Organizational issues during the liquidation of buildings

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Abstract. In the presented study, an analysis of issues related to the organization of construction processes during the liquidation of buildings under various conditions was carried out. The main questions in this case are questions of analysis of the initial data, questions of the choice of means of mechanization and the selection of the numerical and qualification composition of workers. In addition, the analysis of factors influencing technical and economic indicators is of great importance. Under the liquidation of objects means the demolition and dismantling of buildings. Demolition and dismantling of buildings can be carried out under various conditions. These conditions can be classified according to the following criteria: by the type of construction activity, within the framework of which the liquidation of the object is carried out; by type of objects to be liquidated; by designation of objects subject to liquidation, to which special conditions are imposed; according to the conditions of spatial limitation of the production of works; according to the conditions of the organization of work. Demolition and dismantling works are extremely dangerous for the life and health of people involved in the liquidation of the facility and the population living or located in close proximity to the construction site and also bear the risk of harm to the environment, movable and immovable property of individuals and legal entities, persons and engineering infrastructure. Therefore, to ensure the safety of the work performed, it is necessary to have a set of standards that establish the rules for the design of organizational and technological documentation for demolition or dismantling, the performance of work during the liquidation of the facility and strict control over the implementation of technology and safety. The study of the processes of demolition and dismantling of buildings for residential and civil purposes showed that there are many unresolved issues related to the organization of this type of construction work. When organizing liquidation, it is necessary to make scientifically based decisions. The feasibility study is based on taking into account the influence of various factors on the construction industry and evaluating a set of solutions for planning the execution of work. The study of this issue will reduce the costs of organizing this type of work and make science-based decisions. The development of a technical and economic mechanism is a necessity for the development of the modern construction industry.

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Keywords: liquidation of construction objects, residential buildings, life cycle of buildings, cost costs of the construction object, demolition and dismantling of buildings, conditions for the organization of construction works, efficiency improvement

1 Introduction

In recent years, the development of the main directions of the national economy is associated with such areas as sustainable development, mobility and globalization. Preservation of the existing infrastructure and comprehensive improvement of the living environment is a priority in modern conditions. Socio-economic development is inextricably linked with these areas. The theory of sustainable development in many areas and spheres of life is aimed at creating harmony in the "man-society-nature" system. Urban planning is a process of creating a human environment, consisting of the environment of life and its subjects, one of which is the housing and civil fund. At the same time, the state of the housing stock is an indicator of the level of development. To maintain the proper condition and develop the quality of the housing stock, it is necessary to carry out major repairs, reconstruction and renovation of urban areas. The development of the construction industry entails the development of technologies used in the process of erecting buildings and structures. In addition to the traditional ways of performing, managing and controlling of works, flexible technologies are also emerging that prove their practical effectiveness in conditions of dynamism and intensification. The concept of renovation refers to the demolition of old dilapidated housing and the construction of a new one to replace the old one. The active development of the construction industry develops the latest technologies. However, construction practically does not focus on improving demolition technologies.

Development cycles and changes in possible priorities in urban planning determine the need for the renovation of territories and their sustainable development. Under these conditions, spatial restructuring is formed. One of the main directions in the field of spatial restructuring is the renewal of the built-up area. In order to develop the investment and construction process and urban planning activities, the development of a mechanism for the renovation of urban areas is of particular importance. The problems of cyclic development in the field of spatial-territorial planning of territories were studied in the works. The development of the national economy with an eye to the implementation of strategic goals is inextricably linked with the field of study. The dynamics of modern economic processes requires not just taking into account external factors and existing problems, but forecasting changes, modeling systemic changes. The intensive development of new technologies, purposeful investments in the economy, the transformation of the industrial, transport, energy and housing and communal framework of fixed assets set a new pace for construction. Its ultimate goal is to create a real estate sector that ensures balanced spatial development. In the face of increasing competition for high-quality human resources necessary for the development of modern civilization, the requirements for the quality and comfort of residential premises are undergoing dramatic changes. At the same time, one of the main objectives of this study is to provide some insight into the principles of integrated approaches to the formation of a viable urban environment. Based on the theory of sustainable development, economic theory, design and structural approaches, the authors propose a system of principles for the formation of a viable urban environment. Their novelty lies in taking into account the cyclical dynamics of the urban planning process in management, facilities and resources. Integrative use of structural approaches. The use of the proposed comprehensive principles will contribute to a significant acceleration of the urban development process. The study of questions devoted to the cyclical development of

real estate has been considered in many studies [1-5, 17-20]. However, many questions remain for further study.

2 Methods

Object of study: construction processes during the liquidation of buildings (demolition and dismantling of buildings). Subject of study: organizational and economic relations arising from the demolition and dismantling of obsolete capital construction projects. The purpose of study: the development of cost-effective mechanisms for the implementation of technical solutions in the field of the use of innovative technologies for the demolition and dismantling of buildings for civil purposes in under different conditions. The methods of theoretical analysis of scientific and normative-technical literature, general scientific methods and the method of expert assessments were used in the work. Scientific and technical hypothesis: the possibility of implementing renovation plans with the help of a cost-effective mechanism that allows you to reasonably make decisions on the demolition and dismantling of buildings. The theoretical and methodological basis were the works of scientists in the field of liquidation of construction projects. Regulatory and legislative acts, methodological documents on the issues of repair, reconstruction, housing construction, as well as scientific publications of the periodical press on the problems of liquidation of capital construction projects were used. To substantiate the provisions put forward in the dissertation, methods of logical and economic-mathematical analysis were applied, elements of a systematic approach and mathematical methods for processing statistical data, the method of multiple correlation and the method of expert assessments were used. The information base for the evidence of the main provisions of the study, the reliability of the conclusions and recommendations were statistical and analytical materials, specialized reports, as well as information, analytical, statistical materials published in the scientific literature, periodicals.

3 Results

The life cycle of construction objects affects not only the development of the project, construction, direct operation, but also their subsequent demolition. Due to the steadily growing trend towards renovation and reconstruction of former, now non-functioning, industrial zones, the need for cities in free territories, as well as the dismantling of damaged, emergency and decommissioned buildings, the importance of demolition is not only as important as the construction of new structures, but also shows an increase in demand, which is shown by modern scientific and technical research. In the process of creating construction products, long-term and short-term, material and intangible, primary and secondary, permanent, periodic and episodic, production and consumer, and many other types of cycles arise and interact. The following types of cycles are of particular importance in construction: construction; design; the life cycle of real estate; investment; innovative [19].

The above cycles are supplemented by many life cycles of participants in investment and construction activities. Their range is truly enormous. These are business entities, government agencies, financial and public organizations, citizens. Understanding that the plurality of cycles creates and fills the cyclical dynamics of investment and construction activities, in most studies is only declarative. At the same time, the targeted focusing of cycles of different nature predetermines the quality of development. It varies depending on

the nature of the development trajectory. Limit trajectories can be both accelerated, realizing the synergetic potential of cyclical dynamics, and destructive, requiring constant correction and additional costs [5].

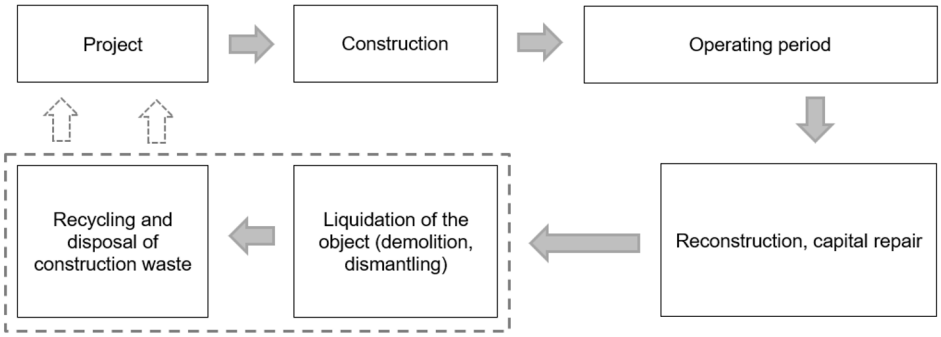

Fig. 1. The main stages of the life cycle of a capital construction object.

The cyclic nature of economic phenomena is not only its inherent property, but also the subject of economic analysis. Modern forms of managerial decision-making require the analysis of many cycles that correspond to all types of activities. In the investment and construction sector, accounting and coordination of such cycles as construction, design, investment, procurement, reproduction, leasing are necessary both in terms of the need to synchronize them and in terms of determining the nature of the industry and development trend. The analysis showed that investment and construction activity is characterized by three main types of development. Increased strength is inherent in high levels of cyclic synchronization. Degradation trends are the result of mismatched cycles. Stabilizing properties are inherent in normal modes that maintain pre-existing relationships and periodic correlations. Studying the cyclicality of investment and construction processes is impossible without understanding their dependencies. The principle of synchronization and subordination of cycles should be used not only for the design of economical systems, but also for the development of management tools. The problem of the cyclical development of scientific schools and innovative ideas in the field of spatial and territorial development of real estate has been studied. The stages of the cycle are studied on the example of the architectural direction. This made it possible to identify needs and opportunities for the development of new technological platforms and create effective forms of public-private partnership [20].

To monitor and adjust the cost of actual periodic costs during the planned period of operation of an efficient residential building at the cost of maintaining and consuming communal resources, a behavioral coefficient was developed. The coefficient takes into account deviations from the standards and is equal to the ratio of the sum of planned costs for the entire life cycle of an efficient house, calculated according to regulatory documents, for the planned period of its operation and the sum of actual indicators of the cost of periodic costs for the year. Land turnover management in the investment and construction sector implies a whole list of tools for regulating all aspects of construction activity, from the analysis of an investment object from the beginning of its existence to obsolescence and physical deterioration, to the implementation and implementation of construction ideas, supported by an analytical analysis of their effectiveness [6,7,8]. The path to success lies only if all the above stages of implementation and management are observed. The development of a new mechanism will allow, due to the justification of organizational decisions and the use of new technologies at the design stage of an object, in the future to significantly reduce overall costs in the aggregate. As a result, this will lead to a significant reduction in the cost of the object. The total cost of the building in this case includes the

costs at all stages of the building's life cycle: design, construction, operation, disposal of building elements or the building as a whole [9,10]. The main costs in the process of the life cycle of a building for objects of standard series are presented in table. 1.

Table 1. An approximate estimate of the duration and cost of the main stages of the life cycle of a capital construction object (by the example of the life cycle of standard series buildings)

Project (design)	Construction	Operating period	Capital repairs, reconstruction	Liquidation of the object	Recycling and disposal of construction waste
1	2	3	4	5	6
1-2 years	1-4 years	75-100 years	till 1 year	till 0,5 year	0,2 year
1,4%	2,7%	95%	0,7%	0,3%	0,1%
~ 10 mill. r.	~ 150 mill. r.	~ 100 mill. r.	~ 50 mill. r.	~ 20 mill. r.	~ 10 mill. r.
3,0%	45,0%	30%	15,0%	6,0%	3,0%

The presented table shows approximate data on the costs during the life cycle of a building, including the creation, operation and liquidation of a residential building. The data was obtained as a result of the analysis of project documentation, statistical data on the repairs of this building and data obtained as a result of a technical survey. Calculation of the total cost of the main stages of the life cycle of a capital construction object:

$$C_{l.c.} = K_{L.}\left(\sum_{t_1}^{n}\frac{C_1}{(1+r)^n} + \sum_{t_2}^{n}\frac{C_2}{(1+r)^n} + \sum_{t_3}^{n}\frac{C_3}{(1+r)^n} + \sum_{t_4}^{n}\frac{C_4}{(1+r)^n} + \sum_{t_5}^{n}\frac{C_5}{(1+r)^n} + \sum_{t_6}^{n}\frac{C_6}{(1+r)^n}\right) \quad (1)$$

where n is the planned period of operation, t_1, t_2, t_3, t_4, t_5, t_6 are the duration of the periods of design, construction, operation and disposal, respectively, r is the discount rate, K_L is the liquidation rate.

The calculation is made in rubles, and the total cost is divided into two groups of costs:

1) non-recurring construction and commissioning costs:
- design cost;
- the cost of construction and installation works, including materials.

2) periodic costs during the planned period of operation:
- cost of maintenance, current and major repairs;
- the cost of consumed communal resources.

In urban planning for the development and reconstruction of unbearable residential buildings, a guaranteed forecast of the increase in area and number of inhabitants is required due to the installation of inserts, outbuildings, superstructures and attics and, therefore, the reliability of organizational and urban planning measures to justify the feasibility of investing. However, there are no data for assessing the territorial reserve in the development of buildings by compacting them. For urban planning justification for the possibility of mass construction of additional floors of various design schemes and systems, there are no reliable methods for calculating the bearing capacity of residential buildings prior to their technical examination.

The development of a new model and mechanism will allow, due to the justification of organizational decisions and the use of new technologies at the design stage of an object, in the future to significantly reduce overall costs in the aggregate. As a result, this will lead to a significant reduction in the cost of the object. The total cost of the building in this case includes the costs at all stages of the building's life cycle: design, construction, operation, disposal of building elements or the building as a whole. So, the main task of the model is to estimate the final cost of the design solution of the future object, which will provide a low cost of ownership for the entire period of the object's life cycle. The final criterion for evaluating a building is the present value of ownership, equal to the ratio of the final cost to its planned operating period [11,12].

To make organizational and technological decisions when planning construction, it is necessary to take into account the requirements of regulatory, technical documents, which can be conditionally divided into groups:

1) to the composition of organizational and technological documentation;
2) requirements for labor safety, fire and environmental safety;
3) time and technical parameters of work performance;
4) requirements for the organization of the construction site;
5) organizational requirements for the production of work;
6) technological requirements for the production of works.

The above requirements must be taken into account when developing organizational and technological documentation. Demolition and liquidation of a building by one of the collapse methods with preliminary dismantling of technical systems and finishing elements. Dismantling and liquidation of a building (structure) by dismantling prefabricated and collapse of monolithic structures with preliminary dismantling of technical systems and finishing elements. In addition, another important issue in this type of construction is "Waste Management". Waste disposal - the use of waste for the production of goods (products), performance of work, provision of services, including the reuse of waste, including the reuse of waste for its intended purpose (recycling), their return to the production cycle after appropriate preparation (regeneration). To start this type of construction work, it is necessary to recognize the building as emergency. This may be done for various reasons.

Consider the main goals of the cause of demolition (table 2).

Table 2. The main goals of the cause of demolition

№	Objectives for demolition	Reasons for demolition
1	Profit or cost reduction	Territory Development Changes
2	Clearing the construction area	Economic reasons
3	Execution of the owner's decision	Outdated appearance of the object
4	Implementation of investor and developer plans	Change of technology and enterprise profile
5	Liquidation of objects that do not fit into urban planning standards	Elimination of consequences of accidents
6	Liquidation of abandoned territories	Building collapse due to natural factors

In addition, the concepts of demolition and dismantling are associated with the following terms: major repairs; reconstruction; rehabilitation (modernization); durability of buildings and structures; deterioration of buildings and structures; survey; technical condition of structures; working condition; working condition; limited working condition; invalid (inoperable) state; emergency condition; recovery; gain [13,14].

In some situations, the dismantling and demolition of a structure is much more difficult than the construction of new buildings. This may seem unbelievable. Therefore, it is considered necessary to consider such situations directly on the example of the reconstruction of a functioning industrial organization.

Preparation and organization of construction during the demolition and dismantling of buildings consists of several stages.

The main stages of the organization of work include:

1) stage-1. order of the executive authority (local government) "on decommissioning"; order of the owner of the object; court decisions and other grounds.

2) stage-2. scheme of project implementation and conclusion of contracts; preparation and conclusion of contracts for design and survey works; -preparation and conclusion of a contract for construction and installation work.

3) stage-3. development of project documentation; obtaining the necessary approvals and permits;

- confirmation by expert opinion.

It is worth emphasizing that it is necessary to form a special section of project documentation for the dismantling and demolition of a certain structure. The project documentation for the construction of a new building or the reconstruction of an existing one must include a project for the organization of work on dismantling and demolition. The specified project is formed directly by the design organization. It is in this document that the stages of the implementation of certain works are noted, which, in turn, ensure the full safety of the premises, and also determine technical and technological solutions. In the project organization of work, the design organization evaluates the situational location of objects. In the event that the object to be demolished is located in a densely populated urban area or on the territory of a functioning organization, then the first step is the safety of residents of nearby houses or employees working in the organization, surrounding structures or landscape. And in direct dependence on this, the choice of technology for the production of works is already being carried out. In the process of implementing project activities, one of the significant roles is played by employees of the contractor, which directly dismantles certain structures. Depending on the experience and high qualification of engineers and employees of this organization, both safety and labor intensity of work come exactly. For example, employees with extensive work experience will offer the most appropriate method of work in order to achieve the desired result at the lowest cost to the company [15,16].

Carrying out the dismantling of structures in a densely built-up area is a rather complicated and painstaking process. This is due to the fact that it requires the selection of the necessary equipment and specialized equipment that is required for dismantling. Specialists in the field of construction carry out the planning of dismantling and form absolutely all the necessary documentation for this. It is a project and plan prepared in advance that will save time and money for the client, and in addition, increase the safety of employees in the process of carrying out various construction works. Thus, the dismantling and dismantling of these structures must be carried out without fail, taking into account all the requirements and norms existing in this area. When preparing, the structure itself is also taken into account, and at the same time the territory adjacent to this structure, its location, the current state of the object, the presence or absence of any communications at the object, and much more. When manually dismantling brick structures, hand tools are used, and at the same time, all kinds of devices.

When organizing the demolition and dismantling of buildings and structures, the following main stages can be distinguished:

1) preparatory stage. At the stage under consideration, the territory on which the building is located is necessarily fenced off from absolutely all sides. At this stage, it is required to open an order that will directly grant the right to carry out construction work in the future.

2) the second stage. With the help of all kinds of specialized equipment, the demolition of the bearing walls of the structure and the ceiling is carried out.

3) the third stage. The presented stage is the most difficult, since it concerns the disassembly of the structure by the manual method. Workers manually carry out the demolition of the foundation, and at the same time they carry out the analysis of existing blockages and metal structures. It should be noted that sometimes only manual dismantling of structures is possible, in other words, without the use of additional equipment.

4) the final stage. As part of this stage, it carries out the removal of accumulated construction waste with its further disposal. It should be noted that the cost of dismantling directly depends on the amount of work performed. For any type of work that is

interconnected with a large amount of destruction, the requirements that apply to fire and environmental safety are mandatory [4].

The liquidation of construction objects can be carried out under various conditions. These conditions can be classified according to the following criteria:

1) by type of construction activity, within the framework of which the liquidation of the object is carried out: renovation, modernization, retreat, reconstruction, overhaul, conservation of the object.

2) by type of objects to be liquidated: objects of industrial, non-industrial purposes, linear objects.

3) according to the purpose of the objects to be liquidated, to which special conditions are imposed: objects of cultural heritage, especially dangerous, technically complex and unique objects.

4) according to the conditions of spatial limitation of work performance: liquidation of a part of the object (partial demolition, dismantling), liquidation in cramped conditions.

5) according to the conditions of organization of work: the liquidation of objects in the conditions of destroyed territories that have a technogenic and anthropogenic character.

Demolition and dismantling works are extremely dangerous for the life and health of people involved in the liquidation of the facility, and the population living or located in close proximity to the construction site, and also bear the risk of harm to the environment, movable and immovable property of individuals and legal entities, persons and engineering infrastructure. Therefore, to ensure the safety of the work performed, it is necessary to have a set of standards that establish the rules for the design of organizational and technological documentation for demolition or dismantling, the performance of work during the liquidation of the facility and strict control over the implementation of technology and safety. The most difficult problems that arise in the course of demolition work are the generated noise and dust. In this regard, legislative restrictions were adopted in the field of their formation and distribution, both at the regional and federal levels. On the territory of the country, there are regulatory legal acts in the field of noise and dust control, which ensure the principles of safety and health of workers directly at the construction site, which also establish the classification of noise; determine and standardize the parameters and maximum permissible noise levels at workplaces, permissible noise levels in the premises of residential, public buildings and on the territory of residential development.

4 Conclusions

Thus, the regulatory and legal support of organizational and technological their dismantling parameters are represented by a complex of interrelated regulatory, legal and methodological documentation that ensures efficiency, safety and quality at each stage of dismantling operations (survey, design, liquidation of the facility, waste disposal). Analyzing the regulatory and methodological documentation in the field of organizational and technological parameters for the dismantling of large-panel residential buildings of the first mass series, we can draw the following conclusions and practical recommendations on the quality of domestic legislation:

- it is not possible to determine the standard duration of dismantling of buildings for housing and civil purposes for each individual series or for each individual element of the building of this series, which is necessary for the accurate development of work schedules in the organizational and technological documentation;

- there are no prices for determining the composition and consumption of materials, machines and labor costs of workers, machines and mechanisms for many structural elements of residential buildings when calculating estimates and costing for dismantling work;

- it is required to introduce in the form of separate collections into the existing documentation the normative duration and prices to determine the composition and consumption of materials, machines and labor costs of workers, machines and mechanisms during the dismantling residential buildings;
- it is necessary to update the regulatory documentation in the field of organizational and technological parameters in order to replace outdated methods of work with modern, more progressive and popular technologies with modern mechanization tools;
- it is necessary to develop a unified methodological documentation, which would include with graphic illustrations all the necessary organizational and technological measures, labor protection and safety, labor costs, mechanical equipment and material consumption that require dismantling during production;
- introduction of amendments to the domestic legislation in the field of urban planning on the need to develop organizational and technological documentation for the demolition and dismantling of capital construction projects, as well as the possible processing and disposal of construction waste, at the design stage of an object during the implementation of an investment and construction project.

The study of the processes of demolition and dismantling of buildings for civil purposes in the conditions of urban areas showed that there are many unresolved issues related to the organization of this type of construction work. In order to preserve the urban structure and the integrated development of the living environment, it is necessary to carry out work on the phased renovation of the urban territory. When organizing this process, it is necessary to solve many problems and make scientifically based decisions. The feasibility study is based on taking into account the influence of various factors on the construction industry and evaluating a set of solutions for planning the execution of work. The development of an organizational and economic mechanism for the demolition and dismantling of buildings for housing and civil purposes in the conditions of renovation of urban areas is necessary in modern conditions. The study of this issue will reduce the costs of organizing this type of work and make science-based decisions. The development of a technical and economic mechanism is a necessity for the development of the modern construction industry.

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