

# Fundamentals of Economic Diagnostics and Modeling in Assessing Socio-Economic Development

Sotvoldiev Nodirbek Jurabaevich,  
Candidate of Economic Sciences, Associate Professor of Namangan State University  
nodirbek.s@mail.ru

## Article Info

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**Abstract:** Management decisions are made based on the problem. The problem is the imbalance between the situation and the result that needs to be achieved. A diagnosis should be made to determine this discrepancy. This requires quantitative assessment of various aspects of the situation. Quantitative recording of economic indicators will determine how well they meet these criteria. Hence, economic diagnostics is based on a model expressed in quantities. At the same time, the quantitative data obtained should be explored in meaning. Therefore, the diagnostic model is of analytical nature. Generally, economic diagnostics is based on a model that is based on quantitative evaluation and content analysis.

Diagnostics is performed using direct statistical data and sophisticated methods of economic analysis without direct access to the system. Economic diagnostics assesses how much inflow flows into outputs or how efficiently the resources are involved.

Economic diagnostics is based on the use of indirect measurements, and it defines modeling techniques. Therefore, a systematic review of system data, research using statistical techniques, the use of economic and mathematical models, and the use of linear programming to achieve quantitative expression goals are required.

Finding solutions for optimizing object performance In the mathematical model, the factors affecting the activity of an object are represented as variables. The analysis provides an integral indicator of the number of variables. Therefore, mathematical modeling allows optimizing the path in the "resource-result" chain by quantifying the expected results. From this point of view, economic and mathematical modeling is an important part of economic diagnostics.

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## I. Introduction

In a market economy, a new approach to managing economic activities in all sectors of the economy is becoming increasingly important. Evaluating the performance of enterprises using a system of different coefficients is one of the most widely used methods in economic diagnostics today.

Today, special attention is paid to economic diagnostics of the enterprise using financial ratios, which are an integral part of financial analysis. However, it is difficult to see how these coefficients are interpreted according to a single criterion for enterprises operating in different industries, that is, in a certain way.

The experience of developed countries shows that economic development is not always the same. From time to time, economic growth and economic recession are an objective process for the country's economy. Therefore, economic diagnostics plays an important role in assessing sustainable rates of socio-economic development.

Economic diagnostics plays an important role in the micro- and macro-level regulation of socio-economic development and in addressing existing problems. This requires research to improve the economic diagnosis based on socioeconomic and natural resource capabilities.

Economic diagnostics is an important element of organizational and economic

management processes and is part of the information and analytical support. In the general approach, the diagnosis can be interpreted as a doctrine of the methods and principles of identifying inconsistencies that may or may not occur in the object-specific functions under study. Diagnosis of the object from the economic point of view is carried out with the purpose of increasing its effectiveness, strengthening its survival in the conditions of free competition and market relations.

Economic diagnostics is based on information processing. At the same time, the methods used to process information should not exclude the various qualitative characteristics of processes represented by the economic performance of the object, but rather identify problems related to these aspects. To summarize, the purpose of the diagnosis is to provide information and justify economic decisions (managerial, financial, organizational).

Of course, it is not feasible to look at economic diagnostics separately from the overall chain of managerial decision-making. In fact, there is a need to follow a multitude of principles that are diagnostic at all stages of information management, information processing and management decisions.

## II. Literature review

The concept of economic diagnostics is a relatively new concept. Therefore, its definitions in economic literature have only been in recent years. Experts and economists often use the term economic diagnosis or financial diagnostics. At the same time, some economist scholars point out that economic or financial diagnostics is replaced by economic or financial analysis, while others claim that these concepts are different. In particular, Russian scientific publications O. Grishchenko, LE Basovsky, AM Lunyova, AL Basovsky, EN Vyborova, IA Lieberman consider economic diagnostics and economic analysis as one concept<sup>1</sup>. However, VV Savchuk,

Sh.A.Omarov, GV Loginov, EM Trenenkov, SA Dvedenidova believe that it is necessary to differentiate these two concepts.<sup>2</sup>.

## III. Research methodology

In this work, several economic, mathematical, and modeling methods were used to describe the economic diagnosis. In particular, the methods of economic analysis using only statistical information, without direct access to the system, are described. It evaluates the extent to which the resources raised through economic diagnostics are effective. Such methods reveal the peculiarities of economic diagnostics and its modeling processes.

## IV. Analysis and results

In our opinion, economic diagnostics are distinctive and should include the following:

Observe the fundamental principles of theoretical and applied sciences in assessing the economic state of the research object and predicting its expected changes, including the importance and relevance of the studied processes;

the complex nature of economic diagnostics and the use of a system of interrelated economic indicators;

classification of events studied in the use and processing of economic data for diagnostic purposes and categorization of factors influencing them based on quantitative and qualitative criteria;

substantiating the internal reserves that can be used to improve the performance of the facility by comparative analysis in the analysis of economic activity for diagnostic purposes;

envisage wide use of advanced experience in the activities of a subject in the results of economic diagnostics;

- to base on reliable and reliable source of information in carrying out economic diagnostics.

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and diagnostics of financial and economic activities. INFRA-M, RIOR, 2005. -- S. 54 55. [www.cfin.ru](http://www.cfin.ru). Savchuk V.P. Financial diagnostics of the enterprise and support of management decisions. [www.cfin.ru](http://www.cfin.ru). Omarov Sh.A. The essence of the economic diagnosis of the results of the enterprise. [http://www.rusnauka.com/DNI\\_2006/Economics/10\\_omarov\\_tez\\_3.doc.htm](http://www.rusnauka.com/DNI_2006/Economics/10_omarov_tez_3.doc.htm) ; Loginov. G.V. Matrix of enterprise diagnostics // Management in Russia and abroad. - M.: 2004. No. 5. - C 45-47 ; Trenenkov E.M., Dvedenidova S.A. Diagnostics in crisis management. / Management in Russia and abroad. - M.: 2002. No. 2. - S. 23-24.

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<sup>1</sup> Grishchenko O.V. Analysis and diagnostics of the financial and economic activities of the enterprise: textbook: publishing house TRTU, 2000. - C 6-7 ; Vyborova E.N. Diagnostics of financial stability of business markets. Auditor. No. 12, 2002. - S. 16-17 ; Liberman I.A. Analysis

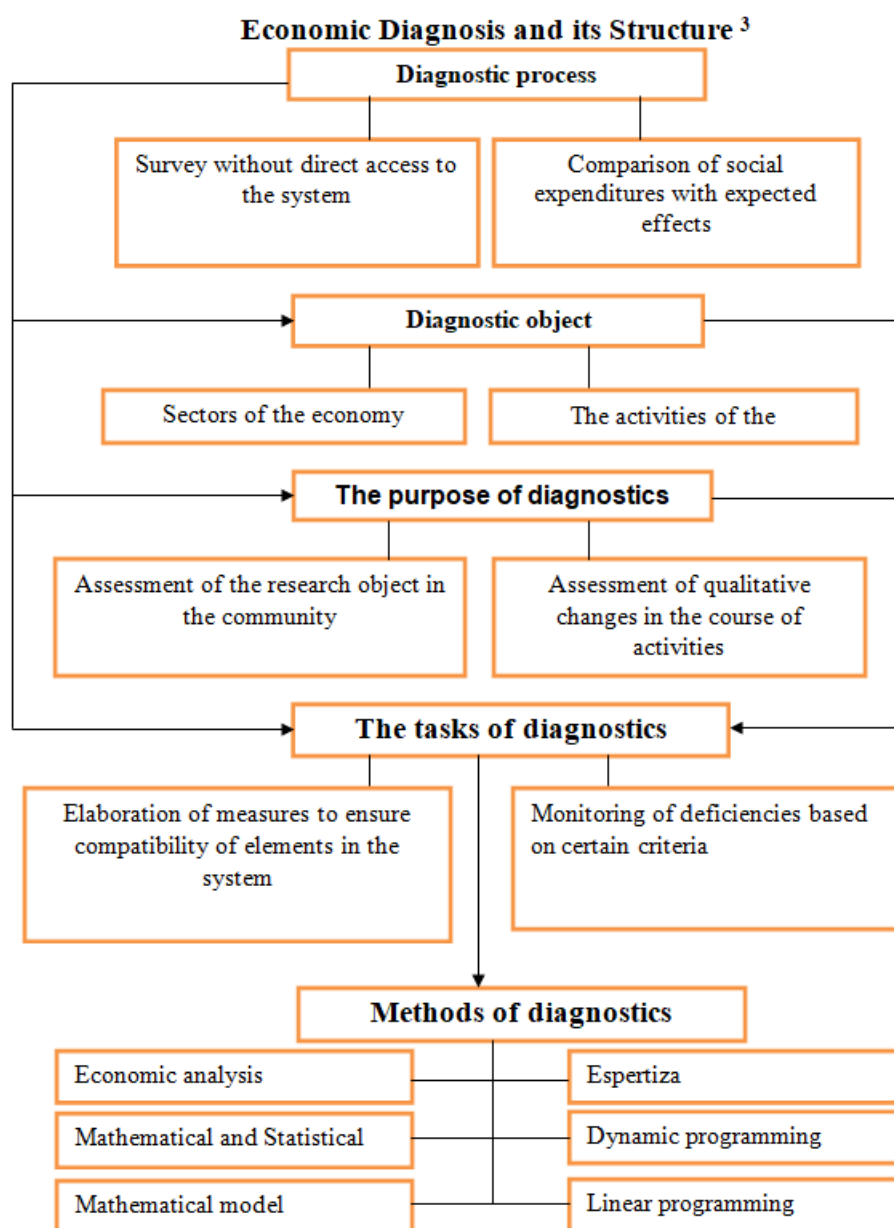
Economic diagnostics should also include criteria for selecting alternatives to improve the performance of the facility. Economic diagnostics by assessing the results of activities, gathering and analyzing information, appears to link other constituents. In this case, economic diagnostics can help to select and implement the characteristics needed to obtain specific results. The methods and assessments used in diagnostics should not only passively reflect the actual state of affairs, but also allow them to identify problems

and make decisions in a timely manner to adjust the strategy and tactics of the facility.

In general, economic diagnostics is important in the following areas: identification of existing problems and trends; justification of modernization measures; scientific and practical approach to further development issues.

In our opinion, the economic diagnostics in relation to the assessment of socio-economic development can be explained as follows (Figure 1):

**Figure 1**



As we have seen above, economic diagnostics can be viewed as a five-step analytical process. These stages are interconnected and

organized so that an optimal result can be achieved. Each step is based on the previous one.

Economic diagnostics requires the following methods:

research using direct statistical data and sophisticated methods of economic analysis without directly entering the system;

examination of systematized data;

research using mathematical and statistical methods;

use of dynamic programming and mathematical models;

use linear programming that provides optimization to achieve quantitative expression goals.

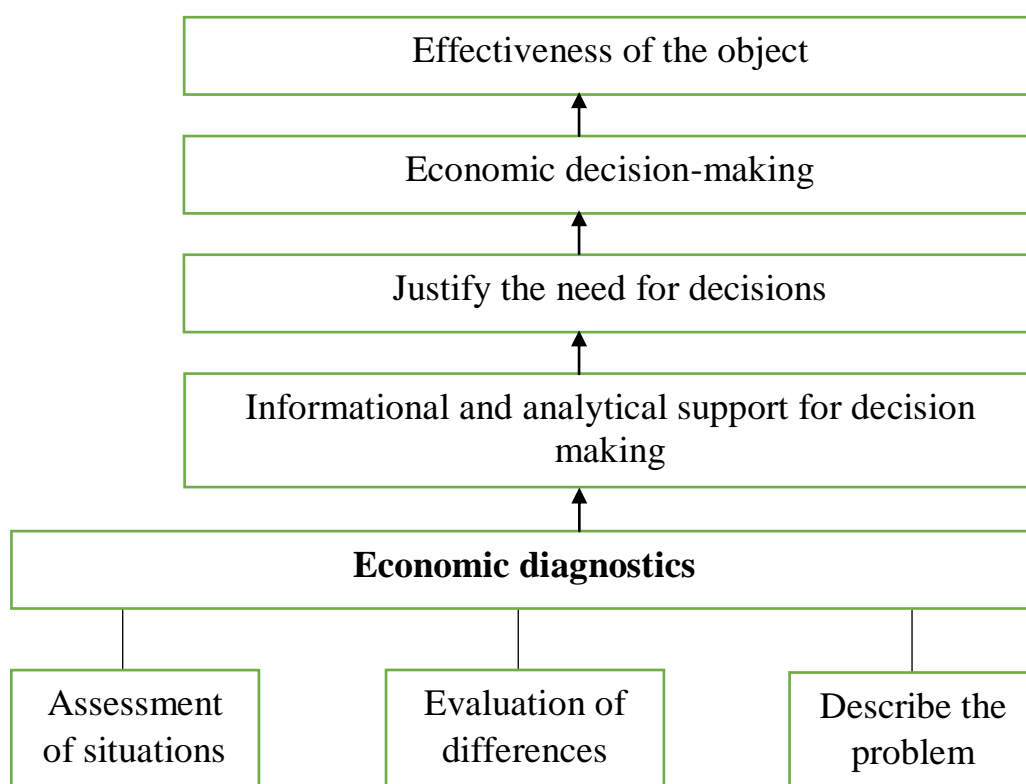
The main purpose of economic diagnostics is to assess the financial and economic situation and to identify sustainability and to identify opportunities and resources for development. To achieve this goal, of course, the main directions of

financial and economic policy will be used. Economic diagnostics is one of the important tools in pursuing this policy. According to the results of economic diagnostics it is possible to compare the position of the research object in the society or to assess the changes in its condition over different time periods.

Typically, the differences between the desired results and the results obtained are often considered problematic in achieving results stemming from the target function of the research object. The difference is not always clear. Therefore, the main task of economic diagnostics is to identify economic (economic) problems associated with the management process. In our opinion, this can be expressed in the form of Figure 2.

**Figure 2**

**The role of economic diagnostics in ensuring the effectiveness of facility operations**



Economic diagnostics is performed in the form of analysis of the information collected and processed. Accordingly, the following three areas of analysis can be considered significant:

assessment of the condition (efficiency) of activity of the object, determination of its changes in spatial and temporal aspects;

study of the key factors that led to changes in economic potential and their impact;

Defining reserves for enhancing performance.

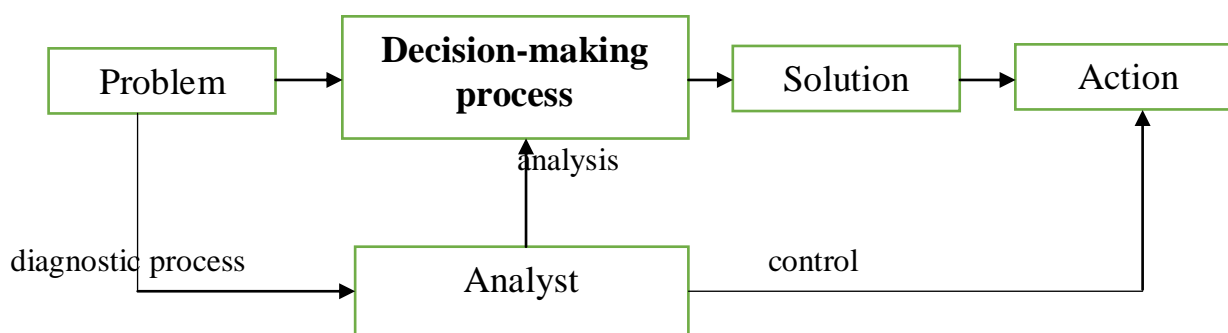
It is important to note that although it is difficult to separate processes and concepts such as diagnostics, control, analysis, evaluation, the

task of diagnosis can also be viewed as indicating the cause of the objective and analysis. From this point of view, diagnostics in the narrow sense is to identify the problem and, in the broadest sense, to assess the problem, to isolate it from other

problems, to know, to make a logical basis for decisions with clarity of the situation. Figure 3 illustrates the role of diagnostics in decision-making and implementation.

Figure 3

### The role of diagnostics in management



As a result of economic diagnostics the areas of activity of the facility determine the factors and causes that impede achievement of common goals. To do this, the diagnostic relies on numbers, compares numbers, and seeks to describe the factors that cause changes in numbers. At the same time, it is based on a clear understanding of the specificity of the diagnostic site in each case and the anticipation of certain important features of that category.

An important aspect of economic diagnostics is that an object should be treated as a system. This approach requires studying the system without separating it from the environment in which the object operates. Therefore, the consideration of the object and its performance in order to improve it is considered to be one of the most important characteristics of the system as a system.

Depending on the tasks set by the economic diagnostics, the initial information and analytical base of the studied facility will be formed, methods of analysis and software for diagnostics will be selected. In order to provide the basis for conclusions drawn from economic diagnostics, it is necessary to identify trends in dynamic series, to solve mathematical problems or equations algorithms, to develop probable scenarios for the development of the studied object, to develop short-, medium-, and long-term forecast variants of key indicators.

One of the goals of economic diagnostics is to give an overview of the development trends

of the facility. At the same time, the following basic principles can be distinguished in economic diagnostics:

- alignment of the monitoring system with the monitored object. The system of indicators used in economic diagnostics must accurately reflect the basic characteristics of the object under study;

- economic diagnostics should be able to summarize the principles that are being implemented at a later stage, and that the results of the principles at one stage should be comparable to the other;

There is a need for a systematic approach to conducting economic diagnostics, and it is advisable to implement it in a comprehensive manner.

The system of indicators used for economic diagnostics must meet certain requirements. Including:

- the apples used in economic diagnostics must be interrelated and interrelated;

- the indicators used in the analysis must be consistent with the system of state statistics, have sufficient scope and be uniformly interpreted;

- to be able to check the indicators and the results of their analysis from the standpoint of non-objective reality;

The parameters used must be synchronized in terms of time of receipt and other necessary features, reflecting the current state of the facility.

In our opinion, the aforementioned principles should be the basis for the gradual



development and improvement of economic diagnosis.

The first step in examining facility activity through economic diagnostics is to identify existing problems. To do this, you need to have a good idea of all the processes in the facility. It is well known that the problem appears as the difference between what is expected to be achieved and what is actually achieved. In order to find out why this is needed, an economic diagnosis is required. The information required for economic diagnostics, along with logical concepts, is also quantitatively expressed.

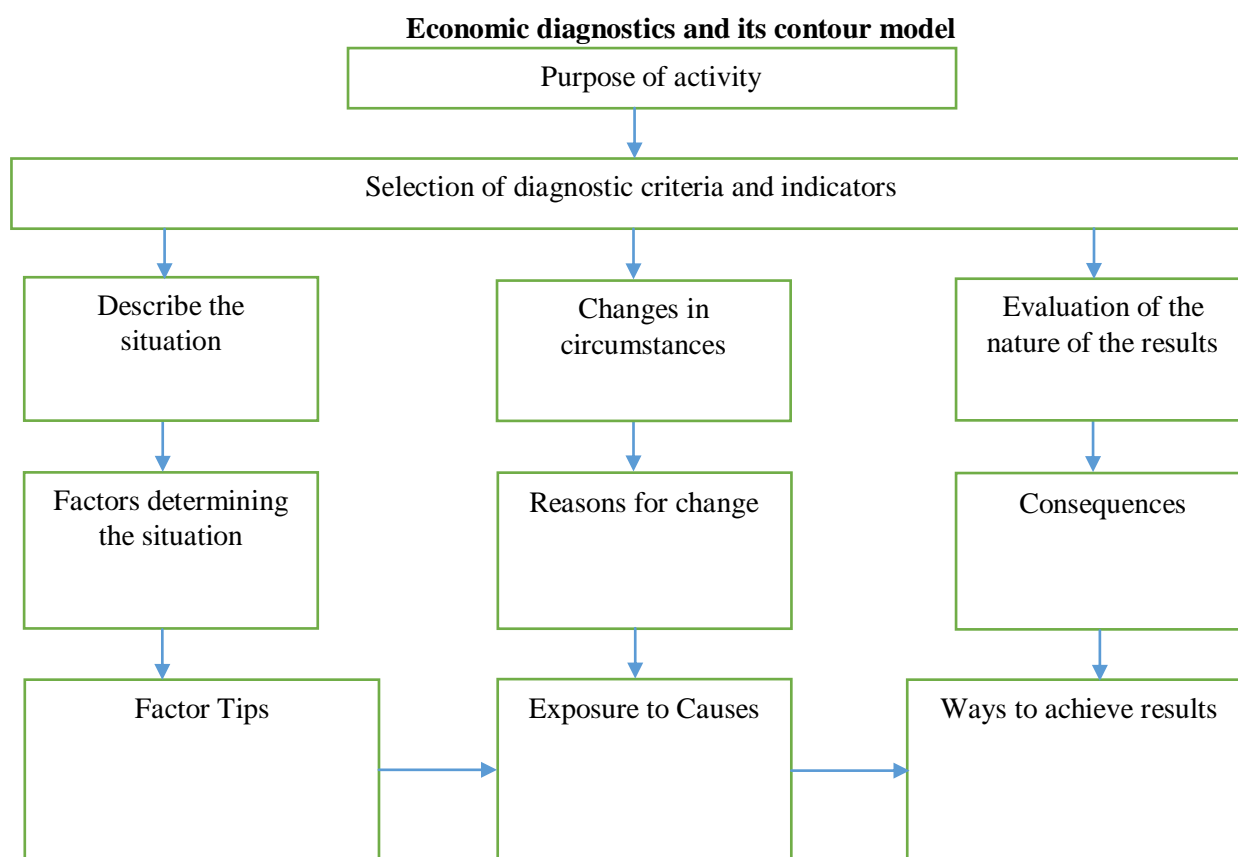
Of course, just recording the deviations in the goal is not enough. It is necessary to interpret

The economic diagnostic model can be represented in Figure 4.

the collected and processed information and to draw important conclusions. Therefore, it is desirable to focus on economic diagnostics to reveal the causes and factors of improvement or deterioration of the results of activities and to develop and substantiate appropriate measures. Therefore, the economic diagnostic model should be analytical.

In the model of economic diagnostics, it is necessary to evaluate the condition of the facility, as well as to ensure that the facility is in a new state. If necessary, problems with unsatisfactory results should be identified.

**Figure 4**



Quantitative indicators are used consistently in research in economic diagnostics. The quantitative aspect of the research involves three stages: 1) measurement; 2) mathematical modeling; 3) development of conclusions. Variable indicators and regularities of quantitative measurement are presented at the measurement

stage. Mathematical modeling is to bring the results of measurements into mathematical dependencies. The conclusions are based on quantitative measurements that eliminate the causes of problems and facilitate the optimization of the facility's operations. All stages are interconnected and complement each other.

The above three stages - measuring, mathematical modeling and drawing conclusions - have their features. At the same time, their differences are contingent. For example, size itself can be thought of as mathematical modeling, any indicator or scale of measurement can be regarded as a mathematical model (as opposed to an economic indicator - an economical-mathematical model), and this model reflects the significant relationship of the object. In general, measurement can be interpreted as a method of research using a model. In my estimation, as in modeling, the economic problem is transferred to mathematics. In both cases, the main problem is to quantify the object and its essential characteristics.

Of course, economic metrics are more of an indirect measure. Here we have to consider the links between the measurements and the measurement capabilities. The economic-mathematical model serves as a form of expression of such dependencies. The modeling process can be considered as the search for the optimal number of variables.

As mentioned, the model somehow reflects important features, processes and interconnectedness in real systems. Models can be built on different bases: models that represent the properties or movement of a real object; models that embody a concept or idea; models that represent movement and incorporate generalization in thinking (concept).

In economic and mathematical modeling, socio-economic problems are expressed in the language of mathematics. The study of the system of equations, mathematical formulas, or other mathematical expressions allows for a deeper study of the relationship that can be expressed in quantities in real events. The model thus serves as a tool for object exploration. The model can be used to monitor, evaluate and analyze the phenomenon or system activity under study. The model is used for a variety of purposes. The modeling structure consists of 3 stages: 1) model development; 2) model research; 3) study of the real object based on the model.

Depending on the measuring instruments used, metric and non-metric models differ. The metric model is developed as a mathematical algorithm. In this algorithm mathematically expresses the dependence of the dependent

variable on other independent variables (indicators) that define it. Non-metric models show the structural characteristics of the event and the relationship between the elements.

Depending on the objectives of the study, it is possible to distinguish between descriptive and normative models. How do descriptive models take place? or how can it evolve? answers to the questions. Sometimes these tasks are interpreted as the tasks of economic diagnostics. In this case, the diagnosis is limited only by explaining and observing the observed facts, which is a passive role. In particular, the object is investigated by descriptive modeling in the form of correlation analysis, that is, by evaluating the statistical correlation of the real situation with the model dimensions representing the dependence of the event and its variables.

Regulatory models are designed to ensure that the object under study is in a state of being, and the factors necessary to achieve the optimal state are studied. The main objective is to show the rational direction of the object's activities, along with reflection of the real reality. Whether the model is a descriptive or normative model depends on its mathematical structure and the nature of its use. Consequently, economic diagnostics often requires the use of normative models.

One of the challenges in developing diagnostic models of object activity is to summarize indicators used for various purposes. Summarizing assessments is an important source of information when describing an issue or situation. Also, any studies refer to summarizing indicators by several criteria.

It is important to note that it is necessary to use generalized indicators to quantify the outcome event that is expressed by several indicators or that several features are considered important. Such phenomena can be regarded as multi-dimensional, measurable properties of points in a multidimensional space. Each facility has many features from an economic diagnostic point of view, and its quantitative measurement can be accomplished in a variety of ways, depending on the objectives of the study. However, the selection of indicators to reflect the multidimensional outcome should not be accidental and it is necessary to rely on logical qualitative analysis. In

order to measure any economic or social amount, quantities (indicators) should be selected that are closely linked to these processes, allowing for joint review, and drawing conclusions about the research object or its activities.

Such indicators, which reflect any of the properties of the objects under investigation, are the coefficients of significance in the comparison of objects with their quantity. If any of the properties of an object are expressed in greater numbers, that is, more elaborate, it becomes more and more important to take into account comparisons of objects. Consequently, how many characteristics are expressed can also influence the conclusions of the study.

A generalized estimation can also be made by developing an economic and mathematical model that relies on indicators (indicators) that represent the condition and activity of the object. The generalized assessment or indicator increases the reliability and validity of the conclusions drawn from the analysis of individual indicators. A more complex indicator based on summarizing several simple indicators is called aggregation or aggregation.

Because the characteristics of the object vary in different levels and sizes, they can also be summarized with different levels of quality in their generalization, which negatively affects the accuracy of diagnostic findings. There are often two ways of summarizing:

summarizing indices of small-scale events to have a large-scale index (the simplest form of aggregation);

development of a new generalized indicator based on any qualitative characteristics that link them with different names and contents.

In normal aggregation, the sum of the indicators is calculated or the mean is calculated. Developing a generalized index from different content indicators is justified only when they have a common content and a common measurement. The above indicators can be summarized using estimates.

As a result of the combination of private indicators, integral indicators are formed. The indicators obtained as a result of aggregation of indicators summarize the events that occur in the system and serve to represent their interrelations. Also, integrated indicators characterize the

system's performance characteristics - efficiency and financial stability. Accumulation combines a large number of indicators to increase the information reliability of the research.

There is a problem of methodological nature in the implementation of aggregation by simple arithmetic or by another complex algorithm. One of the most important is justification of criteria or criteria for aggregation. At the same time it is necessary to identify the signs that accurately characterize the studied feature, to give it appropriate place in the integral index, to determine the effect of each selected trait on the integral.

Particular factors are the importance of the indicator's effect on the totality of the indicator, that is, the amount of the integral value. Significantly, on the one hand, the object characterizes itself. On the other hand, the determination of significance is made by the researcher, and depends on how he approaches the definition of an integral indicator, what methods he can use, and how he can use it. In fact, a more theoretical basis for determining the effects of each individual indicator on the basis of logical analysis is the best way to determine its weight in a general or integral value. However, not all opportunities are available for economic diagnostics.

It is also possible to refer to mathematical statistics when evaluating the significance of the indicator. In the simplest approach, it is determined by the extent to which the effects of the indicators or indicators under consideration determine the total dispersion inherent in the event. The correlation coefficient of the integral index with the private index is considered as the quantitative representation of the importance of the private index. In some cases, the significance of the indicators is determined by expert assessment or all indicators are considered as equal.

By combining individual indicators with integral values by their significance, this is the following formula:

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

Here it is:

y – sum of integral index;



$n$  – weight of private indicators  
 $a_i$  –  $i$ - the weight of the indicator  
 $x_i$  –  $i$ - private index weight

The following conditions must be met in order for this formula to be validly developed and used for economic diagnostic conclusions:

$x_i$  - private indicators can be measured on a continuous scale, all of them are known for their quantities, and the greater their quantity, in other equal conditions, will have a positive effect on the performance of the system;

the impact of changes in private indicators on outcomes is constant over the period under review;

An integral indicator exists and is a smooth function of its arguments within the limits of the study, and therefore, that function can be differentiated several or more times.

In the formula above, the importance of private indicators is expressed in the weight given to them.

Integrative indicators can also be used to diagnose the economic and financial condition of the research object or trends in its changes. In particular, it is possible to draw conclusions using liquidity ratios and combining financial performance indicators with a specific algorithm. However, it is impossible to overlook the fact that many of the integral indicators have a number of shortcomings. Including:

In the development of integral indicators, a certain amount of information is lost due to generalization. Because in some generalized indicators, the deterioration of performance on some indicators may be offset by improvement in other indicators. In reality, however, it is often the case that, on the one hand, it is not compensated for by the deterioration of results and on the other. Different socio-economic indicators may not be fully equivalent to each other and may be interchangeable within each other;

Integrated indices developed without relying on mathematical statistics are not sufficiently complex, as a result, the effect of aggregation indices is not apparent;

when determining coefficients or category boundaries, it is necessary to rely on sound judgment or empirical data, and it is not possible to substantiate them logically;

procedures for calculating integral indicators are not always justified or interpreted;

While integrated indicators do not cover all of the existing problems, it does not mean that they occur.

the interplay of factors in integral indicators prevents the full disclosure of factors;

In some cases, changes in the content of indicators used by their importance are not intended;

it is often necessary to use the existing empirical norms, which lack clarity and are small.

Clearly, the implementation of economic diagnostics cannot achieve the desired results without modeling and requires the development of principally new models.

Dynamics for social and economic phenomena is characteristic of their study, which involves the movement (development) of the object studied. In this process, moving the object towards its ideal model will serve as a criterion for assessing its actual state. Therefore, pursuing an ideal or benchmark requires the development of a normative model. The purpose of the normative model is not to reflect reality but to determine how well the activity of an object is conducted. On the basis of it there should be a system of indicators characterizing the object's condition.

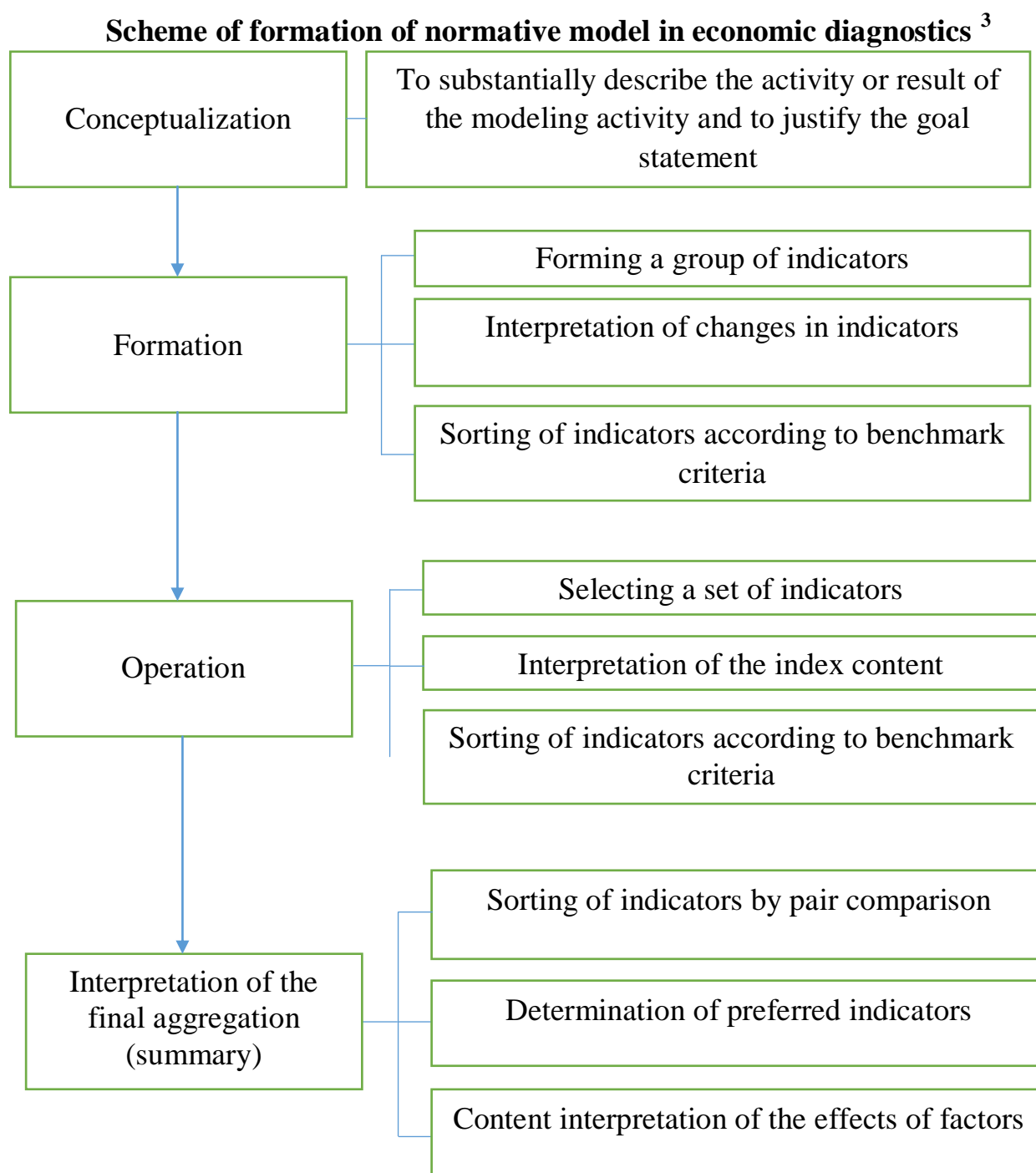
Normative models are shaped by the researcher, but that does not mean that they are subjective constructs. The starting point is the assumption that regularities exist in the internal and external properties of the object under analysis. Diagnosis is about revealing objective laws and developing specific conclusions based on their study.

Accordingly, the first step in the implementation of economic diagnostics is to develop its theoretical framework, that is, conceptualize it. In the second stage, a constructive model is formed. In the third step, it is necessary to develop a constructive model. Its development is the benchmark for the best dynamic state of the object being modeled. A constructive model should serve as a model of form and content. It identifies, interprets, and compares indicators of indicators based on research objectives. The fourth step, which is common to all models and provides a direct basis for the development of conclusions, is the

interpretation of final sets in terms of quality. Fig. 5 shows the relationship between model types that

need to be developed in economic diagnostics.

Figure 5



<sup>3</sup> Developed by the authors.

This approach to modeling is systemic and complex. The systematicity is expressed in the model, where the dynamics of indicators is considered in terms of their interrelations, and the inherent nature of the system (which does not exist in individual elements due to the whole system). Complexity is provided by indicators that reflect all aspects of the activity modeled in the set, regardless of their size. In general, modeling should move from conceptual to constructive and from operational to model.

While such a set of indicators performs a normative function when set for the purpose of the modeling, the descriptive model that reflects the activity demonstrates real reality. In either case, the need to sort them remains. This combination of indicators or indicators minimizes the loss of information as the role of each indicator is clearly demonstrated. In such a combination, the combination of positive and negative effects does not occur.

The general list of principles to be applied in economic diagnostics can be summarized in Table 1.

Table 1

**Diagnostic model development principles**

Types of principles	Principle aspects		
	scientific	separately	special
<b>Methodological</b>	science, abstraction, idealization	systematic, general concepts, definition of features	complexity, use of norms, benchmarking, universality, integration, interconnection of indicators
<b>Methodical</b>	formulate concepts in the same context	Constructiveness of system-forming functions and definitions	comparative, unit, accuracy, development
<b>Application in practice</b>	usability, usefulness, quantitative determination	interpretation, adaptability to many subjects	Identity, universality, visualization, built on the basis of existing accounting

Clearly, when developing diagnostic models, separate and specific principles need to be followed, starting with scientific principles, to summarize these indicators, not only by measuring them, but by qualitative approaches.

## V. Conclusion/Recommendations

In conclusion, the determination of financial, economic and management problems, the ability to achieve and achieve the goals set under the constant changes of external and internal factors requires strict adherence to the principles of economic diagnostics. Economic

The usefulness of the model, that is, the ability to use it to draw valid conclusions, is one of the important conditions for the diagnostic process. Only when this condition is met will the results of the diagnostics include measures designed to improve the performance of the facility in terms of goals and can serve as the basis for management decisions. This condition also allows for the use of diagnostic findings in the monitoring and analysis of facility performance. The usefulness of the diagnostic model is also reflected in the display of output (output) information. Such information should be presented in an understandable and convenient way to use it in the implementation of appropriate management principles. In the output information provided by the diagnostic model, the identification of current and future problems in the activities of the facility determines the value of the model.

diagnostics and modeling is a complex process. This process takes place when combining indicators of different contents. In this case, it is necessary to find the unit of measure that is common to different indicators. In these cases, indicators that do not participate in the formulation may also be included in the list. Therefore, the formulation of outcome indicators is a very complex task, both horizontal and vertical. In the manufacturing sector, aggregation is often performed using prices. However, there is a partial loss of information in the aggregation

process. This is because even prices do not fully represent all the results of production.

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