Investment support for the implementation of scientific developments as a basis for the production of construction materials

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Abstract. The introduction of new types of materials is one of the conditions of economic growth, as well as the means to meet public needs and realize the interests of society, to constantly expand the market space of competing subjects of the economy. The development and introduction of new types of materials into production is of great importance for the State as a means of increasing competitiveness and eliminating the dependence of the State on the mismatch of life cycles of produced materials. Many interesting technologies and materials are emerging today, but there are many barriers to innovation and to modernization in the construction industry. The construction industry is the main opportunity for the growth of competitiveness and prosperity of the national economy. Therefore, its high-tech development is so necessary in modern realities. Moreover, the knowledge and application of new technologies in construction is extremely important for citizens, which will lead to savings in the construction and maintenance of residential premises. In general, the construction industry needs to get state stimulation of the development and introduction of innovative technologies in construction, which will allow to dramatically increase the volume of construction in the country and stimulate the introduction of innovations, otherwise against the background of the growing progress in developed countries construction revolution risks a final loss of competitiveness in this sphere.

Ensuring the quality of durability of building materials and structures is one of the current tasks of modern construction. The priority areas of development of the industry of construction materials are ensuring high operational properties and competitiveness of products, reducing the energy intensity of production processes through the use of local raw materials, as well as the use of new innovative technologies [1,2]. For this purpose new approaches and techniques of design and synthesis of construction materials are required, consisting in rational selection of raw materials and complex of modern modifiers, which allow to achieve specified physical and mechanical characteristics of construction materials and products from them.

The production of construction and finishing materials is a huge industry with a wide range of products. However, it should be noted that the quality of construction materials used by the manufacturer does not always meet the requirements of the quality management system. Many unscrupulous manufacturers do not specify the composition, properties of the materials or indicate the composition that is not true, together with the conduct of poor quality construction works, an
unsatisfactory result can be obtained. Thus, the quality of construction materials and production technologies are today a huge problem for the consumer.

A number of factors can be identified, both at the level of legislation and at the level of the industry, which influence the use of innovative materials in construction. At the level of legislation, in connection with the adoption of 261 Federal Law "On Energy Saving and Increase of Energy Efficiency and on Amendments to Certain Legislative Acts of the Russian Federation," there was a need for the use of energy-efficient materials in the construction of new buildings and structures, as well as in their reconstruction. In this case, innovative materials are the basis for the development of technical solutions [3].

Building energy-efficient buildings is profitable. For the developer it is an opportunity to sell at an increased price, for the buyer - to invest at the stage of purchase of real estate, and further save in its operation.

At the level of the construction industry, one of the motivations for introducing modern materials and technologies into the sphere of construction is to reduce the cost of construction at the stage of production of structural elements and construction of buildings directly. For example, the use of composite materials in the manufacture of Reinforced Concrete products, such as reinforcement, fibre or various aggregates - foam glass, Penetron "Admixa," can not only improve the physical and technical characteristics of construction materials, but, accordingly, increase the service life, but also will allow significant savings. Thus, the use of composite reinforcement from glass-plastic in non-bearing elements of buildings allows to achieve savings from 15 to 28% at the stage of manufacture of Reinforced concrete products [4,5].

Another important motivation for the developer to promote the introduction of modern materials and technologies is the significant expansion of the operational capabilities of buildings and structures. For example, thanks to the use of "penetrating waterproofing" at the stage of construction of buildings and structures, the developer has the opportunity to use spaces under buildings for commercial sale: it is possible to build underground parking lots or to use these areas for commercial hiring. At the same time, the developer can derive maximum profit from the sale of real space with minimal investment, as well as exclude risks related to warranty repairs and compensation for damage. With high land costs, it makes sense to make the most of it for commercial purposes. It is modern technologies that allow such results to be achieved.

The developer often faces various tasks, which cannot be solved without the application of non-standard technical approaches. It can be a task to build multi-storey buildings on bad soil, or to build complex monolithic structures without a large number of bearing elements or any other task that can be solved by using modern construction materials in the development of technical solutions. For example, due to composite materials, it is possible to strengthen structures without increasing the weight of structures, as well as without loss of space and area.

It is worth pointing out that the construction industry as a whole is immune to new technologies, namely the low costs of Research & Development (R & D), conservatism of designers, contractors and consumers themselves are the main characteristics of this industry. Of all industrial spheres, innovation in construction comes almost least [6]. However, with the passage of time and the massive penetration of innovative developments into all spheres of activity, the conservative construction industry is forced to change its established traditions and introduce processes of radical change.

The main obstacle to the development and introduction of innovative technologies in the construction sector is the absence of a clear State policy in the field of construction. There is practically no system of economic stimulation of innovation in construction.

The system of laws and regulations in the field of energy saving in construction is still pending. This does not allow the formation of technological corridors in construction. In Russia, the authorities have appointed a road map for construction "Improvement of the entrepreneurial climate in the sphere of construction". However, there are doubts that this road map will fundamentally change the situation in the industry. Major problems for housing construction, for example, are the lack of clear urban planning policies, the inconsistency of urban planning plans and plans of natural monopolies,
the insufficient investments of the State in engineering and social infrastructure, and the insufficiency of existing mechanisms for financing construction.

In analysing innovations in the sphere of state regulation of the construction sphere, it can be argued that the general state strategy provides for further liberalization of the sphere of construction and reduction of the role of the state. It is difficult to imagine that such a strategy, not supplemented by modern tools of state stimulation of development and introduction of innovative technologies in construction, will allow to dramatically increase the volume of construction in the country and stimulate the introduction of innovations [7].

New technologies play a huge role in any production, their introduction reduces costs and speed of production, improves the quality of products. New patents determine the emergence of new products that can make a healthy competition with the old ones. In terms of promoting the use of innovative materials, the most effective is the initial introduction of innovative materials and technologies at the company’s business process level. Innovative processes should permeate all scientific, technical, production, marketing activities and ultimately focus on meeting market needs and achieving commercial results, as does any business process [8]. The innovation process is considered as a set of sequential work - from obtaining theoretical knowledge to consumer use of goods created on the basis of new knowledge. Innovative process does not come to an end with introduction (emergence in the market of a new product, service or bringing to design capacity of new technology), is not interrupted after introduction as in process of distribution the innovation is improved, gains new consumer properties. At the same time, the enterprise needs to introduce the concept of "innovation cycle," which involves establishing a feedback between the consumer of a new product, service, method, technology and scientific component of innovation [9,10].

The development and production of a new type of construction material requires the presentation of an innovative idea in the form of a business plan. At the same time, it is important to justify the prospects of innovation in the market, to assess the possibilities of its production implementation, to determine the efficiency of technological investments, as well as to analyse the impact of innovation on the economic growth and development of the enterprise economy as a whole [11]. In each construction organization, the process of introducing and developing new innovative materials should consist of several defined stages. The main steps are shown in Picture 1.

**Picture 1.** Stages of implementation of a new type of construction material in the company

Each step reflected in the scheme implies a need for a certain level of staff with specific skills, knowledge. Therefore, it will be necessary to resort to training of personnel, which will be carried out in two main directions: training of theory and practice of carrying out works on the implementation of this project, as well as retraining and advanced training of personnel in those areas in which there will
be a need during the implementation of the program. In case of promotion of innovations in construction production, even lower-level personnel - builders, construction workers, finishing masters and so on - will have to undergo training in correct handling of materials of the new generation. Compliance with the stages of the scheme will allow to minimize risks of introduction of innovative materials and prepare for potential difficulties in their implementation.

Russia now sees a marked trend towards innovation in construction and production. Large developers, such as PIC, Gals, Donstroy and others, are actively working on innovative directions in the field of construction materials, design, implementation of BIM-technologies, in the process of management of facilities and utilities. Now the industry is already entering a new round of development, when a lot of statistical data have been accumulated, experience of using various materials and technologies has been analysed [12].

A striking example of an innovative construction company in Russia is the largest company Technonikol. For example, last year one of the significant innovations was the ELVATOP polymer membrane, based on the Elvaloy® polymer plasticizer developed by DuPont™. Elvaloy® plasticizer membranes are in high demand in the EU and the USA: they are durable and have high chemical resistance. But for Russia this product is new. Not so long ago the innovative material for facades lining - tiles TECHNONIKOL HAUBERK, made on the basis of glass-canvass, improved bitumen and granulate from natural basalt, has been released [13]. The facade tile has a patent, produced at one of the factories of the corporation in Ryazan. The material is highly reliable and easy to install, and is also affordable.

"Among our other innovative products recently introduced to the market, the aluminized steam-insulating membrane PAROBARIERE, which is characterized by increased strength, reliability and the highest steam resistance. Basalt thermal insulation of GreenGuard without exaggeration can be called a breakthrough in the segment of stone wool. In its production, a safe biopolymer binder of organic origin is used, which is harmless and environmentally friendly. The technology has been developed by our specialists," continues Eugene Voilov [14,15]. Moreover, in April 2019, the company launched the production of construction films in Ryazan to provide reliable steam, hydro- and wind protection. The plant has equipment, which has no analogues in Russia. Deliveries of products are planned both to various regions of the Russian Federation and abroad - to the CIS and Eastern Europe.

The structure of Technonikol Company includes a scientific center, the main directions of which are the creation of new roofing, hydro- and heat-insulating materials, modernization of existing technology. The Scientific Centre has an extensive research base. Laboratories occupy an area of more than 250 square meters and are equipped with modern equipment, with the help of which it is possible to study physical and mechanical characteristics of materials in a wide range of temperatures, to accurately determine the structure and composition of raw components, to test the durability of materials.

The research activity of the Scientific Center is aimed at studying and preventing the causes of aging materials, expanding the working ranges of temperatures of roofing materials, increasing the range of their use. Scientific research and the introduction of advanced technologies will allow TechnoNICOLE to market several new products each year [16].

The key to successful development of production tomorrow is continuous work in the field of research and development. The development of new technologies is the main goal of the Scientific Center.

Main directions of activity of the Scientific Center:
- Improvement of techniques of the analysis of raw materials, materials and finished goods, introduction of express techniques.
- General and methodological support for thermal insulation laboratories of TechnoNICOLE.
- Development of new promising products and directions.
- Basic studies on finished products and raw materials; Creation of a library of samples of raw materials, products of the company’s plants.
Work on applications of enterprises and divisions: carrying out chemical, thermal, microscopic and other types of analysis, power in solving technological problems.

- Raw material selection tests and recommendations.
- Patent work.

The above-mentioned directions are investments of TechnoNICOLE Corporation in scientific development - it is support of the Russian industry of construction materials and preservation of competitiveness of domestic products on the world market [17,18].

As noted earlier, the introduction of new types of materials is directly linked to economic progress and, although it may lead to rapid economic growth, there are some contradictions, including economic ones. The introduction of new construction material creates new needs, which could lead to an increase in unmet demand. There may be negative consequences associated with unpredictable results of introducing certain achievements into production (pollution, accidents, disasters); Underestimating the meaning of the human factor. Important problems of global scale were increasing distance from sources of raw materials and energy, exhaustion of natural sources of raw materials both in quantity and in terms of its physical properties [19]. As a result of the study of the economic problem of introducing new types of materials, the following conclusions can be drawn. First, the State must act actively to improve the quality and structure of aggregate demand. Secondly, the State has an obligation to actively stimulate the supply of scarce factors of production. Third, it is necessary to identify and support those technologies whose development will indicate the interests of domestic enterprises and provide them with competitive advantages in the world market. Fourth, the state should improve the mechanism of regulation of legal relations in the market of scientific technical products in order to ensure consistency of interests in carrying out technological developments, their patenting and sale. Fifth, it is necessary to define a system of tax incentives for the realization of the interests of innovative enterprises and to develop and implement programmes to increase the level of education of the population and professional training of personnel in the scientific and technical sphere.

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