

## ASSESSMENT OF THE QUALITY OF MANAGEMENT OF THE RECONSTRUCTION OF AN IMMOVABLE OBJECT OF HISTORICAL DEVELOPMENT OF THE CITY

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**Introduction.** The housing stock of the city of Odessa is quite diverse [1; 2]. This diversity is due to the change over time of such characteristics and parameters as purpose, architectural and planning decision, configuration in the plan, availability of engineering networks, number of floors, location of the building on the site, and others. All these characteristics have undergone significant changes over time due to the development of capacities and capabilities of the construction base, functional requirements, construction traditions and trends [3; 4].

An economic criterion for the preservation and modernisation of an existing building is the comparison of the construction of old buildings with new ones that have similar urban, technical and architectural characteristics (area, degree of improvement, capitalisation, number of floors, etc.). In this regard, for the economic evaluation of each old building, it is necessary to take into account the general mode of reconstruction in the given territory, that is, the density and reliability of the building, its functional and historical and cultural [1; 2].

The value of the historical environment and territory in the central part of Odessa imposes a number of restrictions on the location, size, configuration, architectural solution of the building, technology of work, which leads to a 1.5–2 times increase in the price of new construction, and accordingly increases the economic expediency of preservation and modernisation of old buildings.

Therefore, it is proposed to create in the city of Odessa the "Corporate scientific and technical complex town-planning power reconstruction "CSTC T-PPR" as an innovative organisational structure, which will use in practice the accumulated scientific and technical potential for reconstruction of the buildings of the historical development of Odessa according to energy efficiency standards, taking into account the foreign experience [1; 2]. The criterion for the preservation and modernisation of an existing building is a comparison between the construction of old buildings and new buildings with similar urban, technical and architectural characteristics. The economic criterion for determining the general regime of reconstruction is the efficiency of the use of the territory. The final technical and economic analysis is based on cost documentation and comparison with similar reconstruction projects [5].

**Analysis of recent research and publications.** Reconstruction is a continuous process that takes place differently in each city, depending on previous growth and modern needs [1; 3; 6–9]. This determines the meaning of

the city as a historical phenomenon in which different epochs are intertwined [3; 4; 12]. The main tasks of reconstruction include not only prolonging the life of buildings, but also eliminating physical and moral wear and tear, improving living conditions [3], equipping residential buildings with modern technical equipment [8], increasing operational characteristics [7], improving energy efficiency [11] and architectural expressiveness [1; 3; 4; 10].

The economic evaluation of the progress of work is the basis for the evaluation of construction management [2; 5; 12–15]. Management expertise is defined as a study of the quality of the management process and drawing a motivated conclusion about it, which is used for the purpose of further influencing both the management object and (or) the management subject [14]. The main objective of management expertise is to assess the quality of the management system as a whole, i.e., the whole set of elements, namely: the subject and the object of management, connected by information flows circulating between them. The pragmatic aim of management expertise is to increase the efficiency and quality of property management at all stages of its life cycle. The conclusion on the quality of the management process must either confirm trust in the subject of management (accredit it) or express distrust in it (not accredit it). The subject of management expertise is therefore the analysis of the quality of management.

The defining argument of any process in general, and of management processes in particular, is time [14]. It follows that the study of any process means the dynamic fixation of its essential characteristics over time [5; 12; 15]. The set of dynamic characteristics of the management object is conventionally defined as the management trajectory [16]. In the general case, i.e., under the influence of unaccounted environmental influences, there will be a discrepancy or, in other words, a divergence between the planned state of the management object and its actual characteristics. The size of the gap between the actual and the planned state is the basis for concluding on the quality of management and for making the appropriate management decision. A systematic approach that focuses on a comprehensive assessment of all essential characteristics of the management object is important for management expertise.

The tasks of management expertise follow from the analysis of general management functions. Regulatory influences due to general functions such as planning, organisation and regulation are transmitted directly from the subject to the object of management. Information about the state of the managed object is transmitted via feedback (control function).

Describing the development of a construction project is an informationally complex process because it depends on a large number of influencing characteristics [5; 12; 13; 15; 16]. Therefore, at the planning stage, a modelling methodology is used that predicts the change of not all, but only some of the process characteristics [16]. No model can be completely identical to the original, especially since in the situation under consideration the original can only appear in the future. In general, the control models considered are homomorphic, because the ambiguity of their representation, unlike isomorphic models, only works in one direction. It follows that the model of the management process can more or less unambiguously determine the future properties of the original, but the regression (return or projection) of the properties of the original to the initial properties can have multiple interpretations. However, despite their fundamental similarity to models of management processes, they allow for the systematic (albeit often qualitative) description of management objects and the planning of management decisions on this basis.

The management unit thus performs general management functions through the modelling methodology. Therefore, the main objective of management expertise is the task of analysing models:

- management process of construction planning;
- organization of its resource support;
- process implementation control;
- regulation, as a process of direct influence on the object of management.

In general, the modelling of management processes allows for some multivariation [14; 17]. However, in practice, one of the possible models is used for a specific situation, which must meet the following main requirements:

- maximisation of the adequacy (relevance) of the original;
- adaptation (adjustment) to changing conditions, i.e. its reliability over time;
- effectiveness, both in terms of achieving the objective and in terms of the costs associated with its use.

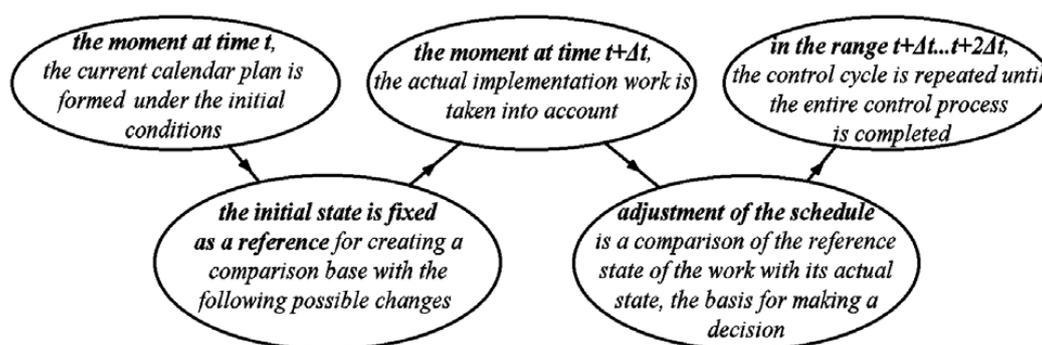
**Objectives of the article:** to study the method of measuring the quality of management as a simulation of the function of calendar planning and management on the example of the calendar plan "Management of the reconstruction of a real estate of the historical building of the city of Odessa".

**Research methods:** modelling of the function of calendar planning and management (model of the management process – calendar plan), assessment of the timeliness of works, as well as universal methods of statistical modelling.

**The main material of the study.** Any general process of managing the immovable property of a historical monument consists of managing individual interdependent processes: organisational, labour, information and others. A generally accepted way of their dynamic representation is a calendar plan. The calendar plan is such a project document, which dynamically (i.e. in time) displays the terms and costs of works [5; 18–21]. The most visual form of the schedule is the graphic one. It is widely used in the form of a linear schedule (Gantt chart). In terms of content, the calendar plan systematically combines technology, organisation and economy of construction production. Calendar plans are the basis both for the organisation of construction production and for project management [20]. Calendar plans are developed within the framework of the following projects: the business plan of an investment construction project, the project of construction organisation, the project of investment justification, offers for their submission to subcontracting, the project of work execution, technological maps and others [5; 18; 19]. The schedule is also the basis for preparing the construction financing schedule and the cash flow schedule related to the evaluation of the economic viability of the project [19; 21].

The first stage of calendar planning involves choosing a work organisation model that best meets production needs and specific economic and technical conditions. Depending on the existing conditions, an organisational and technological scheme is determined, which is the basis for the development of a calendar planning model. The organisational and technological scheme mainly determines the topological setting of the calendar planning task, as well as essential conditions, criteria and restrictions. The methods and ways of organising works are determined by the specific conditions of construction, the way of connecting works in their technological sequence, in time and in space [17–19]. The creation of an organisational and technological scheme for the construction of an object is a complex creative process that requires a highly qualified specialist in the field of construction schedule planning.

For the implementation of the control function, arrays of data on the actual performance of works are intended [18; 20]. On the basis of control of the actual state of work performance, regulatory influences are formed, which are contained in the corresponding reformulation of the calendar plan. Therefore, the calendar plan reflects the dynamics of work performance and is a structure that is being rebuilt dynamically. This makes it possible to repeat general management functions in a complex management process at certain intervals (day, decade, month) (Figure 1).



**Figure 1. The sequence of actions within each cycle of management of an immovable object of a historical building**

*Source: developed by the authors to substantiate the complex management process*

The full completion of the management process is characterised in the calendar plan by determining the actual performance of all works, both in terms of output and cost [18; 20; 21]. It is natural that the initial calendar plan and its actual implementation will differ, and the assessment of this difference according to one or another criterion will also be an assessment of the management as a whole.

The criterion for assessing the quality of management will be explained. Consider the situation shown in Figure 2. According to the original plan, the work should be completed at the time  $T_p$  and at the cost  $C_p$ . In fact, this work was completed at the time  $T_f$  and at the cost  $C_f$ . The corresponding deviations from the plan are defined as  $\Delta T = T_f - T_p$  and  $\Delta C = C_f - C_p$ . The performance of each task for the management process as a whole

has a certain consumer value. As a first approximation, the consumer value is determined by its payment or simply by the cost of expenses.

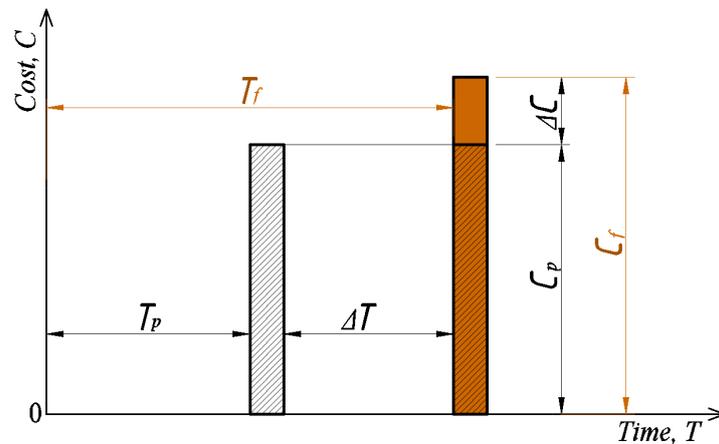


Figure 2. Main characteristics of work performance: *p* – plan; *f* – fact

Source: developed by the authors to justify the criterion for evaluating the quality of management

Discounting is used to bring different values to a single point in time, with the most common option being discounting at the beginning of the project. The evaluation scheme considered assumes that the evaluation of management quality should be determined by calculating the net discounted investment. This indirectly determines the current consumer value of the project, and the higher it is, the more effective the management process will be.

The planned net discounted investments  $NPI_p$  (Net Profitability Index) have the following form:

$$NPI_{p,i} = \sum_i C_{p,i} (1 + E)^{-T_p}, \tag{1}$$

where *i* is the ordinal index of the work performed; *E* is the discount rate, according to which the economic efficiency of the project was planned.

The actual fact is net discounted investment  $NPI_f$  (Net Profitability Index) looks like this:

$$NPI_{f,i} = \sum_i C_{p,i} (1 + E)^{-T_p - \Delta T} - \sum_i \Delta C (1 + E)^{-T_p - \Delta T} \tag{2}$$

When individual works are carried out, their cost may exceed the planned cost. It is obvious that this circumstance reduces the corresponding consumption value, and therefore the second term of this calculation formula enters with a negative sign. If the actual cost of paying for the work is less than the planned cost, this means that an additional cash flow has been generated, which increases the current consumption value.

The relative efficiency of *REM management* (Relative efficiency of management) is generally determined by the ratio of actual to planned net discounted investments:

$$REM = \frac{NPI_f}{NPI_p} \tag{3}$$

The value of the management index fluctuates around one, and its increase indicates greater management efficiency.

Let's consider the modelling of the management function as calendar planning, which includes the calculation of the management quality index on the example of the conditional calendar schedule presented in Figure 3 under the title "Management of the reconstruction of an immovable object of the historical building of the city of Odessa".

Despite the fact that the calendar plan is a dynamically developing system, two of its events are defined as invariants of this system – the general beginning of the basic plan and its general end. Usually, during the planning of the calendar, the general beginning of the basic plan is determined in a directive way, and the general end of the basic plan is determined by the sum of the general beginning and the normative-directive duration of the reconstruction. Usually, the actual start of the reconstruction coincides with the planned start, and the actual end of the reconstruction depends on the actual performance of all the works and generally shows a deviation from the set goal. Therefore, the optimal control should be designed to minimise this deviation. In

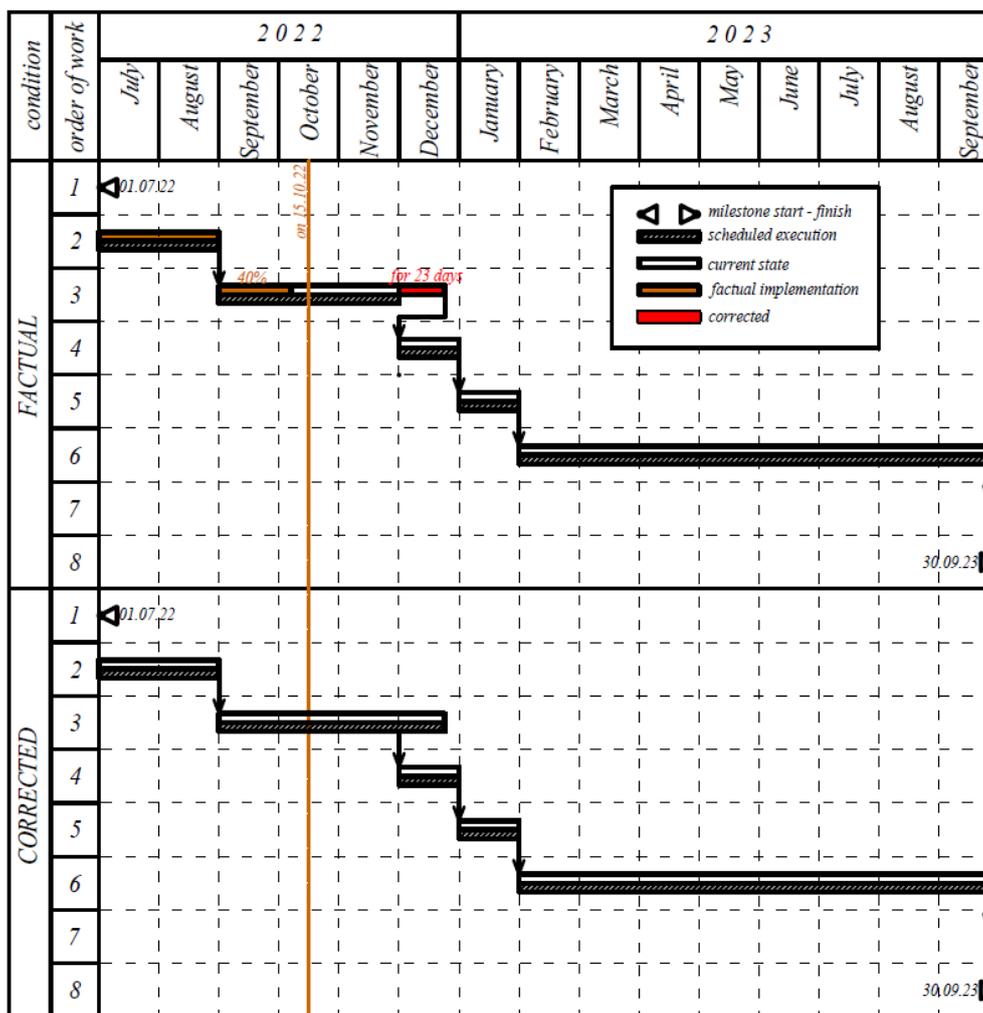


Figure 3. Linear calendar graph "Management reconstruction of an immovable object of the historical building of the city of Odessa"

Source: developed by the authors on the basis of modeling management decisions of CSTC T-PPR

project management systems, it is accepted that works that do not have a duration and are only the result of some event are called milestones. Accordingly, in Figure 3, the basic start and finish of construction, reflected by the corresponding milestones, are indicated by triangles.

Between the beginning and the end of the reconstruction, the following works are planned (Table 1).

Table 1

The information and calculation part of the calendar plan

№ n/n	Name of works	Duration, days
1	General start of the basic plan	01.07.2022
2	Obtaining permits and drawing up a design task	60
3	Development of design and technological documentation	90
4	General organizational and technological training	30
5	Preparation for reconstruction of objects	30
6	Reconstruction (performance of construction and installation works)	23 5
7	Commissioning of the reconstructed facility	5
8	End of the basic plan in general terms	30.09.2023

Source: developed by the authors for the modeling of management decisions of CSTC T-PPR

According to the example, all the listed works will be carried out sequentially. When displaying the linear calendar schedule "Management of reconstruction of the immovable object of the historical building of the city of Odessa" (Figure 3), the following graphic means of presenting works on a time scale are used: to display the works according to the basic (reference) calendar schedule, the lower shaded rectangle is used; the upper unshaded rectangle is used to display the current state of work; coloured shading of a part of the current state of work is used to display completed parts of the work.

Consider the actual status of the reconstruction as of the control date of October 15, 2022. According to the reference calendar, by this date the second work (obtaining permits and drawing up a design task) should be completed in full, and the third work (drawing up design and technological documentation) should be 50% complete. As a matter of fact, by this date 100% of the 2nd work (obtaining permits and elaboration of design task) has been completed, and only 40% of the work on elaboration of design and technological documentation for reconstruction of the immovable object of a historical building in Odessa. Considering that 50% of the time is spent on 40% of the work, it is reasonable to assume that the planned duration of the work will increase to 113 days. This will lead to a change in all the conditions of the subsequent works and an increase in the total duration of the reconstruction by 23 days. Thus, the implementation of the control function allows not only to record the actual state of performance of any work, but also to make a forecast of its further performance.

Therefore, a change in the date of completion of all subsequent works will lead to a change in the overall deadline for reconstruction, which is considered to be a negative phenomenon. Therefore, the decision-maker should influence the system in such a way as to minimise the consequences of the delay in the execution of the design works. One of the possible solutions is to extend the development of design and technological documentation to 113 days. In addition, two works are carried out in parallel for 23 days. After that, the calendar plan is recalculated and the work schedule shown in Figure 3 (actual) is obtained.

In order to implement the proposed regulatory influence, it is necessary to apply an administrative method of management, the essence of which is that the start date of the general organisational and technological preparation remains unchanged. The introduced corrective influence makes it possible to organise the achievement of the main goal in a new way and is characterised by the fact that the new calendar plan differs from the original plan (Figure 3, corrected).

Consider how to estimate this difference in the economic categories introduced earlier by determining the discount rate. It is determined at  $E = 30\%$  for the invested capital. The adjusted calendar plan differs from the original one in that the final payment for the completed work on the development of project and technological documentation is made in the 6th month (on the 24th day), and in the original one – at the end of the 5th month. If the amount of the payment is 2 million hryvnias, its delay will reduce the discounted investment before the beginning by 10,070 hryvnias. *IQM* management quality index calculated by formulas (1)...(3) = 0.99.

Once the current plan has been adjusted, it can be presented as a new baseline (Figure 3, corrected). Once the next inspection date has been set, if necessary, the whole process is repeated as described above.

**Conclusions.** It should be noted that the described method of measuring the quality of management allows the index of the quality of management to be calculated dynamically, taking into account iteration. Moreover, this index can be used to determine the degree of responsibility of the managers of specific works. The presented model of management quality assessment is appropriate because it is based on the modern concept of investment project effectiveness assessment. In principle, this model has the property of adaptability. However, it is necessary to take into account the dependence of the discount rate on time in order to obtain an optimal effect. Finally, the model is effective because it allows dynamic evaluation of the results of management activities and fairly detailed forecasts of the development of the management process.

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JEL M11, D20, L74

**Iryna Posternak**, Candidate of Technical Sciences, Associate Professor, Senior Lecturer at the Department of Organization of Construction and Labor Protection, Odesa State Academy of Civil Engineering and Architecture. **Serhii Posternak**, Candidate of Technical Sciences, Associate Professor, Technical Expert of Private Company "Composite". **Oleksii Posternak**, Student, Odesa State Academy of Civil Engineering and Architecture. **Assessment of the quality of management of the reconstruction of an immovable object of historical development of the city.**

The economic evaluation of the work in progress is the basis for the evaluation of the construction management. The planned course of management is designed on the basis of the actual determination of the initial state of object management and the expected forecast of its state in the future. The purpose of the study is to evaluate the method of measuring the quality of management as a simulation of the function of calendar planning and management on the example of the calendar schedule "Management of reconstruction of an immovable object of the historical building of the city of Odessa". The research was carried out by the method of modelling the function of calendar planning and management (a model of the management process – a calendar schedule) with the help of the assessment of the timeliness of works. It is proposed to create in the city of Odessa the "Corporate scientific and technical complex

town-planning power reconstruction "CSTC T-PPR", as an innovative organisational structure, which will use in practice the accumulated scientific and technical potential for reconstruction of buildings of the historical development of Odessa according to energy efficiency standards with the involvement of foreign experience. Any general process of management of immovable property of a historical monument consists of individual management of interdependent processes: organisational, labour, information and others. A generally accepted way of their dynamic representation is a calendar plan. As the calendar plan systematically combines the economy, organisation and technology of construction production and shows the execution of works in time, it is a dynamically regulated structure. The procedure described for measuring the quality of management allows the index of the quality of management to be calculated dynamically, taking into account iteration. Moreover, this index can be used to determine the degree of responsibility of the managers of specific works. The presented model of assessing the quality of management is adequate because it is based on the modern concept of assessing the effectiveness of investment projects. In principle, this model is adaptable. However, it is necessary to take into account the dependence of the discount rate on time in order to obtain an optimal effect. Finally, the model is effective because it allows to dynamically evaluate the result of management activities and to make fairly detailed forecasts of the development of the management process.

**Key words:** management quality assessment, economic evaluation of the progress of works, management expertise, calendar planning, a complex of urban planning and energy reconstruction, an immovable object of a historical building.

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JEL M11, D20, L74

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Економічна оцінка ходу виконання робіт є основою для оцінки управління будівництвом. Планувальна траєкторія управління проектується на основі фактичного визначення початкового стану об'єкта управління й передбачуваного прогнозу його стану в майбутньому. Мета дослідження полягає в оцінці процедури виміру якості управління, як моделювання функції календарного планування й управління на прикладі календарного графіка «Управління реконструкцією нерухомого об'єкту історичної забудови міста Одеси». Дослідження виконане методом моделювання функції календарного планування й управління (модель керуючого процесу – календарний графік) за допомогою оцінки своєчасності робіт. Пропонується створити у місті Одесі "Корпоративний науково-технічний комплекс містобудівної енергореконструкції «КНТК МЕРек», як інноваційну організаційну структуру, яка використовує на практиці накопичений науково-технічний потенціал для реконструкції будівель історичної забудови Одеси за стандартами енергоефективності з залученням іноземного досвіду. Будь-який загальний процес управління нерухомим об'єктом історичної забудови складається з управління окремими взаємозалежними процесами: організаційними, трудовими, інформаційними й іншими. Загальноприйнятим способом їхнього динамічного відображення є календарний план. Враховуючи, що календарний план системно об'єднує економіку, організацію та технологію будівельного виробництва, показуючи виконання робіт у часі, є структурою, що регулюється динамічно. Описана процедура виміру якості управління дозволяє динамічно розраховувати індекс якості управління з врахуванням ітерації. Більше того, за даним індексом можна визначити й ступінь відповідальності виконавців конкретних робіт. Представлена модель оцінки якості управління є адекватною, тому що базується на сучасній концепції оцінки ефективності інвестиційних проектів. Дана модель в основі має властивість адаптивності. Однак необхідно врахувати залежність норми дисконту від часу для оптимального впливу. І нарешті, модель ефективна, тому що дозволяє динамічно оцінювати результат управлінської діяльності та формувати досить детальні прогнози розвитку процесу управління.

**Ключові слова:** оцінка якості управління, економічна оцінка ходу виконання робіт, управлінська експертиза, календарне планування, комплекс містобудівної енергореконструкції, нерухомий об'єкт історичної забудови.