

AZERBAIJAN REPUBLIC

Manuscript copyright

ABSTRACT

**of the submitted dissertation for the degree of Doctor of
Philosophy**

**IMPACT OF SCIENTIFIC TECHNOLOGIES AND
INNOVATIONS ON THE DEVELOPMENT OF THE
CONSTRUCTION INDUSTRY IN AZERBAIJAN
REPUBLIC**

Specialty: **5312.01“Industrial economics”**

Field of study: **Economic sciences**

Applicant: **Fatahova Nargiz Rafael**

Ganja - 2022

The thesis work was carried out at Azerbaijan University of Architecture and Construction.

Academic supervisor: Doctor of economic sciences, professor
Aliyev Adalat Bayramali

Official opponents: Doctor of Economics, Ass. Prof
Anar Fazil Abbasov

Doctor of Economics, Professor
Ramiz Kamal Iskandar

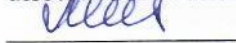
Ph.D. in Economics, Ass. Prof.
Rana Ramazan Modinova

ED 2.42 Joint Dissertation Council of Azerbaijan State Agricultural University and Azerbaijan Cooperation University operating under Azerbaijan State Agricultural University of the Supreme Attestation Commission under the President of the Republic of Azerbaijan.

Chairman of the dissertation
council:



Scientific Secretary of the
dissertation council:



Chairman of the scientific
seminar:



Member of ANAS. D.Es. Prof
Ziyad Aliabbas Samadzade

Ph.D. in Economics, Ass. Prof.
Parvin Elman Mukhtarova

Doctor of Economics, Professor
Islam Haji İbrahimov

GENERAL CHARACTERISTICS OF THE WORK

Urgency of the research and development degree. The problems of applying the scientific, technological and innovative method of development and its management become the most valuable factor under the conditions of market relations in any country at any stage of economic development. Their significance for Azerbaijan Republic is also crucially important. The economic efficiency of the industrial and construction sector and economy of the country depends on skillful, justified scientific and production activities to create and implement novelties, innovations and to implement developments. The topic of this thesis deals with these topical problems.

Without in-depth research and perception of these issues, it is impossible to provide the required level of implemented scientific technologies and innovations that could contribute and effectively influence the economic strategy of the construction industry and the economy of Azerbaijan as a whole in order to meet fully the requirements of the consumer. The introduction of the developed scientific technologies and innovations in the construction industry is extremely important. Along with it, scientific, technical and innovative activities in the field of construction contribute to the creation and implementation of science-based construction technologies providing high quality scientific, technical and innovative construction products, services and works, which is the most effective for the economy of any construction company and country as a whole. It allows to determine their competitiveness and competitors, both in the domestic and foreign markets.

Research carried out in this direction contributes to ensuring efficient operational and financial and economic activities of all construction sectors of the country as a whole.

The solution of scientific problems becomes more complicated in the context of globalization in the modern world and under the conditions of high competition in the construction industry. Not only the economic renovation of the growth of the industrial potential of the country, but also the creation of a highly competitive construction

economy based on scientific, technical and innovative development comes into the picture.

The study shows that over the past decade, the economy of Azerbaijan has demonstrated a high growth in the country's economic potential. However, unfortunately, in its structure of industrial and especially construction production, there are no significant progressive changes. Over the years, there has been a constant increase in the share of exports of oil and gas products. The structure of the country's exports is characterized by a constantly growing share of products of the fuel and energy complex, which has reached 95% level.

It is necessary to develop and implement consistently a science-based structural policy in the industrial and construction sectors, which will be able to meet the modern requirements of the global economy in order to make the economy of Azerbaijan more stable. Such a policy is based on the maximum use of the developed advanced scientific technologies and the knowledge economy based on the scientific, technical and innovative level. Just this factor is the basis of economic growth, increase of the country's competitiveness and reduction of its dependence on the world market. All this requires deep economic knowledge under the conditions of market economy, since the construction company identifying the requirements of the market most competently and competently survives under the market conditions, thereby creates and organizes construction production on advanced scientific, technical and innovative grounds, providing itself with high income and highly qualified workforce.

The growth of specific weight of the scientific - technical and innovative activities contributes to the intensive development of industry and the construction field. The information and intellectual product in the economy has become an important and necessary fundamental basis for research centers for the creation and development of economically sound technologies for the entire construction industry.

The effectiveness of the use of the latest modern scientific and technological developments in the field of construction in Azerbaijan Republic is the basis of the social security of the population, the

successful development of which depends on the comprehensive innovation and scientific and technical policy pursued in the country.

While implementing market transformations and integrating the Republic of Azerbaijan into the world community and its transformation into the world economic system, it happens due to the increase in scientific research and innovative developments in the entire field of construction activity. The transition of the country's economy to an innovative path of development becomes the most important requirement and expedient in the context of globalization.

The conditions for the transition of the country's economy disclosed in the Concept of Economic Development of Azerbaijan – 2020 require the allocation of certain financial resources by the government of Azerbaijan to research centers and active cooperation with such developed countries as Canada, China, Germany, the USA and Japan. It is necessary to take into account the specific conditions of Azerbaijan with its rich, unique natural resources, production and scientific and technical potentials under these conditions.

Due to the fact that it is necessary to take into account the fact that in the context of globalization a number of research centers fall under the control of transnational companies, which in turn leads to the commercialization of all construction enterprises of an intellectual product. Therefore, all the existing scientific and technical potential, the financial resources of the country shall be used to develop the latest technologies in the field of construction and the latest building materials having high economic potential in our country, including the government. That is to say that it is necessary to develop a domestic technological scientific and innovative concept allowing to solve the most important tasks of the socio-economic orientation of the whole country from the economic point of view, especially in the construction sector.

The research gives grounds to assert that economic advantages in the field of construction are possible only by using the latest technics, technology, building materials developed on the basis of science. The studies carried out at “AzVirt” road construction company showed that the current policy in the field of construction of

roads and airfields allowed this construction company to develop the latest building materials, the latest technology for the construction of roads and an airfield which was economically justified and allowed the company to increase its competitiveness both in the foreign and domestic markets. At the same time, the developed technology allowed to save energy resources and the operational life of roads and airfields.

Moreover, it was necessary to study the research work of specialists in various scientific profiles in the process of research of the thesis work. Studies show that recently, issues of innovation and scientific and technical security have been given special attention.

It is necessary to note among them the works performed by famous Azerbaijani scientists such as: Aliyev A.B., Aliyev A.M., Aliyev, K.A., Aliyev T.N., Ahmedov G.M., Babayev L.B., Gasimov F.G. , Huseynova A.D., Najafov Z.M., Nuriev A.Kh., foreign scientists Balabanov I., Brian T., Baroncheev V., Valenta F., Voldachek L., Valdaitsev S., Goldstein G., Gvishiani D., Goncharenko L., Lowes B., Lenton E., Chadwick L., Rappoport V., Fatkhutdinov R., Santo B., Schumpeter J. and others.

At the same time, without belittling the merits of the scientific works of the above-mentioned scientists, it should be noted that the work in the field of introducing technologies and innovations in the construction of roads and airfields of limestone materials has not been widely used. The problems of economic efficiency and resource saving of scientific technologies and innovations when introduced into the construction of roads and airfields have not yet been sufficiently studied.

All of the above predetermines the relevance of the dissertation, the subject and object of the study, its purpose and objectives.

The object of the study is the road construction organization AzVirt LLC.

The subject of the research is the theoretical, methodological and practical issues of the impact of scientific, technical and innovative developments on the development of the construction industry and road construction.

The purpose of the study is to determine the role and place of scientific, technological and innovative developments in the process of creating and mastering innovations in road and airfield construction and to develop scientific and methodological recommendations for the use of modern building materials and technologies in the construction of roads and airfields.

The research objective includes the solution of the following issues:

- to explore the theoretical and methodological foundations of innovations in the construction industry;
- to characterize the methods of regulation, organization and financing of scientific, technological and innovative activities in construction enterprises;
- characterize the organizational and economic problems of the construction industry;
- economically justify the use of limestone materials in road and airfield construction;
- to substantiate the economic efficiency of the use of activated mineral powder and limestone waste in the construction of roads and airfields;
- to identify the socio-economic effects of the introduction of economically sound scientific and technical developments in the construction industry in Azerbaijan;
- develop a methodology for determining the quality of asphalt mixtures;
- substantiate the economic efficiency of the use of activated mineral powder and limestone waste in the construction of roads and airfields;
- develop measures to support the scientific, technological and innovative activities of construction enterprises.

The research methods in the course of the study, a dialectical and system-functional approach, the method of scientific abstraction, analysis and synthesis, modern analysis tools, structural, comparative, graphical analysis, modeling methods, economic and statistical grouping, conceptual approaches, etc.

The main questions to be defended are: The following provisions containing novelty, or having the character of novelty, are submitted for defense:

- the concept of management of scientific, technical and innovative activities in the field of construction,
 - methods of organizing and financing innovative and scientific and technical activities for construction industry facilities;
 - a system of innovative communications in the preparation of new production at a construction company;
 - a model of the innovation process depending on the management function, - a model for introducing innovations into production;
 - a model that determines ways to stimulate innovation and their characteristics in the construction industry;
 - a mechanism for achieving high quality building materials, through the introduction of the "Express method for determining the quality of asphalt mixtures";
 - substantiation of the advantages of using limestone materials in road and airfield construction.
- Methods for improving the quality of building materials.

The scientific novelty of the study includes a set of measures for the development, implementation and management of scientific, technological and innovative achievements affecting the efficiency of managing the economy of construction organizations and industry in a market economy, among which the most significant are:

- the concept of managing the scientific, technical and innovative activities of construction enterprises has been developed, which contributes to the improvement of the quantitative and qualitative state of production factors in the construction industry [70., c58-66];
 - methods for organizing and financing innovative and scientific and technical activities of construction industry facilities have been developed that contribute to the production of competitive products [69.c., 193-200];
 - a system of innovative communications has been developed in the preparation of new production at a construction enterprise, which is a set of regulatory and technological measures that regulate the

scientific and technical modernization of construction production and contribute to the improvement of mechanisms for state support of innovative projects [71 p., 88-95];

- developed and tested in practice a model for introducing innovations into production [73.c.46-48];

- a model has been developed that determines the ways to stimulate innovation and their characteristics[74.s.127-140];

- for the first time in world practice, a mechanism has been developed to achieve high quality building materials by introducing an "Express method for determining the quality of asphalt concrete mixtures", which helps to increase the economic efficiency of road construction [76.c., 317-320].

- the advantages of using limestone materials in road and airfield construction have been identified, the introduction of which provides significant cost savings by increasing the operational life of roads and airfields, and has a positive effect on the environment[78.c.,93-99].

- methods have been developed to improve the quality of building materials [72c, 23-30].

The theoretical and practical significance of research.

The theoretical significance of the study lies in the expansion and development of the theoretical base for research in the construction industry, as well as in the systematization of knowledge about road construction as an integral, intensively developing structure.

The practical significance of the study lies in the fact that the methodological approaches and practical recommendations contained in the dissertation can be used by the relevant government agencies in the development of policies in the construction sector and the strategy for the development of road construction, as well as business structures when conducting marketing research in order to improve the quality building materials based on the introduction of scientific, technical and innovative innovations.

The most important provisions and conclusions of the dissertation are used in the educational process at the Azerbaijan University of Architecture and Construction.

Approbation and introduction. The main provisions and results of the dissertation work were reported at international and republican conferences, including at the scientific and practical conference “Organizational and technological problems of using porous concrete blocks” Gobustone” (Baku, 2015); International Scientific and Practical Conference "Economics and Management: Problems, Trends, Development Prospects" (Cheboksary, 2015), Ways of corporate analysis to support scientific, technological and innovative activities at enterprises, - materials of the Republican scientific and practical conference "The current state of industry and development problems: the impact of technology parks and industrial areas on the economic development of the country” (Baku-2019).

The monograph "The role of the scientific, technological and innovative factor in the economy of the state" was published, as well as 16 scientific articles, 4 of them abroad, in the press recognized by the Higher Attestation Commission of the Republic of Azerbaijan,

The results of the dissertation work were accepted for use in the road construction organization LLC “AzVirt” (Certificate of implementation dated December 20, 2015, Protocol No. 9 dated December 11, 2015).

Name of the organization where the dissertation work is performed. The dissertation work was carried out at the Azerbaijan University of Architecture and Construction at the Department of Economic Theory and Marketing.

The total volume of the dissertation with signs, indicating the volume of the structural units of the dissertation separately:

The dissertation is presented on 147 pages, consists of an introduction, three chapters and nine paragraphs, a conclusion, a list of references and two appendices. Contains 16 tables, 30 figures. The total content of the dissertation includes its vast extensive structural subdivisions in signs. The total volume of the dissertation work is (230143 characters), incl. introduction (15360 sign), chapter I (67127 sign), chapter II (64759 sign), chapter III (34967 sign), conclusion (7073 sign),

Summary of the thesis work

The relevance of the topic is substantiated, the goals, objectives, subject and object of research are determined, the scientific novelty and practical significance of the performed scientific work are reflected **in the introduction**.

The first chapter titled "Methodology for the application of scientific technologies and innovations in the economy of the construction enterprises of the country" is devoted to the strategy of developing the concept of innovative and scientific and technological activities, the influence of the rationalist concept and external factors of the innovative and scientific and technological sphere on the effective management of the economy, revealing the essence of economic growth. Factors are disclosed, which include the availability of human resources, fixed capital, the level of scientific, technological and innovation policy.

The international experience shows that individual countries spend a lot of money on investments. For example, the United States spent 2.9% of GDP on research and development, Germany -2.8% of GDP, Israel-2.9% of GDP, Japan -3.6% of GDP, the countries of the Commonwealth of Independent States spend much less: Belorussia - 0.74% of GDP, Russia - 1.04% of GDP.

We also consider it important to identify the factors hindering innovation at the industrial enterprises of Azerbaijan.

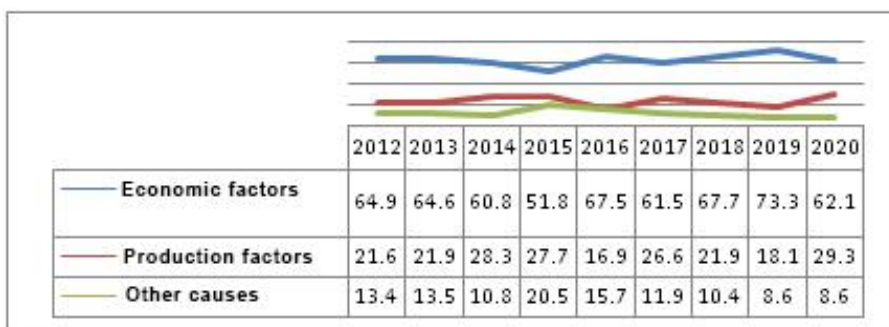


Figure 1. **Factors hindering innovation in the industry of Azerbaijan**

As it is obvious from the figure, the biggest obstacles to the development of innovation in the country are economic factors.

The followings can be called as an integral part of economic factors:

- lack of own funds,
- insufficient financial support from the state,
- low solvency of demand for new products,
- high cost of innovation,
- high economic risk,
- long payback periods for new products.

Demand factors analyzing the price level, consumer resources, net volume of exports, as well as distribution factors, i.e. rationality and completeness of the involvement of resources in the production process determining the efficiency of the use of resources involved in the economic turnover have been investigated. Models of the innovation process have been studied depending on the management function. Methods for developing an innovative strategy have been considered taking into account the prospects for the development of industrial enterprises based on the theory of transaction costs. The conducted researches give grounds to assert that it is necessary to create an innovative and scientific and technological system in order to develop a strategy for innovation and scientific and technological policy for the resuscitation of the economy of the country. Examining the work on the principles of management according to F. Taylor, it becomes obvious that he put forward his own rationalistic system for managing innovation and scientific and technological activities, where the principle of management and the principle of reengineering are disclosed. The author developed the principles of a rationalistic concept of management basing on a systematic approach within the framework of the rationalistic concept of management and the principles of a systematic approach (*Table 1*).

The analysis of the principles of the rationalistic concept of management - the design of labor processes based on the classical school, a systematic approach, the principles of universal quality management allows us to conclude that the analyzed principles

have not lost their relevance. The author developed a rationalistic concept of innovation activity management in relation to the CIS countries, including for the Azerbaijan Republic transitioned to the conditions of market economy in the thesis work on the basis of research of the principles of the rationalistic concept of management according to F.Taylor, A.Fayol, G.Emerson, G.Ford, J.Juran.

Table 1. Principles of a rationalistic concept of management on the basis of systematic approach

	Name of the principle	Context of the principle
1.	Building a model of an existing activity	Activity is viewed as a set of interrelated models of business procedures, often referred to as “asis” (“as is”) in the Western practice
2.	Analysis of the existing elements of the control object (products, services, works, material resources, means of labor, technology, production structure, methods of organizing production, personnel, economy). Analysis of the elements of the subject of management (functions, processes, information, office equipment, management methods, personnel, organizational structure, management economics, management decisions) in terms of increasing their efficiency	Fixation of numerical indicators for evaluating the effectiveness of work and procedures, dividing them into different categories of costs for each element of the object and subject of management
3.	Development of options for improving each element	Modeling, automation of processes, rationalization, modernization of business procedures, the use of tools for describing functions or processes, combined with the use of methods and tools of functional cost analysis to reduce costs
4.	Selection of the final version of the improved elements of the control system	Connection of improved elements into a single management system, creation of an organization model “as it should be”

The study of the rationalistic concept of the management of scientific, technical and innovative activities requires an analysis of the external factors of the innovation sphere affecting the effectiveness of management.

In the second chapter titled “**Research and analysis of the organization of the state of financing scientific, technological and innovative activities in the construction enterprises**”, the methods of organizing and financing innovative activities of construction enterprises and organizations have been studied at the base of AzVirt LLC. Scientific and technological innovations, product - innovations and the process of innovations have been considered, as well, the essence of real capital-forming investments and financial investments contributing to the increase in fixed assets and working capital to obtain a specific income has been revealed.

The system of innovative communications in the preparation of new production at construction enterprises has been studied in two stages of a set of regulatory technical measures, which include: experimental design work, production of technological equipment and the latest building materials of non-standard equipment. The essence of the preparation for the production of new construction products requiring the construction work in accordance with the new developed technology with norms and rules, the requirements of the system of standards is distinguished by high economic efficiency saving material resources and increasing operational resources.

Three basic forms such as administrative and economic, program-targeted and initiative forms of organization of the innovation process have been explored in this chapter. The principles of the development of scientific technologies and its introduction into the construction industry with the validity of its economic superiority have been studied at the base of AzVirt LLC. The “Classification of Investments” developed by the author is presented in Fig. 1.

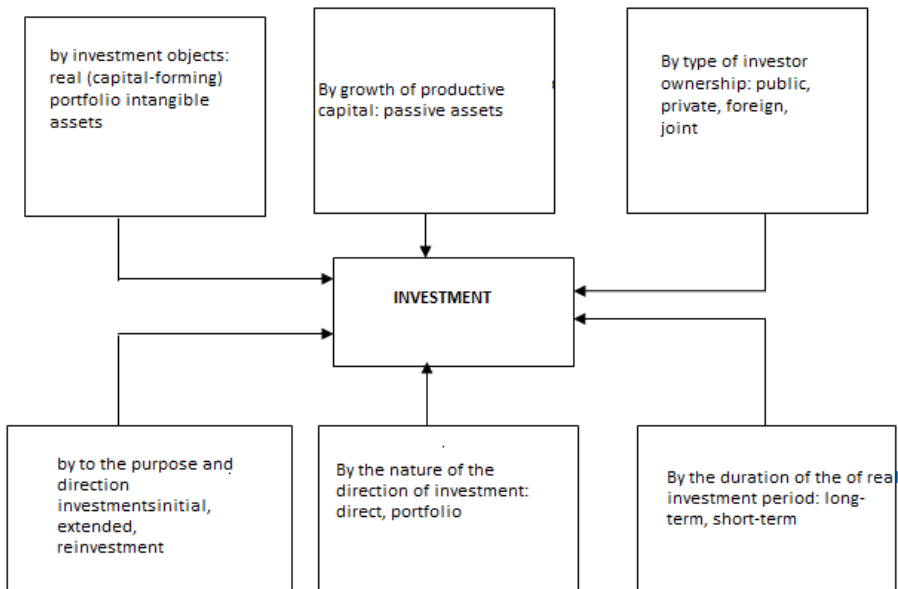


Figure 2. Classification of investment

The economic indicators obtained as a result of the introduction of the latest technologies and the latest building materials in road construction have been studied. The enterprises set themselves the task of releasing a new product in the field of innovation. It means the development of new, progressive technologies, management methods, restructuring, that is, replacing the old organizational structure with a new one, new logistics of financial flows and so on.

Innovative activity includes not only, in fact, innovative processes, but also marketing research of markets for goods, their consumer properties, a new approach to organizing information, consulting, social and other types of services. The innovative activity of a construction company can be carried out not only locally at any of the stages of innovative processes, but also outside of their path of acquiring patents, licenses, know-how and so on.

In modern conditions, the leading companies in the US and Western countries direct the bulk of their research and development spending to such progressive industrial sectors as information and electronics, medicines and devices, ground motor vehicles (cars and so on). While conducting scientific research at the base of the road

construction organization “AzVirt LLC”, the economic feasibility of introducing the latest technologies and the latest building materials in the construction of roads and airfields in Azerbaijan was considered and analyzed. The fact is that the latest technologies developed and the latest building materials in laboratory conditions at AzVirt LLC, used in the construction of roads and airfields are distinguished by the best physical and chemical characteristics with improved qualities and contribute to a 2-3-fold increase in the life of road construction facilities and airfields.

However, the economic benefits of introducing the latest technologies and the latest building materials into the construction industry have not been considered and made public to other construction organizations. While considering the issues of the latest technologies and innovations, we have studied the economic benefits of the latest technologies and innovations introduced in the construction of roads and airfields at AzVirt LLC. The studies have shown that the scientific school of road construction in Azerbaijan Republic has been developed thanks to the Azerbaijani-German joint venture AzalVirtgen (JV "AzVirt") headed by the famous scientist, Doctor of Technical Sciences, Professor A.M.Aliyev.

Thus, the studies show the enormous economic feasibility of science-based development of technology for the construction of roads and airfields. The economic efficiency of the use of limestone materials in the construction of bitumen-concrete mixture roads and airfields in the republic has been considered in the thesis. The research materials proving the economic efficiency of the use of limestone materials in road and airfield construction which ensures the proximity of limestone quarries (Nardaran, Mashtagha, Garadagh, Guzdek) from construction sites, reducing transport costs for the delivery of shingle, increasing the life of these roads by two times, the elimination of the problems of the load on the axle of cars, which allows year-round operation of roads and runways, reducing the cost of construction work by several times are presented in the thesis.

If, thanks to the construction technology using limestone materials proposed by the Professor Aliyev A.M., the cost of constructing runway-2 at Baku airport with the length of 3,300 m and

a width of 60 m was 4.3 million USD, while a runway of the same size during construction in the city of Tbilisi costed 44.8 million USD, i.e. the cost of construction exceeded almost 10 times the cost of building a runway in Baku. Due to the strength of the coating of the working part of the runway, long-term operation is ensured with the reception of aircraft with the maximum weight categories such as B-747, AN-124, etc.

For example, let's consider the difference in costs in the manufacture of bitumen-concrete mixture:

Option 1: according to the old technology with the addition of non-activated mineral powder;

Option 2: according to the new technology with the addition of activated mineral powder.

Option 1. While manufacturing 1 ton of bitumen-concrete mixture with non-activated mineral powder, the design temperature of preparation is 170⁰ C. The consumed amount of electric power is 14 kW taking into account the fact that the cost of 1 kW of electric power is 0.05 man., therefore, the production of 1 ton of bitumen-concrete mixture consumes

$$14\text{kW} \times 0.05 \text{ man.} = 0.70 \text{ man. electric power}$$

The consumed amount of natural gas is 20 cubic meters. Based on the fact that the cost of 1 cubic meter. natural gas costs 0.08 manats, therefore, the production of 1 ton of bitumen-concrete mixture consumes

$$20 \text{ cubic meters} \times 0.08 \text{ man.} = 1.60 \text{ man. natural gas}$$

In total, the consumed amount of expenses for the manufacture of 1 ton of bitumen concrete mixture with non-activated mineral powder in total is 0.70 manats. + 1.60 man. = 2.30 man.

Option 2. For the production of the same amount of bitumen-concrete mixture with activated mineral powder, the designed preparation temperature is 130°C.

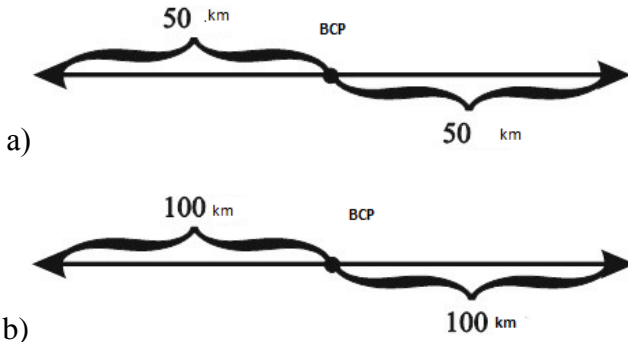
The consumed amount of electric power is 11 kW. Given the fact that the cost of 1 kW. of electric power is 0.05 man., therefore, the production of 1 ton of bitumen-concrete mixture consumes

$$11 \text{ kW} \times 0.05 \text{ man.} = 0.55 \text{ man. electric power}$$

The consumed amount of natural gas is 16 cubic meters. Based on the fact that the cost of 1 cubic meter natural gas costs 0.08 manats, therefore, the production of 1 ton of bitumen-concrete mixture consumes

$$16 \text{ cubic meters.} \times 0.08 \text{man.} = 1.28 \text{ man. natural gas}$$

Totally, the consumed amount of expenses for the manufacture of 1 ton of bitumen-concrete mixture with activated mineral powder in total is 0.55 manats. + 1.28man. = 1.83man. So, the difference in the production of bitumen concrete mixture with non-activated and activated mineral powder is 2.30 man. - 1.83man. = 0.47 man. In addition, bitumen-concrete mixture with non-activated mineral powder at 170⁰ C design temperature can be transported within the radius of 50 km. Transportation during long-term transportation reduces the mobility of the bitumen-concrete mixture. Moreover, bitumen-concrete mixture with activated mineral powder at 130⁰ C design temperature can be transported within the radius of 100 km. (Figure 2. a; b.).



**Figure 2. Permissible distance of bitumen-concrete products:
a) without, b) while using activated mineral powder.**

Thus, the use of activated mineral powder not only reduces the consumption of electric power and natural gas, but also increases the duration of transportation of the bitumen-concrete mixture.

This situation requires the calculation of the temperature and technological parameters of the transport operations of the bitumen-concrete mixture for delivery to road construction sites from the bitumen-concrete plant. The volume of their use in the pavement of

the lower layer, subgrade, upper layer, lower layer, underlying layer of limestone and in the form of activated mineral powders is considered in this work to calculate the economic efficiency of the use of limestone materials in road and airfield construction. It shall be borne in mind that gravel and crushed stone were used instead of limestone.

The calculation was made by the author from the need for crushed stone, gravel, sand, limestone material, activated mineral powder per 1 m² with an 8-lane road width of 32 meters, a length of 1 km (1000m). In this case, 1 km = 1000 m², with the width of a two-way 4-lane road (8 lanes in total). Calculations are given in Appendices 1 and 2 to this thesis.

Thus, while replacing gravel or crushed stone with limestone material per 1 km, 248,320 AZN per 1 km will be saved for the construction of roads.

While replacing crushed stone with limestone materials - 558,720 manats per 1 km will be saved. Replacing gravel with limestone materials will allow to save 2,483,200 AZN per 10 km of road construction.

While replacing crushed stone with limestone material, the savings will amount to 5,587,200 manats. In the first case, savings per 100 km will amount to 24,832,000 manats when replacing gravel with limestone materials.

In the second case, while replacing crushed stone with limestone materials, it will amount to 55,872,000 manats.

Calculations show that the economic efficiency of using limestone materials in the construction of roads: when replacing gravel with limestone materials on Baku-Gazakh-Georgian border section of 508 km with a road width of 32 meters would be 124.160.000 manats; while replacing crushed stone with limestone material, this amount will be 279.360.000 manats. Thus, moreover, savings of gravel and crushed stone for such an amount would be ensured.

The operation life of road is up to 18-20 years with this technology for constructing the structure of pavements or airfields. This situation makes the roads of Azerbaijan Republic attractive for the international transport of all leading countries in the future.

If in the future, the part of Gazakh-Baku road built using limestone materials is provided with 16.5 tons bearing load on the average axle of the car, then when using this section of the road, taking into account the payment of 40 \$ per 100 km, the fee charged on 1 million vehicles from foreign countries would amount to

$$\frac{40\$ \times 500 \text{ km}}{100 \text{ km}} = 200\$$$

$$200 \$ \times 1000000 \text{ vehicles} = 200.000.000 \$.$$

The fee will be 200,000,000 USD per year in one direction only for the use of the Gazakh-Baku-Gazakh road section.

The same can be said about the the Northern border of Astara-Baku-Guba road with Russia. Here the total length is more than 400 km.

On this section, during the construction of roads with a bearing capacity of 16.5 tons on the middle axle of the car with the prospect of using this road by foreign countries

$$\frac{40\$ \times 400 \text{ km}}{100\text{km}} = 160\$$$

$$160 \text{ USD} \times 1000000 \text{ vehicles} = 160000000 \text{ USD}$$

Thus, the annual profit from two directions of the highways Baku-Gazakh-Baku, Astara-Baku-Guba Northern border with Russia and back with carrying capacity of 16.5 tons on the middle axle of the car will bring 200.000.000 USD + 160.000 .000 million USD = 360.000.000 USD income to the country's budget. Such an amount of profit from the construction of roads using limestone materials will seriously contribute to the investment of foreign banks in the development of the road sector in Azerbaijan.

The issues of economic efficiency of using activated mineral powder and limestone in the form of new building materials are studied in the third chapter titled "**Efficiency and ways to ensure the benefits of using modern building materials and technologies in the construction of roads and airfields**". The economic feasibility of using the developed "Express Method" has been studied to determine the quality of bitumen concrete, in the manufacture at the factory which excludes defects in road construction, improves the quality of building

material and reduces unforeseen material costs in the entire construction space.

Based on the history of the development of this scientific technology, the author conducted studies of the economic efficiency of the use of limestone in construction. Considered unsuitable for construction for hundreds of years and causing environmental problems, limestone waste has found its way into road construction, bringing huge profits to organizations producing building materials from limestone. Thus, environmental problems were also solved. Deductions from the profits of construction organizations producing building materials from limestone, only through the sale of waste limestone materials (deductions from profits) to the state budget have increased several times. Today, once considered unsuitable material, limestone waste is sold at a price of 9 manats per 1 m³. We have developed a schedule for using the amount of limestone waste in m³ from 1995 to 2020 (Figure 3).

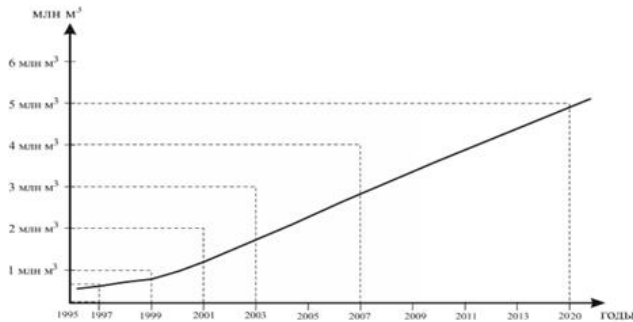


Figure 3. Use of limestone waste quantities from 1995 to 2020

Based on the profits of enterprises producing building materials from limestone only from the sale of limestone waste, it is possible to calculate the deduction of % of profits to the state budget using the formula:

$$X_{M^3} \cdot 7 \text{ man} = \sum Y$$

Where X_{M^3} – is the total amount of limestone waste sold for the period from 1995 to 2020

7 man. - the cost of 1 m³ of limestone waste.

$\sum Y$ is the total profit from the sale of limestone waste from enterprises.

From here you can calculate and count from the profit received to the state budget in %.

$$\frac{\sum Y \cdot 100\%}{\% (\text{budget contribution})} = \sum Y_{\Delta}$$

Where % (budget contribution) is the percentage of deductions to the state budget from the profit of the enterprise.

$\sum Y_{\Delta}$ - the amount transferred to the state budget for the period from 1995 to 2020 from the profits of organizations selling limestone waste.

At the same time, studies of the economic superiority of limestone waste in the construction of roads and airfields showed that the use of limestone material in the construction of subgrade, the preparation of limestone-crushed stone mixtures and the use of activated mineral powder from limestone in the production of bitumen concrete mixtures allows to increase 1.5-2 times the strength, density and shear resistance of the structural layers of road and airfield pavements.

Along with these factors, significant savings in bitumen consumption shall be noted while using activated mineral powder from limestone in the production of asphalt mixtures, which is about 15–24% compared to the need for a binder in conventional technologies for preparing mixtures using non-activated mineral powder. The calculation of the economic efficiency of the use of limestone materials and activated mineral powder from limestone in airfield construction is carried out in the work and the corresponding calculations are given as an example (Table 2) for the construction of a runway (runway) at Baku International Airport, built in 1995 year and has been reliably operated up to today for 18 years.

Comparison of the given data in Table 2 compiled by the author of the indicators is made from the comparison of the technology for the production of works using limestone materials and activated mineral powder from limestone (I option) and the traditional

technology for the production of works using crushed stone-sand gravel materials and non-activated mineral powder (II option).

Huge material resources, financial costs, transport fuel and energy costs are required to correct the made mistake and ultimately it does not provide complete information about the quality of bitumen concrete pavements throughout the entire construction site, that is, the effect of existing laboratory research methods ≤ 0 , with an increase in costs.

$$\sum \text{sum of expenses} = \sum_1 + \sum_2 + \sum_3 + \sum_4 + \sum_5 + \sum_6 + \sum_7 + \sum_8$$

\sum_1 – the cost of removing low-quality bitumen concrete;

\sum_2 is the cost of transporting the removed bitumen concrete to the bitumen concrete plant;

\sum_3 - the cost of replenishing the necessary missing components of bitumen concrete;

\sum_4 is the cost of recycling of bitumen concrete;

\sum_5 – expenses for repeated expenses for energy carriers;

\sum_6 – expenses for the operational cost of bitumen concrete;

\sum_7 - the cost of re-transporting of asphalt concrete mixture from the asphalt plant to the construction site for restoration;

\sum_8 – labor costs.

In the end result, the effectiveness of the measures taken is ≤ 0 , that is, \sum expenses itself ≤ 0 .

The new "Express method" for determining the quality of the bitumen concrete mixture completely eliminates the ingress of low-quality asphalt mix to the construction site.

Considering the scale of the construction of roads and airfields around the world, the introduction of the "Express Method" for determining the quality of the bitumen concrete mixture brings real economic benefits in saving all types of material, financial, technical resources, estimated at hundreds of billions dollars.

The conclusion contains generalizations, conclusions and proposals of the author, reflecting the goal, objectives and novelty of the study.

As a result of the study of the influence of scientific technologies and innovations on the development of the construction

industry in the Republic of Azerbaijan, carried out in the dissertation, the following scientific results were obtained:

Table 2. Calculations for the arrangement of the runway (RWY) at the international airport in Baku.

Option I (using limestone materials and activated limestone mineral powder)		Option II (using gravel-sand materials and non-activated mineral powder)		Difference in the cost of 1 m ³ of structural layers between I and II options, manat
Structural layers	Cost m ² , manat	Structural layers	Cost m ² , manat	
The top layer of the bitumen concrete mixture based on activated mineral powder, h=5 cm	7,20	The top layer of the bitumen concrete mixture based on non-activated mineral powder, h=5 cm	7,46	0,26
The lower layer of the bitumen concrete mixture based on activated mineral powder, h=7 cm	9,66	The lower layer of the bitumen concrete mixture based on non-activated mineral powder, h=7 cm	10,03	0,37
Upper base layer of bitumen concrete mixture, h=28 cm	36,34	Upper base layer of bitumen concrete mixture, h=28 cm	36,34	0,00
The bottom layer of the base is made of limestone-crushed stone mixture, h=30 cm	8,42	The bottom layer of the base is made of limestone-crushed stone mixture, h=30 cm	14,90	6,48
Working layer of limestone subgrade, h=30 cm	2,78	Working layer of subgrade made of gravel-sand material, h=30 cm	11,01	8,23
Totally	64,17		80,06	15,34

1. The concept of managing the scientific, technical and innovative activities of construction enterprises has been developed, which contributes to the improvement of the quantitative and qualitative state of production factors in the construction industry

Its purpose is to introduce modern technologies into production, taking into account foreign practice.

The concept includes the consistent implementation of the following measures:

a) Analysis of the state of fixed production assets, raw materials used, the level of labor mechanization, the production technology used and the organizational level of production management.

b) Study of the level of quality and competitiveness of products, personnel management systems and the structure of production, economic and economic activities from the standpoint of increasing their economic opportunities.

c) Control over the indicators of financial, economic and production activities based on numerical indicators, which makes it possible to assess the state of the economy of an industrial enterprise, including construction.

d) Development of programs to improve each element of the production management system and production capacity, through the introduction of modern latest technologies and innovations.

e) Automation of production processes and its modernization with the improvement of the function of production activities with the efficiency of determining indicators of production costs.

f) Approval of the final version of the elements of the economic management system of any industry. Development of improved methods of a unified management system, as the creation of a perfect production management model.

2. The concept of development of strategic parameters of the socio-economic system has been developed, which includes, as elements, methods of organizing and financing innovative and scientific and technical activities of construction industry facilities that contribute to the production of competitive products. It is considered as a combination of two types of elements - controlled parameters and control actions that define two levels of the strategy - "what needs to be changed and how to change". The proposed approaches make it possible to develop a strategic management mechanism for virtually any socio-economic system.

The enterprise development strategy includes basic and functional strategies as its components.

Basic is a model of enterprise behavior in a particular market situation. For example: competitive strategy in selected markets, market selection strategy; And then, obtaining a competitive advantage already in the chosen market: based on leadership in the quality of the products offered, market specialization, leadership in prices, market cooperation.

Functional - This is a set of activities and programs for various functional areas and divisions of the enterprise, that is, strategies that complement the main strategy, selected in accordance with the main activities of the company. They are of subordinate importance and in fact are resource programs that ensure the practical implementation of key strategies.

3. The features of the requirements of the laws of the organization to the management of innovation activity are studied and, on this basis, the goals of management of innovation activity in the organization are determined from the standpoint of the study of organizational theories. The essence of the requirements of the basic laws of organizations for the management of innovation activity is revealed.

For the first time, a scientific analysis of a realistic management system for innovation and scientific and technical activities was carried out according to the principles of Taylor, Fayol, Emerson, Ford, Deming, Juran, on the basis of which the author developed a model of interaction between external and internal institutions in the process of introducing innovative and scientific and technical innovations in the country's economy .

4. The reasons for the destruction of newly built roads and methods for forming the structure of strengthening the upper layer of the subgrade are revealed and analyzed, and the economic feasibility of introducing the latest technologies and building materials in the construction of roads and airfields, which contribute to an increase in the operational life of roads by 3-4 times, is confirmed.

A system of innovative communications has been developed in the preparation of new production at a construction company, which is a set of regulatory and technological measures that regulate the

scientific and technical modernization of construction production and contribute to the improvement of mechanisms for state support of innovative projects;

5. The innovative essence of the "Express method for controlling the quality of the asphalt concrete mixture", developed in the road construction organization AzVirt LLC, is disclosed, which excludes the possibility of poor-quality products entering the construction site, thereby providing significant savings in material, technical, financial and raw materials.

The advantages of organizing the production activities of construction organizations that ensure their innovative and technological superiority over other organizations using the "Express Method for Controlling the Quality of Asphalt Concrete Mix", which significantly increased their competitiveness, were identified and evaluated.

6. The advantages of using limestone materials in road and airfield construction have been identified, the introduction of which provides significant cost savings by increasing the operational life of roads and airfields, and has a positive effect on the environment.

7. The economic feasibility of introducing innovative technological developments on the use of activated mineral powders in the technology of preparing asphalt concrete products used in the construction of roads and airfields, which contribute to an increase in the service life of asphalt concrete pavements from 6-8 years to 18-20 years, has been proved. The technological and economic innovative characteristics of these developments require the mandatory introduction of these developments in all areas of the construction of transport communications.

The calculation of economic efficiency from the use of activated mineral powder in road construction has been carried out and it has been proved that this scientific, technological and innovative innovation ensures the high competitiveness of a road construction company, saving financial resources for the enterprise.

8. Methods for stimulating innovation and scientific and technical activities at the macro level are considered, on the basis of which a table is developed that determines the ways to stimulate innovative

and scientific and technical activities and their characteristics of the impact on the economy of construction enterprises.

A set of methodological and practical measures has been developed to introduce scientific, technological and innovative achievements in road construction that affect the efficiency of economic management of construction organizations.

The key provisions of the thesis work are reflected in the following publications of the author:

1. Socio-psychological aspects of business, Journal of Scientific News. "Gerb"(West) University, Publishing and Printing Center. Baku -2015

2. Development of a scientific and technological innovation strategy taking into account the prospects for the development of construction enterprises based on the theory of transaction costs (macroeconomics (market), industry (cluster) and innovation policy). The Ministry of Education of Azerbaijan Republic, the Department of "Technology, organization and management of construction production" of the Azerbaijan University of Architecture and Construction, Materials of the Scientific-practical conference on organizational-technological problems of using "Gobustone" aerated concrete blocks AUAC Polygraphic Center. Baku, November 26, 2015.

3. Economic policy of stimulation and support of innovative activity of the state. Journal of Economy and Entrepreneurship. Economics and Entrepreneurship. Moscow. - 2015

4. Research of models of innovation process in dependence on management functions in the construction organizations. "Audit" magazine, Baku Business University Publishing House, Baku-2015

5. Formation of the concept of management of innovative and scientific and technological activities and its impact on the economy. Scientific-practical and methodological journal "Finance Economics Strategy", Russia, Voronezh SUAC. -2015

6. Development of an innovation strategy taking into account the prospects for the development of construction enterprises based on the theory of transaction costs (macroeconomics-(market), industry-

(cluster) and innovation policy. Azerbaijan University. "Ipekyolu" journal 2015.

7. Economic, technological and innovative advantage of the "Express method" for determining the quality of bitumen concrete mixtures, Federal State Budgetary Educational Institution of Higher Professional Education "Chuvash State University named after I.N. Ulyanov", Kharkov State Pedagogical University named after G.S. Skovoroda, Aktobe Regional State University named after K. Zhubanov, Center for Scientific Cooperation "Interactive Plus", "Economics and Management: Problems, Trends, Development Prospects". Collection of materials of the International scientific - practical conference. Cheboksary. -2015.

8. The role of scientific, technological and innovation factor in the economy of the state, (**monograph**) Ministry of Culture and Tourism of the Republic of Azerbaijan. "Ganjlik" publishing house, Baku.-2015.

9. Investment feasibility of contributions to the country's innovation system and the role of the state, Economics and management in mechanical engineering, Moscow -2015. No. 6.

10. The role of innovation in strengthening the socio-economic potential of the country, AzUAC, Construction Economics and Management, 2016. №1.

11. Innovation and investment as a factor in the success of construction companies. ANAS "Scientific works" journal 2016. №1

12. Economic efficiency of the use of activated mineral powder and limestone in the construction of roads and airfields, Cooperation University, Baku. – 2017.

13. Methods of stimulating and supporting scientific, technological and innovative activities at the state level, "Scientific and pedagogical news" of OdlarYurdu University. -2017. № 46

14. Features of the basic laws and its impact on the scientific, technological and innovative level of the organization, Republican scientific-practical conference on "Actual problems of implementation of economic reforms in Azerbaijan", 2018.

15. Ways to conduct corporate analysis to support scientific, technological and innovative activities in enterprises, Materials of the

Republican Scientific-Practical Conference on "Modern state of industry and development problems: the impact of technoparks and industrial districts on the economic development of the country", Baku 2019, Part II.

16. Methodology of assessment in the construction-investment process, International Scientific Conference "Infrastructure support of the diversified economy: main trends and directions of development", Baku 2019. Part III.

17. Directions for improving the organization and management of construction, AzUAC, Construction Economics and Management, 2022. №1.

The defense of the dissertation will be held at the meeting of the Joint Dissertation Council ED 2.42 of Azerbaijan State Agricultural University and Azerbaijan Cooperation University operating under Azerbaijan State Agricultural University on “26” October 2022 at 16:00 o'clock.

Address: 450 Ataturk Avenue, AZ 2000, Ganja city, Azerbaijan,

The dissertation is accessible at the library of Azerbaijan State Agricultural University.

Electronic versions of the dissertation and abstract are posted on the official website (www.adau.edu.az) of Azerbaijan State Agricultural University.

The abstract was sent to the necessary addresses on 26 september 2022.

Signed for publication: 22.09.22
Paper format: (60x84) 1/16
Volume:47174 characters
Circulation: 20