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THE ROLE OF DIAGNOSTIC MODELS IN THE STUDY OF THE ACTIVITIES OF HIGHER EDUCATION INSTITUTIONS

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Annotation: The article reveals the importance of economic diagnostics in the study of higher education. The role of economic diagnostics in ensuring the effectiveness of the higher education institution and the importance of diagnostic models are highlighted. Scientific proposals and practical recommendations for the diagnosis of the economic and financial condition of the higher education institution or trends in it are given.

Keywords: higher education institution, diagnostic models, economic diagnostics, integral indicators, mathematical modeling.

Introduction

The first step in studying the activities of a higher education institution (HEI) through diagnostics is to identify existing problems. To do this, it is necessary to correctly imagine the educational process and other processes in the activities of the university. It is well known that the problem manifests itself as the difference between the result of an activity that needs to be achieved and the results that are actually achieved. A diagnosis is needed to determine the causes. Quantitatively expressed indicators also serve as logical information for diagnosis. In addition to regularly recording quantitative indicators, the university's information system should also indicate their compliance with accepted criteria (goals, norms, forecasts, etc.).

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The main part

It is known that higher education is a separate element of the country's higher education system. The task of this system is to implement higher education and train highly qualified personnel. The educational potential of a higher education system reflects the extent to which this system is capable of performing its function. The following indicators are used to assess the educational potential of the higher education system:

socio-economic opportunities for the development of higher education (number of universities, the number of students admitted to universities, the number of students, the number of specialists trained in universities);

demographic conditions for the development of higher education (the number of graduates of secondary schools, the number of graduates of academic lyceums and vocational colleges, the number of those wishing to enter higher education);

labor potential of the higher education system (number of professors and teachers, including those with academic degrees and academic titles, number of teaching assistants, number of administrative staff);

Material and technical base of higher education institutions (area of educational and laboratory buildings, area of student dormitories, provision of educational and experimental materials, provision of educational and scientific literature, educational equipment);

Financial potential of higher education institutions (volumes of budget funding, extra-budgetary funds, including private and foreign investments, etc.);

indicators summarizing the effectiveness of the higher education system (number of applicants for higher education, number of applicants for 1 place, number of requirements per 10000 population, number of specialists graduating per 10000 population, number of students per 1 teacher, per 1 student area of incoming educational and laboratory buildings, area of common accommodation per 1 student, indicators of student mastery, indicators of the reasons for expulsion from the ranks of students, indicators of employment of graduates);

indicators of the level of education of the population (total number of people with higher education, their share in the employed population).

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Based on these indicators, it will be possible to diagnose the level of development of higher education in the country, including the quality of higher education. The statistics of these indicators serve to increase the reliability of diagnostic conclusions. It should be noted that the above indicators are important for the analysis of the activities of individual universities.

Quantitative indicators are used consistently in diagnostic research. The quantitative side of research involves 3 steps: 1) measurement; 2) mathematical modeling; 3) develop conclusions. During the measurement phase, variable indicators and regularities in quantitative measurement are presented. Mathematical modeling consists of converting measurement results into the appearance of mathematical dependencies. The conclusions are based on quantitative measures that eliminate the causes of problems and create conditions for optimizing the operation of the facility.

All stages are interconnected and complement each other. The system of economic measurements has a special place in the diagnosis of the quality of education. Because from the point of view of socio-economic development, it will be necessary to express the results as economic indicators. In the context of market relations, the results of diagnostic modeling should be secondary economic indicators - economic feasibility of evaluation of educational services (products of higher education), the effective use of intellectual, pedagogical, social potential or human capital concentrated in higher education.

The 3 stages mentioned above - measurement, mathematical modeling and development of conclusions - have their own characteristics. At the same time, their differences are conditional. For example, the measurement itself can be thought of as a mathematical modeling, any indicator or scale of its measurement can be considered as a mathematical model (relative to the economic indicator - the economic-mathematical model) and this model reflects the important relationships inherent in the object. In general, measurement can also be interpreted as a method of research using a model. In size, as in modeling, the economic problem is translated into mathematical language. In both cases, the main problem is the quantitative representation of the object and its important characteristics. The inseparability of the tasks in

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measurement and modeling is also evident in the study of university activities. This is because in higher education, as in economic systems, economic processes occur in different areas of its activities.

Of course, economic measurements are more indirect measurements. Here it is necessary to work taking into account the relationships between the descriptions to be measured and the measurement capabilities. The economic-mathematical model serves as a form of expression of such dependencies. The modeling process, on the other hand, can be seen as a search for optimal amounts of variables.

It is obvious that economic diagnostics of the quality of education in the activities of higher education is one of the problems studied through economic-mathematical modeling. As noted, the model somehow reflects important features, processes, and interdependencies in real systems. Models can be built on a variety of bases: models that represent the properties or movements of a real existing object; models that embody any or thought-expressing concept; models that represent action and generalize in thinking (concept).

In economic-mathematical modeling, socio-economic problems are expressed in the language of mathematics. The study of systems of equations, mathematical formulas, or other mathematical expressions allows for a sufficiently in-depth study of relationships that have quantitative expression in real events. Thus, the model serves as a tool for object research. The model can be used to monitor, evaluate, and analyze the performance of an event or system under study. The model is also used for educational purposes. The modeling structure includes 3 stages: 1) model development; 2) model research; 3) study the real object based on the model.

Depending on the measuring instruments used, metric and non-metric models differ. The metric model is developed in the form of a mathematical algorithm. This mathematically expresses the dependence of the dependent variable on the other independent variables (indicators) that define it in the algorithm. Non-metric models show structural descriptions of an event and the relationships between elements.

Depending on the objectives of the study, descriptive and normative models can be distinguished. How do descriptive models happen? or how

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can it develop? seeks answers to the following questions: It is sometimes interpreted that the tasks of diagnostics consist of precisely these questions. In this case, the diagnosis is limited to explaining and predicting the observed facts, i.e. it plays a passive role. For example, in descriptive models in the form of correlation analysis, the object is studied by approximation, that is, by assessing the statistical correlation of the real situation with the dimensions in the model, representing the relationship between the event and the variables that define it.

What should normative models be like? answers the question. Such models are aimed at ensuring that any state of the object under study is achieved, and the factors necessary to achieve the optimal state are investigated. The main purpose is to show the rational direction of the object's activity, along with the reflection of real reality. Whether a model is a descriptive or normative model depends on both its mathematical structure and the nature of its use. Hence, diagnostics requires the use of more normative models.

One of the problems in the development of diagnostic models of higher education is the generalization of indicators used for different purposes. A generalized assessment is an important source of information in describing a problem related to an event or situation. It also refers to generalizing indicators on several criteria in any study.

It should be noted that it is necessary to use generalizing indicators in the quantitative representation of the resulting event, which is represented by several indicators or several signs are considered important. Such phenomena are multidimensional, their quantitatively measurable properties can be thought of as points in multidimensional space. Each university has many features in terms of diagnostics of the quality of education, and quantifying them can be done in different ways depending on the research objectives. But the selection of indicators to reflect a multidimensional result cannot be random, and it is necessary to rely on logical qualitative analysis. In order to measure any economic or social quantity, it is necessary to select quantities (indicators) that are realistically related to it, the joint consideration of which allows to draw certain conclusions about the object of research or its activities.

Separate factors are the significance of the indicator for the strength of the impact of each indicator on the measured overall property, i.e. the

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amount of the integral indicator. In significance, on the one hand, the object characterizes its own property. On the other hand, the determination of significance is done by the researcher, depending on how he approaches the determination of the integral indicator, what methods he uses, and whether he is able to use it. In fact, the most accurate way to determine the weight of each particular indicator on the basis of a logical analysis is to determine its weight in the general or integral indicator. However, such an option is not always available when performing diagnostics.

It is also possible to refer to mathematical statistics to assess the significance of an indicator. In the simplest approach, it is determined by how much of the total variance specific to the event determines the effect of the indicator or indicators under consideration. The correlation coefficient of an integral indicator with a specific indicator is taken as a quantitative expression of the significance of the specific indicator. In some cases, the significance of the indicators is determined by an expert or all indicators are taken as equally important.

If the individual indicators are combined into an integral indicator, weighing them according to their importance, it is in the form of the following formula:

$$y = \sum_{i=1}^{n} a_i \, x_i$$

Here:

y – the amount of the integral indicator;

n – weight of specific indicators

a_i – i- the weight of the indicator

x_i – i- the weight of the specific indicator

The following conditions must be met for this formula to be able to reasonably develop and use diagnostic conclusions:

x_i specific indicators can be measured quantitatively on a continuous scale, their quantities are known for all objects, as well as their quantity, in other equal conditions, has a positive effect on the results of system performance;

the effect of changes in specific indicators on the results will be constant in the range under study;

an integral exponent is a flat (smooth) function of its arguments within the existing and studied boundaries, and therefore that function can be differentiated multiple or desired times.

In the above formula, the importance of specific indicators is expressed in the weights given to them.

The formation of an integral indicator from specific indicators can also be expressed in the form of an indicator function, and it is based on the following formula:

$$y = x_1^a * x_2^a \dots x_n^a$$

In cases where the effect of specific indicators on the integral indicator is complex, it is even more difficult to generalize them. For example, it is possible to suggest complex indicators to express the efficiency of higher education or the potential of higher education.

$$CKK = \sqrt{P^2 + Y^2 + F^2 + M^2 + U^2}$$

Here:

CKK – complex coefficient of efficiency;

P – the level of implementation of the production plan by specialists;

Y – the level of the number of students per 1 teacher in relation to the norm;

F – armed with fixed assets relative to the standard;

M – the level of material costs relative to the standard;

U – employment rate of graduates.

Conclusion

Integral indicators can also be used to diagnose the economic and financial situation of the university or trends in it. For example, it is possible to draw conclusions using liquidity ratios and combining indicators of financial needs with them on the basis of a certain algorithm. However, it should not be overlooked that a number of shortcomings are specific to most of the integral indicators. Including:

in the development of integral indicators, a certain amount of information is lost due to generalization. This is because the deterioration of results on some indicators in the aggregate indicators may be offset by the improvement on other indicators. In reality, however, it is often possible that the deterioration of the result on the one hand is not offset by the improvement on the other. Different socio-

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economic indicators cannot be fully equivalent to each other and can replace each other only within certain limits (lack of reagents can not be replaced by pedagogical skills);
integral indicators developed without reliance on mathematical statistics are not sufficiently complex in nature, as the effect of the indicators included in the aggregation in the final result is not visible;
the determination of weighting coefficients or the boundaries of categories must be based on sound reasoning or empirical data, and it is not possible to substantiate them sufficiently logically and theoretically;
the process of calculating integral indicators is not always justified or interpreted;
integral indicators do not cover all of the existing problems, nor do they indicate that they are emerging.
neglect of the interaction of factors in integral indicators, prevents the full disclosure of the influence of factors;
in some cases it is not envisaged that the composition of the indicators used will change depending on their significance;
in most cases it is necessary to use empirical norms that have been decided in practice, in which there is a lack of clarity and a small number.
It is obvious that the necessary results cannot be achieved without modeling in the economic diagnostics of higher education, and the development of fundamentally new models is required.

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