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**FINANCING AND QUALITY OF HOUSING CONSTRUCTION:  
INTRODUCTION OF INFORMATION SYSTEMS AS A REGULATORY TOOL**

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**Abstract**

Housing construction is one of the most important areas of construction, which not only provides normal living conditions for the population but also contributes to improving their quality in general. Housing construction plays an important role in the socio-economic development of the country as a powerful source of the multiplier effect to stimulate related industries by solving social problems and expanding investment opportunities for the population. The article analyzes the scientific literature on the problem of regulating the activities of participants and the introduction of information systems in the field of housing construction.

**Keywords**

Housing construction – Regulation of housing construction – Information systems

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## Introduction

At present, ideas about the promising areas of housing construction (HC), the quality of housing, its main functional purpose and level of comfort are gradually transforming under the influence of evolutionary social changes. The root cause of these changes is the development of social relations that are inherent in various socio-economic systems and affect the formation of housing conditions of the population and economic sectors. Among other things, HC stimulates the improvement of the life quality of the population, affects the rate of inflation and unemployment, and, most importantly, attracts long-term investments in improving the living conditions of the population.

The formation of qualitatively new housing conditions for the population in the country depends on the effectiveness of systemic factors, including: development trends of construction and individual segments of the real estate market, as well as behavior and intentions of its main participants; the volume of capital and the speed of its turnover in the primary and secondary real estate market, including mortgage lending; purchasing power of the population, its intentions to invest in real estate; housing policy of the state and local authorities, its targets and tools for solving problems in this area. Given the multiplicative effect of HC and its significant impact on other areas of economic activity and living conditions of the population, it is possible to assume an increase in these dependencies<sup>1</sup>.

It is necessary to analyze the HC as an object of the regulation of the activities of its participants through the introduction of information systems.

Modern scientific research on the problems of development and improvement of the HC quality is actively developed in an interdisciplinary context. However, in the dominant areas of research, the HC is considered mainly as a component of the economic complex of the country, the development of which depends on the macroeconomic situation in the country and, at the same time, affects it, stimulating the development of other sectors of the economy<sup>2</sup>.

Thus, according to researchers, construction activity is part of the economic system of the state, which is inextricably linked with trade, investment, and financial activities and is designed to ensure industrial, housing, and road transport development. At the same time, an economic system is an object of legislative support and its components require a balanced regulatory material and a harmonious combination of state regulation and self-regulation<sup>3</sup>. In turn, construction activity, as economic activity, is permeated with a combination of public and private interests, which requires the direction of such interests along the trajectories of the established legal economic order, determined *a priori* by the socially accepted configurations of compromise between them<sup>4</sup>.

<sup>1</sup> D. J. Wilson, "Fiscal Spending Jobs Multipliers: Evidence from the 2009 American Recovery and Reinvestment Act", *American Economic Journal: Economic Policy* Vol: 4 num 3 (2011): 251–282.

<sup>2</sup> A. N. Asaul y V. P. Grakhov, *Integrativnoe upravlenie v investitsionno-stroitelnoi* (Saint Petersburg: Gumanistika, 2007); G. P. Meen, "Housing cycles and efficiency", *Scottish Journal of Political Economy* Vol: 47 num 2 (2000): 114–140 y K. Tsatsaronis y H. Zhu, "What drives housing price dynamics: crosscountry evidence", *BIS Quarterly Review* (2004): 65–78.

<sup>3</sup> A. M. Platonov. et al. *Proizvodstvennyi menedzhment v stroitelstve: uchebnik* (Ekaterinburg: UrFU, 2016).

<sup>4</sup> M. A. Koroleva; E. S. Kondyukova; L. V. Daineko y N. M. Karavaeva, *Ekonomika stroitel'nogo predpriyatiya: ucheb. posobie* (Ekaterinburg: Izd-vo Uralskogo universiteta, 2019).

Some aspects of the HC development and its impact on the living conditions of the population are presented in the research of the industry direction<sup>5</sup>.

Thus, P.G. Grabovy and A.I. Solunsky understand the process of creation, as well as expansion, reconstruction, and technical re-equipment in order to make a profit and provide citizens with adequate living conditions, of new housing and civil facilities under the term "residential construction", which requires the involvement of significant financial, labor, scientific, technical, and administrative resources. According to their classification, HC can include: 1) construction of new facilities, 2) expansion, reconstruction, technical re-equipment (in the direction of environmental technologies introduction) of residential and civil facilities<sup>6</sup>.

The features of HC, according to Ya.S. Melkunov, are, first, its high cost, which requires such an amount of funds that can be accumulated over a certain, sometimes quite long period, which depends on the income level of the population, and, second, great socio-economic importance, since it affects the improvement of the population life quality and produces a powerful animated effect on related industries. At the same time, according to the author, the city-planning tasks of creating a network of educational institutions, health care, culture, public utilities, public services, landscaping, and improvement of the territory<sup>7</sup> are solved simultaneously with the construction of residential buildings, which transforms large financial assets into construction. V.A. Koshelev understands the regulation of HC as the tools, using which public authorities establish mandatory requirements for enterprises and citizens operating in the construction industry<sup>8</sup>. Using a systems approach, L.A. Soldatova and Yu.V. Popova consider the regulation of HC as a complex of measures of state bodies of legislative, executive, and control nature, aimed at stabilizing and adapting the existing economic system to the changing conditions of development of a country (region). This understanding makes it possible to reveal the content of the regulation of HC from the point of view of a systems approach to management, which includes the following provisions: formation of goals and objectives for the development of HC, definition of regulatory objects, organization of the management system, identification of regulatory subjects and formation of their structure, differentiation of functions and selection of necessary methods of regulation, and evaluation of regulatory results<sup>9</sup>.

Scholars distinguish the following forms of HC regulation: financial and credit support for construction companies, material and technical support, tax preferences, information services, management assistance, and advisory assistance<sup>10</sup>.

<sup>5</sup> P. Smets, "Small is beautiful, but big is often the practice: Housing microfinance in discussion", *Habitat International* Vol: 30 num 3 (2006): 595-613 y E. Hasgöl, "Incremental housing: A participation process solution for informal housing", *ITU A/Z* Vol: 13 num 1 (2016): 15-27.

<sup>6</sup> P. G. Grabovy y A. I. Solunsky, *Organizatsiya, planirovanie i upravlenie stroitelstvom: Uchebnik* (Moscow: Izd-vo Prospekt, 2012).

<sup>7</sup> Ya. S. Melkunov, *Ekonomicheskaya otsenka effektivnosti investitsii i finansirovaniya investitsionnykh proektov* (Moscow: Dim, 2009).

<sup>8</sup> V. A. Koshelev, "Sovershenstvovanie regulirovaniya rynka zhilishchnogo stroitelstva dlya snizheniya innovatsionnykh riskov stroitelnykh organizatsii", *Ekonomika i upravlenie* num 11 Vol: 72 (2010): 111-114.

<sup>9</sup> L. A. Soldatova y Yu. V. Popova, "Teoreticheskii analiz osobennostei antikrizisnogo biznes-regulirovaniya zhilishchnogo stroitelstva", *Zhilishchnye strategii* num 2 Vol: 4 (2015): 241–252.

<sup>10</sup> E. E. Ermolaev; Zh. V. Selezneva y E. A. Sklyarova, *Osnovy regulirovaniya i upravleniya zhilishchno-kommunalnym kompleksom: uchebnoe posobie* (Samara: SGASU, 2014).

According to S.N. Bratanovsky, the regulation of HC is a set of institutional and legal elements of the management system, which includes institutions of executive and legislative power, as well as subjects of construction activities (developers, customers, contractors, intermediaries, credit institutions and insurance companies). At the same time, the regulation system of HC includes state regulatory bodies, supervision, control and regulatory framework, and self-regulatory organizations with informal regulations and auxiliary rules<sup>11</sup>.

Improving the quality of HC, as noted by P.B. Fomin, is due not only to effective regulation of the construction industry but also to the systematic provision of up-to-date information, which has acquired a new meaning today. The researcher believes that there is a formation of the information society in modern conditions, which is characterized by the desire for the optimal use of resources available to society (natural, human, economic) based on the full use of information and communication technologies and the transformation of knowledge and information into a real productive force. Consequently, information has acquired economic content and the processes of working with it have taken a dominant position at all stages of production relations<sup>12</sup>.

According to researchers<sup>13</sup>, the creation and implementation of information management technologies in the HC as a whole solve three major problems<sup>14</sup>:

- ensuring close information interaction between individual stages of the construction cycle;
- development of integrated information systems for management of construction organizations and enterprises of the construction industry;
- development of a unified information support system for the construction industry.

The solution of the first task provides information support for the system of interdependent phases (planning, design, resource support, construction, operation), each of which corresponds to the software package that implements it. It is necessary to use a project management system in order to coordinate the management of all phases of the cycle. Thus, the combination of aggregated and delegated phase information models makes it possible to build the most optimal information technology for managing the entire construction cycle. For this purpose, information interaction by means of reception-

<sup>11</sup> S. N. Bratanovsky y A. V. Erkhov, Upravlenie gradostroitelnyim kompleksom v Rossii (administrativno-pravovoi aspekt) (Saratov: IPR Media, 2009).

<sup>12</sup> P. B. Fomin, "Povyshenie kachestva zhilishchnogo obespecheniya naseleniya na osnove stroitelnykh innovatsii mezourovnya", Transport business in Russia num 4 (2015): 40-41.

<sup>13</sup> S. Thomas; S. Lee; J. Spencer; R. Tucker y R. Chapman, "Impacts of Design/Information Technology on Project Outcomes", Journal of Construction Engineering and Management Vol: 130 num 4 (2004): 586-597 y Y. Zhu y G. Augenbroe, "A conceptual model for supporting the integration of inter-organizational information processes of AEC projects", Automation in construction Vol: 15 num 2 (2006): 200-211.

<sup>14</sup> K. Reizenbuk; T. Sarapulova; S. Shchedrin y I. Shchedrina, "Application of Distributed Computing in Developing Architecture of Intelligent Information System for Automated Stock Exchange Trading", Journal of Advanced Research in Dynamical and Control Systems Vol: 11 num 8 (2019): 2549-2555 y Z. K. Omarova; S. I. Nikishov; A. S. Ellaryan; A. D. Bobryshev y E. Yu. Kamchatova, "Information Technology in Logistics Systems: Problems, Solutions, Innovations", Journal of Advanced Research in Dynamical and Control Systems Vol: 11 num 10 (2019): 581-586.

transmission (export-import) of the corresponding files or the use of single regulatory reference information should be carried out at various stages of the cycle between phase technologies. The unifying factor of the cycle stages is a database system focused on a specific system of coding and classification of technical and economic information<sup>15</sup>.

The second task to be solved when creating and implementing information management technologies in HC is the formation of integrated information management systems for construction organizations and enterprises of the construction industry. This task is a logical continuation of the above-mentioned task – ensuring close information interaction between the individual stages of the construction cycle.

The third task of creating and implementing information management technologies in the HC is to develop a unified information system for housing construction (UISHC). The purpose of creating the UISHC is to provide all participants with reliable and complete information about the objects of the HC. This system creates the highest level information environment, which provides information to the system of regulation and management of HC.

At the same time, according to A.M. Tararin, the publicity of information about the objects of construction activities, including HC, and the legality of construction activities are reliable means of ensuring the effectiveness of economic order. The specificity of monitoring is that it is necessary for diverse and rapidly changing conditions of market economic relations that require immediate and effective decision-making. The corresponding response will affect the profitability of enterprises, the implementation of plans and programs, or the construction and further operation of HC<sup>16</sup>.

In this regard, the information needs of participants in this type of activity should be specific and much broader, formed during the preparation of reports and used to manage complex processes. The most important information reflects the relationship between individual participants, coordinates interaction, allows working together, and clearly defines the rights, duties, and responsibilities of each of them.

The purpose of the article is a systematic presentation of the use of information support in regulating the activities of participants in the HC – investors, developers, customers, contractors, shareholders – in the joint implementation of construction activities.

Research Hypothesis: The system of users of the information system in the joint implementation of construction activities in the field of HC is related to their information interests, types of information, its purpose and use for the analysis of this activity.

## Methods

Research methods were based on the principles of a systems approach, which provides for the establishment of significant dependencies in the field under study. The following research methods were used in the research:

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<sup>15</sup> C. S. Duvel y K. Schmidt, "Integrating relational database technology into the construction management curriculum", *Journal of Construction Education* Vol: 7 num 2 (2002): 74-85.

<sup>16</sup> A. M. Tararin; M. V. Karandeeva y O. A. Sukhareva, *Informatsionnoe obespechenie gradostroitelnoi deyatel'nosti* (Nizniy Novgorod: NGASU, 2012).

- analysis of the scientific literature on the problem of regulating the activities of participants and the introduction of information systems in the field of HC;
- expert survey to determine the criteria and main indicators of the information support system in the field of HC.

Thirty-six experts were invited to participate in the online expert survey: employees of construction companies (22 people) and specialists in the field of information technology (14 people).

## Results

According to the experts, the following criteria should be established in the study of activities in the field of HC and its information needs:

1. Information users – quality parameters oriented to the consumer;
2. Types of information – the place of accounting and reporting information in the information system of construction activities.

Following these criteria, the corresponding indicators of the information support system in the field of HC were determined (Tables 1 and 2).

Information users		Information requirements	%*
Property owners: - investors; - participatory; - shareholders; - developers; - customers	potential	Business activity, profitability, financial stability, and other parameters of investment attractiveness	86%
	real	Property liquidity, profitability, dividend policy	83%
Individual developers (equity holders): - legal entities; - individuals	potential	Qualitative characteristics of existing facilities and investment projects	80.5%
	real	Progress in implementing investment projects and providing them with financial resources	83%
Contractors: - general contractors; - subcontractors	Construction deals		97%
	Methods for estimating income and expenses		91.5%
	Payment methods with customers		83%
	Timing of implementation of certain obligations		80.5%
	Other issues that reflect the relationship between construction participants		75%
State authorities	tax administration	Correctness of tax imputation and completeness of tax and obligatory payments	89%
	statistical authorities	Summarizing information at the sectoral and regional levels	86%
	technical and architectural supervision bodies	Compliance with established norms, rules, and tolerances	75%
	Central Bank of the Russian Federation	Information related to the protection of shareholders' interests and rights	69%
Debtors and creditors		Compliance with contractual discipline, solvency and other partnerships	75%
Internal users	Directors, managers, and other executives		72%
	Collectives of workers in construction enterprises		69%

Table 1

Information users and their interests as a component of the information support system for activities in the field of HC

Types of information	Information characteristics	%*
Basic information	Regulatory and legal	97%
	Regulatory reference	91.5%
	Business planning	86%
	Design and estimate	80.5%
Information about the actual state of the business	Accounting information	89%
	Financial statements	83%
	Statistical information	75%
	Other non-system data	69%

Table 2  
Types of information as a component of the information support system for activities in the field of HC

## Discussion

It was important to correctly identify users and their information needs among the qualitative features. Some experts divided all users of account information into three groups: a) those who manage the business (directors, managers); b) those who are outside the company (real and potential investors, creditors); c) persons, groups, and bodies that have indirect interests in this business (tax, planning and regulatory authorities, buyers, the public). Accounting and analytical information is grouped in the same way when the following categories are selected: information for enterprise management (management accounting); information for external consumers that follows from financial accounting; information related to taxation.

If we consider these classifications of users from the point of view of activity in the field of HC, then, according to the experts, the owners should rank first among them, that is, investors, participants, and shareholders. They, not managers, decide the most important issues of the strategy for the activity and development of the HC. Second, information users, such as investors and ordinary creditors, should not be grouped because of different interests. Creditors are mainly interested in information about the financial stability and solvency of the entity, while the investor needs more information about the structure of assets and liabilities, business area and activities, income and expenses, distribution and use of profits, etc.

Direct information users among the participants in the activities in the field of HC are investors, developers, designers, customers, equipment suppliers, general contractors, and subcontractors. Despite the fact that their duties and functions are different, they participate in the construction process at different stages, having one goal – the construction and commissioning of an operationally ready facility.

There is another type of external users in modern conditions that are directly related to the implementation of the construction company's planned volumes of work. This applies to shareholders who, together with this company, build objects, finance them, and later operate them.

Characteristic features that distinguish them from ordinary customers, which determine their information needs, are the following:

- operating, as a rule, in the field of HC;
- carrying out joint construction with a construction company;
- jointly financing buildings in proportion to the shares of the productive area or other parameters;
- acquiring ownership rights to a part of the constructed object before or after its commissioning.

The allocation of shareholders to a separate group of information users in the field of HC is due to the fact that the lack of centralized sources of financing led to a significant reduction in the volume of HC. Under such conditions, the share of a specific type of construction activity has increased significantly – attracting share-building customers (full or partial), the problematic issues of which have determined the adoption of regulatory acts that have led to significant changes in the aspect of raising funds of participants in shared construction.

Thus, the UISHC was introduced (Article 23 dated December 30, 2004, No. 214-FL "On participation in shared construction of apartment buildings and other real estate objects" with the amendment made to the Federal Law dated June 27, 2019, No. 151-FL), as well as stricter requirements for both the developer and the management and founders of construction companies. The implementation of the developer's contractual obligations on shared construction was completely changed while the regulation of the targeted use of borrowed funds was strengthened.

In the discussion, the experts paid special attention to the UISHC and the mandatory placement of specific information in it by the developer (Article 3.1 of Law No. 214-FL). Also, the subjects of information are other parties of shared construction, responsible for its quality completion: various state bodies – controlling, authorized, registration of rights, executive authorities at all levels in the field of HC, and other persons who are obliged to post information in the UISHC.

Decree of the Government of the Russian Federation dated March 26, 2019 No. 319 established the main characteristics of the information posted in the UISHC, as well as the procedure for its storage and processing. In this case, liability for violations of the order of placing information in the UISHC is provided in the Administrative Code of the Russian Federation.

Also, the majority of the experts (61%) noted that it is advisable to consider that two large groups of data are used in the decision-making process in order to streamline the information system used in the management of enterprises:

- basic information that defines the objectives, norms, parameters of real actions, and existing restrictions in the implementation of investments;
- information that reflects the actual state of management objects in the process of forming an investment portfolio and implementing individual projects during the construction and commissioning of objects.

The first group includes regulatory-legal, regulatory reference, business planning, and design and estimate information. The second group includes accounting, reporting, and statistical information, as well as non-accounting data.

At the same time, some experts (22%) suggested dividing information in the field of capital construction into two blocks: conditionally constant and transient data. The remaining experts (17%) divided the information on the basis of stability into constant, conditional-constant, and transient. The stability period can be determined for a certain period of time: month, quarter. Design and estimate information, which differs significantly from the planned and normative information, was singled out by them in a separate form.

The experts proposed allocating geospatial data obtained through geographic information systems (GIS), which are information technologies that provide for the collection, processing, analysis, modeling, visualization, and delivery of geospatial data from information banks and databases, metadata, as well as geospatial data services, in a separate category of information that should be present in the UISHC.

The experts clarified that the correspondingly formed spatially-oriented information base data, using modern software for creating an urban planning cadastre, can provide the analytical segment of GIS with the construction of the necessary models for HC needs, land management, as well as for information support of state bodies, local governments, legal entities, and individuals. As a result of this approach, it is possible to regulate the issue from providing conditions and restrictions for construction objects to putting them into operation on new principles.

Most of them currently use the licensed ArcGIS software from ESRI, the world's leading GIS technology company. Currently, ESRI has implemented a significant reduction in the cost of its software products for the urban development industry and has a sufficient number of ready-made both paid and free applications. One does not need to spend time writing and adapting them with this approach, but it is possible to enter the appropriate system into operation immediately, with the installation of a software product. When using the ArcGIS software line, the development and formation of appropriate databases are guided by the application of ISO 19100 series standards.

Considering the modern experience of informatization of public administration systems in the leading countries of the world, the experts proposed the creation of an integrated information and analytical system that will combine distributed databases in the following areas: regional policy; territory planning policy; construction policy; housing policy; housing and communal services policy. This approach will significantly save money and increase the information content of each specialist and their productivity.

## Conclusions

HC regulation is a set of institutional and legal elements of the management system, which includes executive and legislative authorities, as well as construction entities (builders, customers, contractors, intermediaries, credit institutions and insurance companies). Therefore, the regulation system of the construction industry includes state regulatory bodies, supervision and control, regulatory framework, and self-regulatory organizations with informal regulations and auxiliary rules.

Housing construction as an object of regulation has specific features that have their manifestations, including in the information support. Only a comprehensive approach to determining the information base, which will consider the information needs of individual users and the ability to provide certain information at all stages of the construction cycle of an HC project, will allow for an effective and better analysis for managing the construction activities of enterprises.

Thus, the results of the study confirmed the hypothesis that the system of users of the information system in the joint implementation of construction activities in the field of housing construction is related to their information interests, types of information, its purpose and use for the analysis of this activity.

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