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ASSESSMENT OF LIFE CYCLE COSTS OF PUBLIC BUILDINGS OF SOCIO-CULTURAL PURPOSE

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Abstract

The paper presents the results of calculating the life cycle costs for eleven public buildings of social and cultural purposes: kindergartens, schools, clinics. A brief analysis of the obtained data is carried out, the structure of life cycle costs is considered, conclusions are drawn that reveal the specifics of estimating the costs of public buildings for social and cultural purposes. The importance and significance of assessing the costs of the life cycle of public buildings at the pre-project stage, the stage of design, construction and operation is revealed.

Keywords: life cycle costs, public buildings for housing and civil purposes, features of assessing the life cycle costs of public buildings.

ОЦЕНКА ЗАТРАТ ЖИЗНЕННОГО ЦИКЛА ОБЩЕСТВЕННЫХ ЗДАНИЙ СОЦИАЛЬНО-КУЛЬТУРНОГО НАЗНАЧЕНИЯ

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Реферат

В работе приведены результаты расчета затрат жизненного цикла по одиннадцати общественным зданиям социально-культурного назначения: детским садам, школам, поликлиникам. Выполнен краткий анализ полученных данных, рассмотрена структура затрат жизненного цикла, сделаны выводы, раскрывающие специфику оценки затрат общественных зданий социально-культурного назначения. Раскрыта важность и значимость оценки затрат жизненного цикла общественных зданий на предпроектной стадии, стадии проектирования, строительства и эксплуатации.

Ключевые слова: затраты жизненного цикла, общественные здания жилищно-гражданского назначения, особенности оценки затрат жизненного цикла общественных зданий.

Introduction

One of the key priorities of the state policy is the creation of comfortable conditions for life, work and human development. Social and cultural facilities are a natural and indispensable component of a comfortable living environment. The social sphere includes preschool and educational institutions, clinics and other infrastructure facilities that ensure social stability, health, education and comprehensive development of the individual.

According to the Program for the Socio-Economic Development of the Republic of Belarus for 2021-2025, approved by Decree of the President of the Republic of Belarus dated July 29, 2021 No. 292, by the end of 2025, it is planned to build at least 90 institutions of preschool education, including in the cities of Minsk, Soligorsk, Brest, Baranovichi, Zhabinka, Orsha, Rechitsa, Shklov, in Minsk, Dzerzhinsky and Pukhovichi regions. And in 2026-2030, it is planned to create an electronic database on preschool education institutions. The plans provide for the construction (reconstruction) of at least 45 educational institutions, including in the cities of Minsk, Gomel, Bobruisk, Stolbtsy, Fanipol, Molodechno, Baranovichi, Kobrin, Stolin. In addition, the construction of primary health care facilities should ensure that medical services are within walking distance.

However, construction (reconstruction) must be carried out economically rationally, reasonably. At the same time, the rationality of spending funds should be ensured not only and not so much in terms of construction costs, as in terms of operating costs. To develop an economic justification tool for rational spending on construction, taking into account the entire set of costs associated with the construction, operation, repairs, modernization and demolition of this building, a methodology was developed and the life cycle costs of public buildings for social and cultural purposes were calculated.

Main part

For each property, there are one-time costs for its construction, costs for operation and maintenance, major repairs and, ultimately, demolition. The essence of the assessment of the life cycle of a building is that in order to make a decision on the choice of materials, products, structures, installed equipment and justify the technical and economic indicators of the designed object, it is necessary to compare one-time and periodic costs for the construction, operation and demolition of the building [1].

The life cycle of an object, as a period of time of its existence, is defined in a narrow and expanded sense. In a narrow sense, the life cycle of a real estate object includes three main phases: formation, operation and demolition [2]. In a broader sense, the life cycle of a real estate object consists of the stage of formation of an idea for the development of the territory (pre-project stage), design of a real estate object, construction, operation and liquidation of the object [3].

The first attempt to connect the life cycle of products with factorized demand is S. Hirsch [4]. Then, in 1966, R. Vernon put forward the theory of the International Product Life Cycle Theory in marketing. The advantage of this approach is that it describes not the production of a single item, but the period of product circulation on the market [5].

At present, many works of foreign authors are devoted to the methodology for estimating the costs of the life cycle of products in various industries and areas of application, including, back in the late 1980s, a review work by D. Gairdner, which contained 130 references and qualified LCA not as a theory, but as concept [6].

In the Republic of Belarus, a lot of work was also carried out to assess the costs of the life cycle of residential buildings, which made it possible to form a methodology for estimating the costs of the life cycle of residential buildings [7]. Based on this methodology, an assessment was made of the life cycle costs of public buildings for social and cultural purposes: 5 kindergartens (for 200 and 230 places), 3 schools (for 501, 765, 1020 school places) and 3 polyclinics (for 650 and 850 visits). per shift).

All calculations were carried out based on the construction conditions of the facility for 1 year, and the service life of 50 years. Calculations were made in Belarusian rubles in prices as of 01/01/2022.

The basis for the calculations was the design data for the facilities, information from the conclusions of the State Construction Expertise, the estimated cost of construction, design technical and economic indicators of operating costs, prices and tariffs set by energy supply organizations. The results of calculating the life cycle costs for 11 public buildings of social and cultural purpose are shown in Figure 1.

Kindergartens have the lowest life cycle costs. Also, these objects were distinguished by a high degree of typing, so the calculations showed a greater convergence of values. The life cycle costs for the three schools have a much wider range of values both in terms of area and cost. However, the specific indicators of life cycle costs per 1 m^2 of the total area of the building, which reflects the diameter of the spheres in Figure 1, are the lowest of all three groups of objects. The widest range of scatter of life cycle cost values is found in polyclinic buildings. At the same time, it is clearly seen that for objects with a smaller total area, the unit costs per 1 m2 of the total area are higher.

In general, it can be noted that there is a direct relationship between the total area of buildings and life cycle costs.

The structure of life cycle costs for kindergartens, schools and clinics is shown in Figure 2.

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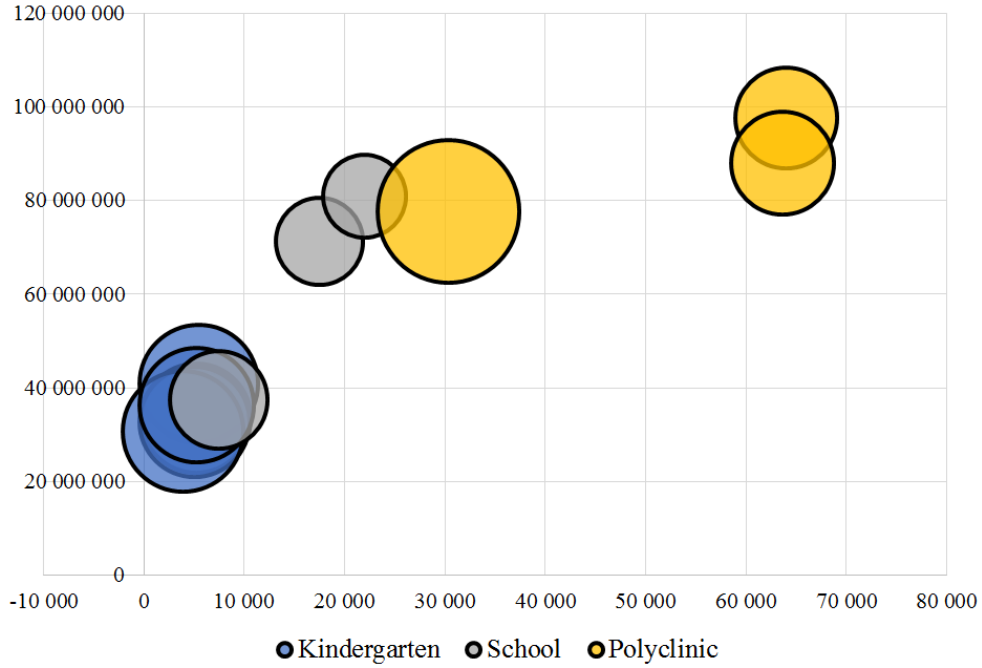

Figure 1 – Life cycle costs depending on the total area of buildings, total Belarusian rubles as of 01.01.2022

Source: Author's own calculations based on data from construction projects

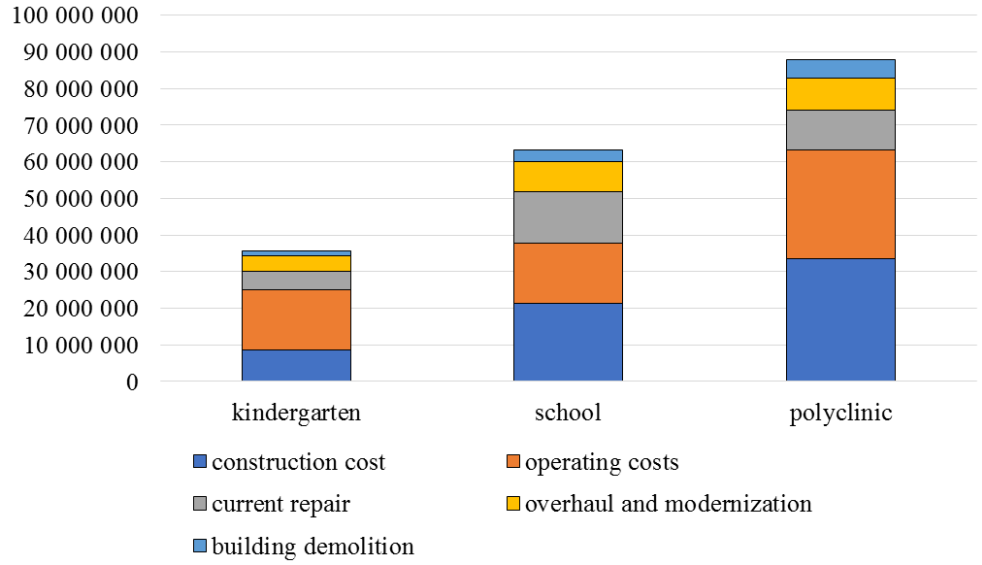

Figure 2 – The cost structure of the life cycle of public buildings for social and cultural purposes

Source: Author's own calculations based on data from construction projects

An analysis of the life cycle costs of public buildings for social and cultural purposes led to the conclusion that from the total value of the life cycle costs:

one-time costs for the construction of social and cultural facilities range from 20.68 % to 48.88 %;

operating costs from 24.75 % to 52.31 %;

current repair costs from 12.06 % to 25.65 %;

overhaul and modernization costs from 7.94 % to 14.86 %;

demolition costs from 3.10 % to 7.33 %.

In general, the costs related to construction activities (construction, maintenance and overhaul, modernization, demolition) range from 75.25 % to 47.69 % of the life cycle costs of public buildings.

The assessment of the life cycle costs of public buildings for social and cultural purposes, carried out for such facilities as kindergartens, schools, clinics, allows us to conclude that methodically the cost assessment for social and cultural facilities is identical to the assessment of residential buildings. The stages of the life cycle, the list of costs, the calculation algorithm reflects the specifics of the creation and operation of real estate objects.

The identified features of estimating the costs of public buildings for social and cultural purposes include the following provisions:

– objects of public buildings (kindergartens, schools, clinics) are overwhelmingly created at the expense of the budget, with state regulation of prices for construction, maintenance, operation, repair and modernization;
– objects of public buildings (kindergartens, schools, clinics) are overwhelmingly created according to standard and reusable designs, which facilitates the calculation of life cycle costs;
– in the structure of one-time costs for the construction of social facilities, the share of costs for technological equipment is quite large, compared with residential buildings. When assessing the life cycle costs of public buildings for social and cultural purposes, the cost of

technological equipment was not taken into account in the calculations, since these costs relate to the production and economic activities of the organization, and not the maintenance and service of buildings and structures;
- to assess the rationality of costs, the Standards for the marginal cost of construction of social and cultural facilities as of January 1, 2021, established by the Decree of the Ministry of Architecture and Construction of the Republic of Belarus No. 69 dated July 21, 2021, are used;
- tariffs for payment for heat and electric energy for social and cultural facilities are set by structural divisions of the Ministry of Energy of the Republic of Belarus in the context of regions. For budgetary organizations, tariffs are set at a level lower than for commercial organizations, but higher than for paying utility bills by the population;
- current repair of premises in schools is carried out annually, before the start of the school year. At the same time, the implementation of repair work is partially financed from the funds of the boards of trustees, sponsorship;
- overhaul and modernization of facilities, as a rule, is carried out for individual elements of the building (arrangement of a barrier-free environment, access control systems, modernization of eating places and food preparation, etc.). Comprehensive modernization of buildings is actually carried out after a 45-50-year service life, that is, when the building is close to the end of the standard service life;
- assessment of the life cycle costs of public buildings for social and cultural purposes can be performed both per unit of the total area of the facility and per unit of capacity. The specific indicator, which provides a comparison of indicators of the cost of construction, operating costs and the cost of capital (current) repairs, modernization, reconstruction and demolition of facilities, are indicators of the number of places (for schools, kindergartens) or the number of visits (for clinics, sports and recreation centers). centers). Specific indicators of costs per consumer unit of facility capacity to the greatest extent reflect the functional relationship between consumer goods, which are provided by the operation of these facilities, and payment for their construction and operation.

Conclusion

In general, the use of the methodology for assessing the life cycle costs in relation to the objects of public buildings for social and cultural purposes at the pre-project stage, design and construction stages allows:
- based on a comparative analysis of projects, choose the option whose life cycle costs are lower, and, accordingly, in the aggregate will provide savings in the budget, or another customer financing the construction and operation of the facility;
- stimulate the construction of energy-saving and, in general, resource-saving buildings and structures that reduce operating costs;
- to form a database of standard construction projects that provide minimum life cycle costs for the required space-planning indicators;
- evaluate the effect of scale of construction, justifying the increase in life cycle costs with an increase in space-planning indicators, capacity, throughput of the construction object;
- given that public buildings for social and cultural purposes are massively built according to standard designs, life cycle cost assessment allows you to get a multiplier effect from optimizing the technical and economic parameters of the building.

All this together shows the importance and significance of life cycle cost assessment at the design stage, the need to monitor and control the actual costs of building operation throughout its entire life cycle.

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