Development of the innovative digital cluster in the housing and communal sector

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Abstract. The housing and communal sector occupies one of the main places in the social area, because it contributes to the reproduction of human resources. The housing and communal sector is in a crisis, and the current reforms seem to be ineffective. In this regard, the authors have developed a mechanism of development of innovative digital clusters in the housing and communal sector. It can improve the quality of housing and communal services, will contribute to the development of the innovative environment and digital technologies, creation of sectoral innovation systems in the supporting zones of housing and communal services, intensify investment activity and improve competitiveness of housing and communal companies. The author's definition of innovation housing and communal clusters is offered, the process of development and implementation of innovative digital projects is described, the assessment of socio-economic effects of innovation projects is provided.

1. Introduction
Currently, there is no effective system of housing and communal sector reformation (formal and informal institutions fail to correspond to the target indicators of innovative reforms and market conditions). The following features characterize the housing and communal sector: the ineffective management system, low quality services, worn-out communal infrastructures, imperfect legislation, the lack of continuity in the development of the sector, outdated equipment, high energy losses, poor monitoring of facilities, low innovation activity, etc. Thus, in order to overcome the crisis of the housing and communal sector, it is necessary to develop and implement effective tools.

2. Development of the innovative digital cluster in the housing and communal sector
It is necessary to develop innovative digital clusters in the housing and communal sector. According to the founder of the cluster theory M. Porter, clusters are an effective tool for stimulating the development of innovative technologies and economic growth. The cluster development factors were investigated by R. Coase, J. Schumpeter, F. Peru, E. Bergman, and E. Fraser [6,19].

Cluster development issues have been studied by Russian researchers. Their interest is due to the large-scale positive experience of creating innovative clusters in developed countries, which have proven the effectiveness of this mechanism.

In France, there are a number of efficient clusters, special attention is paid to the links between business and science. There is a continuous development of business innovations.
In Finland, the cluster approach gained popularity in 1990; “cluster maps” were developed for each industry, and it is planned to create research centers to improve the technologies and skills of the workforce and build up the intellectual capital.

In Japan, the cluster approach was formed in 2001, the structures of new clusters are based on foreign innovation clusters, which are composed of universities and research laboratories, large, medium and small companies. The main attention is paid to the development of science.

In the USA, as well as in Japan, the main role in the development of clusters is assigned to science - financial support is reduced to research grants and infrastructure development.

According to the authors, the innovation housing and communal cluster is a set of interconnected economic entities (government authorities, educational environment, companies, providers of housing and communal services, etc.) that aim to obtain a synergistic effect that contributes to the development of an innovative digital environment in the housing and communal sector [8,16].

The synergistic effect is an increase in the efficiency of activities as a result of integration, combining individual parts into a single system due to the systemic effect [11].

The concept of development of innovative digital clusters in the housing and communal sector should reflect a number of fundamental positions: economic and social prerequisites for clusters; interest of participants in the cluster development; participants, innovative digital technologies, etc.

The main directions for the development of clusters in the housing and communal sector are: stimulating effective information interactions between cluster members, improving the quality of management in the housing sector, stimulating innovation mechanisms for the commercialization of innovations, stimulating digital technologies, developing cooperation with educational organizations, providing state benefits, reducing administrative barriers, etc [1,2,9,15]. The authors has developed a mechanism for the innovative digital cluster development in the housing and communal sector (Figure 1).
Figure 1. The mechanism for the development of an innovative digital cluster in the housing and communal sector.

This mechanism is a set of interrelated and interacting participants. The synergistic effect is achieved as a result of quantitative and qualitative changes in the housing and communal sector, i.e. innovative technologies can improve the quality of housing and communal services through the development of servers, the use of energy-efficient materials, the implementation of digital and automated control systems. The cluster is aimed at preventing accidents, transferring meter readings, using resources in a rational way.

The main participants in the innovative digital cluster and their tasks are as follows:
- federal, regional, local government agencies that improve the quality of life of the population, fight against crises, monitor activities of housing and communal companies and homeowners’ associations;
- housing and communal companies (management companies, homeowners’ associations, housing cooperatives) that provide consumers with quality services, implement innovative digital technologies, increase the financial sustainability of activities, etc.
- consumers (legal entities, individuals) that receive high-quality housing and communal services;
- education institutions (universities, research institutes) that train highly qualified and professional personnel, develop and apply innovative and digital technologies; receive grants for new scientific developments (prototypes) in the housing sector.
- resource providers that provide resources / housing services and obtain financial benefits.
In addition to the above participants, the Ministry of Housing and Communal Economy, the Ministry of Regional and Economic Development, the Federal Fund for Assistance to Reforming of the Housing and Communal Sector, venture companies, and investors are involved in the cluster [4,13,17,25].

The innovative digital housing and communal cluster is based on business partnership, whose main focus is to support research activities and implement innovative technologies in the production process [5,7,10,20].

Innovative digital clusters should develop “from top to bottom” using with government support measures (including through public-private partnerships, subsidies, preferential taxes and other instruments).

Due to the fact that the housing and communal sector is the most socially oriented area, the government agencies should create conditions for the development of innovative digital clusters (regulatory and legal legislation) [12,26,27].

The main functions of government in the implementation of this mechanism are: forecasting, i.e. simulation of the development of an innovative digital cluster in the housing and communal sector; planning of the parameters of the intra-cluster innovative digital interaction; development of socio-economic standards; monitoring (control, information support, management, comprehensive analysis, accounting); vertical and horizontal coordination (implementation of coordinated inter-cluster policy), etc.

The innovative infrastructure of the educational environment is as follows:
- new knowledge: fundamental research, applied research [23];
- personnel: scientific and innovative resources, training and retraining of specialists in priority areas of science and innovation
- services: experts in the field of protection and commercialization of intellectual activities, standardization and certification, business incubators (assisting applicants in finding effective innovative and digital solutions);
- material and technical base: scientific laboratories, techno parks;
- funding: federal and regional budgetary funds, extra-budgetary sources, own funds [21,24].

The process of developing and implementing an innovative digital project is a sequence of actions that increase the level of socio-economic efficiency of the housing and communal sector.

At the first stage, innovative digital programs for housing and communal services are developed, projects are agreed with all cluster members.

The next stage is the development of innovative digital projects. At this stage, goals, objectives, a subject and an object, terms of the investment and innovation project are determined. If the goal and objectives coincide with government interests, there are grounds for supporting the cluster. The generation of innovative and digital ideas / solutions is based on the educational environment (universities, centers of innovation and scientific research), the viability of ideas is assessed, and assistance in the search for effective solutions is provided. The roles are distributed among cluster members, the technological innovations, digital solutions, management innovations and modern management techniques are implemented, and innovation management systems are created. Innovation lifecycle management processes are carried out, the methodological, information and consulting, educational support is provided for implementing the cluster policy, design experiments are conducted, and required adjustments to the innovative digital projects are made.

At the final stage, the investment and innovation project is implemented. This stage includes two modules:
- the innovative digital development module (technology, data and knowledge bases) involves the creation of a single information space (combining all regulatory, technical, economic information into a single database with the possibility of electronic mailing to the subjects of the housing and communal cluster). It has access to new technologies, R&D results, joint scientific research with the aim of further implementation in production, the use of digital and automated control systems.
- the monitoring module: monitoring of the external environment (economic, regulatory, scientific and technical, territorial and geographical, etc.) and the internal environment (human resources of the management apparatus, financial and economic resources, information support and pricing systems).

The result of the innovative digital cluster is a socio-economic effect, i.e. improved quality of services, reduced production costs, competitiveness; the cluster approach should become a “growth point for the housing and communal sector”.

An incentive to enter an innovation-oriented cluster can be: availability of technologies, offices, production equipment; tax incentives; large investment and innovation programs; communication and exchange of experience with other participants in; investment and financial assistance.

The cluster development is aimed at solving the main problems of development of the housing and communal sector both in the short term and in the long term.

The planned socio-economic effect by the end of the t-th year is

\[ P_i^t = \frac{p_i^f}{p_i^p} \]  

(1)

where \( P_i^t \) is the indicator reflecting the planned socio-economic effect;

\( p_i^f \) is the planned indicator of the socio-economic effect in the t-th year;

\( p_i^p \) is the actual value of the indicator by the end of the t-th year.

In order to compare the socio-economic effects in different regions, it is necessary to use indicators that take into account the initial parameters of development of the housing and communal sector in the region.

The growth rate of the socio-economic effect in the t-th year is

\[ K_i^t = \frac{p_i^f}{p_i^N} \]  

(2)

where \( K_i^t \) – growth rate of the indicator value in the t-th year.

The coefficient shows how many times the indicator has changed at the end of the t-th year in comparison with the indicator at the beginning of the year;

\( p_i^N \) is the planned indicator of the socio-economic effect in the t-th year;

\( p_i^f \) is the actual value of the indicator by the end of the t-th year [22].

The mechanism for the development of an innovative digital cluster should be based on the principles of consistency, synergy, innovation, openness, transparency, information content, and responsibility.

The criteria of efficiency of the innovative digital cluster are: the total number of organizations involved in the cluster; total profits from the sales of innovative products; average number of employees; total volume of private investments aimed at the development of production, development and promotion of new / digital products / services; share of innovative companies among the cluster residents [14,18].

Thus, clustering in the housing and communal sector strengthens relationships between cluster members, facilitates access to new (innovative / digital) technologies, sharing knowledge and fixed assets and distributes risks of joint economic activities (including R&D organization); attracts investment, increases sustainability and competitiveness.

Figure 2 shows the advantages of innovative digital clusters in the housing and communal sector.
- Concept of priority development of the housing and communal sector (development of innovation and digital technologies, etc.)
- Coordination of R&D funded from

Government agencies

Core of the innovative digital cluster of housing and communal services

Housing and communal companies

Research and education institutions

- Improvement of conditions for implementing advanced technologies;
- Improvement of efficiency of budget expenditures.

- Attraction of housing and communal and scientific companies
- Expansion of competencies of housing and communal companies (training, early forecasting, development of prototypes of innovative digital projects, creation of chatbots, feasibility study, patent, etc.)

- Improvement of the environment for innovation, stimulation of demand for innovative products
- Financial support for the implementation of innovative digital projects.

Figure 2. Advantages of an innovative digital cluster in the housing and communal sector.

The study made it possible to draw the following conclusions. The development of an innovative digital cluster in the housing and communal sector has the following directions: improvement of the quality of housing and communal services; creation of a control and monitoring system; development of social infrastructures; adaptation of the existing housing management scheme taking into account the requirements of innovative and digital development.

The development of this cluster requires well-coordinated interactions of all participants in the digital innovation mechanism.

3. Conclusion

The development of cluster structures makes it possible to create innovative, technological, investment, information and marketing relationships and exchange experience and skills, which ensures the synergistic effect from cooperation and integration of efforts of various business entities on an innovative basis.

Thus, when reforming the housing and communal sector, the clusters can accelerate its development by stimulating innovative activities and creating a competitive environment.

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