

## Performance Indicators of the Decision Support System in the Management of the University's Property Complex

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**Annotation:** In the context of assessing the effectiveness of the management of the property complex of a higher educational institution (university) the task of structuring the process of managing the university's fixed assets is formulated. The process is divided into three sublevels. A systematic analysis of existing indicators for assessing the effectiveness of the management of fixed assets has been carried out. The procedure for managing the property complex of the university has been formalized and the parameters of a rational solution to the management task have been identified. The conceptual structure of the decision support system for the management of the property complex of the university is constructed. A functional model of the system has been developed.

**Keywords:** efficiency of management of the property complex, functional model, fixed assets, decision support system, indicators of profile use, hierarchical model.

### Introduction

Global transformations in the educational sphere have caused the urgency of improving the property management systems of higher educational institutions. In accordance with [1], educational institutions will have to implement a set of measures to create modern educational facilities, infrastructure, campuses, fill the shortage of places in dormitories and improve the efficiency of managing the property complex of a higher educational institution (university).

The process of managing the university's fixed assets. It is divided into three sublevels.

The indicators are distributed in 5 directions:

- Indicators of the state of the property complex characterize the property status of the university's fixed assets.
- Indicators of the financial condition of fixed assets reflect the financial condition of the university's fixed assets.
- Profile usage indicators determine the efficiency of the use of real estate.
- Energy efficiency indicators reflect the use of energy resources at the university.
- Business activity indicators reflect the level of profitability of the university.

In accordance with the method of hierarchy analysis, the ranking of property management performance indicators is carried out in a hierarchical aggregate containing 4 levels:

- goal;
- groups of indicators;
- indicators;
- factors.

The designed decision support system includes the following subsystems:

- subsystem for processing expert opinions;
- subsystem of formation of accounting data of fixed assets;

➤ subsystem of decision-making on the effectiveness of university property management.

The key direction is to improve the management process of the property complex of higher educational institutions. The achievement of effective management of fixed assets (OS) should be accompanied by the improvement of information support based on the development of models and algorithms [4]. The complexity of the task of managing the university's property complex is influenced by the multidimensional nature of the ongoing processes (technical, economic, legal, etc.) and their interrelationships, a large number of different types of indicators, the presence of uncertain dependencies, characteristics that determine the state of the university's property complex [5]. These circumstances lead to the fact that management decision support systems are used to solve the management problem [6].

**Setting the task of managing the property complex of the university**

In general, the task of managing the university's property complex is formulated as follows: to distribute a given amount of V financial resources among the number of m areas of work with the university's fixed assets for the implementation of a set of management decisions (MD) to improve efficiency. At the same time, MD  $D = (D_1, D_2, \dots, D_m)$  on the distribution of financial resources are made based on the analysis of the situation characterized by a set of indicators of the university's property complex  $X = (X_1, X_2, \dots, X_n)$ , where n is the number of groups of indicators. Each group includes a certain number of  $l_i$  indicators, where  $i = (1, 2, \dots, n)$ , i.e.  $X_1 = (x_{11}, x_{12}, \dots, x_{1l_1}), \dots, X_n = (x_{n1}, x_{n2}, \dots, x_{nl_n})$ . The amount of funds provided must not exceed the specified total amount of funding V from the federal budget: The solution for the j-th direction of work,  $j = (1, 2, \dots, m)$ ,

has the form  $D_j(X) = \begin{cases} 1, \text{увердить комплекс УУР} \\ 0, \text{корректировать комплекс УУР} \end{cases}$ . Let's imagine the task of managing the property complex of the university in the form of an interconnected hierarchy of tasks of lesser complexity (Fig. 1).

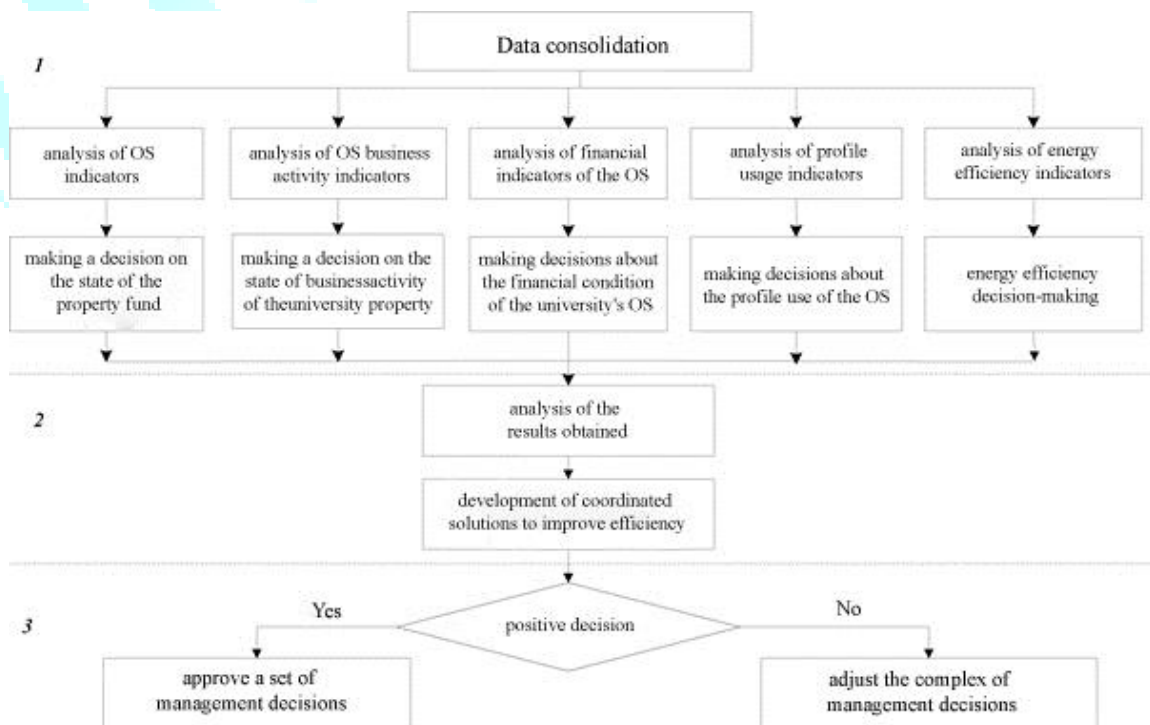


Fig. 1. Block diagram of the tasks of managing the property complex of the university: OS - fixed assets [7]

The first level is responsible for the consolidation of indicators and criteria for evaluating the effectiveness of management. The second level serves as a generalization of the results obtained at the first level, as a result, a single set of decisions is made [7]. With a positive decision, the amount of financing for the implementation of the SD complex is calculated at the third level, or (with a negative decision) the SD complex is adjusted.

An important task is to identify systemic relationships and patterns of functioning in the subject field associated with the property complex of the university and characterized by the corresponding groups of indicators that make up the information base for analysis.

### Indicators of the university's property complex

The issue of assessing the effectiveness of property management is multidimensional, based on the methodology of assessing the effectiveness of the property complex [8, 9] and is impossible without assessing the energy efficiency of the use of property [10] and the processes of OS repair [11]. It is proposed to distribute the indicators of the property complex into the following groups that have the greatest impact on decision-making: indicators of the property status of the OS, financial activity, business activity, profile use, energy efficiency (Fig. 1, level 1):

$$X = (X_1, X_2, X_3, X_4, X_5),$$

where  $X_1 = (x_{11}, x_{12}, \dots, x_{23})$  is a group of 13 OS status indicators;  $X_2 = (x_{21}, x_{22}, \dots, x_{26})$  is a group of 6 OS business activity indicators;  $X_3 = (x_{31}, x_{32}, \dots, x_{36})$  is a group of 6 OS financial indicators;  $X_4 = (x_{41}, x_{42}, \dots, x_{46})$  - a group of 6 indicators of profile OS usage;  $X_5 = (x_{51}, x_{52}, \dots, x_{64})$  - a group of 14 energy efficiency indicators.

The group of indicators of the state of the OS (GISOS) describes the property status of the OS of the university. This group includes the most general indicators of the effectiveness of the management of the property complex. The most significant indicators of this group are the indicators of capital strength, the coefficients of renewal and growth of the OS. Capital ratio is an indicator that characterizes the cost of operating systems designed for one employee. This indicator can be calculated both for the whole university as a whole and for its specific site. The capital ratio indicator makes it possible to analyze the structure of the university's fixed assets, as well as to track changes in employee productivity. The renewal coefficient is the ratio of the cost of equipment received by the university to its cost at the end of the period. The growth rate of the OS characterizes the increase in the cost of the OS due to their updating.

The group of indicators of business activity (GIBA) characterizes the level of profitability of the university. The business activity coefficient allows us to characterize how effectively the university uses its fixed assets. The value of the turnover coefficient of the OS depends on the characteristics of the institution. This indicator characterizes the level of OS operation and the effectiveness of their application.

The group of financial indicators (GFI) reflects the financial condition of the university's property complex. The coverage ratio reflects the university's ability to pay off debts through the available OS. The financial stability coefficient is calculated on the basis of the balance sheet and allows you to measure whether the university is financially stable enough, reflects how much of the assets are financed from sustainable sources.

The group of indicators of profile use (GIPU) characterizes the use of real estate to a greater extent. The coefficient of profile use of areas characterizes the areas directly used in the learning process. The coefficient of maintenance and restoration of the OS shows the ratio of costs from extra-budgetary sources to the aggregate of utility and operating costs.

The group of energy efficiency indicators reflects the use of energy resources by the university.

45 quantitative and qualitative indicators of assessing the effectiveness of the management of the university's property complex have been identified (Table).

**Indicators of the effectiveness of the management of the university's property complex\***

Indicator	Designation	Formula	Indicator	Designation	Formula	Indicator	Designation	Formula	Indicator	Designation	Formula
GISOS						GIBA			GFI		
$K_1$	$x_{11}$	$K_1 = I/P_{oc}$	$K_6$	$A_7$	$K_6 = P_{oc1}/P_{oc2}$	$K_{10}$	$B_1$	$K_{10} = A/P_{oc}$	$T_{деб}$	$C_1$	$T_{деб} = A/D_{деб}$
$K_2$	$A_2$	$K_2 = E/P_{oc}$	$K_7$	$A_8$	$K_7 = P_{выб}/P_{noc}$	$K_{11}$	$B_2$	$K_{11} = A_{бюд}/A$	$T_{кред}$	$C_2$	$T_{кред} = A/D_{кред}$
$K_3$	$A_3$	$K_3 = S_1/S$	$K_8$	$A_9$	$K_8 = P_{oc}/V$	$K_{12}$	$B_3$	$K_{12} = A/P_{oc}$	$K_{16}$	$C_3$	$K_{16} = (\Phi - A_3 - U)/V$
		$K_3' = S_2/S$	$\Phi_o$	$A_{10}$	$\Phi_o = P_{oc}/N$						
$K_4$	$A_4$	$F = P_{пос}/P_{oc}$	$\Phi_B$	$A_{11}$	$\Phi_B = P_{oc}/S_{зем}$				$K_{18}$	$C_5$	$K_{18} = A/D_{кред}$

Indicator	Designation	Formula	Indicator	Designation	Formula	Indicator	Designation	Formula	Indicator	Designation	Formula
$K_3$	$A_5$	$K_5 = P_{воч}/P_{oc}$	$E_8$	$A_{12}$	$K_6 = P_{oc1}/P_{oc2}$	$K_{14}$	$B_5$	$K_{14} = N/A$	$K_{19}$	$C_6$	$K_{19} = P_{oc}/V$
$W$	$A_6$	$W = P_{тоc}/P_{oc}$	$K_9$	$A_{13}$	$K_9 = P_{инв}/P_{обш}$	$K_{15}$	$B_6$	$K_{15} = A/P_{oc}$			
GIPU			$K_{20}$	$D_1$	$K_{20} = S_{обр}/S$	$O_1$	$D_3$	$O_1 = S_{зд}/K$	$K_{22}$	$D_5$	$K_{22} = P_{инзх}/P_{баланс}$
			$K_{21}$	$D_2$	$K_{21} = E_{вком}/(E_{вком} + E_2)$	$O_2$	$D_4$	$O_1 = S_{лаб}/K$			

\*I - depreciation of the OS at the end (beginning) of the year;  $P_{oc}$  - the book value of the OC at the beginning (end) of the year; E - the cost of capital repairs from the budget/extra-budgetary funds;  $S_1$  - the area of buildings leased by the university;  $S_2$  - the area of buildings leased by the university; S - the total area university buildings;  $P_{noc}$  - the cost of the OC received during the year;  $P_{воч}$  - the cost of the OC retired during the year;  $P_{тоc}$  - the book value of the type of OC at the beginning (end) of the year;  $P_{oc1}$  - the book value of the OC at the end of the year;  $P_{oc2}$  - the book value of the OC at the beginning of the year;  $P_{выб}$  - the cost of the OC retired during the year; V - balance currency;  $N_{раб}$  - the average number of employees;  $S_{зем}$  - the total land area;  $E_{им}$  - the cost of maintaining the property;  $S_{зд}$  - the total area of buildings;  $S_{лаб}$  - educational and laboratory area;  $P_{инв}$  - the value of real estate not included in the inventory;  $A_{бюд}$  - the amount of budget financing (extra-budgetary); A - the total amount of funding from all sources;  $A_{бюдж/внебюдж}$  - the amount of funds received from the budget (extra-budgetary);  $E_{обр}$  - expenses for the maintenance of an educational institution for the year;  $N_{обуч}$  - the number of students; F - capital investments for the year;  $D_{деб}$  - the average amount of accounts receivable for the year;  $D_{кред}$  - the average amount of accounts payable for the year; F - the amount of funds and funds for special purposes;  $A_3$  - the amount of borrowed funds;  $S_{обр}$  - the amount of the area of an educational institution

used for the educational process;  $E_{\text{БКОН}}$  - utility and operating costs, extra-budgetary;  $E_2$  - utility and operating costs, budget;  $P_{\text{общ}}$  - the cost of the OC received during the year;  $N_{\text{здан}}$  - the number of unaccounted buildings and structures on the balance sheet of the institution;  $N$  - the total number of buildings and structures;  $U$  - depreciation of the OC;  $K$  - the given contingent of students;  $P_{\text{баланс}}$  - the total book value of real estate;  $P_{\text{нпзнач}}$  Value - the value of real estate used for other purposes.

The ranking of the indicators of the effectiveness of the management of the property complex of the university into a hierarchical set containing 4 levels was carried out: 1st level - goal: improving the efficiency of the management of the property complex of the university; 2nd level - groups of indicators; 3rd level - indicators; 4th - factors.

### Conclusion

A systematic analysis of factors and indicators that determine the effectiveness of the management of the property complex of higher educational institutions, reflecting both quantitative and qualitative indicators, is carried out. A block diagram of the task hierarchical factor model of the efficiency indicators of the management of the property complex of the university has been developed.

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