ZAMONAVIY IQTISODIYOT VA INTELLEKTUAL TEXNOLOGIYALAR
Ilmiy-uslubiy elektron jurnali — Sharq universiteti
ISSN: 3093-9062 Vol. 1 No. 1 (2026)

INSTITUTIONAL AND ECONOMIC MECHANISMS FOR DEVELOPING SCIENTIFIC AND RESEARCH ACTIVITIES IN THE BUILDING MATERIALS INDUSTRY

Goziyev Murodjon Shokirjonovich,
Lecturer at the Department of Economics and Tourism,
Fergana State University,
EMAIL: murodjon130180@gmail.com
DOI: https://doi.org/10.66493/ppdbkk74

Abstract: This article examines how to advance R and D (the strategic process of selecting, funding, and overseeing a mix of research projects to align with business goals, balance risk and reward, and maximize long-term value) in the construction materials industry. The aim is to justify institutional and economic mechanisms that reduce the gap between research outputs and industrial adoption. The study employs system analysis, comparative reasoning, and synthesis of practice-based cases. The results propose an integrated model linking R and D portfolio governance, technology transfer, and standardization, contributing to innovation management theory.

Keywords: construction materials, research and development, innovation ecosystem, technology transfer, standardization, R and D portfolio, industrial cooperation

Introduction

The building materials industry is one of the sectors with a high multiplier effect in the national economy, which is distinguished by the high share of materials in the cost structure of housing, infrastructure and industrial construction. Therefore, any technological increase in material cost, energy capacity, logistics costs, resource utilization efficiency and quality stability directly affects price dynamics, project duration and quality indicators, and the overall investment climate in the construction market. However, the trend observed in the global scientific space in recent years

© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

shows that innovations in building materials are not limited to finding a new binder or composite recipe, but are accompanied by complex institutional changes such as digitization of production, transfer of waste processing chains to a closed circuit, standardization of the product life cycle, modernization of testing and certification infrastructure [1; 6]. Therefore, the problem of development of scientific research activities in the network is two-fold in content: on the one hand, the scientific result itself, and on the other hand, the management and cooperation mechanisms that bring the result to the market.

The research problem is that many manufacturers cannot systematically organize R and D activities even with the understanding of the need for scientific research: selection of priority topics, financing of the laboratory and pilot test chain, formalization of intellectual property, conclusion of technology transfer contracts, compliance with standards and regulations specific institutions for risk distribution at the stage of ensuring and market implementation are not sufficiently functioning. As a result, scientific ideas often remain at the level of an article or sample of experience, while production delays investment decisions that ensure medium and long-term technological competitiveness, preferring to minimize short-term costs. While the scientific literature notes that the innovative “valley” phenomenon, that is, the institutional gap between laboratory results and industrial implementation, is common to many industries, this gap for the building materials industry is more complex because the product’s features such as safety, durability, long-term durability are strongly linked to regulatory requirements and testing protocols [2; 7]. In this respect, the research gap is that, given the high normative sensitivity of the network to the introduction of the scientific result, the conceptual model and practical mechanisms that see R and D management, transfer and standardization as a whole system are not sufficiently justified.

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

The purpose of this article is to systematically justify the institutional and economic mechanisms that serve to develop research activities in the building materials industry, and to propose an integrated model that accelerates the implementation of the result between the production enterprise, scientific organization and regulatory infrastructure. To achieve the goal, the following tasks were logically set: firstly, to determine the links of the R and D process in the network and the transaction costs in them; secondly, to develop the principles of R and D portfolio management at the enterprise level; thirdly, to justify network-friendly mechanisms of technology transfer and commercialization of intellectual property; fourthly, to propose ways to reduce the risks of implementation by harmonizing the standardization and testing system with R and D.

Methods

The research methodology relied on a systematic approach that combines conceptual and practical levels. In the first block, the network innovation ecosystem "scientific idea, laboratory verification, pilot production, industrial implementation, standardization and market diffusion", and the decision-making criteria and transaction costs were logically separated at each stage. Here, the method of systematic analysis made it possible to see not only the technological, but also the organizational, legal and economic components of the R and D process as a whole. In the second block, a comparative approach was used, and the models of cooperation between enterprise-scientific center-standardization institutes found in international practice and their level of flexibility were analyzed [6; 7]. The selection of comparative analysis was necessary to clarify that the pace of innovation in the building materials industry is often more dependent on the quality of institutions than on the level of technology.

As an empirical basis, industrial reports in open sources, practical recommendations on technology transfer, and analytical views on typical implementation problems in scientific directions on building materials were

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

synthesized. In this case, the “practical case synthesis” approach was chosen, and not clinging to the example of a separate enterprise or one region in a narrow circle, the recurring situations typical for the network, that is, energy-saving furnaces, reducing the share of clinker based on additives, using secondary raw materials, quality general institutional obstacles encountered in areas such as digitization of control were summarized [1; 4]. In the methodology, a way was chosen to analyze the regulatory legal context not directly through the listing of documents, but through economic logic, the impact of standardization and certification requirements on the innovation cycle, because the task of the article is not to interpret the regulatory framework, but to justify the mechanisms of integration into the management of R and D.

Analytical modeling elements were used in the development of results: when choosing the R and D portfolio, criteria such as “expected effect, implementation complexity, test and standardization costs, implementation period, number of partners were interpreted in relation to each other. This approach made it possible to explain indicators not by calculation formulas, but by the logic of giving weight in management decisions. The selection of methods was focused on the justification of practical mechanisms for the development of scientific activity in the network and their placement in a conceptual model in accordance with the research goal.

Results

The results of the analysis showed that the factors slowing down the activity of R and D in the building materials industry are primarily related to the lack of coordination between the links of the innovation process, rather than the lack of a technological idea. Even if a positive result is obtained at the laboratory stage of R and D, if the capacity for pilot production, the stability of raw material batches, the completeness of test protocols and the way of product certification are not planned in advance, the enterprise considers the introduction of innovation to be economically excessive risk. Based on this, the first result was based on the concept of “integrated implementation path”: as

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

soon as the R and D topic is selected, the standardization requirements, test design and the minimum outline of the future technological regulation are formed in parallel. This approach reduces the number of processing in later stages, reducing transaction costs and reducing time loss.

The second result was the development of principles of the R and D portfolio management mechanism at the enterprise level that correspond to the network characteristics. Many innovations in building materials "incremental" have an economic impact in nature, that is, by gradually improving the existing technology, but such projects are often carried out in a fragmented manner at the initiative of individual departments. The portfolio approach implies that R and D topics are balanced into three categories: energy and resource efficiency projects; medium-term projects that increase quality and stability; promising projects with a long testing and standardization cycle aimed at creating new product classes. The scientific contribution of this categorization is that it provides the logic of risk diversification given the normative sensitivity and capital capacity in the network, and "reduces the management errors that come from over-relying on one large innovation".

A third result is the proposed network-adapted contract architecture for technology transfer and intellectual property commercialization. Building materials developments often rely on a set of practical knowledge such as prescriptions, additive composition, heat treatment regimen, grinding and mixing parameters, and their complete protection with a simple patent is not always effective. Therefore, the transfer mechanism is built not only on patenting, but on the concept of "technological package": laboratory protocol, pilot test results, quality control cards, recommendations on the variability of raw materials, and a training module for production staff are submitted together. In this case, the economic motivation for the enterprise is connected to the principle of "step-by-step payment": payments are made sequentially after laboratory confirmation, stable batch in pilot power, and approval of regulatory indicators in industrial capacity.

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

As a result, the problem of trust in the transfer process is reduced, because the parties divide the risk over time.

The fourth result is the “early verification” mechanism for standardization and integration of test infrastructure with R and D. Acceptance of products in the market of construction materials largely depends on the recognition of test results and the possibility of inclusion in the project documents. Therefore, it was proposed to establish cooperation with testing laboratories at the R and D stage not only in the final certification, but also at the level of the initial samples. “The practical result of early verification” is that the research direction is optimized in the range of target parameters without going beyond the normative limits; which reduces further processing costs. Also, systematic communication with the test infrastructure increases the reproducibility of R and D results, as measurement differences between laboratory and production are detected early.

As a fifth result, the economic mechanisms stimulating scientific research activities in the network were reinterpreted at the level of internal management of the enterprise. The analysis found that many businesses see R and D as “cost center” and require a result that appears in the short-term financial statements. In the proposed approach, R and D “are evaluated as a separate link in the value creation chain”: energy consumption, waste share, processing costs, guaranteed quality indicators and the value created by logistics optimization are included in the conceptual assessment at the stage before introduction. This approach facilitates the justification of the resources allocated to R and D, as it is shown that the result is obtained not only from the sale of new products, but also from the reduction of costs and risks.

Discussion

The results obtained are consistent with innovative systems and technology transfer theories that are widely discussed in the scientific literature, but differ in that

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

they take into account the specific regulatory and safety limitations of the building materials industry. In particular, within the concept of national innovation systems, it is emphasized that institutional harmony determines the effectiveness of innovation, in which the quality of relations between science, education, business and state institutions is seen as a decisive factor [6]. In our results, the same connections were put in the center, but in building materials it was shown that the “hard” point of this connection is a standardization and testing system. This aspect introduces network clarification into the theory of innovative systems: if financing is sufficient to close the innovative “valley” in some sectors, it turns out that it is necessary to ensure regulatory compliance in building materials from an early stage.

Approaches to technology transfer include university-industry cooperation, licensing and spin-off mechanisms [7]. However, in the practice of building materials, since the transfer object is often “tacit knowledge”, that is, an unwritten set of knowledge connected to process parameters and technological discipline, only transferring the result to production with a license agreement in many cases does not have the expected effect. Therefore, the “technological package” architecture proposed in the article is interpreted as a practical solution to the problem of codification of knowledge in transfer theory: it increases the reproducibility of transfer by connecting patent and know-how elements with training, test protocol and quality control. This approach, while in harmony with the idea of “full-cycle implementation” found in Russian and international literature, makes the testing and regulation link central to building materials [2; 9].

The results of R and D portfolio management are conceptually consistent with the principles of diversification and risk balancing in strategic management literature [8]. However, the portfolio balance in the building materials network is directly related not only to market uncertainty, but also to the variability of raw materials and the volatility of energy resource prices. Therefore, the proposal to divide the portfolio into three

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

categories gives more accurate management “tili” in connecting the enterprise’s strategy with technological modernization: fast-acting energy-saving projects maintain the short-term competitiveness of the enterprise, medium-term quality projects strengthen market confidence, and long-term new product projects in the network forms technological leadership. In the literature, this equilibrium is often expressed in general terms, and in our interpretation, the duration of the normative test cycle was introduced as a portfolio criterion, which is closer to real management decisions in building materials.

The “early verification” mechanism for integrating standardization with R and D is in line with the views on quality management and working with technical regulations, because the stability of product quality is the main condition of safety and reliability in the construction industry [1; 5]. However, in existing approaches, standardization is often described as the final stage of implementation, resulting in regulatory obstacles at the end of R and D. Our results reconstruct this logic in the opposite direction: by adopting the test and standard requirements as “design constraint” at an early stage, the direction of R and D becomes clearer and the number of reprocesses decreases as we move to the pilot stage. This scientifically means that in the building materials industry, the innovation cycle “should be controlled at regulation-test-centered” coordinates, not technology-centered“.

In the works of local researchers, the need to strengthen innovative activities in industry, to improve the mechanisms of cooperation with scientific organizations and introduction of scientific developments into production was noted [3; 4]. Continuing this direction, this article links proposals to concrete problems of the network, that is, institutions of implementation in areas such as optimization of clinker share, application of secondary raw materials, reduction of energy capacity. As a result, the concept of “innovative ecosystem” does not remain abstract, but acquires operational content through the R and D portfolio, transfer agreement and test-standardization

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

chain. However, the limitation of the article is that the results are based on systematic-analytical generalization, not empirical statistical calculations; therefore, in the future, detailed economic assessments and examination of the dynamics of indicators in the section of enterprises will be a logical continuation of the research.

Another important dimension that complements the above analysis is the role of digitalization and data management in strengthening the innovation ecosystem of the building materials industry. In recent years, digital technologies such as process monitoring systems, industrial sensors, and data analytics platforms have begun to play a crucial role in improving the efficiency of research and development processes. Within the framework of innovation system theory, digital tools can be interpreted as mechanisms that enhance coordination between research institutions and production enterprises by accelerating feedback cycles and enabling more accurate experimental validation. In the building materials sector, where technological processes are highly dependent on raw material composition, temperature regimes, and energy consumption parameters, the integration of digital monitoring systems allows researchers and engineers to collect real-time operational data. This data, in turn, improves the reliability of pilot experiments and facilitates the faster adaptation of laboratory results to industrial-scale production.

Furthermore, the incorporation of environmental and sustainability considerations into the innovation process has become increasingly significant. International research emphasizes that modern industrial innovation should be aligned not only with economic competitiveness but also with environmental efficiency and resource conservation. In the context of building materials, this means that R and D activities must simultaneously address issues such as reduction of carbon emissions, efficient utilization of secondary raw materials, and optimization of energy consumption in production processes. Consequently, the proposed innovation management model can also be interpreted as a tool for achieving environmental modernization. Projects aimed

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

at decreasing clinker content, increasing the share of industrial waste in cement production, or introducing alternative fuels can be classified within the medium- and long-term segments of the R and D portfolio, since they require both technological experimentation and regulatory approval. By incorporating such projects into the innovation portfolio, enterprises not only enhance technological competitiveness but also align their activities with global sustainability trends.

Conclusion

The article justified that the development of research activities in the building materials industry requires, first of all, the harmonization of institutional and economic mechanisms that lead to the industrial introduction of laboratory results. Standardization of the R and D process and integration with the test infrastructure from the early stage have been shown to reduce implementation risks and reduce time loss. At the enterprise level, balancing the R and D portfolio by energy efficiency, quality stability and new product classes makes management decisions more accurate in the context of the network's normative sensitivity and capital capacity. In technology transfer, "technological package" and the principle of payment connected to the step-by-step result increase the reproducibility of scientific development and improve the distribution of trust and risk among partners. Theoretically, the article enriches innovative systems and transfer approaches with the regulatory-testing-centric nature of the building materials network, and in practice, it offers a management model aimed at implementation for enterprises and scientific organizations. In the future, it is appropriate to deepen this model by experimental-industrial tests on individual material groups, as well as by evaluating the dynamics of investment efficiency and transaction costs in the section of enterprises.

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026

ISSN: 3093-9062 Vol. 1 No. 1 (2026)

References

[1] Neville A. M. Properties of Concrete. Harlow: Pearson Education Limited, 2011. 872 p.

[2] Bazhenov Yu. M. Technology of Concrete. Moscow: Publishing House ASV, 2011. 528 p.

[3] Karimov A. A. Innovative development of the building materials industry: management and economic mechanisms. Tashkent: Economics, 2020. 196 p.

[4] Kholmatov B. S., Abdullayev D. A. Organizational and economic foundations of the introduction of resource-saving technologies in the production of building materials. Samarkand: Samarkand University Publishing House, 2019. 168 p.

[5] GOST 7.1–2020. Bibliographic record. Bibliographic description. General requirements and rules of compilation. Moscow: Standartinform, 2020. 60 p.

[6] OECD. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation. 4th edition. Paris: OECD Publishing, 2018. 258 p.

[7] Etzkowitz H., Leydesdorff L. Universities and the Global Knowledge Economy: A Triple Helix of University-Industry-Government Relations. London: Pinter, 1997. 196 p.

[8] Chesbrough H. Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston: Harvard Business School Press, 2003. 227 p.

[9] Telichenko V. I. Innovative materials and technologies in construction. Moscow: MGSU, 2016. 312 p.

DOI: https://doi.org/10.66493/ppdbkk74
© Sharq universiteti, 2026