Innovation management in construction companies in the context of macroeconomic volatility

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Abstract. The article explores the features of modern construction companies operating in the context of macroeconomic volatility. The concept of innovation for construction enterprises is clarified and their classification is given based on different criteria. The features of managing innovative activities of companies engaged in construction and installation works are determined. The main directions for eliminating the negative impact of macroeconomic volatility on the innovative activity of construction companies are identified and substantiated.

1 Introduction

In the past decade, the issue of innovation-driven development of the Russian economy has become a distinct current trend, widely discussed by both the academic community and practitioners at conferences and forums of different levels. It acquires strategic importance for the enterprises which create conditions for the effective operation of sectors of the national economy by manufacturing high-quality construction products. The construction industry also solves an important task of satisfying the housing needs of members of modern postindustrial society.

Certain structural components of the issue of innovative activity of construction companies have already been explored in economic papers, including the concept and peculiarities of innovation in construction [1], features and problems of innovation activity in construction [2], features of managing innovation activity of construction and assembly companies [3], innovative directions for the development of construction enterprises in the digital environment [4].

Despite the extensive number of publications on the problem under study, systemic analytical studies of issues related to the innovation management in construction companies in conditions of macroeconomic volatility have not yet been properly reflected in the papers of Russian economists. At the same time, macroeconomic volatility (caused by abrupt changes in the geopolitical situation, economic crises, cyclic and market factors, financial policy failures, deterioration of relations with a number of foreign countries) led to a decline in business activity in sectors of the Russian economy, increased unemployment and poverty

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of a part of the population, rising capital outflow from the country, reduced real incomes of the population and higher inflation.

In this regard, it seems relevant to develop comprehensive solutions to issues related to the specifics of innovation management in construction companies in conditions of macroeconomic volatility to increase the efficiency and competitiveness of business entities engaged in the investment and construction complex of the country.

2 Materials and methods

The main provisions of this article were developed based on the review of papers found in scientific databases Scopus and Web of Science and dedicated to the issues of management of innovation activity of construction companies in conditions of economic volatility. Professional articles published in these journals over the past five years were selected for the study.

The search for necessary data, as well as their further analysis, was carried out using the following keywords: construction companies, innovation, innovation activity, macroeconomic volatility, inflation, economic growth, stakeholders, partnerships.

3 Results

As a result of the study, several scientific statements were developed regarding the concept of innovations in the construction industry, their classification and innovative activities of construction enterprises. This helped substantiate the main directions for eliminating the negative impact of macroeconomic volatility on the innovative activity of modern construction companies.

4 Discussion

Construction is a key sector of the national economy, largely responsible for the effective solution of the most important tasks which are related to the long-term program for the social and economic development of the country. This is due to the fact that the construction complex creates fixed assets for all industries of the current Russian economy, along with technical upgrading and reconstruction.

Institutionally, construction as an industry includes general construction and specialized enterprises, design, exploration and research organizations and companies engaged in construction and installation works on the right of economic or operational management.

Construction firms are complex dynamic systems with several features that distinguish them from businesses operating in other sectors of the national economy (Figure 1).

The 2020 macroeconomic crisis, which researchers call a macroeconomic shock, led to a significant increase in construction costs, disruption of existing production chains, decline in demand for construction products from both the population and businesses, financial hardship of construction companies and skills shortages. It seems possible to stabilize the current situation in the construction industry only through the innovative activity of construction companies, as evidenced by the increased publication activity in this area [5].

The concept of innovation activity of construction companies is based on the category of innovation. In the construction industry, innovative activities can be interpreted as technological, organizational, economic, social and marketing business processes of varying degrees of innovation (fundamentally new, new to the company or market, improved or modified), the implementation of which will provide additional economic benefits for construction enterprises.

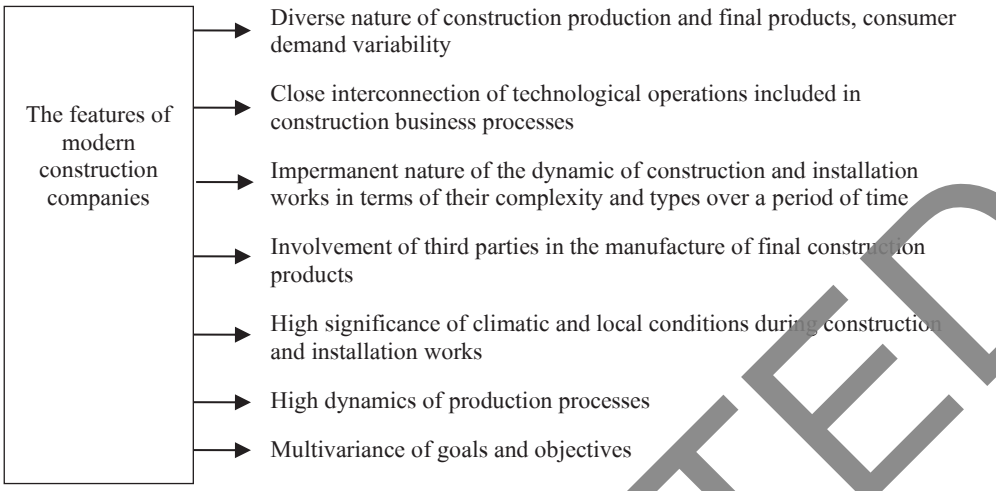

Fig. 1. The features of modern construction companies

The types of innovations in the construction industry are diverse and can be classified according to various criteria (Figure 2).

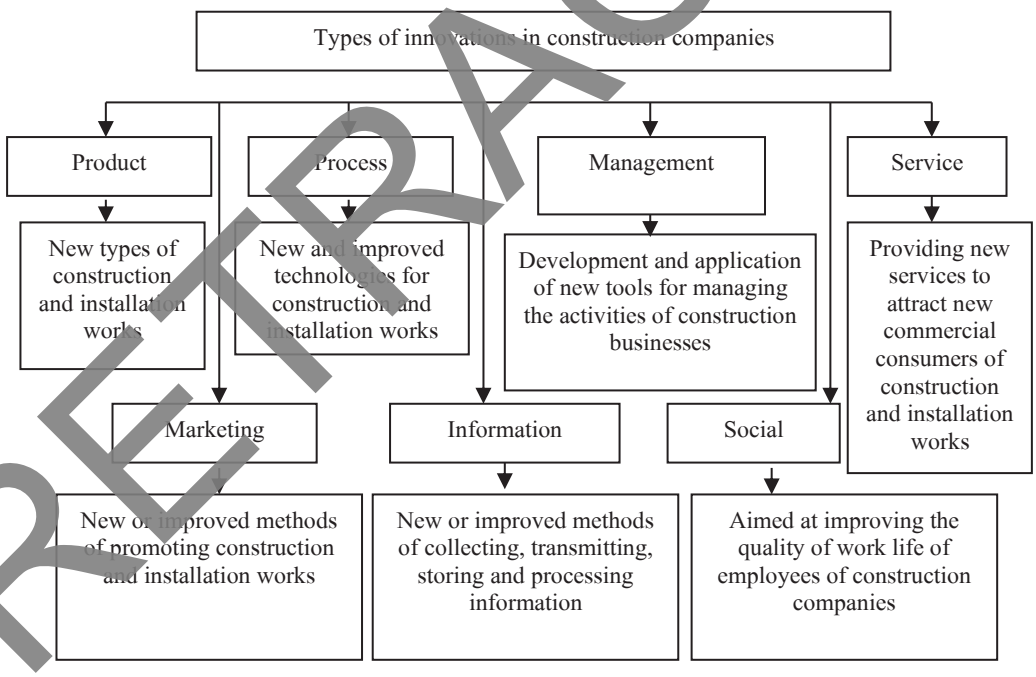

Fig. 2. Types of innovations in construction companies.

It should be noted that currently the key innovation in construction is BIM technology. Basically, BIM technology is a computer model for designing a new building which consists of several components (Figure 3).

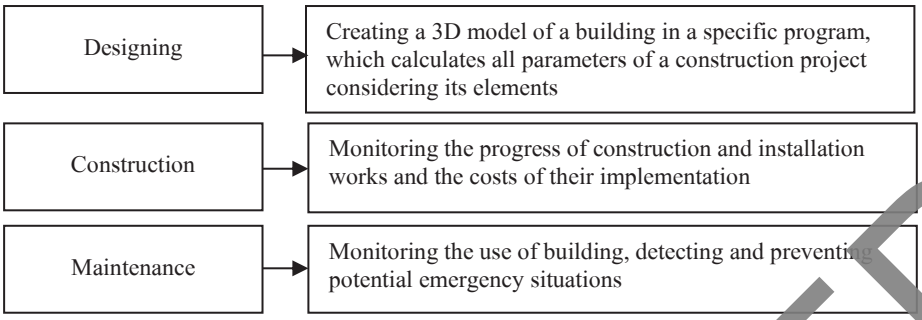

Fig. 3. Components of a computer model for the construction of a new building (BIM technology)

Buildings designed and built using BIM technology are characterized by high quality and well-planned infrastructure. They are convenient and safe for visitors. In addition, the labor intensity of developing and implementing a construction project is reduced at all stages.

It is possible to calculate the costs of labor or tasks that are carried out by robots. All parameters of a construction project can be presented in the form of a three-dimensional model, which can be modified depending on the ratio between certain structural elements. The main advantage of BIM technology is cost and time savings.

Modern economic literature presents different approaches to characterizing the innovation activity [6]. Systematization of these approaches, considering the peculiarities of construction companies, makes it possible to define the concept under study as a special type of activities, the main goal of which is the development and commercialization of innovation projects, involving the development of product, process, management, social and marketing innovations aimed at improving the level of satisfaction of the needs of the population and businesses for construction products of various purposes.

The innovative activities of construction companies are multifaceted and include the following main areas:

1. Research, design and development.
2. Technical and technological re-equipment to provide new or improved construction and installation works.
3. Patent and licensing activities.
4. Certification and standardization of construction products.
5. Innovation analysis.
6. Innovative marketing. Study of market needs, assessment of competitors, generation of new ideas, finding and attracting new customers, marketing support for innovation projects.
7. Arrangement of multichannel financing of innovative activities.
8. Activities for training and retraining of personnel for innovative activities of construction companies.

Certainly, such multifaceted innovative activity of modern construction businesses should be a managed process, given that its implementation in current conditions faces a number of problems, including the following:

- lack of financial resources for innovation activity,
- shortage of qualified personnel with the required competencies in the field of innovation,
- insufficient state support for innovation projects,
- lack of an effective mechanism for fostering innovations,
- underdevelopment of innovation infrastructure.

In our view, the management of innovative activity of construction companies should be seen as the targeted impact of the management subject on all kinds of resources consumed in the innovation process using a set of methods and techniques in order to achieve the best possible efficiency of innovations. Such management should be carried out considering the current social and economic situation in the country, which is characterized by instability.

In economic papers, macroeconomic instability is seen as economic fluctuations, which are manifested in increased unemployment, inflation, state budget and foreign trade balance deficits and underutilization of production capacity [7, 8].

Amid intensified globalization processes and ongoing global challenges, the current conditions for the development of the Russian economy are changing and characterized by macroeconomic instability, which implies a radical change in the operation of industries, sectors and companies. The changes gradually accumulate in the social and economic system and when dominance begins to exceed the effect of stabilizing factors that maintain system equilibrium, a loss of equilibrium occurs and the system becomes unstable. The economic system begins to develop unevenly, in waves, which in economic theory is called the law of diminishing marginal productivity of all factors.

Reaching the economic stability trajectory will largely depend on the state efforts to eliminate or minimize the factors that generate macroeconomic volatility. However, a set of stabilization measures can be implemented within each sector and enterprise. For construction companies, this could involve the following areas (Figure 4).

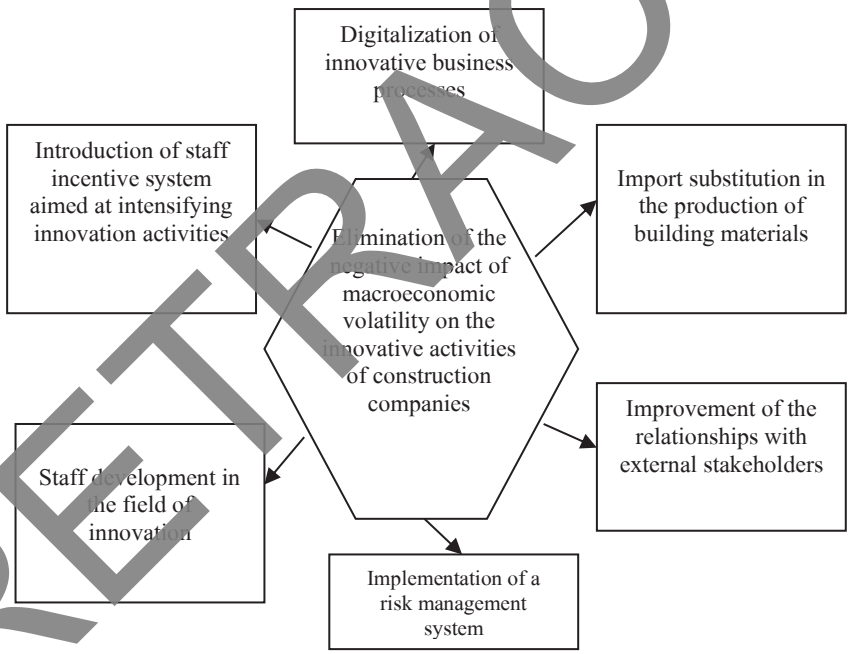

Fig. 4. Directions for eliminating the negative impact of macroeconomic volatility on the innovative activities of construction companies

Let us take a closer look at each of the directions. Construction companies have partnerships with a number of external stakeholders, interaction with which can have a significant impact on their economic growth rate. The main stakeholders of construction companies are:

- suppliers of building materials,
- design organizations,

- contractors,
- research institutions,
- financial and credit institutions,
- licensing and certification authorities,
- public authorities,
- organizations providing legal support.

The listed groups of external stakeholders interact by pooling different kinds of resources and coordinating their actions in the process of implementing project business decisions. Therefore, construction companies should enhance their relationships with partners by using innovative communication channels and technologies.

In this regard, developing a digital environment of construction businesses is of great importance. Currently, the innovation activity of large construction companies shows a trend of active development towards the use of various digital services and building an ecosystem around them.

The practice of digital transformation of the construction industry proves conclusively that so-called technological radars are becoming more widespread. These are tools applied for long-term planning of the use of digital technologies in a construction company. Digital radars typically include artificial intelligence, robotics and collaboration tools, blockchain, 3D printing and smart contracts. They are developed based on big data and artificial intelligence to generate forecasts on strategically important digital technologies. Technological radars are quite complex in terms of the list of input data and large Russian construction companies are just beginning to use them.

We may therefore conclude that the existing theoretical and methodological framework for managing the innovative development of construction companies in the digital environment, for the most part, covers only the project implementation phase, without paying due attention to strategic, long-term planning of the development of construction businesses.

Improving the management of innovation activity of construction companies in conditions of macroeconomic volatility certainly implies the implementation of a risk management system. For this purpose, it is possible to use the methods given in Table 1.

Table 1 – Risk management methods for the innovation process of construction companies

Risk management methods	Specifics
1. Risk avoidance	1.1 Partial withdrawal from innovative activities 1.2 Rejection of any deals with unreliable partners 1.3 Innovation activity insurance
2. Risk compensation	2.1 Creation of a reserve fund 2.2 Establishment of unions, associations and mutual support funds 2.3 Development of strategic planning of innovation activity 2.4 Lobbying for bills that provide for the neutralization of predicted risk factors
3. Risk localization	3.1 Creation of venture enterprises 3.2 Separation of the riskiest divisions of an enterprise into independent structural units
4. Risk dissipation	4.1 Diversification of activities 4.2 Broadening the circle of business partners 4.3 Diversification of the investment portfolio of a construction company 4.4 Expanding the construction materials market 4.5 Distribution of risk across stages of the innovative project implementation

All measures aimed at improving innovative activities of construction companies in the context of macroeconomic volatility should have adequate staff support. Currently, the training of construction workers takes place in a four-level vocational education system:

- secondary vocational education,
- higher education – bachelor's degree,
- higher professional education - specialty, master's degree,
- higher education - training of highly qualified personnel.

However, according to experts, the system of high school and postgraduate training for the construction industry is not structured and does not correspond to the current needs of construction companies for innovative personnel [9]. Therefore, educational institutions of various levels engaged in training staff for the construction industry need to improve their educational programs based on its current state and existing challenges in the field of innovation.

Employees of construction enterprises can acquire the necessary competencies in the innovation area through advanced training and professional retraining courses, mostly online. Currently, there are different kinds of such courses, which include the study of the following important issues:

1. Efficient innovation management.
2. Development of innovative projects.
3. Stages of the life cycle of innovative solutions.
4. Resource base for innovation activities.

The development of import substitution in the building materials sector has its specifics. The fact is that materials for mass construction are produced in Russia, while materials of medium and high price segments are mostly imported. Engineering systems also heavily dependent on imports, including ventilation and pumping equipment, fire safety and warning systems, shut-off and control plumbing equipment and automatic control systems. Thus, the solution to the problem is as follows. In case of resources that require a significant reserve of time for allocation, logistics chains are being restructured and the necessary materials and equipment are introduced via new routes. Next, Russian production is stimulated, including R&D for creating resources with indicators higher than those of foreign analogues, ultimately leading to import substitution.

To effectively help local construction companies, the Russian Ministry of Construction, together with the National Constructors Union (NOSTROY), developed a catalog of import substitution. An interdepartmental working group explores whether domestic and imported from friendly countries building materials correspond to foreign analogues. In case of positive decision, the materials are entered into the register. As a result, builders can replace construction materials that are currently unavailable without additional examinations and unnecessary bureaucratic procedures.

In most cases, issues of import substitution are related to high-tech equipment, construction machines and mechanisms. Different stakeholders work together closely to solve these issues, including public authorities, research institutes; small and medium-sized businesses are also involved. A radical restructuring of operation takes place. Supply chains are changing, and new approaches are developed.

Summing up, the main areas for eliminating the negative impact of macroeconomic volatility on the innovative activities of construction companies are developed, but they require further improvement in accordance with the dynamics of modern social and economic processes.

5 Conclusions

Construction, as one of the leading sectors of the Russian economy, which provides the population and businesses with buildings and facilities, has been developing over the last few years in conditions of macroeconomic volatility inherent to the entire social and economic system of the country. Macroeconomic instability is caused by abrupt changes in the geopolitical situation, economic crises, cyclic market factors and the introduction of sanctions by foreign countries. This had a negative impact on the construction sector, as it led to a decrease in demand for construction products and an increase in their prices, a lack of high-quality building materials and advanced technological equipment, and a deterioration in the financial results of construction companies.

The main direction of stabilizing the economic situation of construction enterprises is to develop their innovation activity in accordance with the framework of the fourth and sixth technological ways and the digital economy requirements. The innovative activities of construction companies are multifaceted and include research, production and infrastructural components.

To eliminate the negative impact of macroeconomic volatility on the innovation activity of construction companies, they need to develop promising areas, including the digitalization of business processes, import substitution in the production of construction mechanisms, improvement of partnerships with external stakeholders, introduction of a risk management system and methods for stimulating innovations and staff support for innovative management solutions.

These activities will ensure the sustainable operation of construction companies in the current conditions of macroeconomic volatility.

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