

“Smart” modernization of housing management systems as the condition of competitiveness and security of the regional economy

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Abstract — “Smart Region” is a new paradigm of improving the competitiveness and security of the regional economy at the present stage, the transition to which is not fully possible without the “smart” modernization of housing management systems. The search and justification of “smart” areas of modernization of housing management systems is a relevant and popular direction of scientific researches in solving the problems of improving competitiveness and security of the regional economy.

The purpose of the study is the theoretical and methodological justification of approaches to the “smart” modernization of housing management systems as the condition for increasing the competitiveness and security of the regional economy. To achieve the main purpose, the tasks were solved: the assessment of the current state of the housing stock and management systems was given; the problems preventing the process of “smart” modernization of housing management systems were identified; the proposals for the “smart” modernization of housing management systems based on the comparative experience of successful practices were developed and justified.

The object of the study is the housing stock on the example of a typical region and the city of the Southern Federal District, the subject is the external and internal factors, the processes of “smart” modernization of housing management systems. The obtained results and conclusions are characterized by novelty, scientific and practical importance in terms of substantiation of the concept of “smart” modernization of the housing stock as the condition for a competitive, safe and sustainable development of

the region's economy. To carry out effective “smart” modernization of housing management systems, the project has been developed which include the creation of unified information space through the creation of the information and consulting portal site - the main platform for interaction between all participants of housing management processes at the regional and city levels.

Keywords — “smart” modernization, management system, housing stock, condition, factor, competitiveness, safety, economy, region

I. INTRODUCTION

The concept of “smart region” development has special relevance in the modern dynamically changing environmental conditions, which include the economy, demographic situation, scientific and technological progress, politics. The most important and largest part of the urban economy is the housing stock of the city and the region, which requires more competent and effective management in the new modern conditions. Without a “smart” modernization of housing management systems, this is impossible.

The search and justification of “smart” directions of modernization of housing management systems plays the important role for the economy of the city of Volgograd and the Volgograd region, and it is a potential tool to ensure the sustainability and support for their general welfare and development, that increases the competitiveness and security

of the city's economy and economy of the region. Therefore, at the present stage the important part of the development of the housing stock of Volgograd and the Volgograd region is the transformations in the housing management system, which should be primarily directed to creating reliable and safe living conditions for citizens through the development of "smart" ways to modernize management of this sphere.

In the development of "smart" directions of modernization of housing management systems, it is necessary to consider a set of measures, namely, high-quality and safe maintenance of the housing stock and the creation of the effective model of interaction between all participants in housing management processes at the regional and city levels. The existing housing management system in the city of Volgograd and the Volgograd region predetermines the need for its improvement of development of our region at the present stage. Today, according to the author opinion, it is necessary to base on the formation of the "effective owner", who should actually participate in the process of housing management, as well as on the formation of effective interaction between all participants in the housing management processes in the city and region.

In this regard, it is necessary to monitor the state of the housing stock of the city and the region, to receive operatively information about repair work, maintenance and operation of housing and give it to all participants of housing relations free of charge. The lack of information, analytical and consulting support in solving problems in the management of the housing stock of the city and region determines the need to create the unified information space through the creation of the information consulting portal site of housing and communal services as the main platform for interaction of all participants in the housing stock management processes at the regional and city levels.

II. MATERIALS AND METHODS (MODEL)

The analysis of the current state of housing stock and management systems of the city and region. At present, efficient maintenance and management of the housing stock of any city or region should be ensured by the coordinated work of enterprises and companies that provide: housing services, repair and operation production, water supply and drainage, power supply, heat supply, gas supply, external landscaping, including sanitary cleaning, gardening, as well as municipal solid waste management.

The radical change in the population attitude to the content of their housing can play the important role in the implementation of "smart" modernization of housing management systems. The concept of "housing stock" is used quite widely in the legislation. This concept includes the totality of all dwellings located in the territory of the Russian Federation (part 1 of article 19 of the Housing Code). According to the Code of the Russian legislation, *the housing stock is the totality of all premises intended for housing located on the territory of the Russian Federation, regardless of the type of property and the purpose of its use, including apartments, houses, office and specialized housing, as well as*

other buildings that are inhabitable according to sanitary standards.

Today the management of the housing stock is carried out directly by the owner of the housing stock, associations of owners, competent authorities or the management company. At present, the structure of housing management authority includes: public authorities, local governments, specially competent authorities, management companies; authorities implementing the state registration of residential buildings and premises; the authorities involved in the accounting of the housing stock, the authorities which control over the use, maintenance and repair of the housing stock; partnerships of property owners; authorities of public initiative [1].

On the eve of the First World War, the country's urban housing stock was only 180 million square meters. On average, in most major cities there were 2.0-2.5 square meters of living space per employee. In the capital of Russia - St. Petersburg - 400 thousand people (more than a third of the total population of the city) lived in the chambers, basements, attic. Today the housing stock of Russia is more than 3 billion square meters. At the end of 2016, the housing stock of the Russian Federation amounted to 19,650 thousand buildings with a total area of 3,177 million square meters, including 2,293 million square meters in urban settlements (72%), and 884 million square meters (28%) in the countryside. The housing stock consisted of 3,224 thousand apartment buildings with a total area of 2,237 million square meters (70%) and 16,426 thousand individual residential buildings with a total area of 974 million square meters (30%) [2].

On the territory of the Volgograd region there are 423 thousand units of housing stock, the total area of which is over 56.0 million square meters, three quarters of which (76%) are located in urban areas. On the territory of the Volgograd region, the main number of apartment buildings was built in the period 1946-1970 (Table 1).

TABLE I. DISTRIBUTION OF RESIDENTIAL AREA BY YEARS OF CONSTRUCTION IN THE REGIONS, % [2].

Name of the subject of the Russian Federation	Years of commissioning				
	Before 1920	1921-1945	1946-1970	1971-1995	After 1995
1	2	3	4	5	6
Russian Federation	5.0	10.5	44.2	28.2	12.1
Ryazan region	15.8	17.7	43.0	17.2	6.4
Smolensk region	0.4	5.0	61.2	28.6	4.8
Tambov region	6.5	12.9	47.2	27.4	6.0
Tver region	8.5	22.5	41.3	20.7	7.1
Yaroslavl region	14.8	21.1	36.9	20.3	6.9
Moscow	5.7	15.4	41.8	7.0	30.2
St. Petersburg	9.6	6.1	52.1	5.5	26.8
Astrakhan region	9.9	9.3	43.4	26.6	10.8
Volgograd region	4.8	11.3	45.1	29.8	9.0
Rostov region	5.6	10.0	48.8	27.4	8.2

More than 60% of the housing stock in the city of Volgograd was built in the period 1946-1970. The age of 60% of residential buildings in the city of Volgograd is more than 40 years [2; 3].

Today, the average age of the Russian building is 42 years. That is significantly more than in Japan (30 years), roughly equal to the USA and Germany (44 years), but significantly lower than in the UK (about 60 years) [3; 4; 5; 6; 7; 8; 9].

As a result, the slowdown in the construction of residential buildings naturally led to the aging of the housing stock, and its failure to repair led to an increase in the share of dilapidated and emergency housing. 8.7% of apartment buildings in Russia have wear over 66%. The area of dilapidated housing is 68 million square meters. The area of the emergency housing stock is 19.6 million square meters. By the end of 2015, the share of dilapidated and emergency housing stock in the total area of all housing stock of the Russian Federation decreased to 2.5% [10; 11].

The wear of apartment housing stock of the Volgograd region [3; 12]:

- is up to 30% – 15790 units of apartment buildings or 53% of the total apartment housing stock;
- is up to 65% – 12278 units of apartment buildings or 41% of the total apartment housing stock;
- is up to 70% – 1151 units of apartment buildings or 4% of the total apartment housing stock;
- is over 70% – 621 units of apartment buildings or 2% of the total apartment housing stock.

The total area of dilapidated and emergency housing stock is 1.3% of the available housing stock of the Volgograd region. At the same time, the largest share of dilapidated and emergency housing is located in Volgograd - 54.8%, in Volzhsky - 16.8% [12].

Russian apartment housing stock is characterized by the high need for overhaul. The main reason is that the volume of the housing stock overhaul reduced in the 1990s. At the beginning of 2010, about 282.9 thousand apartment buildings (9% of their total number) needed overhaul. The overhaul was carried out in 72.3 thousand apartment buildings, that is 25.6% of the specific need. According to the Federal State Statistics Service, the total area of overhauled apartment buildings by the end of 2014 amounted to 21,099 thousand square meters, in 2015 their total area increased and amounted to 28193.1 thousand square meters. At the same time, the total cost of overhaul of apartment buildings throughout Russia amounted to 67905 million rubles, in 2015 the costs increased and amounted to 71291.9 million rubles. [12; 13]

For 2014-2017 in the Volgograd region within the part of the overhaul of the apartment buildings, 748 apartment buildings were repaired, for which 2,542 million rubles were spent. In 2018, in the Volgograd region, it was planned to carry out overhaul of 472 apartment buildings located in 46 municipalities of the region [14]. There are negative factors in the implementation of the overhaul program for housing stock of the apartment buildings:

- low collection of overhaul fees;
- low quality of overhauls.

Most residents of the Volgograd region, according to media reports, complain about the lack of information about overhaul and non-transparent criteria for selecting objects for overhaul.

Thus, the unsatisfactory condition of the Volgograd region's housing stock and its obsolescence require the immediate search and justification of the "smart" directions of modernization of the housing fund management systems, that mean the systems that ensure the consistency of actions of all participants in the process of housing management in accordance with the chosen direction of the "smart" modernization.

Currently, the development of "smart" modernization of housing management systems in most regions of Russia, in particular, the Volgograd region, has received little attention. It is necessary to consider only some experience of successful practices in the implementation of smart services and technologies in housing and communal services. So the well-known experience in this area is offered by the Republic of Tatarstan. Since 2011 "Open Kazan" information portal has been operating, which is developed with the assistance of the Kazan mayoralty, it is designed to automate the submission of applications to the municipal housing and communal services and utility bills. By reporting a problem to the housing and communal services, city residents can monitor the progress of work on the portal in real time, and upon completion of work, note the fact that the problem was fixed and close the application. In addition, the portal is designed to simplify public monitoring of the situation in the housing and communal service sector: the map on the main page presents a detailed picture of the emergency and repair work which is carried out in the city [15].

Arkhangelsk Region has another experience in this area. In 2011, the project "Internet Portal of the housing and communal service of the Arkhangelsk Region" was started. The main purpose of the project is to ensure the constitutional rights of citizens to access information. The managing companies disclose information about the management of apartment buildings on Internet Portal of the housing and communal service, and residents have the opportunity to directly contact both their managing companies and the authorities. Also, Internet Portal of the housing and communal service contains the most comprehensive database of apartment buildings in the Arkhangelsk region: including the design features of the house, information about house managing and other useful information. For portal users, this is the opportunity to learn everything about management of their house [16].

At the beginning of December 2018, at the All-Russian Forum "Private Utility Infrastructure Operators", Deputy Minister of construction and housing and communal service of Russia A. Chibis presented the project "Smart City" [17]. The project "Smart City" involves using digital technologies to solve the problem of resource management efficiency, particularly in the housing and communal service. Planned

indicators of the project section “Smart Cities” of the program “Digital Economy” in the direction of housing and communal service are approved (Table 2):

TABLE II. PLANNED INDICATORS OF THE PROJECT SECTION “SMART CITIES” AND THE PROGRAM “DIGITAL ECONOMY” [17].

Indicators	2019	2020	2021	2022	2023	2024
“Smart” housing and communal service						
The share of new consumers (including households in new buildings) and consumers who replaced metering devices during 2018-2020. (including during overhaul) which use devices of the remote accounting of consumption of heat, power and communal resources, %	-	50	90	90	90	95
The share of field audit of control and supervisory authorities in order to control the objects of generation and distribution of fuel and energy resources and utility resources in comparison with 2018, %	-	-5	-10	-15	-20	-30
The share of applications for connection to the network of electricity and heat, water supply and sanitation, which are supplied electronically, %	5	40	50	60	70	90

Also, the well-known portal state information city of housing and communal service is a unified federal centralized information system operating on the basis of software, technical and information resources. This system is designed to ensure the collection, processing, storage, provision, placement and use of information about housing stock, cost and list of common property management services in apartment buildings, maintenance and repair of common property in apartment buildings, etc. But while this system does not work in full force and, unfortunately, does not take into account the regional specifics of housing management systems.

III. RESULTS AND DISCUSSION

A. Identification of problems hampering the process of “smart” modernization of housing management systems

In the course of monitoring activities to find directions of “smart” modernization of housing management systems, inconsistencies were identified in their practical implementation. The main problems hampering the process of “smart” modernization of the housing management systems of the city of Volgograd and the Volgograd region are:

- insufficient explanatory work and training among the population about housing stock management within the the regional housing fund management system;

- insufficient explanatory work among the population about overhaul of housing stock including the lack of information to the public about the formation and purpose of the overhaul of the apartment buildings;
- lack of professional companies that provide analytical and consulting services to both the public and professional participants in the housing and utilities market of the city;
- lack of analytical substantiation in the context of individual segments of the housing management system for the executive authorities to make constructive decisions on its further sustainable development and improving its competitiveness and safety;
- late preparation and issuance of operational information. The analytical reports of the Volgograd statistics state the facts and show the common trends in the indicator change. The frequency of collection and the possibility of data forms of housing stock, management companies do not allow to monitor the status of the housing sector in the operational mode.

Thus, information-analytical and consulting support for the executive and local authorities of Volgograd and the Volgograd region is becoming extremely relevant when making management decisions within the management system of the housing fund in the region. At present, in the city of Volgograd and in the region as a whole, the demand for high-quality analytical and research materials about the most topical topics persists in the sphere of housing management.

B. Proposals for the formation of directions of “smart” modernization of housing management systems

In this regard, a team of authors of the department “Management and development of urban economy and construction” of Volgograd State Technical University proposed the project to create an information and consulting site-portal “Electronic services for housing and communal services” in the framework of the implementation of the concepts of “Smart city” and “Smart region”.

The main purpose of this project is the introduction of innovative technologies and services that provide for the automation of energy efficiency management in enterprises and companies of the city (region), and the economical use of urban living and housing stock.

The main tasks of the proposed project are:

- increasing the level of information transparency for the formation of the “effective owner”, management of the housing stock of the city (region) by means of permanent monitoring of the state of the housing stock, creating and forming together with the managing companies electronic passports for each apartment building of the city (region) , as well as the provision of analytical material to state and non-state housing and utilities authorities;

- the development of the market of professional managers in the housing sector through conferences, seminars, training courses, the provision of modern scientific and methodological literature, etc.;
- the formation of conditions for the use of resource-saving technologies, the transition from the cost-based pricing system to stimulating through the use of innovative technologies, providing for the automation of energy efficiency management at enterprises and companies of the city (region);
- the implementation of comprehensive researches, sociological surveys in the field of housing and communal services of the city and region with the participation of representatives of the executive authorities of the Volgograd region and all participants in the management system of the housing stock of the city (region);
- providing consulting services to the population and professional participants of the housing and communal services market of the city (region) with the involvement of specialists and representatives of the executive authorities of the Volgograd region.

By the end of its implementation, the authors plan the following key results of the project:

- the creation of a common information space for all participants in the housing (city) and regional housing management system, in particular, the housing and communal infrastructure of the city (region) for the effective exchange of relevant operational, research, and analytical information between housing and communal companies, between the population and housing and communal enterprises;
- the registration of the majority of companies participating in the housing management system of the city and the region (enterprises of housing and communal infrastructure), including managing companies and creating with them the unified database of electronic passports for the city's apartment buildings (reliable information about the current state of the specific housing stock and measures for its improvement: detailed information about current, capital repair, the cost of them and the contractors), that will allow the population and the executive authorities to better control the current activities of the managing companies;
- the creation of conditions for the application of resource-saving technologies in housing communal services through the use of innovative technologies that provide for the automation of energy efficiency management at enterprises and companies of the city (region) and the economical use of urban living systems and housing stock;
- the creation of a professional educational base for training professional managers in the housing and communal sectors through conferences, seminars, training courses, etc.;

- the development of a system of survey indicators, continuous monitoring of the development of the housing and communal sector of the city (region) and the formation of priorities for sustainable development, improving competitiveness and security of the regional economy;
- the creation of conditions for the provision of consulting services to the population and professional participants in the housing and communal infrastructure of the city (region) with the involvement of specialists of all authority levels.

IV. CONCLUSION

The implementation of the proposed project is aimed at increasing the efficiency and comfort of life and improving the urban environment. The implementation of the project of the creation of the information and consulting site-portal "Electronic services for housing and communal services" will undoubtedly influence on the socio-economic development of our city and region through:

- improving the efficiency of interconnection and interaction between all participants in the housing management processes at the regional (city) level, increasing the responsibility and quality of housing management in the region (city) by managing companies and communal department through the creation of unified information space between consumers and producers of housing and communal services of the region (city);
- improving the social climate of the region (city) by creating the most comfortable and safe living conditions for the population in residential apartment buildings and private houses by improving the quality of housing and communal services.

References

- [1] Borisova N.I., Borisov A.V. Current state and problems of water supply and sanitation sector in the new economic development of Russia and its regions [Economy and business] 2014. vol. 8 (49). p. 728-732.
- [2] Borisova N.I., Borisov A.V. Problems of increasing energy efficiency in the Russian cities of new innovative economic environment. In collection: *Actual problems of the introduction of energy efficient technologies in the construction and engineering of urban farming systems: Proceedings of the II International Scientific and Practical Conference*. Kyzyl, Russia, 2015. p.13-18.
- [3] Volgogradskaya oblast' v tsifrah. 2016: kratkii sb. Terr. organ Fed. sluzhby gos. statistiki po Volgograd. obl. [Volgograd region in figures. 2016. Short digest. Territorial branch of the Federal Service for State Statistics]. Volgograd: Volgogradstat Publ., 2017, 376 p. Available at: <http://volgostat.gks.ru/>. Reference date: 05.02.2019
- [4] Turok, I. Cities, regions and competitiveness. [Regional Studies]. 2004. 38, pp.1061-1075.
- [5] Kresl, P. & Singh, B. (2011). Urban Competitiveness and US Metropolitan Centres. [Urban Studies]. 2011. 49(2), pp. 239-254. doi:10.1177/0042098011399592
- [6] Budd, L. & Hirmis, A. Conceptual framework for regional competitiveness. [Regional Studies]. 2004. vol. 38, pp.1007-1020.
- [7] Begg, I. Cities and Competitiveness. CURS Urban Stud. [Urban Studies]. 1999. vol. 36(5), pp. 795-809. doi:10.1080/0042098993222

- [8] Ehrlich, Maximilian V.; Hilber, Christian A. L.; Schoni, Olivier. Institutional settings and urban sprawl: Evidence from Europe [journal of housing economics]. 2018, vol. 42, pp.4-18
- [9] 15. Chauvin, Juan Pablo; Glaeser, Edward; Ma, Yueran What is different about urbanization in rich and poor countries? Cities in Brazil, China, India and the United States [journal of urban economics]. 2017. vol. 98, pp.17-49
- [10] Maksimchuk, O., Pershina, T., Golikova, G., Borisova, N., & Ivashova, S. (2015). The concept of energy saving management in housing and communal services: a systematic approach. Volgograd: Crouton, 284 p.
- [11] Maksimchuk, O. & Pershina, T. Competitiveness of modern cities (by the example of large cities in the Southern federal district). [Sociology of City]. 2016. vol. 2, pp.104-122
- [12] Shipkova E. V., Borisova N.I., Borisov A.V. Realization of energy saving potential in housing and communal services of Russia and Volgograd region. [Economy and business] 2016. vol. 3-2 (68-2). p. 439-444.
- [13] Gutnikova, E. Evaluation of competitiveness of the city. [Problems of the Territory]. 2013. vol. 6(68), pp. 22-29
- [14] Site UNO "regional Fund of overhaul" [Electronic resource] Available at: <http://капремонт34.рф/index.php/realizatsiya-programmy> Reference date: 01.02.2019.
- [15] Information portal "Open Kazan" [Electronic resource] Available at: <https://open.kzn.ru/> Reference date: 10.02.2019 г.
- [16] The portal of housing and communal services of the Arkhangelsk region [Electronic resource] Available at: <https://gkh.dvinaland.ru/> Reference date: 10.02.2019 г.
- [17] Ministry of construction has developed a draft standard "smart" city [Electronic resource]. Available at: <https://roskvartal.ru/tehnologii-v-zhkh/9810/minstroy-rf-razrabotal-proekt-standarta-umnogo-goroda> Reference date: 30.01.2019 г.