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IMPROVING THE FINANCING MECHANISMS OF INNOVATION ACTIVITY IN THE CONSTRUCTION MATERIALS MANUFACTURING SECTOR

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Abstract: This scientific study examines the improvement of financing mechanisms for innovation activity in the construction materials manufacturing sector. The research theoretically substantiates the interrelation between innovation development, investment processes and funding sources, and proposes mechanisms for the effective utilization of off-budget resources, foreign capital and capital market instruments. To alleviate the constraints associated with credit-based financing of innovation projects, the study justifies the need for broader implementation of alternative financial instruments such as venture capital, grants, investment funds and public-private partnership mechanisms. As a result, an integrated mechanism aimed at increasing the economic efficiency of financial support for innovation activity in the industry has been developed.

Key words: innovation activity, financing mechanisms, construction materials industry, investments, alternative financing, venture capital, public-private partnership.

INTRODUCTION

Issues related to managing the economic activities of enterprises in the construction materials industry of Uzbekistan, as well as tasks aimed at improving practices to enhance the innovative activity of business entities, hold significant importance. In order to effectively implement these tasks, it is necessary to refine the theoretical and methodological aspects of the concept of “innovative activity” and to establish cluster structures within the construction materials industry that form a value-added chain—from the extraction of raw materials to their processing and the production of finished construction and finishing materials. Increasing innovative activity requires the development of an integrated evaluation system for indicators such as the coefficient of innovative product manufacturing, the coefficient of expenditures on innovation, the profitability coefficient of innovative products, the coefficient of research and development expenditures, the coefficient of employees with academic degrees, the index of innovative efficiency, as well as patents and licenses. This should be complemented by scientific research focused on designing multi-factor models that, on the basis of effective instruments for enhancing innovative activity in economic processes of construction materials enterprises, provide forecast indicators up to 2028.

This article, to a certain extent, serves to fulfill the tasks outlined in the Decree of the President of the Republic of Uzbekistan dated September 11, 2023, No. PF-158 “On the Strategy Uzbekistan–2030”; the Decree dated January 28, 2022, No. PF-60 “On the Development Strategy of New Uzbekistan for 2022–2026”; the Decree dated September 21, 2018, No. PF-5544 “On Approval of the Strategy for Innovative Development of the Republic of Uzbekistan for 2019–2021”; the Decree dated November 27, 2020, No. PF-6119 “On Approval of the Strategy for the Modernization, Accelerated and Innovative Development of the Construction Sector of the Republic of Uzbekistan for 2021–2025”; the Resolution dated May 7, 2018, No. PQ-3698 “On Additional Measures to Improve the Mechanisms of Introducing Innovations into Sectors of the Economy”; the Resolution dated May 23, 2019, No. PQ-4335 “On Additional Measures for the Accelerated Development of the Construction Materials Industry”; as well as other regulatory legal documents related to this sector.

REVIEW OF LITERATURE ON THE SUBJECT

In scientific sources on the subject, the mechanisms of financing innovative activity are interpreted as a key factor in the modernization of the economy. In particular, Porter and Schumpeter consider innovation to be

the foundation of competitiveness, while local authors such as A.M. Ismailov, E.Kh. Tukhtayev, and Yuldoshev emphasize the significance of investment instruments and public–private partnership mechanisms in stimulating innovative activity within the construction materials industry. According to the author, the innovative activity of enterprises in the construction materials sector should be understood as the processes of creating and introducing innovations through qualitative and quantitative transformations of innovative activity indicators, which are fundamentally based on human capital.

National science agencies have become central to advancing innovation in construction materials through structured research programs. For instance, the U.S. National Science Foundation's Materials Innovation Platforms were created to accelerate discovery and deployment of new alloys, composites, and processing technologies by providing access to shared infrastructure and fostering interdisciplinary collaboration (NSF, 2024). Similarly, the U.S. Department of Energy supports small businesses engaged in advanced materials and manufacturing innovation through its SBIR/STTR funding programs, offering non-dilutive Phase I grants that enable proof-of-concept development (DOE, 2023).

Demand-side mechanisms also play a significant role in shaping innovation. Scholars such as Bergman, Krupnick, and Shih highlight that policy tools like innovation prizes, government procurement commitments, advance market commitments, milestone-based payments, and industry standards act as strong incentives to commercialize novel technologies. These mechanisms are particularly effective in energy-intensive sectors such as cement and steel, where long-term decarbonization goals require innovation beyond traditional R&D financing (Bergman et al., 2023).

Empirical research has shown that firms typically employ a combination of eight financing instruments to support innovation: internal funds, bank loans, credit lines, trade credit, equity, grants, leasing, and factoring. Each of these options carries distinct cost and risk implications, and firms often combine them to balance liquidity with investment needs (Santos, 2024). Reports by consulting institutions also emphasize the importance of financial flexibility in construction companies. Deloitte, for example, notes a shift in the industry away from lump-sum contracts toward reimbursable models, combined with strategic material sourcing as a way to stabilize cash flow and facilitate innovation financing (Deloitte, 2024).

Taking the above into account, when clarifying the essence of the concepts of “innovation” and “innovative activity” in the construction materials industry, it is necessary to focus on their key characteristics.

RESEARCH METHODOLOGY

In this study, the activities of large and medium-sized enterprises operating in the construction materials industry of the Republic of Uzbekistan (including “Ko'p Tarmoqli Biznes” LLC and “Nanrob Mobile System” JVC) were analyzed. During the course of the research, the following methods were employed: comparative and statistical analysis, economic-mathematical modeling, expert evaluation, as well as the method of systematization and generalization of scientific literature. These approaches made it possible to assess the dynamics of innovative activity in the construction materials sector, identify key factors influencing enterprise competitiveness, and develop recommendations for enhancing the efficiency of innovation financing mechanisms.

ANALYSIS AND RESULTS

At the current stage of the national economy, each enterprise in the construction materials industry is required to systematically expand its production capacity, increase the scale of output, modernize production assets in a timely manner, and organize production processes with precision and thoroughness. Such factors, by enhancing the innovative activity of the enterprise, ensure its competitiveness under market conditions. To properly evaluate and effectively manage these factors, it is necessary to establish a multi-stage comprehensive system that encompasses all key indicators. For this reason, based on the category of “enterprise innovative activity,” it is essential to assess the set of resources and reserves and to form a management system that ensures the development and efficient operation of enterprises.

Improving the mechanisms of financing innovative activity in the construction materials production sector is one of the most urgent tasks in today's competitive economy. The creation of effective mechanisms for financing innovative projects ensures the sustainability of enterprise operations and contributes to the renewal of production capacities. This, in turn, facilitates the technological modernization of the sector, strengthens export potential, and supports the production of competitive products that meet market demand.

The following table presents the technological structure of investments in fixed capital in percent terms and their changes in coefficients. Particular attention is paid to the share and coefficients of investments in fixed capital directed towards construction and installation works, equipment and machinery, as well as all other capital works and expenditures (Table 1).

Table 1. The technological structure of investments in fixed capital in the Republic of Uzbekistan ¹

Years	2013		2015		2017		2019		2020		2021		2022		2023	
	percent	coef.	percent	coef.	percent	coef.	percent	coef.	percent	coef.	percent	coef.	percent	coef.	percent	coef.
Total investments in fixed capital:	100	1,23	100	1,14	100	1,41	100	1,58	100	1,07	100	1,21	100	1,25	100	1,33
Including:																
Construction and installation works	49,7	1,02	51,0	0,99	52,0	1,02	44,6	0,84	40,2	0,90	43,4	1,08	48,7	1,04	50,9	1,12
Machinery and equipment	35,2	1,05	31,6	0,98	34,4	1,09	43,8	1,33	52,1	1,19	49,5	0,95	33,4	0,92	39,4	1,25
Other capital works and expenditures	15,1	0,84	17,4	1,07	13,6	0,78	11,6	0,85	7,7	0,66	7,1	0,92	17,9	1,07	18,1	1,07

It is noteworthy that the technological structure of investments in fixed capital in our country—specifically, investments allocated for construction and installation works—did not demonstrate a consistent growth trend during 2013–2023. On the contrary, the highest figure was recorded in 2018, after which a certain decline was observed. In particular, the share of such investments amounted to 49.7 percent in 2013, 53.4 percent in 2018, and 48.7 percent in 2022. Accordingly, the variation coefficients of returns on investments in fixed capital also differed across periods, standing at 1.02 in 2013, 1.03 in 2018, and 1.04 in 2022.

At the same time, the volume of investments directed toward machinery and equipment increased, accounting for 35.2 percent in 2013, 32.9 percent in 2018, and 33.4 percent in 2023, respectively. In this category, the variation coefficients of returns also differed: 1.05 in 2013, 0.96 in 2018, and 0.92 in 2022.

When analyzing the data presented in the table below, a vertical analysis method was applied to evaluate the innovative activity of all enterprises in the construction materials industry. According to this analysis, the “Nanrob Mobile System” JVC enterprise demonstrated an average profitability coefficient of 0.17 for the share of innovative products, while the “Ko’p Tarmoqli Biznes” LLC enterprise showed an average profitability coefficient of 0.14 (see Table 1).

During the research, the proposed methodology for assessing the innovative activity of construction materials enterprises was submitted for expert evaluation in order to develop an integral assessment framework.

$$IN_f = (I_m * I_c * I_p * S_c * IL_{ul} * I_e * PI)^{1/(7-n)}$$

That is, among the proposed alternative approaches, in order to answer the question “Is the integral evaluation method for assessing the innovative activity of construction materials industry enterprises effective?”, we applied the “expert evaluation” method. The main advantage of this method lies in the fact that it is used in cases where it is impossible or insufficient to provide a purely quantitative assessment of economic phenomena, and where forming subjective opinions regarding a particular process or object is required. In such instances, conclusions are drawn and decisions are made based on the opinions of industry specialists (experts).

Proceeding from this, it can be stated that according to the results of expert surveys, the integral assessment of innovative activity in construction materials enterprises should be carried out within the following coefficient ranges: “very high” ($0.8 \leq IN_f < 1.0$), “high” ($0.64 \leq IN_f < 0.8$), “moderately risky” ($0.37 \leq IN_f < 0.64$), “risky” ($0.2 \leq IN_f < 0.37$), and “highly risky” ($0 \leq IN_f < 0.2$). In order to develop a profitability coefficient scale for evaluating the innovative activity of construction materials industry enterprises based on expert opinions, and to assess the quality of their level of agreement, it is recommended to use Harrington’s verbal–numerical scale (Table 2).

¹ O‘zbekiston Respublikasi Prezidenti huzuridagi statistika agentligi ma‘lumotlari asosida muallif tomonidan tuzilgan. www.stat.uz

Table 2. Coefficient indicators of innovative activity of construction materials industry enterprises²

№	Names of indicators	2019		2020		2021		2022		2023		average profitability ratio	
		«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC	«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC	«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC	«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC	«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC	«Nanrob Mobile System” JVC	“Ko’p tarmoqli biznes” LLC
1	Share of innovative products	0,14	0,11	0,16	0,14	0,15	0,12	0,18	0,15	0,21	0,16	0,17	0,14
2	Coefficient of expenditures on innovation	0,18	0,13	0,21	0,16	0,20	0,15	0,23	0,18	0,27	0,19	0,22	0,16
3	Profitability coefficient of innovative products	0,28	0,20	0,29	0,20	0,29	0,23	0,30	0,21	0,33	0,20	0,30	0,21
4	Share of research and development expenditures	0	0	0	0	0	0	0	0	0	0	0,00	0,00
5	Share of employees with academic degrees	0	0	0	0	0	0	0	0	0	0	0,00	0,00
6	Innovation efficiency index	0,24	0,18	0,27	0,22	0,27	0,21	0,31	0,24	0,35	0,25	0,29	0,22
7	Indicator of patents and licenses	0	0	0	0	0	0	0	0	0	0	0,00	0,00

Based on the formula we have proposed for determining the coefficient of enterprise innovative activity, an integral indicator of innovative activity was calculated for the two construction materials industry enterprises analyzed above. Accordingly, it can be observed that the integral coefficient of innovative activity for the “Nanrob Mobile System” JVC construction materials enterprise amounted to 0.23.

$$IN_{f1} = (0.17 * 0.22 * 0.3 * 0.29)^{1/4} = 0.23 \quad (1)$$

It can also be observed that the integral coefficient of innovative activity for the “Ko’p Tarmoqli Biznes” LLC construction materials enterprise amounted to 0.17.

$$IN_{f2} = (0.14 * 0.16 * 0.21 * 0.22)^{1/4} = 0.17 \quad (1)$$

As a result of the conducted analyses, it was revealed that, on the basis of integral indicators of vertical and horizontal analysis in construction materials manufacturing enterprises, the levels of financial activity ($M_f = 1.025$), production activity ($I_{chf} = 1.216$), marketing activity ($Mar_f = 1.002$), managerial activity ($B_f = 1.242$), and labor activity ($Meh_f = 0.947$) remain within acceptable ranges, which provides the opportunity to maintain a high level of innovative activity. In this context, it becomes possible to determine the weighting coefficients of the factors that constitute the structure of innovative activity in construction materials industry enterprises.

CONCLUSIONS AND SUGGESTIONS

In conclusion, it can be stated that the integral evaluation of the innovative activity of construction materials industry enterprises holds significant importance, as it takes into account all aspects of enterprise operations. This, in turn, enables a more accurate assessment and management of the overall condition and development prospects of enterprises. Moreover, it allows the identification of areas within enterprises that require additional investment. At the same time, integral evaluation helps enterprises enhance their innovative activity, adapt to market conditions, and design appropriate strategies, including making decisions on investing in new projects or reallocating existing resources. Overall, the integral assessment of innovative activity in construction materials industry enterprises is crucial for improving efficiency and ensuring sustainable development.

² Qurilish materiallari sanoati korxonalari ma’lumotlari asosida muallif tomonidan ishlab chiqilgan.

Enhancing economic mechanisms is essential for increasing the innovative activity of construction materials industry enterprises, ensuring their competitiveness, and guaranteeing sustainable growth. The results of the study demonstrate that the implementation of economic instruments that stimulate innovation in practice provides opportunities for efficient use of resources, the introduction of new production technologies, and expansion of market share.

In this regard, strengthening state support policies, introducing tax and credit incentives, and integrating scientific research with production emerge as key factors. To fully realize the innovative potential of construction materials industry enterprises, it is necessary to modernize market mechanisms and implement innovative management approaches into practice.

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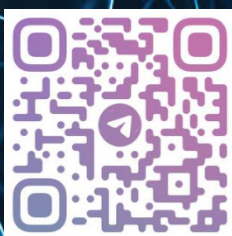
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