Life cycle of the facility and its cost at the construction stage

Victoria Markovna Kruglyakova[1,*]

[1]Moscow State University of Civil Engineering, 26, Yaroslavskoye shosse, Moscow, 129337, Russia

Abstract: The article presents a study of the main aspects of managing the value of real estate in the process of implementing investment and construction activities. The study was conducted in the context of the concept of the "life cycle of a capital construction facility" with the decomposition of its stages into regulatory, financial, economic and engineering. The life cycle of an object creation project is defined as a subsystem in the structure of the overall life cycle of an object, combining a set of stages implemented in the process of creating an object. The author has formulated the main factors affecting the value of real estate during the construction at various stages of the project life cycle. The paper defines a mechanism for managing the cost of an object as interrelated stages of the project life cycle, price-forming factors and methodological support for the process of its economic assessment with the definition of types of value, taking into account the objectives of determining the value of the object in the process of its creation. The use of the tools and methods presented by the author is designed to ensure an increase in the efficiency of managerial decision-making during the construction.

Keywords: investment and construction activities, object of unfinished construction, life cycle of the facility, market value of real estate, construction readiness of the facility, valuation methods, capital construction projects, liquidity risks, construction and technical expertise

1. Introduction

The current state of the construction complex of the Russian Federation is largely due to the active development of investment and construction activities, the effectiveness of which is currently being considered in the context of the search for integrated support mechanisms for the implementation of construction projects of economic, social and environmental effects. One of the priority goals of the implementation of an investment project in construction from the perspective of a private investor is the construction of a new or previously built object on a land plot in order to create an asset with value for a certain range of real estate market participants. The main equivalent of value in the field of economic measurement is the value of an asset. The investor's desire to increase the value of an object created during construction or transformation is a natural intention aimed at increasing the economic efficiency of the project. However, the increase in the value of a

[*]Corresponding author: vinikat@mail.ru

real estate object when it enters the market during the implementation of development projects can be ensured not only by increasing construction costs. An equally important indicator of measuring the value of an object being created is the assessment of the effectiveness of construction costs in terms of further use of the object, expressed in its economic, environmental and social benefits [1].

Currently, considerable attention is being paid to research in the field of investment and construction activities in connection with the problems of managing the cost of project implementation [2, 3, 4, 5].

A lot of works by industry specialists have also been devoted to the study of the value of real estate objects in operation [6, 7, 8].

At the same time, the content of the concepts of "construction cost" and "value of a real estate object" at the stage of construction of a capital construction object has essential differences that are not fully identified. As a result, the terminology used is confused and, as a result, incorrect interpretation and application of methodological support for the process of determining these indicators is allowed.

Thus, the study of the tools for managing the value of a real estate object being created in conjunction with the methodological support of the process of its economic assessment is one of their important components of the analytical support of investment and construction activities. The need for the development of this toolkit and, in connection with it, methodological support for the valuation of real estate at the stage of its construction determined the relevance of the research conducted by the author.

2. Materials and Methods

In the context of the presented research, first of all, it is necessary to determine the essence of the two concepts:

1. *The cost of construction* (the cost of an investment construction project, the cost of capital expenditures).
2. *The value of the property* (value in use or value in exchange).

These forms of value expression have different natures. In the first case, the cost of works, materials, machinery, equipment and services that are necessary for the implementation of an investment construction project up to the commissioning of the facility is subject to research [2]. In the second case, the value of a real estate object means the economic meter of an object (a land plot with an improvement created on it) in the understanding of real estate market participants based on the characteristics of the object on a specific date. The cost of an object can be determined at various stages of construction and operation of the object - from the initial stage of the project in relation to the land plot on which the object is planned to be built, to a ready–to-operate object launched on the real estate market, with its further operation, possible transformation and, ultimately, demolition) [8].

The interrelation of the concepts under consideration in the primary real estate market is obvious – after all, the cost of building an object can act as a price guide for market participants of objects under construction and newly commissioned. However, accounting for the productivity of costs and their contribution to the cost of a single real estate object in the process of its creation can be ensured precisely on the basis of measuring the value of the object, and not the costs that were carried out by the investor [6].

Based on the presented logic, it should be noted the modern features of the formalization of the process of creating an object and its further physical and economic life. The corresponding process can be described using the concept of "object life cycle".

In general, the life cycle of an object in investment and construction activities is understood as a period of time calculated from the moment when the investment idea arises to the moment when the physical life of the object ends as a result of its demolition [9].

Thus, if we consider the content of the complete construction cycle of an object, we can identify its main stages of the life cycle:

1. *Analysis of the experience and the idea of the project* (investment plan, definition of the general concept of the construction project).
2. *Investment justification and audit* (feasibility study or pre-project stage, including marketing, determination of the preliminary amount of investment costs and sources of financing, assessment of the economic efficiency of investments, analysis of the level of uncertainty and risk assessment).
3. *Design and working documentation* (engineering surveys, project development, examination of design estimates, obtaining a construction permit).
4. *Construction* (production of works, author's supervision, issuance of executive documentation, commissioning of the facility).
5. *Operation* (formation of sources of income and control over their receipt, optimization of operating costs taking into account accepted engineering and technical design decisions, provision of repair work taking into account inter-repair cycles).
6. *Modernization* (reconstruction of the facility, taking into account the current market conditions and the economic feasibility of the development of the facility) or *Demolition* (completion of the life cycle) of the construction facility.

Based on the structure of the tasks that need to be solved in the process of implementing an investment and construction project, according to the author, it is necessary to distinguish: regulatory, financial, economic and engineering and technological life cycles of the object. The content of each type of life cycle, taking into account its main stages, is presented in Table 1.

Table 1. Structure of the life cycle of a real estate object at various stages of the project implementation

Type of life cycle / stage	Regulatory and legal	Financial and economic	Engineering and technology
Stage 1	Analysis of land rights, acquisition of land, analysis and registration of urban planning zoning documents, establishment of VRI	Monitoring of the construction and real estate market. Analysis of the value of the acquired land plot, preparation for a transaction on market conditions. Formation of an investment plan.	Inspection of the land plot for its physical and geological suitability for development
Stage 2	Obtaining a building permit. Contractual work with all organizations involved in the design and construction at all stages of its implementation	Investment justification and audit, including assessment of the economic efficiency of investments, risk analysis and assessment	Development of pre-project documentation. Determination of the sources of resource supply to the development area and the forecast of technological security of the planned construction.

Stage 3	Support of the examination and commissioning of the facility	Development of a sales plan taking into account market conditions and characteristics of the constructed facility	Development of design and working documentation
Stage 4	Registration of rights to the created real estate object. Sales support	Price monitoring and development of recommendations on the conditions for the realization of rights to the built object	Construction of the facility and preparation for commissioning. Commissioning of the facility and debugging of operational indicators
Stage 5	Legal support for facility management and operation	Development of conditions for optimizing revenues and costs from the operation of the facility. Analysis of the economic feasibility of facility modernization	Facility operation management, control of inter-repair cycles
Stage 6	Preparation of documentation for the demolition of the facility	Calculation of costs for dismantling, reclamation of the site, development of recommendations for further use of the land	Organization of demolition of the facility and preparation of the site for sale or new construction

Analyzing the main stages of the life cycle of a construction object, we can conclude that in the description of the life cycle, as a rule, there is no mention of a land plot, to which all the factors of production that cause the creation of a single real estate object are attached. At the same time, in fact, the result of the project is not only the creation of a capital construction facility as such, but also the development of the actual land plot for construction, namely, the laying of engineering communications to the facility, landscaping and landscaping of the territory adjacent to the construction site.

Moreover, when calculating the economic efficiency of the project, it should be remembered that in the cost structure of the project there are costs for the acquisition of land rights, and the income that the real estate object will bring to its owners in the future will be formed not only by the construction object as such, but also by the land on which it is located. The issue of accounting for the costs of acquiring rights to a land plot often goes beyond the description and analysis of the life cycle of a construction object, while the physical life of the object under construction begins with the stage of transformation of the land plot with its preparation for construction and it ends with a free land plot after the demolition of the object.

It should also be noted that the stages presented in Table 1 correspond to a situation where all participants in investment and construction activities ensure effective interaction and ensure compliance with construction deadlines and related procedures in accordance with the project. However, in practice, things often do not work out so well – the construction time increases or construction is suspended, the cost of work and materials increases not only due to rising prices, but also changes in the volume of work and materials compared with those provided for in the initial version of the project.

In addition, regulatory problems may arise related to changes in the process of designing and building land legislation, rationing in construction, the taxation regime for construction activities and real estate, and others. In this case, the structure of construction costs changes, and the planned dates of commissioning of the facility are shifted. Due to changes in the construction parameters, the properties of a single real estate object (a land

plot with a capital construction object being built on it) change. Ultimately, these changes affect the value of the property and, when determining it, it becomes necessary to take into account additional factors that affect the value of the property being evaluated.

The works of various authors are devoted to the development of the classification of objects under construction according to various legal and economic criteria, as well as the technical condition of structures and the degree of construction readiness of the object during construction [10, 11, 12, 13].

It should be noted that at various stages of the construction of an object, the choice of methods for valuing real estate is determined by the peculiarities of the life cycle stage of the object under construction. In this regard, it is necessary to identify a subsystem in the above-described structure of the object's life cycle, which refers to the period of creation of the object. Let's define this subsystem through the term "life cycle of a real estate project".

In the development of the general stages of the life cycle described above, as well as the details of the regulatory, financial, economic and engineering cycles of the object presented by the author in Table 1, let's consider the structure of the life cycle of the project to create a real estate object (hereinafter referred to as the project life cycle). Obviously, the first four stages of the life cycle of a real estate object, presented in Table 1, can be attributed to this subsystem in an integrated manner. The implementation of each of these stages corresponds to a certain transformation of the real estate object, which affects the change of its parameters and, accordingly, the cost. By influencing these parameters, you can control the value of the property being created.

In this study, the author presents tools for managing the value of a real estate object for various management decisions at all stages of the project life cycle.

3. Results

Moving from the description of the structure of the life cycle of the project to the indicators of the value of the real estate object at various stages of its construction, it should be noted that the modern system of standardization of valuation activities in the Russian Federation in its main part is harmonized with International Valuation Standards [14, 15].

Let's formulate the following *main directions of application of the indicator of the value of a real estate object in the construction process*:

1. The use of a land plot with a capital construction object being built on it as collateral for obligations under a credit line opened to finance the project.
2. The reflection of the object in the accounting statements of construction costs with the formation of commodity groups as individual queues of the construction object are put into operation, as well as in connection with the planning of asset taxation.
3. Sale of an object under construction to a new investor in case of assignment of rights under an investment agreement, there are problems with financing the project, including in the procedures of financial rehabilitation or bankruptcy of the developer.
4. Setting the price of equity participation agreements in construction at various stages of the facility's construction readiness (during the construction of residential complexes and the implementation of investment contracts).
5. Determining the value of the shares in the developer company when new project participants enter the project in order to attract additional investment resources.
6. Monitoring the value of the object in order to monitor the achievement of planned profitability indicators of the project when it is resold or leased.

The relationship between the listed areas of application of indicators of the cost of a construction object and the types of cost determined as a basis for further management decision-making is shown in Fig.1.

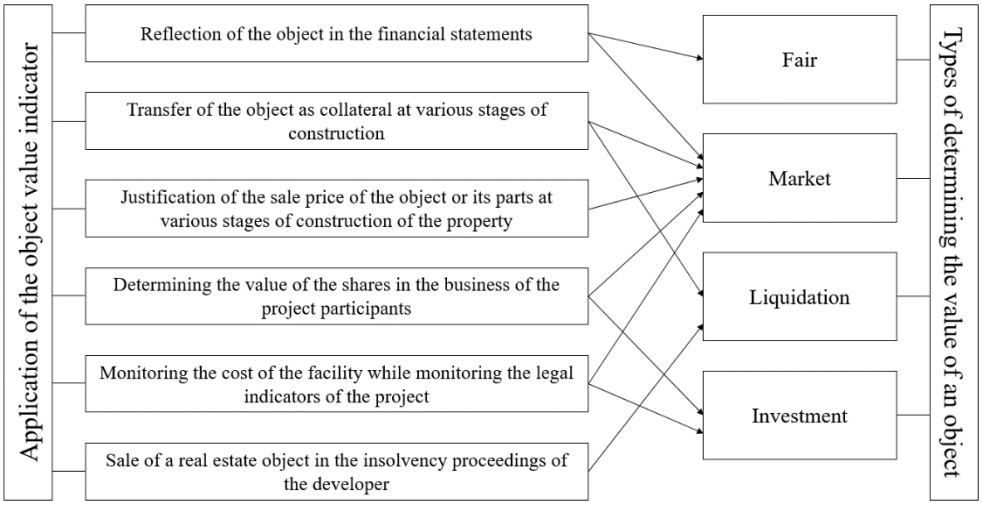

Figure 1. The relationship between the directions of application of the value of the constructed real estate object and the types of value provided for by the valuation standards.

Taking into account the indicated areas of application of the cost indicators of real estate under construction, the following *main factors affecting the value of the object* can be identified:

1. Type of rights and composition of restrictions on the use and development of the facility
2. Compliance of the land plot for planned and implemented construction with the norms of territorial planning.
3. Source and timing of financing the construction project.
4. Availability of a complete package of design estimates and permits for construction.
5. Construction readiness of the facility at the assessment date.
6. Current technical condition of the facility, the presence or absence of defects in construction works and materials.
7. Compliance with or violation of the work schedule.
8. Stage of design and implementation of technological connections to external and internal engineering systems and networks.
9. Facility's readiness for state registration of rights at various stages of construction.

Based on the listed composition of price-forming factors, as well as the above-described structure of the project life cycle, the author highlights the relationship between the main stages of the project life cycle, the directions of application of the real estate value indicator in the construction process and the types of value determined at various stages. The corresponding relationship is reflected in Table 2.

Table 2. Relationship between the stages of the project life cycle and the types of costs determined for various management purposes during the construction of the facility

Name of the stage of the project life cycle	**Main areas of application of the cost indicator**	**Types of determined value of the object**
Experience analysis and project idea	Making a forecast of the cost of purchasing a land plot. Analysis of price dynamics in the real estate industry and the cost of an object planned for construction.	Market value Investment value
Investment	Determining the value of the shares of the project	Market value

justification and audit	participants. Collateral of the land plot. Calculation of the value of a real estate object for various scenarios of project implementation and related risks.	Investment value
Design and working documentation	Collateral of a single real estate object in the current stage of construction readiness. Cost monitoring – monitoring the achievement of targets. Valuation for accounting purposes. Sale of the object to a new investor. Restructuring of the obligations of the project participants. Determining the price of equity contracts in construction.	Market value Investment value Liquidation value
Construction	Valuation for financial reporting purposes. Sale of an object or its lease. Distribution of construction results among project participants.	Market value

With regard to the methods of calculating each type of value indicated in Table 2, it should be noted that the methodology of real estate valuation is based on well-known methods of determining the value of objects [7, 8]. However, in this case, we focus on what price-forming factors that are not used in assessing the value of previously created real estate should be taken into account when determining the value of an object in the process of implementing a project to create it. In this case, the management of the value of the object is based on the use of tools arising from the composition and the ability to control changes in the price-forming factors described in the work.

4. Discussion

Thus, the paper presents a study of the main aspects of managing the value of real estate in the process of implementing investment and construction activities at various stages of the creation of an object. In this context, the main stages of the life cycle of a real estate project are highlighted as a subsystem of the general life cycle of a real estate object. As a rule, well-known scientific publications consider the indicator of the cost of construction costs and its optimization in changing economic conditions as the main focus of the study of an object at the stage of its construction [3, 16]. The author focuses on the study of the indicator of the value of a real estate object in the process of its construction and identifies the main factors, the impact of which in various conditions and for various purposes allows for the management of the value of the object. Thus, the application of the tools and methods presented by the author is designed to ensure an increase in the efficiency of managerial decision-making during the construction of facilities, taking into account the stages of the life cycle of the project and the corresponding risks in the context of current economic changes that have a significant impact on the construction and real estate market.

5. Conclusions

The research conducted by the author allowed us to solve the main tasks of the study aimed at improving the analytical and methodological support of investment and construction activities. Based on the analysis of the structure of the life cycle of the real estate object under construction and the content of each stage of the creation of the object from the land plot planned for development to the totality of the built-up area in the capital construction object located on it, put into operation, the main factors influencing its cost were identified. Also, taking into account the types of cost provided for by modern legislation of the

Russian Federation and International Valuation Standards, the author describes the relationship between the main stages of the life cycle of an object construction project, the directions of application of object cost indicators during construction and the types of cost, the determination of which is based on taking into account the main price-forming factors presented in the work.

The author believes that the presented research can form the basis for the development of a unified methodological support for determining the value of real estate of various types during its construction, as well as the development of reference data, which are currently actively used for constructed facilities, based on a common system of indicators.

References

1. Real estate management: theory and practice/ under the general scientific editorship of P.G. Grabovyy. M.: Publishing House ASV, Publishing House "Enlightener", 2023 – 204 p.
2. Dorokhina E.Yu., Kachurin D.A. Life cycle of a construction project: cost modeling // Fundamental Research. – 2017. No. 8, pp. 159-163.
3. Telminova N.V., Nechaev O.S. Modern problems of state regulation of the real estate market // Region: systems, economics, management. 2023. No. 1 (60), pp. 66-71.
4. Akulova I.I., Kruglyakova V.M., Panfilov D.V. On the development of measures to support the construction industry under sanctions (regional aspect)// Housing construction. – 2023. No. 8, pp. 3-10.
5. Kruglyakova V.M., Dolgov M.A. Development in construction as a form of investment activity in the market real estate // Bulletin of the Voronezh State University. Series: Economics and Management. 2020. No. 4, pp. 54-64.
6. Sternik, S.G. The real estate market and trends in its development / Moscow: KnoRus Publishing House, LLC, 2023. 132 p.
7. Gribovsky S.V. Calculation models of real estate valuation// Property relations in the Russian Federation. 2015. No. 3 (162), pp.26-41.
8. Kruglyakova V.M. Methodology of real estate valuation: special cases of determining the value of land plots and capital construction facilities / CJSC Universitetskaya Kniga, Kursk, 2022. 142 p.
9. Kruglyakova V.M. Kostenko T.V., Smirnova E.N. The content of the life cycle stages of an investment and construction project and the analysis of risks arising during its implementation // Construction and real estate. 2022. No. 2 (11), pp. 102-109.
10. Nurmagambetova A.Z., Zhandauletova J. The concept and classification of unfinished construction. EURASIAN UNION OF SCIENTISTS: journal. Moscow, 2015. Pp. 89-90: Access mode: URL: https://www.elibrary.ru/item.asp?id=27471202
11. Korona O.A. Methodology for assessing unfinished construction projects, risk assessment//Property relations in the Russian Federation. 2021. No. 12 (243), pp. 37-41.
12. Kruglyakova V.M. Methodological support for the economic assessment of unfinished construction projects in modern conditions// Property relations in the Russian Federation. - 2022. No. 4 (247), pp. 28-41.
13. Shirokov A.I. Calculation of accumulated depreciation of buildings and structures in progress. Vestnik of MGSU: Economics, management and organization of construction. 2012. No. 1, pp. 149-152.
14. Bukharin N.A., Ozerov E.S., Pupentsova S.V. Regulatory support of appraisal activities// Peter the Great St. Petersburg Polytechnic University. - St. Petersburg : Polytech Press, 2019. - 525 p.
15. International Valuation Standards, Effective 31 January 2022, www.ivsc.org
16. Wang F. The present and future of the digital transformation of real estate: a systematic review of smart real estate // Biznes-Informatika. 2023. B. 17. No. 2, pp. 85-97.