Strategy for the achievement of an effective life cycle of real property erection and operation

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Abstract. Strategic management of construction systems is a process of making decisions that combine goals setting, determination of long-term milestones and their improvement, determination of activity models, redistribution of external and internal resources of construction organizations to achieve the maximum effects of the life cycle of real property erection and operation [1]. Experts from various industries simultaneously participate in the strategic management of the real property life cycle: engineers, financial industry experts, economists, politicians and other participants in investment and construction activities capable of achieving goals and meeting requirements at all stages of real property erection and operation. A special role is played by indicators of the degree of project risks that arise in the course of external changes and can have a negative impact in the form of possible losses on the final results of project implementation. Risks in one form or another are manifested as changes in financial, technical, organizational and other aspects. Therefore, in the process of construction systems strategic management special attention should be paid to the state of risks.

1 Introduction

Strategic approaches to the development of an effective life cycle of real property have their own features of developing a strategy and managing a construction system taking into account stages of their implementation, which need to be substantiated in detail [2].

The full set of stages of real property development taking into account their efficiency is determined by the following time phases: construction phase I, payback period phase II, operation phase III, within the life cycle of the property (Fig. 1.):

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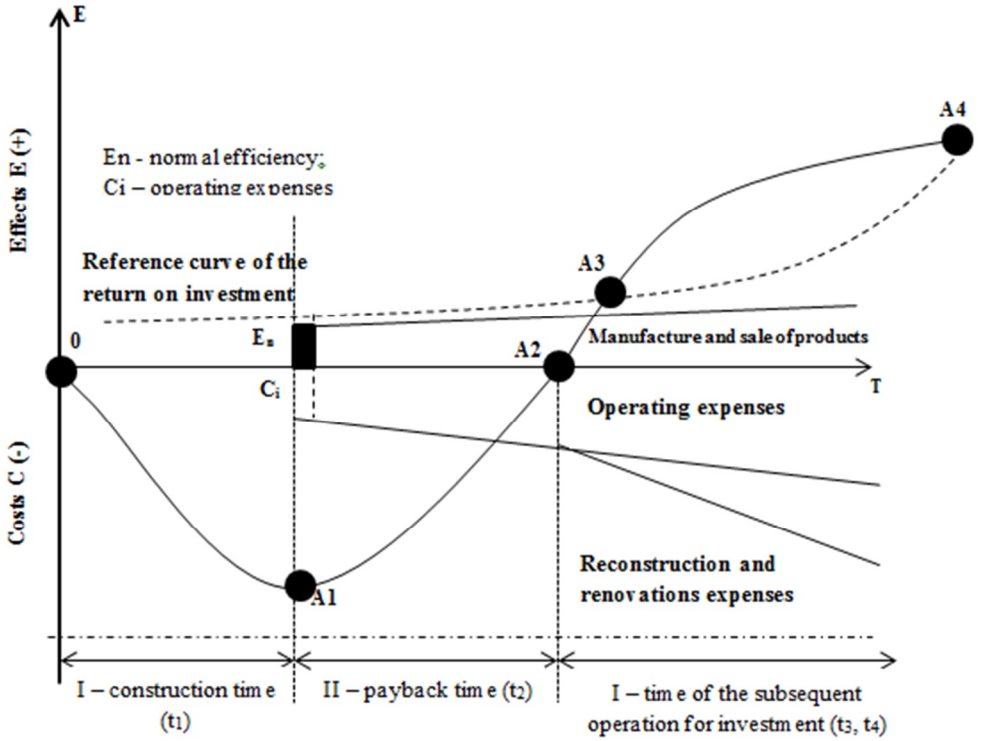

Fig. 1. Life cycle of real property construction and operation.

2 Materials and methods

To evaluate the efficiency of individual phases of the real property life cycle, it is required to proceed from the relevant costs and results of construction and operational periods of this property [3].

The construction and operation efficiency is evaluated during the entire life cycle of the property (starting from the feasibility study of the project (phase I) up to payback (phase II) and modernization (phase III)).

Phase I includes feasibility studies (design, development of technological staging, resource mobilization, concentration of capacities, and creation of the construction infrastructure). A comparison of the estimated costs in this case (C-) and their effects (E+) can be characterized by curve En.

Phase II characterizes reaching a projected production capacity during real property operation (reflected by curves A1A2 and A1′A2′). These curves with different rates of values change can be compared with the standard curve for the return of results. It is possible to determine the payback period of construction systems (prime and operating expenses) using this calculation method. More accurate calculations can be obtained by considering all types of events occurring throughout the entire life cycle of real property in more detail.

The strategy of achieving an efficient life cycle of real property is a process of mastering the new way of thinking, intellectual capabilities, analysis of system situations, a clear focus on the goal in making decisions that provide maximum effects at all stages of the life cycle. At the same time creative thinking should take into account the following [4,5]:

- Creation of various scenarios.
- Determination of agents of change.
- Development of new approaches and goals.
- Performance of actions ensuring maximum effects.

In turn, all of the above actions change under the influence of various indicators of the quality of strategy management and leadership (J. Maurik). The values of these factors characterize the relationship of combined actions in production processes that compete with each other and have certain advantages in the process of real property construction and operation.

3 Results

So, by means of timely monitoring it is possible to determine the main factors that manifest themselves and are taken into account in the calculations (for example, strategic states of phases of the real property being constructed (Fig. 2) or phases of management of risks arising in the process of managing the system as a whole that are also necessary to consider other factors).

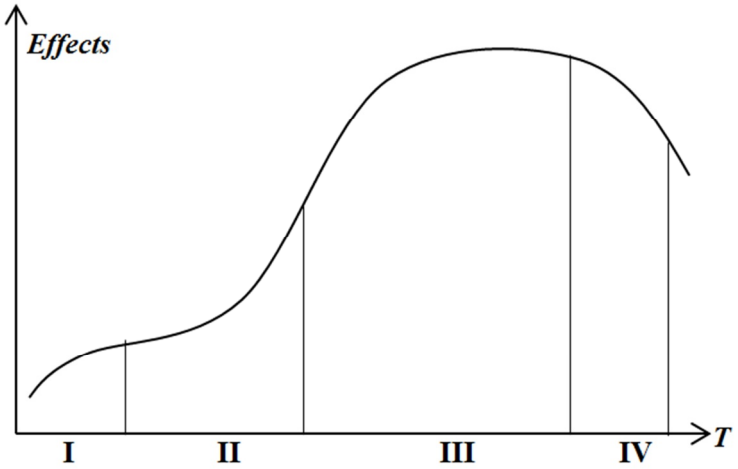

Fig. 2. Project life cycle consisting of basic phases.

The main types of works performed in the process of developing a strategy for the achievement of an effective life cycle can be presented as a diagram of relationships between the types of strategies used based on the state of financial, technical, organizational, economic and socio-political elements of real property (Fig. 3.) [5,6].

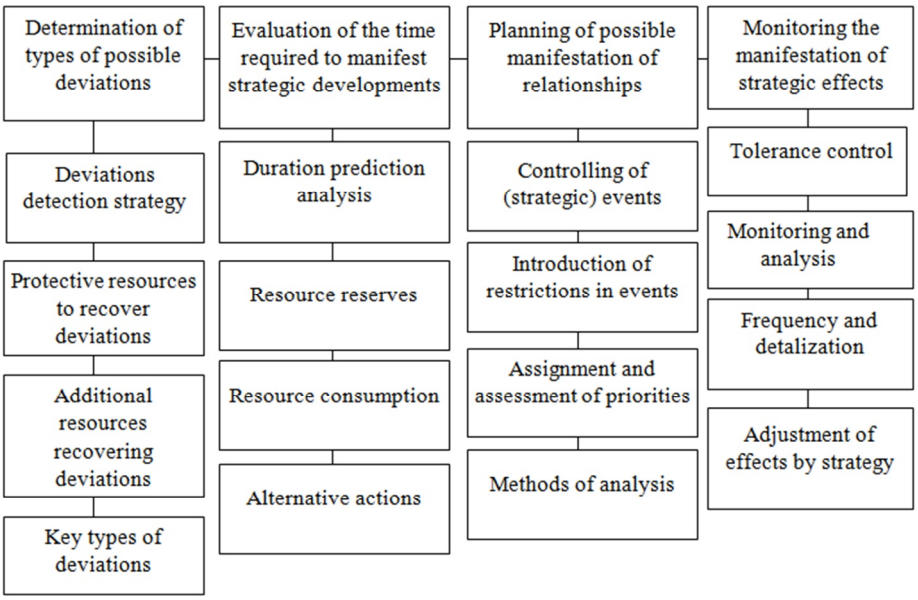

Fig. 3. Diagram for monitoring strategic conditions in construction systems.

Based on the above diagram for monitoring strategic conditions in construction systems, a further risk management strategy was developed (Fig. 4).

When developing a strategy for the achievement of the maximum efficiency in the life cycle of real property, you can use methods of comparing its elements and critical points. For this purpose it is possible to use graphical models for comparing critical points of the life cycle of any property to be analyzed [7].

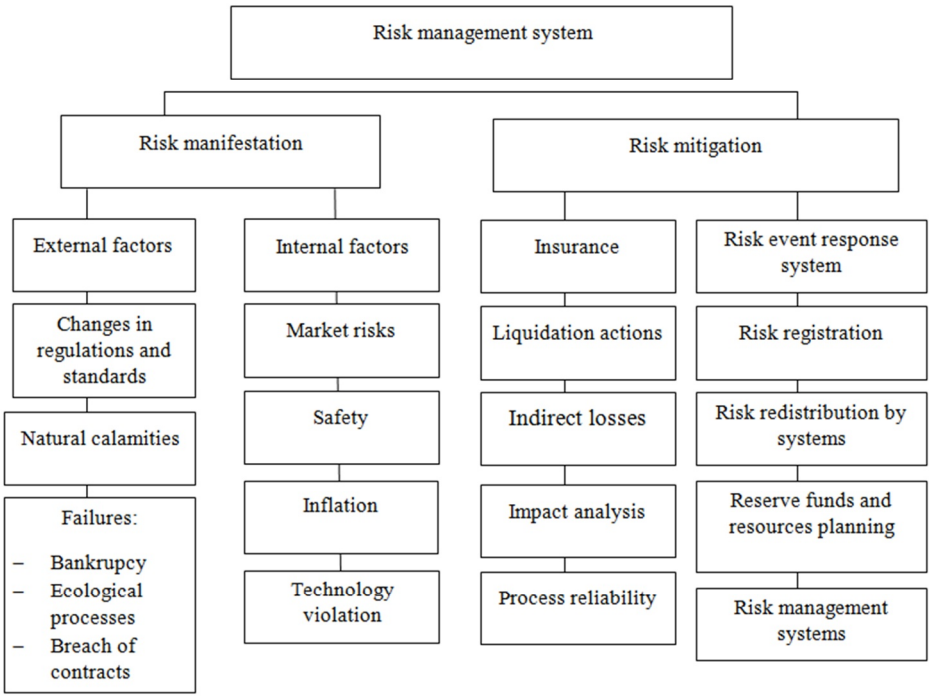

Fig. 4. Diagram of risk management in strategic systems.

4 Discussion

Let's consider some of the most common critical points in the real property life cycle and analyse costs and effects using a specific example [8].

- The calculation of costs and effects during construction facility operation allows to compare and get the main indicators of their commensuration:

$$S_{pr1}=C_1+E_nK_1 \quad (1)$$

$$S_{pr2}=C_2+E_nK_2 \quad (2)$$

where En is the norm coefficient of the comparative efficiency of capital investments.
C is the design cost of the annual output of the compared and operated property under analysis.
S_{pr} is the scenario of analyzing the property with the smallest values.

- Reduction coefficient calculation:

$$B_t=(1+E_{pr})^{t-1}, \quad (3)$$

where E_{pr} is the norm coefficient of reduction of costs occurring at different times.

If you reduce the commensurable values of the integrated reduced costs the i-th year of putting the facility into operation, then you can get effects taking into account capital additions [9,10]:

$$Epr1=C1+Eн\sum KiBti \quad (4)$$

$$Epr2=C2+Eн\sum KiBti \quad (5)$$

In this case effects are calculated taking into acount values of variable costs incurred during the main period of facility construction and operation [11].

Based on the results obtained and analytical data the main critical points of the property life cycle are reduced to the following diagram (Fig. 5):

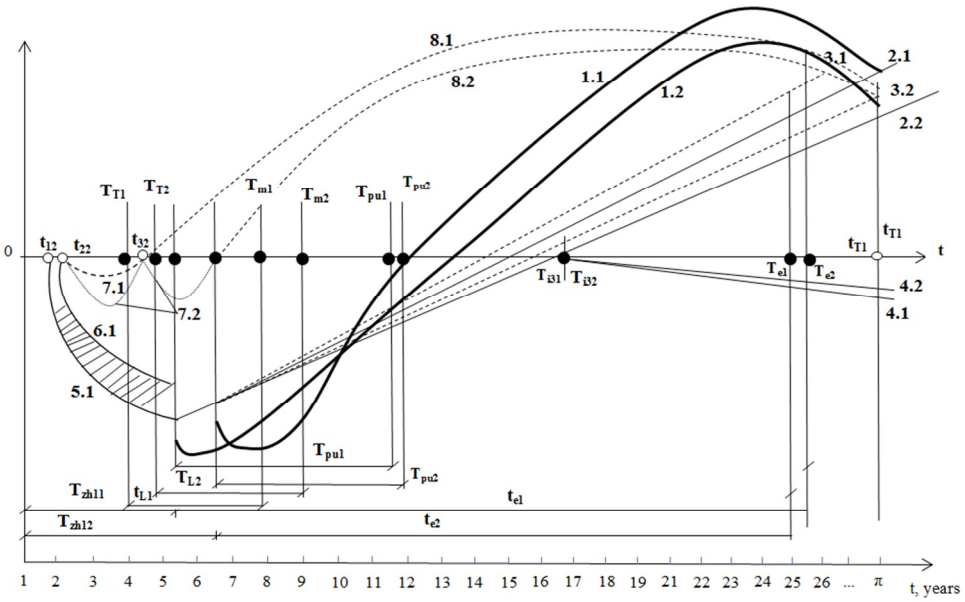

Fig. 5. Diagram of a comparison of constituent elements and critical points of the property life cycle.

Curves of increasing values: 1.1 - characteristics of accumulations from profit flows and renovation of the facility in the 1st situation; 1.2 - the same in the 2nd situation; 2.1 - the normative efficiency of capital investments in the 1st situation; 2.2 - the same in the 2nd situation; 3.1 - the same taking into account the scientific and technological progress in the 1st situation; 3.2 - the same in the 2nd situation; 4.1 - loss of value during depreciation of the facility in the 1st situation; 4.2 - the same in the 2nd situation; 5.1 - capital investments in the facility in the 1st situation; 6.1 - the cost of facility mobility in the 1st situation; 7.1 - diagrams of annual capital investments in the 1st situation; 7.2 - the same in the 2nd situation; 8.1 - the cost of production in the 1st situation; 8.2 - the same in the 2nd situation.

So, it is possible to obtain and compare various elements of the curve for each temporary state of the construction production line and at each critical point.

5 Conclusions

1. Construction of real property should be considered as a complex multi-legged system, the effect of which in practice allows getting maximum effects [12].
2. It is advisable to determine and calculate economic and production effects taking into account all phases of the property life cycle [13].
3. It is advisable to compare constituent elements of construction systems at the first stage by phases of their development, and in the future - by the sum of their combinations throughout the entire life cycle of the property.
4. The efficiency of construction systems erection and operation should be determined taking into account the following main features [14,15]:

- Heterogeneity, non-stationarity, mobility and compatibility of phases and areas of construction operations.
- Innovative sustainability of construction systems.
- Diversity of the combination of elements and critical points of the real property life cycle.
- Determination of profitability zones of construction systems and zones of their development.
- Analysis of the creation of structures of construction processes and their change in time taking into account phase changes in case of an increase and decrease in the production volumes, improvement or deterioration of the product quality, improvement of technical and economic indicators.
- Comparison of fluctuations in the wear and tear and obsolescence of construction systems.
- Maintaining and attracting additional resources for the sustainable development of construction systems.

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