Winter city: staff training features

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Abstract. The education system is one of the most important social institutions, the qualitative state and the result of which determines the level of development of the economy, science and culture of the country as a whole. The problem of training and retraining of workers for the construction industry and housing and communal services is becoming increasingly important for the economy of the country. It is obvious that the necessary volume of housing can be introduced only with appropriate quantitative and qualitative provision of human resources to the construction industry, especially in regions with harsh climatic conditions. Construction organizations need highly qualified personnel. Investment in construction has always been profitable, as this sphere is growing rapidly. Meanwhile, the increase in construction does not automatically entail a tide of human resources into this sector of the economy. However, the analysis shows that the shortage of specialized personnel reduces the pace of construction, especially in regions with severe climates, because for such regions it is necessary to provide a different approach to training, which should provide the necessary set of competences for specialists.

The climate has a significant impact on the lives of people around the world as a determining factor for the functioning of the economy. To a greater extent, it is the harsh climate and the prolonged winter period that cause the organization of the territory of the Russian Federation, which has a huge infrastructure importance for the entire economy. Russia is a northern country, 2/3 of which is in the area of permafrost [1,2]. The climate in the territory of the Russian Federation is characterized by the lowest temperatures among all countries of the world, at which 80% of the territory of the country is northern. Russia as a whole is a northern country, so the concept of "areas of the Far North and similar areas" is quite extensive and includes not only polar and circumpolar territories [3,4]. The 65% territories of the country are directly classified as areas of the Far North and similar areas. In this regard, the long winter period affecting most of the country puts Russia in an economic imbalance with the West.

Strong winds, high relative humidity, low natural illumination in autumn-winter period, in general, long winter period generates high transport and infrastructure costs, higher cost of production and construction. In this regard, the most negative factor affecting the quality of life in areas with a long winter period is the state and development of housing stock and housing and communal services. The following factors should be taken into account in the design of northern buildings[5,6,7]:

- Development of general plans of enterprises and settlements taking into account the patterns of wind conditions and snow traffic in winter;
- Maximum possible blocking of buildings and structures;
- Inadmissibility of complex configurations of buildings in plan and height differences;
• Use of buildings with minimum perimeters of external fences per unit area;
• Reduction of glazing surfaces;
• Reliable sealing of windows, gates and doors;
• Improvement of aesthetic level of buildings and structures;
• Creation of comfortable working conditions in working rooms.

These features and climate characteristics of the Russian Federation dictate a new trend of staff training for the construction industry. The construction complex of Russia is currently more than 130 thousand organizations and enterprises of various forms of ownership, 9.3 thousand enterprises of industry of construction materials, more than 10 thousand design and survey organizations, with the official number of employees 1,683,000 people [8]. Today, this market for the construction complex can be defined as labour-intensive, i.e. there are a large number of unemployed and, accordingly, an excess of labour supply (unskilled or underskilled in terms of work professions).

During the meeting of the Presidium of the Public Council under the Ministry of Construction in October 2019, Volkov Andrei, Rector of the Moscow State University of Civil Engineering or MGSU noted: "The shortage of engineering personnel, economists, managers and other specialists with the highest specialized education in the field of construction in Russia exceeds 100 thousand people. The number of specialists with higher education in construction organizations decreased 1.5 times, the share of staff of retirement age increased, while the share of staff of the economically active age category under 40 years decreased [9,10,11]. There is a steady increase in the outflow of staff, and the number of vacant seats exceeds 10%. Statistical indicators confirm the fact that the personnel potential of the industry construction does not meet the requirements of the market. Many companies solve the personnel issue in various ways. One of the most common and low-cost is the assistance of the "labor force" from the countries of the near abroad. But now the market dictates high demands on workers and specialists, such as knowledge and possession of new materials and technologies. Therefore, large construction companies and companies involved in construction materials pay great attention to the topic of training existing staff and recruiting staff with distinctive knowledge, including knowledge related to the construction, design, architecture, and urban planning of populated areas in winter conditions.

Today, the education system of Russia consists of 741 universities, 65% of their state educational organizations make up the state educational organizations (Picture 1) [12].

![Picture 1. Dynamics of the number of universities of the Russian Federation](image)

Of the fairly large number of universities, the critically low proportion of educational institutions pays attention to the training of students based on the climatic characteristics of the region. Teachers of the Irkutsk National Research Technical University (INRTU) investigate problems of design,
construction and operation of cities in cold climatic conditions. In particular, issues of increased cost, low density of interaction of people (short light day, negative temperatures, snow, ice), seasonality of many activities, reduced emotional background, unreliable engineering systems and low transport availability [13,14]. The researchers assume that the cost of living in winter cities should not exceed the average of the cities of the southern strip. Students, teachers and investors are invited to create joint start-ups that will allow to produce products demanded in winter cities. Moreover, the study of architecture, urban planning, construction and design in winter conditions is taught to students in a number of disciplines:

The direction of preparation of bachelors 07.03.04 - "Town planning":
- Basics of urban zoning;
- Planning organization of land.

Bachelor Training Direction 07.03.01 - "Architecture":
- Design of thermal protection of buildings;
- Housing energy efficiency concepts;
- Architecture of buildings in northern climatic conditions.

Bachelor's training direction 08.03.01 - "Construction," profile "Roads and airfields":
- Research and design in difficult conditions;
- Research and design of roads in permafrost zone;
- Features of road design in permafrost zone.

Direction of bachelor's training 08.03.01 - "Construction," profile "Town planning and economy":
- Energy saving in urban construction and agriculture;
- Resource conservation in urban construction and agriculture;
- Engineering and environmental survey in construction;
- Environmental safety of buildings and structures during construction and operation in northern climatic conditions.

Direction of bachelor's training 08.03.01 - "Construction," profile "Industrial and civil construction":
- Construction in the northern construction and climatic zone;
- Special technologies in construction;
- Modern materials in construction.

Bachelor's training direction 08.03.01 - "Construction," profile "Expertise and real estate management":
- Real estate economy;
- Pricing in construction (taking into account winter conditions);
- Basic organization of operations in harsh climatic conditions;
- Tariff regulation in Housing and communal services.

In the course of training of specialists the purpose to give to students the corresponding competences in the directions of preparation "Construction", "Architecture", "Town planning", "Design" and to focus graduates on activities for design, designing, construction and reconstruction of buildings and constructions in the conditions of the winter city is set. In this regard, the following competences of the student can be distinguished:

Competence of students in the direction: Town planning

To be able:
- Apply the compact principle in the formation of residential buildings and complexes in cold climates [15].

Know:
- Peculiarities of urban planning systems formation taking into account climate;
- Influence of social, historical, economic and natural-climatic factors is a planned solution;
- Techniques of protection of the dwelling against adverse climatic factors.
To own:
• Classification of typological features of residential buildings, ensuring their performance, corresponding to local climate;
• Characterization of climate studies and climate typology of buildings.

Competence of students in the direction: Architecture

To be able:
• Determine the dependence of architecture on climatic factors;
• Is able to take into account and evaluate the role of the main components of urban ecosystems in the formation of architectural objects in different climatic conditions;
• Explore and create new architectural and urban objects with maximum understanding of the degree and nature of environmental factors.

Know:
• Rational design of cities taking into account climatic conditions;
• The impact of climatic zones on space-planning and architectural and design decisions;
• Methods and means of designing a comfortable and safe artificial environment and its components, taking into account environmental factors.

To own:
• Methods of assessing the degree and nature of environmental factors in the design.

Competence of students in the direction: Construction

To be able:
• To calculate the scope of works and the required labour intensity for construction of structures taking into account climatic phenomena and their impact on construction;
• To solve issues of preparation of construction territory, snow-clearing, construction sites.

Know:
• General information and conditions of construction in the Northern construction and climatic zone;
• Physical and geographical conditions of construction;
• Organization of frost-soil monitoring;
• Basis of construction organization design during spring and winter periods;
• Principles of using permafrost soils as building innovations;
• Operation of construction machines and mechanisms at low temperatures;
• Production of earthen, concrete and enclosing structures in harsh climates.

To own:
• Normative and instructional documents, manuals reflecting the specifics of construction in the Northern construction and climatic zone and in the conditions of the Far North;
• Peculiarities of planning of construction and installation works, taking into account the impact of climatic phenomena on construction production;
• Drawing up calendar and network schedules for the provision of preparatory and basic works on construction.

Having learned all competences, the student is aware of theoretical and practical methods of sustainable development of winter cities, which solve problems of snow, cold and strengthen economic potential of the region.

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