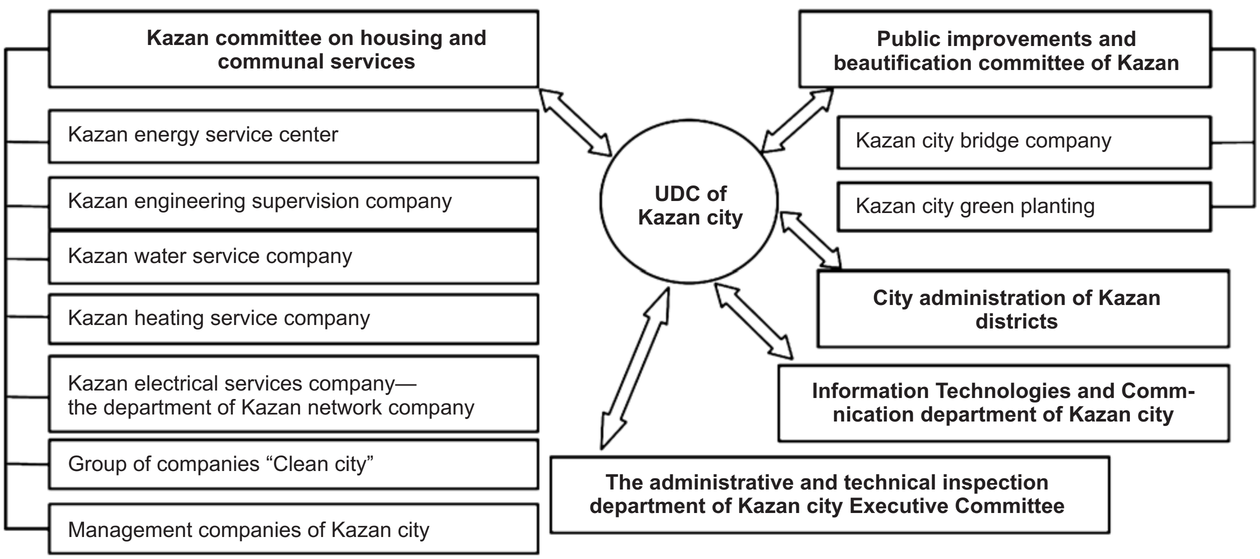

Figure 3.2: The author's scheme of interagency cooperation in the applications tracking subsystem

3. RESULTS

The expected effect of the introduction of the automated control systems with the use of "smart" technologies in public roads system, housing and municipal services is presented below:

1. Municipal equipment repair by means of owners or operators of the property in a timely manner.
2. Generalization of information about planned repairs to coordinate and optimize work of enterprises with different organizational affiliation.
3. Reduction in site visits with service failure.
4. Automated notification of owners or operators of the property about the objects with failures in service.
5. Automated control of instructions performance by receiving photographs directly from the performer.
6. Creating content to make a claim against resource suppliers.
7. Automated control of outages (water, gas, electricity).

The implementation of the Unified Dispatch Centre of Kazan suggests an integration of other automated systems in public roads sphere, housing and municipal services of the city along with applications tracking subsystem. In general, the automated system of the Unified Dispatch Centre of Kazan should include the following subsystems:

1. Applications tracking subsystem has been described in detail above.
2. Navigation and information subsystem which allows to control specialized machinery, tracking its operation and fuel consumption in real time. The expected effect of the introduction of this subsystem is following: reducing the mileage.
    - Reducing the fuel consumption.
    - Improving the efficiency of personnel management.
    - Improving the quality of service.
    - Reducing the number of serious accidents.
    - Rapid response in case of emergency.
    - Improving safety of transport.
3. Geographic information subsystem of accounting of municipal facilities allows you to create new data layers, as well as edit the existing ones. The results of the implementation of this system are:
    - Unified database of urban facilities;
    - Constantly updating data provided by different housing and municipal organizations;
    - Keeping a register of urban objects / inventory of objects;
    - Remote access to the spatial database.
4. The subsystem for data receiving, processing and presentation by means of video cameras, instruments sensors on the objects of housing and municipal services, weather stations, data on road conditions, aerial photography and satellite imagery. Functions of this subsystem are the following:
    - Creating a set of services for monitoring and observing the objects;
    - Online or offline data collection with subsequent data transmission into the database;
    - Data collection from various monitoring or signal processing systems including photos, video, audio, meteorological information, sensors and instrumentation data, motion monitoring systems, etc.;
    - Data processing and binding to database for subsequent analysis.
5. Support subsystem for making decisions performs an automatic processing of data received from other subsystems, forming thematic claim application for data analysis according to the criteria and selection of objects on the basis of permissive or prohibited conditions. The successful implementation of other subsystems together with this one will give city officials the following opportunities:

- To identify the problem area of the county / district ;
- To make reports and statistics for decision making in city management, draw up plans, budgeting, etc.;
- To create reports based on the object's characteristics.

We have collected economic indicators provided by enterprises of road and housing and communal services and calculations to confirm the authenticity of the information that the average economic impact of the introduction of "smart" technology is about 30%.

1. Input data for the calculation:
   - The average income of the enterprise from the use of a transport unit is 1.92 million rubles a year;
   - Actual mileage of a transport unit prior to the introduction of "smart" technologies: 8000 km a month;
   - Normalized fuel consumption - 30 liters;
   - Cost of fuel - 34 rubles per liter.
2. The calculation of fuel economy:
   - Prescriptive mileage before the introduction of "smart" technologies – 8000 km a month.
   - Actual mileage after the introduction of "smart" technologies – 6400 km a month.
   - The difference in mileage: 8000 – 6400 = 1600 (km a month).
   - Based on initial data for calculations fuel economy by one transport unit is : 1,600 km a month * (30 liters / 100 km) * 34 rubles per liter = 16,320 rubles a month.
3. The calculation of earnings growth from the transport unit:
   - Mileage before writing off the vehicle – 1,000,000 km.
   - Useful life – 10 years.
   - Period of operation before the introduction of "smart" technologies.

     1 million km / 8000 km = 125 months

     = 10.4 years;
   - Operating time after the introduction of "smart" technologies:

     1 million km / 6400km = 152 months

     = 13 years;
   - life extension: 2.6 years;
4. Total savings per 1 unit of transport:
   - Increase in profits from the operation of 1 unit of transport:

     2.6 * 1.92 million rubles = 4,992,000 rubles.
   - Fuel savings per 1 unit of transport:

     16 320 rubles a month * 12 months * 13 years = 2,545,920 rubles.

The total average cost-effectiveness per 1 unit of transport after the introduction of "smart" technologies for 13 years will reach 7,537,920 rubles at current prices.

Thus, on the basis of studied Russian and foreign experience on the use of "smart" technologies to manage the city's infrastructure, showing a significant increase in performance and efficiency of the urban agencies and organizations may draw a conclusion that use of such technologies in the field of public roads, housing and municipal services is essential for preserving competitiveness of the economic system of the city-millionaire, and its further development in an unstable economic situation.

4. CONCLUSION

The results of scientific research are developed and justified by organizational and economic approaches to the management of road and housing and municipal economy, contributing to the effective functioning of housing and municipal services in an unstable economic situation.

Evaluating the effectiveness of use of "smart" technology at Integrated situation-monitoring center of Moscow and the General Directorate of public road and transport system of Tatarstan in the Ministry of Transport and Roads of the Republic of Tatarstan has shown that the employment of specialized equipment averages 3h 17 min. continuous driving per day. With an increase of employment of each vehicle at least 5 hours, the number of the vehicle can be reduced by 34%. Thus, the vehicle fleet of the enterprise may also be reduced by 30-35%, which in turn will reduce the labor costs of drivers and maintenance costs of vehicles in similar proportions.

Vehicle fleet of the General Directorate of public road and transport system of Tatarstan in the Ministry of Transport and Roads of the Republic of Tatarstan is more than 1000 transport units. Vehicle fleet of the Integrated situation-monitoring center of Moscow is more than 11 000 units of transport. Since the overall average cost-effectiveness based on 1 vehicle after the introduction of "smart" technologies for 13 years is 7,537,920 rubles in current prices. Thus in reference to the whole vehicle fleet of the two companies the annual cost-effectiveness of the introduction of "smart" technologies will be 576 million rubles and 6.3 billion rubles respectively.

The use of "smart" technologies for the development of city infrastructure management methods is essential to remain competitive, especially true in times of economic crisis, when local budgets are in a tight economy of resources. Also, global practice of using "smart" technology to manage the city's infrastructure reveals a significant increase in performance and efficiency of the activities of agencies and organizations of the complex urban economy.

References

Assanova, A. (2015). Public Policy & Model of Sustainable Development in the Republic of Kazakhstan. Asian Social Science, 11(6), 237-244.

Bakhareva, O.V., Romanova A.I., Safina R.S., Kursina I.M., Shindina T.A. (2015). Infrastructure in the Region: Long-Term Investments of Institutional Investors in Russia. Journal of Advanced Research in Law and Economics, 3(13), 488-503.

Bakhareva, O.V., Romanova A.I., Talipova L.F., Fedorova S.F., Shindina T.A. (2016). On the building information modeling of capital construction projects market development. Journal of Internet Banking and Commerce, 21, 3rd ser. Retrieved 08.11.2016 from http://www.icommercecentral.com/open-access/on-the-building-information-modeling-of-capital-construction-projects-market-development.pdf

Bakri, A.K., Wong S.L., Zulkefly A.K., Jais M. (2012). The Impact of Subprime Mortgage Crisis on Islamic Banking and Islamic Stock Market. Procedia. Social and Behavioral Sciences, 65(3), 668-673.

Berval, A.V., Yelokhova T.A. (2015). Development of management methods with the use of "smart" technologies in the region (for example, the field of road and housing and communal services of the city of Kazan). Proceedings of Kazan State Architectural University, 3(33), 196-202.

Box, G.E.P., Jenkins G.M. (1970). Time-series Analysis: Forecasting and Control. San Francisco, Holden-Day.

Cho, I. (2014). Homeownership and Investment in Risky Assets in Europe. Review of European Studies, 6(4), 254-268.

Efimenko, L.V., Shindina, T.A. (2015). New approaches to expenses management based on sustainable development strategy. European Review of Social Sciences, 2(3), 28-40.

Efimenko, L.V., Shindina T.A., Tabakova E.V., Gavrilova A.V. (2016). Credit risk prediction to individuals. Journal of Internet Banking and Commerce, 2nd ser. Retrieved 08.112016 from http://www.icommercecentral.com/open-access/credit-risk-prediction-to-individuals.pdf.

Gollay, I.N., Gollay A.V., Shindina T.A., Salimonenko E.N., Chuvashova A.D. (2014). Priority areas of analysis of the external environment of a company-innovator depending on a type of introduced innovations. Polish Journal of Management Studies, 13(4), 58-68.

Jiang, F. (2012). The Study of the Relationship between House Price and Price Tolerance in China from the Perspective of Systems Engineering. Systems Engineering Procedia, 5, 74-80.

Khasanov, I.Sh. (2014). Three-Sector Structure of the National Economy of Russia. Asian Social Science, 10(20), 217-225.

Krivtsov, A.I., Kalimullin D.M. (2015). The Model of Changes Management Information System Construction. Review of European Studies, 7(2), 10-14.

Romanova, A.I., Ilina E.V., Dobroserdova E.A., Shindina T.A., Mironova M.D. (2010). The movement of capital in the field of information services. Journal of Internet Banking and Commerce, 1st ser. Retrieved 08.11.2016 from http://www.icommercecentral.com/open-access/the-movement-of-capital-in-the-field-of-information-services.php?aid=62594.

Romanova, A.I., Zagidullina, G.M., Afanasyeva, A.N. & Hkairetdinov, R.S. (2015). Experience in the Region to Increase the Availability of Housing Services. Mediterranean Journal of Social Sciences, 6(4), 549-554.

Rumaizah, M.N., Roshana T., Abdul H.N. (2012). Transparency Initiatives (TI) in Construction: The Social Psychology of Human. Procedia. Social and Behavioral Sciences, 50, 350-360.

The territorial body of the Federal State Statistics. (1999). Retrieved from http://tatstat.gks.ru.

Xie, Y. (2011). Research on the Land Scale Control Model of Public Housing Construction in China: An Example of Harbin. Procedia. Engineering, 15, 5121-5125.

Zagidullina, G.M., Romanova A.I., Zagidullina G.M. (2013). Indicative Model of Socio-Economic Development of Small Towns. World Applied Sciences Journal, 24, 350-357.

Zagidullina, G.M., Romanova A.I., Kleshcheva O.A., Sirazetdinov R.M., Faizullin I.E., Ivanova R.M. (2013). Peculiarities of Housing Construction Development i08.n the Region. Middle-East Journal of Scientific Research, 16, 490-495.