COST MANAGEMENT OF THE LIFE CYCLE OF REAL ESTATE OBJECTS: EXPERIENCE, PROBLEMS AND SOLUTIONS

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Abstract. The authors of the article address the international experience of implementation and use of the concept of evaluation and cost management of Life Cycle Costing (LCC) and Whole Life Appraisal (WLA) of real estate objects. The author’s interpretation of the issues and ways of introduction of this concept in developing countries, in particular in Ukraine, is presented. The article describes the tools and forms of public-private partnership for implementing this concept in the practice of effective functioning of socio-economic systems. Specifics of the managing life cycle costing of real estate objects basing on such approaches/methods as development, maintenance, surveying, and concession are determined. The paper emphasizes the practical significance for all interested parties in the real estate development market of using methods of a comprehensive and systematic approach to the integrated evaluation of assets in the process of their design, construction, operation, and maintenance. The authors focus on the need for comprehensive accounting of the costs of the whole life cycle of a product (both construction products in the form of buildings and structures, and any high-tech products with a long life cycle from its design to disposal). Notable cost management methods (Kaizen Costing, Standard Costing, and Target costing) are considered, as a significant component of the LCC/WLA concept the development. The authors analyse the role of corporate investment funds, joint investment institutions, professional associations, and asset management companies in the implementation of the LCC/WLA concept in the field of real estate development. The respective statistical data (from Ukrainian practical experience) that can be used to prognosticate the impact of inflation in the construction industry are cited. The significance of database digitalization and BIM
technologies in the introduction of the regarded concepts in the practice of construction and development activities is stressed.

**Keywords:** development of real estate, surveying, concession, life cycle of real estate objects, value, expense, condominium.

**INTRODUCTION**

Traditional, most well-established and practical approaches to assessing the feasibility and economic efficiency of investment construction projects focus on minimizing the cost of initial capital investments and, although certain calculations of operating and operating costs are performed, a systematic, integrated assessment of the cost of the entire life cycle of a real estate object is not actually performed, especially in the so-called third world countries. But today, all stakeholders in the construction market are interested in the ratio of price and quality, regardless of whether they are investors, developers, designers, construction contractors, customers, or supply chain participants (Flanagan, Jewell & Norman, 2005).

Over the course of 2-3 decades, the operation and maintenance of an office or residential building might cost several times more expensive than the initial capital costs, but, especially in developing countries, much more attention is paid to initial capital investments than to significant current costs during operation and subsequent maintenance. Sometimes, investment, design and structural construction decisions made at the design and construction stage eventually do not comply with new operating requirements and needs (Nikolaeva, 2015). It is not sustainable to consider only initial costs, when significant cost savings and a positive environmental effect can be achieved over time. A comprehensive life cycle assessment is a valuable tool that takes into account both cost and efficiency over the life of an object and involves balancing capital expenditures with future operating and maintenance costs, regardless of the type of property whether it is a residential building, school, road, airport, or any other infrastructure or public facility (Flanagan, Jewell & Norman, 2005).

The privatization of infrastructure and buildings in advanced economies has led to an increase in the number of options for organizing construction and operation through various forms of public-private partnership, the concession mechanism, etc. The development of tools for assessing the life cycle costing is carried out within the framework of concurrent development of such activities as real estate development and surveying. The concept of surveying is one of the advancement directions of the global economy in the field of commercial real estate management. The analysis of international experience shows that the application of a comprehensive, systematic, professional approach to real estate management provides an opportunity to significantly increase the level of its effectiveness in the interests for the benefit of stakeholders (owners, tenants, the state and society as a whole). It is this conceptual approach to real estate management that is called “surveying”. The concept and tools of LCC are used not only in the evaluation and management of projects/real estate objects, but also in the cost management system of the full life cycle of high-tech
products, which allows a systematic approach to managing the total amount of expenses at all stages of the life cycle of high-tech products in order to minimize them. Comprehensive research and development of this concept at the theoretical and practical levels is an urgent task both for the developed economies of the world and for the economies of countries striving for dynamic, efficient and sustainable development.

Hence the purpose of the article is an analysis of the international experience, tools, advantages and problems of applying the concept of valuation and cost management of the whole life cycle of real estate objects, the formation of directions for solving identified problems and ways to implement this concept in developing countries, in particular in Ukraine.

MATERIALS AND METHODS

To achieve the formulated goal of the article, it makes sense to give clear definitions of the terms “real estate development”, “surveying”, “concession”, and since in these types of activities or legal relations the key to evaluating the effectiveness of real estate objects through the use of the LCC concept can be found. Obviously, it is necessary to analyze and generalize the world experience in using the concept of evaluating and managing the cost of the entire life cycle of real estate projects/objects.

Researchers I. Ivakhnenko and M. Klymchuk give a broad definition of development, extending the term to “energy efficient development”. They interpret energy efficient development as “economic and managerial advancement of commercial real estate, the ultimate goal of which is to make an effective investment decision on the implementation of energy saving measures of a development project based on an economic assessment of commercial efficiency, taking into account possible risks” (Ivakhnenko & Klymchuk, 2018). It is necessary to remind that a development project is a set of tasks and measures for the development of a real estate object of a given quality, carried out within the framework of a plan in conditions of limited resources, time and cost, in order to generate profit or other positive effect (for example, social and/or environmental effect).

The term “survey” literally means inspection or supervision. Translated into Ukrainian, it actually means “Geodesy”. It is deemed expedient to define the meaning of “geodesy” in construction sphere, so that this analogy in terminology could be clear. “Geodesy plays a fundamental role in construction, since the information obtained as a result of the exploration determines the reliability, strength, functionality, and operational characteristics of an architectural structure. Such works are versatile, complex in nature and in the vast majority of cases are mandatory both at the design stage and before putting the construction object into operation” (Geodesy in construction, 2022). Thus, in the organizational and economic sense, the current concept of “surveying” can be interpreted as a set of legal, technical, economic and managerial decisions regarding real estate, the implementation of which ensures the maximum effect from its use (Ivakhnenko & Klymchuk, 2018). In practice, surveying activities provide the development of a real estate management strategy, implementation and control of the introduction of this strategy, selection of contractors, conclusion of the respective contracts for maintenance, servicing, and provision of public services, control over the fulfillment of contractual obligations and the quality of housing and communal
services provided. The idea is to rationally use a real estate object throughout its whole life cycle in order to generate profit for the owner/co-owners, organize real estate development processes, introduce modern energy-saving technologies to increase the level of energy efficiency of the real estate object operation.

According to Ukrainian legislation, which is based on international practice, concession is the granting the right to create (build) and/or manage/operate a concession object by an authorized executive authority or local self-government body to meet public needs on the basis of a concession agreement on a paid basis to a legal entity or individual (business entity). The business entity (concessionaire) assumes obligations, property liability and possible business risks for the creation (construction) and/or management/operation of the concession object in order to meet public needs (Features of the concession, 2023).

The term “concession” (derived from Latin “concession”, which means “permission”, or “assignment”) - a type of agreement on the creation or reconstruction at the expense of the investor (or together with the concessionaire) of objects of real estate that are in state ownership, as a result of which the investor gets the opportunity to operate the object for the period stipulated by the concession agreement on a paid basis, collecting income in his favor. Thus, a concession is a form of state-private partnership (SPP), and involvement of the private sector in the effective management of state property or delivering services that are usually provided by the state, on mutually beneficial terms.

The research methodology, the results of which are presented in this article, is based on a comparative analysis of the world and domestic experience in applying the LCC concept and approaches significantly related to this concept, in the fields of industry of real estate development, surveying, and concession relations as a form of public-private partnership.

The main focus of the study is on the incorporation of the LCC concept in construction.

RESULTS AND DISCUSSION

The countries worldwide give much consideration to the issues of managing the life cycle costing of the product/project. The interest arose in the middle of the 20th century. Today, various standards concerning system engineering exist, which aiming at the enhancement of existing management processes of product lifecycle. Among others, for example, the US standards can be mentioned. They are developed by the 7th subcommittee of the Joint Technology Committee ISO and the International Electrotechnical Commission (IEC). These standards regulate the development of systems and software for lifecycle management (The Militarily Critical Technologies List, 2021).

The US defense industry, which is constantly developing and improving, uses a modern product/project lifecycle management model. During defense procurement in the United States, a project approach is applied to manage the life cycle of defense and special equipment, which is high-tech products, where each procurement program is considered to be a separate “project program” even before the start of its development and approval. The life cycle costing of high-tech products in the US procurement system refers to the total cost of the program “from design to disposal”, which is also called “cost of ownership”. These costs include direct costs for the purchase of products and indirect costs, which are logically related to the program, regardless of the source of funding. The government-industry
strategy CALS (Continuous Acquisition and Life Cycle Support) has been developed and implemented to jointly manage the life cycle of high-tech products in the United States and NATO countries. CALS is a concept and ideology of information support the product life cycle at all its stages, it is based on the use of a single information space (integrated information environment), which provides uniform ways of interaction between all participants in this cycle: product customers (including government agencies and departments), suppliers (manufacturers) products, maintenance and repair personnel, implemented in the form of international standards, which regulate the rules of this interaction mainly with the help of electronic data exchange (EDI).

The concept of "terotechnology", as a development of product life cycle costing management, was introduced in the UK in the early 1970s. Terotechnology is a technology that takes into account a number of factors (technical, technological, and organizational) that affect the operation of equipment throughout its entire service life and increase the efficiency of using this equipment. Further development of the life cycle cost management system in the UK led to the emergence of the idea of capital asset management, which involves optimizing the total cost of repair and maintenance of technical equipment at all stages of their life cycle (Ahuja & Khamba, 2008).

In the 1980s, the idea of life cycle cost management emerged in Germany, and its development in the year 1990 led to the creation of the LCC concept, which is based on the idea of integrated accounting of product life cycle costing (Asiedu & Gu, 1998).

The experience of the Eastern countries has also made a significant contribution to the development of the concept and even the philosophy of the LCC. Since the 1960s of the 20th century, the Japanese concept of target-costing was formed, which over time gained popularity in developed countries. Its essence lies in the fact that the cost of making a product is determined in view of the price of selling this product previously set on the basis of marketing research and taking into account consumer preferences. The further system of cost management for the production of a product is built in view of the previously determined sales price. The implementation of the well-known Kaizen costing method together with the standard costing method allows to maintain the quality characteristics of the product while minimizing the cost of its production. Thus, when the product passes through the stages of the life cycle, statistical data on the level of costs accumulate, which is the basis for applying a normative method that will ensure the rationing of costs and, accordingly, their optimization at the stages of selling and utilization of the product project (Dhillon, 2009).

Organizational and economic issues, and principles and mechanisms of implementation and management of construction projects based on public-private partnership in Ukraine need to be improved. The existing commercial concession mechanisms do not reflect the specifics of contract construction and the complexity of implementing the life cycle of a construction investment project based on SPP. As such an updated organizational and economic mechanism and a practical way to implement SPP in construction, researchers and practitioners in the construction industry propose to create an organization based on a project approach, but of a fundamentally new type, notably the multiagent investment grouping (MIG) (Ryzhakov & Leichenko, 2021). MIG is an aggregated temporary structure of the project type that emerged as a result of the transformation of organizational and
production structures in construction and investment. MIG generates emergent properties basing on the principles of integration of association participants. This structure should function as a specific construction organization and a concession investment company at the same time. Thus, for the economic viability of concession relations, a balance between the cost of the entire service life of the facility, productivity and capital expenditures is important. The concept of the entire lifecycle leads to better solutions for the design, reconstruction and management of objects and assets, as well as provides savings throughout the entire lifecycle.

A principled approach to evaluating the entire life cycle of a real estate object combines knowledge, judgment and data to justify decisions about the future value for money in the long term. Discussion of the principles, methods, advantages and problems of using a comprehensive, systematic approach to the integral valuation of assets in the process of design, construction and operation based on an understanding of the concept of “life cycle of a real estate object” is important for all stakeholders in the real estate development market.

Along with the term “LCC”, the term “WLA” (Whole Life Appraisal) to denote assessment of the entire life cycle is used. WLA is a systematic consideration of all relevant costs, revenues, and outcomes connected with acquisition and ownership of an asset during its physical, economic, functional, operational, and design life (Flanagan, Jewell & Norman, 2005). Respective estimation of the costs that will be incurred over the entire life of an object is able to minimize overall costs by making the right decisions to balance initial capital expenditures with costs over the entire life of the facility. Thus, the terms LCC and WLA are synonymous, just in the name of WLA there is no word “costs”, because it is not only about costs, but also about results, and about evaluating the effectiveness of these costs over the entire life cycle of a particular property. You can add that the term WLA emphasizes coverage of a wider range of factors, including financial, environmental, social and technical aspects, facility management, and the building’s impact on users and the environment throughout the life cycle. The assessment of the entire life cycle should be integrated into the design process from concept to ownership. WLA should be built into the design process at an early stage to ensure the best quality-price ratio not only at the stage of delivery of the object to the customer, but also during the entire period of operation of this object.

It should be understood that the WLA concept does not guarantee an accurate forecast for estimating future expenses and revenues. The degree of accuracy of a forecast depends on the accuracy of available data and the ability to measure costs, revenues, and productivity. There is uncertainty in predicting future costs in the range of a large time horizon, that is, we are talking about the “problem of reliable data”. The credibility of the forecast is determined by a number of factors, but it is necessary to collect and analyze at least some information, since this turns out to be better than its complete absence. This is the list the factors that determine the reliability of the forecast:

- the level of the shadow economy in the country (very high for the post-Soviet countries);
- potential and degree of corruption risks;
- deficiency of strategic management at the level of state leadership;
- quality of the legal, legislative and judicial system in the state;
- the level of competence of the executive branch at all levels, including those of local self-government;
- lack of standardized information about the cost and performance of equipment and resources used;
- the level of competence and professionalism of managers and personnel of enterprises and business structures.

Even in the developed global economies, the concept of WLA is not very common due to a number of psychological and mental reasons:
- concern about the uncertainty of external macro and mesoenvironment, and the impact of future events on the life cycle of a project;
- lack of a sense of true connection and correlation between current money and money spent and received in the future. And the more distant this future is, the harder it is to apprehend this connection;
- splitting the cost of construction and maintenance of real estate objects;
- a diversity of customer requirements and priorities.

Responsibility for the proper operation and maintenance of the facility for a long time by the same team that financed, designed and built it will allow achieving not only economic, but also environmental efficiency.

A well-known procedure for accounting for the cost of future expenses at a given time is discounting, which should also take into account the impact of inflation when determining the discount rate.

For example, the dynamics of changes in inflation indices in the construction industry of Ukraine in comparison with the dynamics of prices for construction in recent years (increasing tendency) can be seen on the website of the Ministry of Finance. From the graph (fig.1.) it can be seen that the dynamics of the price index for construction works generally follows the dynamics of the inflation index over the past 7 years.

Price indices for construction works for the period (2015-2022) according to the Ministry of Finance of Ukraine are shown in Table 1 (Construction Price Index, 2022). The price index for construction works is an indicator that characterizes price changes over a period of time in construction (while implementing construction and installation works). This index shows changes in the cost of a fixed set of material resources in the current period compared to the previous or reference period. Material resources comprise building materials, products, structures, and energy carriers used in construction and installation work.

![Figure 1. Dynamics of changes in inflation indices and construction prices in Ukraine (01.2015-01.2023) (increasing total) (construction Price Index, 2022).](image-url)
Table 1

Price indices for construction and installation works (2015 to 2022), (%)*.

<table>
<thead>
<tr>
<th>November</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Over the year</th>
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<tbody>
<tr>
<td>2015</td>
<td>102.8</td>
<td>104.5</td>
<td>107.8</td>
<td>101.8</td>
<td>100.9</td>
<td>100.5</td>
<td>100.3</td>
<td>99.8</td>
<td>101.2</td>
<td>100.9</td>
<td>100.3</td>
<td>100.2</td>
<td>1122.8</td>
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<tr>
<td>2016</td>
<td>99.3</td>
<td>100.1</td>
<td>100.9</td>
<td>102.4</td>
<td>101.5</td>
<td>100.9</td>
<td>100.4</td>
<td>99.8</td>
<td>101.0</td>
<td>101.1</td>
<td>100.9</td>
<td>101.2</td>
<td>1099.9</td>
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<tr>
<td>2017</td>
<td>100.8</td>
<td>101.2</td>
<td>102.1</td>
<td>101.3</td>
<td>100.5</td>
<td>100.6</td>
<td>100.9</td>
<td>101.1</td>
<td>101.7</td>
<td>101.4</td>
<td>101.6</td>
<td>101.3</td>
<td>1115.7</td>
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<tr>
<td>2018</td>
<td>102.6</td>
<td>103.0</td>
<td>102.0</td>
<td>101.3</td>
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<td>100.5</td>
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<td>100.1</td>
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<td>2019</td>
<td>101.9</td>
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<td>99.8</td>
<td>99.2</td>
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<tr>
<td>2020</td>
<td>102.8</td>
<td>100.5</td>
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<td>100.7</td>
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<td>2021</td>
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* Index values are displayed in percentage in comparison to the previous month

Monitoring of changes in prices for material resources (excluding value-added tax) is carried out from a sample circle of construction organizations. The index of prices for construction works allows you to determine trends in price changes both in construction as a whole, and by types of buildings and structures – housing, non-residential real estate, engineering structures, transport structures, pipelines, communications, industrial structures, etc. Unfortunately, during Russia’s military aggression in Ukraine, which began on February 24 and continues in the present, statistic data in the construction industry have not been updated since March 2022. But for the war, on the basis of a representative array of statistical data, using econometric methods and economic-and-mathematical modeling, it is possible to predict the level of inflation in the construction industry with a sufficient degree of reliability (regardless of the specific country) and consider it when determining the discount rate. War is a terrible specific factor, but this article is about general approaches, principles, expediency of using the concept and, actually, the ideology of the WLA. There is not enough money in developing countries, so the concept of evaluating the entire life cycle of a project is not common. However, in projects funded by international organizations, such countries have to use WLA. The World Bank requires all investment assessments to include WLA before funding the project.

It should be noted that the discount rate should also depend on the degree of novelty and innovation of the development project. Thus, a percentage is added to the “nominal” discount rate, depending on the degree of novelty and, accordingly, the riskiness of the project. This percentage is called the risk premium. The risk premium, as the percentage by which the nominal or so-called “risk-free” discount rate increases, can be set taking into account various factors, such as the history of similar projects or its absence, market conditions, political risks, the financial status of the company/project participants, etc. It is added to the base discount rate used for risk-free projects to account for the additional risk connected with a particular project.

The base discount rate can be determined by the bank loan interest rate, the bank overdraft rate, or the weighted average cost of capital. Weighted average cost of capital (WACC) is the average price that a particular entity pays for the use of total capital generated from various sources, regarding the share of each source in the amount of the capital used. Hence, the estimated discount rate should be adjusted considering the level of inflation, which may vary...
for different types of resources and depends on the degree of innovation of the project. It is important to choose a methodology for discounting future expenses through the calculation of indicators such as Internal rate of Return (IRR) and Annual Equivalent Cost (AEC).

Property and asset management is a growing area of business that contributes to the development of an approach to managing costs and productivity over the entire life of a property. In Ukraine, the structures that provide services for finding investors and developers, including foreign ones, and supporting investment projects are professional associations, corporate investment funds (CIF) and companies with asset management (CAM). For instance, the Ukrainian Venture Capital & Private Equity Association (UVCA) was established to disseminate information about investment opportunities in Ukraine and provide multi-vector support to investors in every aspect of their activities starting from information support to establishing international contacts and communication with the government. By building a link between the Ukrainian and global venture ecosystems, UVCA uses the experience and expertise of foreign partners, promotes the development of the domestic market, activating the flow of capital and information. UVCA is a member of “Invest Europe” (We invest in Ukraine, 2023).

Corporate investment fund (CIF) is a legal entity that is created in the form of a joint-stock company and carries out exclusively joint investment activities. CIF is a form of the institution of common investment. The activity of venture ICI is impossible without CAM functioning, which manages the assets of such funds on the basis of an appropriate license, which allows to carry out such activities. This activity in Ukraine is licensed by the National Securities and Stock Market Commission (NSSMC). CAM can act as a conductor and performer of the WLA technique. Asset management companies in the Ukrainian market provide the following services:

- search for investors through ads for placing investment certificates of funds;
- development of the investment strategy of funds, formation of investment declarations of funds;
- formation (creation) of venture capital funds, advising potential investors, assistance in selecting funds that best meet the expectations of clients (the ratio of potential returns and risks according to the investment declarations of funds managed by CAM);
- search and revision of investment proposals (projects) of enterprises, negotiations and study of personal qualities of entrepreneurs, analysis of the management team of a potential enterprise, which is the recipient of venture capital;
- detailed study of investment proposals, determination of investment risks, development of measures aimed at minimizing them;
- study and forecast of possible income of the fund, the payback period of investments for each project, changes in the cost of investments in each project;
- strategic corporate management of invested enterprises, advisory support of enterprises, notably regarding directions, search for opportunities for enterprise development, market research, etc.;
- personnel recruitment for enterprises;
- drafting medium-term plans for the development of invested enterprises, control and regulation of financial activities of venture fund enterprises, continuous analysis of the reports of invested enterprises;
- search for exit strategies and arrangement of the withdrawal of venture investors from investment projects.

It is necessary to specifically consider the problem of reconstruction, management, and maintenance. From a technical point of view, obviously, it is necessary to start with an assessment of the current physical condition of the property. Depending on the type of an object (housing, public buildings, infrastructure, or engineering structures) and form of their ownership, different approaches should be used, and the implementation of the WLA concept or the elements thereof will require transformation.

It seems that the experience of creating associations of co-owners of multi-story buildings (ACMSB) in post-Soviet Ukraine, as well as in a number of other countries of the former Soviet Union, is poor. Outdated, worn-out housing stock in the type of buildings called “stalinki” and “khrushchevki”, whose age is more than 60-70 years, is transferred to the management of residents of privatized apartments in these buildings, whose interests are represented by the ACMSB board, elected at the general meeting of ACMSB residents. At the same time, ACMSB is not the owner of the land on which the house is located, the land remains the property of the state. The head of an ACMSB elected by the management board is a person who lives in this house and performs the duties of its head on a voluntary basis, or for a small fee according to an employment contract. There is a practice when Chairman of the management board of ACMSB receives a salary amounting to UAH3200 per month (approximately EUR 80) agreed at the general meeting of tenants of ACMSB. In this case, he/she works 5 days a week for 1 hour; hence only 5 working hours per week. It is obvious that the solution to numerous communal problems in an old house requires much more time, effort, professional knowledge, and a scope of hard and soft skills. At the same time, according to the law, ACMSB is not responsible for the obligations of co-owners, and disputes that arise can be resolved in court in line with the current legislation. If co-owners hire an external manager of their apartment building, they are not legally responsible for his/her miscalculations and mistakes. Such an external manager (but he can also live in this house) according to the law of Ukraine “On the peculiarities of the exercise of property rights in an apartment building” there may be an individual entrepreneur or a legal entity, notably a business entity or a legal person, who under a contract with co-owners, ensures proper maintenance and repair of the common property of an apartment building and the adjacent territory as well as and proper living conditions and responding to household needs (Law of Ukraine, 2015). Consequently, unspecified responsibilities combined with the accumulated technical and engineering problems of outdated residential real estate hinder the attraction of effective investors, contractors, and developers to revitalization of residential real estate of this age and type. At the same time, the lion’s share of housing in post-Soviet countries, which now belong to the category of third world countries, belongs to this category.

Analyzing the current state and status of residential property management in Poland, neighboring Ukraine, it can be stated that housing in this country is either the property of a condominium (pl.: Wspólnota Mieszkaniowa (WM)), or the property of a housing cooperative (pl.: Spółdzielnia Mieszkaniowa (SM)). Condominiums are usually established during the construction of new homes by the developer, while houses owned by cooperatives are primarily real estate built by the state in times of socialist Poland, for instance, large
panel houses. The land on which the new house is built belongs to the condominium, and the land on which the cooperative house is located belongs to the state at the municipal level (represented by the city or “gmina” (pl.: community), and the residents pay rent to the cooperative for the right to use the land for 99 years.

Returning to Modern Ukraine, it should be noted that one of the factors contributing to the implementation of the LCC concept in the construction industry and in development activities in our country is the existence of the Unified State Electronic System in the Field of Construction (USESFC), which was created in cooperation with the Ministry of Community Territories and Infrastructure Development, and the Ministry of Digital Transformation of Ukraine with the support of the USAID/ UK aid Project “Transparency and Accountability in Public Administration ad Services” (TAPAS) implemented in collaboration with the East Europe Foundation (The publication of construction data, 2023). This electronic system was created in accordance with the law of Ukraine “On regulation of urban development activities” as a single information and communication system within the Urban Development cadastre, which ensures creation, viewing, sending, accepting, collecting, making, accumulating, processing, using, reviewing, storing, protecting, accounting and information provision in the construction sector, as well as electronic interaction between individuals and legal entities, state bodies, local government bodies, administrative service centers to obtain services stipulated by this law in the construction sector.

A powerful tool for implementing the concept of LCC and WLA in construction is BIM (Building Information Modeling) technology. It is a technology and process used in architecture, engineering, and construction to create and manage digital representations of physical buildings or infrastructure projects. The BIM model serves as a shared knowledge resource for all stakeholders involved in the project, including architects, engineers, contractors, and facility managers. This allows them to collaborate, coordinate, and make informed decisions throughout the entire life cycle of a building or infrastructure project, from design and construction to operation and maintenance. BIM brings together a variety of data sources and disciplines, enabling better analysis, modeling, and evaluation, such as energy analysis, structural analysis, and cost estimation. BIM supports building or infrastructure project management throughout the entire lifecycle, from initial design to demolition, including facility management and maintenance. BIM helps optimize projects, improve the sequence of construction and installation works and reduce material waste, which saves time and, consequently, money.

CONCLUSION

The concept of estimating and managing the value of the entire life cycle of real estate objects. Life Cycle Costing (LCC) and Whole Life Appraisal) (WLA) is a philosophy of socially responsible and, at the same time, cost-effective way of doing business in the field of contract construction and development. This concept requires a strategic and state-oriented perspective on the creation and operation of tangible assets, notably fixed assets of any form of ownership. Evaluating the efficiency of not only capital investments in the creation of a real estate object and current operating costs, but also a comprehensive assessment of the efficiency of operation and maintenance of this object throughout its entire life cycle.
from the project to demolition/revitalization, taking into account the aspects of energy saving and environmental friendliness, is a complex but very urgent task for any state in the modern world. In the residential real estate sector, an attempt to control the entire life cycle of a residential building is the creation of condominiums / associations of co-owners of multistorey buildings, but depending on the status of the country’s economy, the perfection of the legislative framework and the level of financial inclusion, the success and efficiency of such structures differ significantly.

Advanced economies have extensive experience in applying the LCC and WLA concepts and feel the economic and environmental impact of their implementation. Third world countries will sooner or later be forced to study and understand the feasibility and benefits of using these concepts in practice.

The problems of implementing the LCC and WLA concepts comprise legal, investment, financial and socio-economic context, as well as mental, psychological and even ideological aspects. An investor who invests in a real estate object today wants to get Return on Investment (ROI) quickly and in planned amount. Responsibility and interest spread across different individuals or legal entities at various stages of the life cycle of a real estate object is the main obstacle to implement concepts for evaluation and value assessment of the entire life cycle of real estate objects. This obstacle can be overcome through legal and organizational-and-economic improvement of the functioning of such institutions as asset management companies, joint investment institutions, improvement of public-private partnership concession mechanisms, digitalization of construction industry databases and introduction of BIM technologies.

The materials and considerations outlined in the article can be useful for development companies, asset management companies, institutional and private investors, engineering companies in the construction sector, and condominium management.

REFERENCES


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