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# MANAGING THE SUSTAINABILITY OF ECONOMIC SYSTEM AS THE BASIS OF INVESTMENT DEVELOPMENT IN UKRAINE

## Abstract

Nowadays, studying the categories of "economic sustainability", "economic sustainability management" and the peculiarities of these concepts is especially relevant. Their use would provide an opportunity to ensure the sustainable and most effective functioning of the subject of economic relations in the current period of time, as well as to create a high potential for its development and ensuring the conditions for investing capital in the Ukrainian economy. All this determined the purpose of this study, which consists in the analysis of the theory and essence of the economic sustainability concept, the interpretation of the concept of "economic sustainability of the system" and the concept of "management of economic sustainability of the system", distinguishing factors affecting the sustainability of the Ukrainian economic system, determining the relationship of economic sustainability with economic security, investing as well as forecasting the level of the Ukrainian economy sustainability based on the innovative modeling methods. The object of the research is to develop the theory of the "economic sustainability" concept and to determine the level of economic sustainability of the economy aimed at raising the investment climate in Ukraine. To ensure the development, security and investment attractiveness of the Ukrainian economy, an organizational structure of the management model for the sustainability of the Ukrainian economic system was developed using the developed economic and mathematical model.

## Keywords

management, investment climate, economic sustainability, development, state, security, forecasting of the economic sustainability, Ukraine

## JEL Classification

E27, O11, P52

## INTRODUCTION

The rapid dynamics of modern life raises new problems, activates methodological searches, and forms new paradigms of the studying the economic processes. In their numerical list, the problem of determining the sustainability of the Ukrainian economy is singled out. The need to study economic systems in the aspect of their development is due to the fact that the current underestimation of the economy regulation and, as a result, inadequate to the potential capabilities of the state using the levers of economic development management became apparent. This proves the relevance of the above problem and calls for the development of a theoretical-methodological and terminological concepts of management of the state economy in modern conditions.

As the world experience shows, the main purpose of economic systems at various levels, which includes the national economy, the economy of regions, territories, enterprises, etc., is not only to obtain maximum profits, but also to ensure integrated development, the creation of favorable working conditions, the solution of actual scientific-technical and social problems, maximum satisfaction of material and spiritual

needs of people, etc. Despite the difference in goals and objectives of the production-technological and management systems, the performance of each of them is determined by the absence of crisis processes and social tension, the growth of production, financial stability, etc. In the end, the effectiveness of economic systems depends on their potential (material, labor and financial resources), and on the ability to effectively manage the processes taking place in the economy and the social environment. In Ukraine, the significance of these factors is particularly increasing and generates specific problems in managing economic processes at micro, meso and macro levels.

## 1. LITERATURE REVIEW

The necessity of research is determined by the fact that in the global economy, since the end of the twentieth century, the transformational processes are expanding both in the systemic and in the structural-branch nature. In this regard, ensuring the sustainability of the economic systems development becomes of prime importance both in scientific research and in practical developments. Therefore, determining the sustainability of economic systems is relevant and crucial for current activity and for the future both for the economy as a whole, and for its industries, regions, individual enterprises, etc.

The concept of sustainability is fundamental since it is impossible to realize the state of economic growth and progressive development of society without it. This concept has become widely used in the scientific literature of the humanitarian sphere (on the economy and the development of society) only at the end of the twentieth century. Meanwhile, in the technical field, it became widely used in the late nineteenth century, after the concept of sustainability was defined and the theorems on the technical system sustainability were formulated.

In economic theory, “sustainability” is considered as one of the concepts of economic equilibrium, according to which the achievement and maintenance of the equilibrium state in the economy belong to the most important micro- and macro-economic processes. From this concept, it follows that economic actors are trying to translate the economic system into an optimal state, considering it as an equilibrium, which in this context is associated with the notion of sustainability. In the “Great Economic Dictionary”, the category of “sustainability” is interpreted as “... constancy, permanence, non-assignment of the risk of loss and damage” (Bolshoy Economicheskii Slovar, 1997).

Alekseenko (2008) defines “the state of the material, economic and labor resources, their distribution and use, which ensure the development of enterprises on the basis of growth of profits and capital while maintaining solvency and creditworthiness in a permissible level of risk”.

Bugai (2008) treats this category from other positions, namely: “the ability of an enterprise to absorb external and internal destabilizing factors through the efficient use of its resources via the use and improvement of economic potential”.

Ivanov (2005) considers the sustainability of economic systems as follows: “the ability of the economic system does not deviate from its state (statistical or dynamic) with various internal and external destabilizing influences through the effective formation and use of financial, production and organizational mechanisms”.

Udovichenko (2012) treats the notion of sustainability from the point of attaining equilibrium states: “... means the change of equilibrium states that guarantee the achievement of strategic and tactical goals at specific time intervals and ensure the compliance of parameters and results of internal processes with the changing requirements of the internal environment”.

A number of scientists, including Moroz (2008) tend to interpret the sustainability of the economy as its ability to counteract external negative influences and burdens. The list of factors that determine sustainability is quite diverse. In some sources, the procedure for determining the sustainability of the economic system is reduced to the calculation of certain financial indicators, that is, to calculate financial sustainability. In other words, methods have been developed that allow taking into account a large number of both quantitative and qualitative indicators that influence the system’s sustainability. There are ap-

proaches that differentiate external and internal sustainability factors, although it would be more appropriate to divide these factors into those that can affect sustainability and those that provide it.

Pavlovsky (2001) determines the sustainability of the economic system as follows: "The sustainability of the economic system is a certain power of the economic system to reflect its dynamics, which depends on a set of factors".

Tarasova (2008) gives the following definition of the economic system sustainability: "Sustainability refers to the ability of the economic system that has fallen into a negative deviation beyond its permissible state, to return to a state of equilibrium at the expense of its own and borrowed resources".

Popelnukhov (2009) notes that the sustainability of the economic system reflects its ability to effectively counteract adverse internal and external influences, adequately and quickly change its internal structure in accordance with changing conditions. The more stable the system is in adverse events, the more viable it will be.

So, the notion of system sustainability is considered by the authors in regards to its possible equilibrium. If the state of the system is known and the possible disturbances are predicted, then it is necessary to analyze whether the system can return to its original state after the perturbation. Sustainability, in particular, determines that the system will not be transformed under the conditions of the stochastic influence of external factors (perturbations or threats). Resilience, in this case, involves not only inertia and insensitivity of the system to external threats but also its flexible response to changes in the internal and external conditions of functioning in order to ensure the stability of its economic environment.

The state of any system is determined by its type, characteristics and intensity of disturbances. The criterion of the system's sustainability can be a finite closed set of its possible states, subject to the consideration of external influences. Provided that the condition of the system is conditionally fixed at a certain point, and the perturbation at the input of the system is negligible and does not go beyond the given states, then the system can be

considered as stable. The sustainability of the system as a whole will depend on the degree of each of the selected indicators deviation from the corresponding ideal or normative value. An integral indicator of economic sustainability assessment is based on an analysis of all economic processes, as well as a set of measures that could improve this indicator. This indicator can be obtained by composing all selected local indicators.

Shovgenov (2007) extends the notion of system sustainability to socio-economic systems, to which he refers the world community, unions of states, individual states, administrative units within the state, branches of economy, separate enterprises, and groups of people.

Each system has the potential (resource, capital) that directs its development. Development is referred to as changes taking place in a system that acquires a new structural and qualitative-quantitative form, or changes reflecting the nature of the system's functioning. The socioeconomic system is able to evolve from one species to another, in particular to one in which the utilized resources are restored, reproduced, replaced by others, and their expenses are minimized.

According to Shovgenov (2007), the sustainability of the socio-economic system differs significantly from technical and physical sustainability, since the main characteristic of the socio-economic system is a certain equilibrium state and the ability to return to it in the case of harassing actions or preservation of a given trajectory of development in the case of the impact of opposing forces, as well as the ability to effectively use and independently modify the resources of its development without increasing or minimizing the cost of basic, non-renewable resources.

The formation of a sustainable socio-economic system should be based on certain principles such as: improving the quality of life and preserving people's health; satisfaction of the basic life needs of present and future generations; fight against poverty; creation of rational structures of production and nature use; conservation of ecosystems, climate protection and the ozone layer; environmental safety; elimination of all forms of violence against man and nature; prevention of war, terrorism, ecocide; global partnership, etc.

The purpose of the paper is to study the theory and essence of the notion of economic sustainability, to interpret the concept of “economic sustainability of the system” and the concept of “management of economic sustainability of the system”, to distinguish factors influencing the sustainability of the economic system of Ukraine, to determine the relationship of economic sustainability with economic security, and also forecasting the level of the Ukrainian economy sustainability based on the use of innovative modeling methods.

## 2. RESEARCH RESULTS

From the foregoing, we can conclude that the definition of the economic system sustainability in any of the modern scientific interpretations is not complete for several reasons.

First, the sustainability of the economic system is considered from the standpoint of the possible negative impact of external forces, while the objective ability of the system to counteract these forces is often ignored, which creates a mismatch between the nature of the category of sustainability and its scientific interpretation.

Secondly, one of the principles of the development process is the impossibility of returning the system to the starting point of development, which scientifically agrees with the principle of irreversibility of time. If the ability of the system in a certain short-term period to counteract certain external influences and to maintain certain parameters of its functioning within the optimal limits is a positive moment, then the propensity of a stable

system to conservatism and leveling out external influences, regardless of the nature and direction of their actions within the framework of evolutionary processes, is rather a negative phenomenon.

Thirdly, the category of sustainability implies the stability or consistency of the system’s operation parameters, which excludes the ability to achieve certain thresholds. And this, in turn, prevents the emergence of key moments of evolution – the emergence of so-called points “bifurcation”.

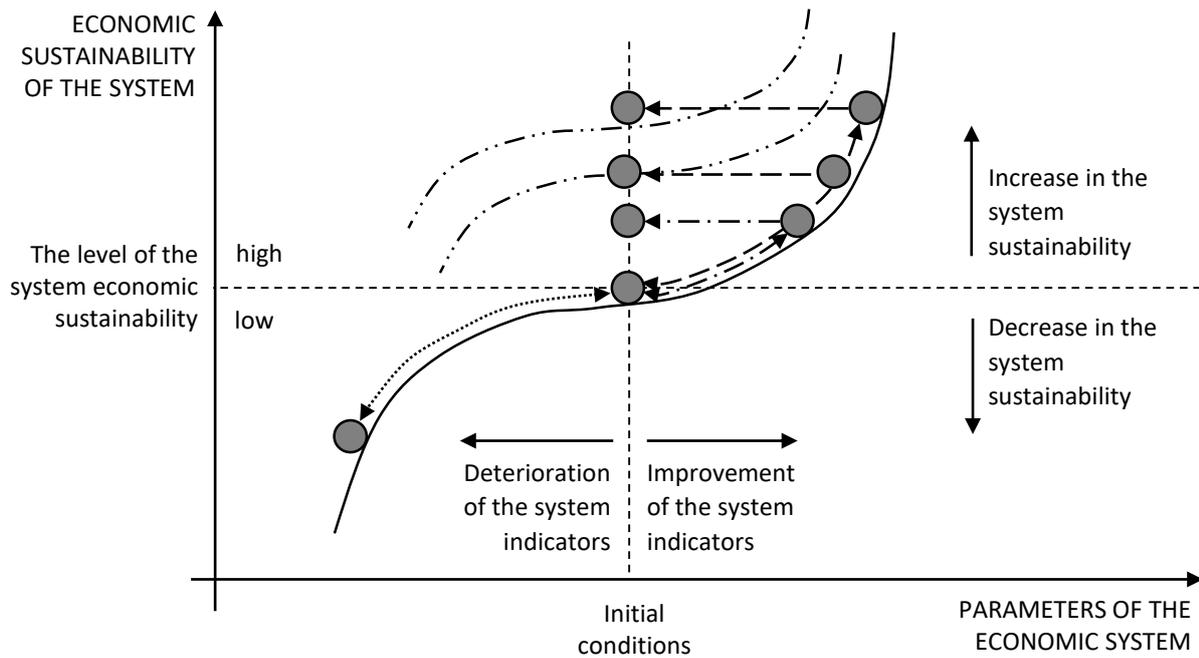
In addition, the concept of the economic system sustainability does not take into account a number of moments related to the scale of the system, its market position, the nature, strength and direction of external forces of the market environment, internal factors (influences), as well as the institutional environment. From this, we can conclude that sustainability in itself cannot be a prerequisite for the further development of the economic system.

Modern economic science offers several indicators for assessing the sustainability of the country’s economy, which are given in Table 1 (Kozlovskiy, 2010).

There is no clear classification of the types of economic systems’ sustainability. However, as to the system approach, one can distinguish the following types of sustainability: the sustainability of technology; technological sustainability; organizational sustainability; sustainability of external connections; socio-psychological sustainability; financial sustainability; environmental sustainability; organizational and economic sustainability; communication sustainability; innovative sustainability; structural sustainability, and others.

**Table 1.** Indicators for assessing the sustainability of the state’s economy

Indicator	Developer	Content
Genuine saving	World Bank	The purpose of the indicator is to show “the value of changes in assets that are important for the system’s development, namely: in productive assets, natural resources, quality of the environment, human resources, foreign assets, etc.”
Environmental sustainability index	Yale and Columbia Universities	The index value is calculated on the basis of 22 indicators. Each indicator is determined by the averaging of two to five variables, all 67 variables are allocated. The “dozens” of the most stable countries for this indicator included Finland, Norway, Canada, Sweden, Switzerland, New Zealand, Australia, Austria, Iceland, Denmark and the United States
Index of sustainable economic welfare	J. Cobb & G. Delhi (USA)	Calculated as GDP per capita, adjusted for the sum of costs for socio-economic and environmental purposes. When calculating the index, the following variables are taken into account: the cost of water pollution, air, loss of agricultural land, compensation to future generations for the loss of non-renewable sources of energy, etc.
Indicator of UN Commission on Sustainable Development	United Nations	This indicator takes into account four areas of activity: social, economic, environmental and institutional. The selection of indicators was carried out according to the scheme: pressure, state, reaction. The primary list covered 134 indicators, then this list was reduced to 60



**Figure 1.** Graphic representation of the essence of the economic sustainability of the system

The authors are invited to supplement this classification with the economic sustainability of the system.

The economic sustainability (Kozlovskiy, 2010; Kozlovskiy et al. 2012) of the system is the ability of the economic system after a certain disturbance (changes in the parameters of the economic system, its indicators) to quickly return to a state not worse than the previous one, to maintain its condition for an arbitrary long time, and also to improve its state to the value of perturbation provided the positive change in the economic parameters of the system. The essence of the system's economic sustainability is represented in Figure 1.

Management of the system's economic sustainability is the use of organizational, economic, and social management methods aimed at ensuring the economic sustainability of the system.

The proposed interpretation of the "economic sustainability of the system" concept made it possible to consider sustainability from the standpoint of both positive and negative effects on the economic system, as well as the possible reaction of the system either to support these impacts or to neutralize them.

The sustainability of the economic system should not be understood as its stability. Stability is continuity, immutability, long-term preservation of a certain constant state or level. Stability is the ability of the system to function without changing its own structure, that is to be in equilibrium. This ability should be unchanged in time.

The proposed interpretation of the category "sustainability of the economic system" has a certain affinity with the category "sustainability of the economic system" in the aspect of "system management" and "self-support".

The category "sustainability of the economic system" is characterized by affinity with the category of "sustainability" of the system based on its manageability. The basis of controllability is the systematic approach and modern information technologies, which allow very quickly to model various options for the development of the economic system, with high accuracy predict the expected results and choose the most optimal variant of development. The difference between the categories of constancy and sustainability is that the economic system can be both stable and unstable at the same time, it may be constant and unstable, but it can not be stable or unstable. It is also worth noting

that constancy in most cases is a static characteristic of the system, and sustainability is dynamic.

Since modern economic systems are complex open systems that have specific properties: integrity, purposefulness, predictability, self-organization (as the desire to preserve the integrity and adapt to changes in the external environment and the system itself), etc., it allows us to assert that such systems are observable, identified and managed. Hypothetically, the characteristics of controllability and observation do not have a quantitative gradation but are characterized by statements “yes” (controlled system) or “no” (non-controlled system). However, in practice, there are other methods of measuring the qualitative characteristics that indirectly evaluate the performance of the system.

A characteristic feature of modern economic systems is their possible disintegration. The fact is that the formation of a hierarchical structure of any economic system takes place on the principle of ensuring the relative independence of each of its elements (subsystems). All elements of the system are interconnected by a certain set of relationships. Therefore, it is highly likely that the destruction of the economic system very often goes through the elimination of these links. The rupture of the latter leads to the collapse of the economic system into a set of microsystems, each of which should also pass the “test for sustainability”.

It is important to note that a sustainable economic system may have unstable elements or even unstable subsystems. In this case, it is necessary to take care of measures to ensure the sustainability of the system as a whole. The easiest way is to reduce the large systems, as well as to cover the local instabilities of the system by way of feedback, thereby bringing them to a controlled form.

The division of systems into small elements can have a positive effect: the system will be more manageable by reducing the degrees of freedom, it will be better observed, which makes it more stable, especially in the period of significant structural changes (Yudin & Goriashko, 1974). There is a certain optimum scale of each particular economic system that will guarantee its “survival” at the appropriate level of organization and management efficiency.

The management of the economic system means the ability of the system to achieve its goal. From the practical point of view the achievement of this goal requires:

- 1) that the control systems of the system has an opportunity to influence the state of the system;
- 2) that there were sufficient resources for the development of the system along the trajectory that achieves the goal.

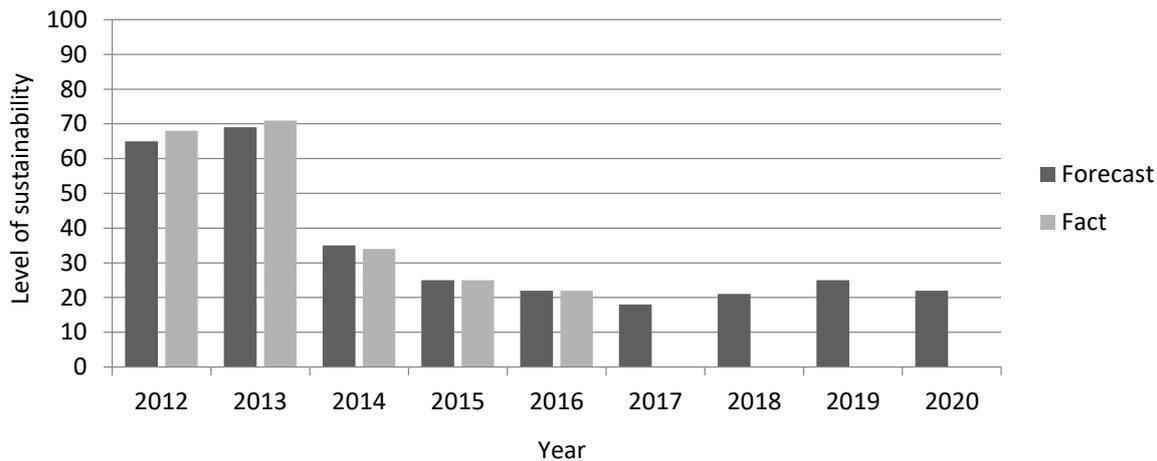
With regard to the management of the purposeful impact on the system, then in relation to economic systems, it is more appropriate to talk about the processes that provide the homeostasis of the system. It is important to emphasize that the sustainability of the economic system is at the same time its qualitative characteristic, as the system can either be stable or unstable.

An important feature of any system is the ability to observe it. Priori (Kozlovskiy, 2010), as noted above, the characteristics of controllability and observation do not have quantitative gradation: the system can be controlled (not observed) or not.

In this regard, it is relevant to use the criterion of sustainability of the economic system to assess its safety, since the violation of sustainability immediately leads to the destruction of the system. However, at present, there are no general methods of building the economic sustainability areas for the given impacts and parameters that would be adequate to the limits of security. This, according to Mogilevsky (1999), greatly complicates the possibility of developing a general constructive theory of security.

The output can be found in the decomposition of the problem, that is, in solving security issues for individual subsystems, interconnections, etc. This can be done by reducing the tasks that is, describing the marginal areas of change of the most critical indicators (or their groups) that affect the sustainability of the system. Then, to study the sustainability of the system, you can choose only those indicators for which you can calculate the area of their permissible values.

As follows from the analysis of the main indicators of the Ukrainian economy development for



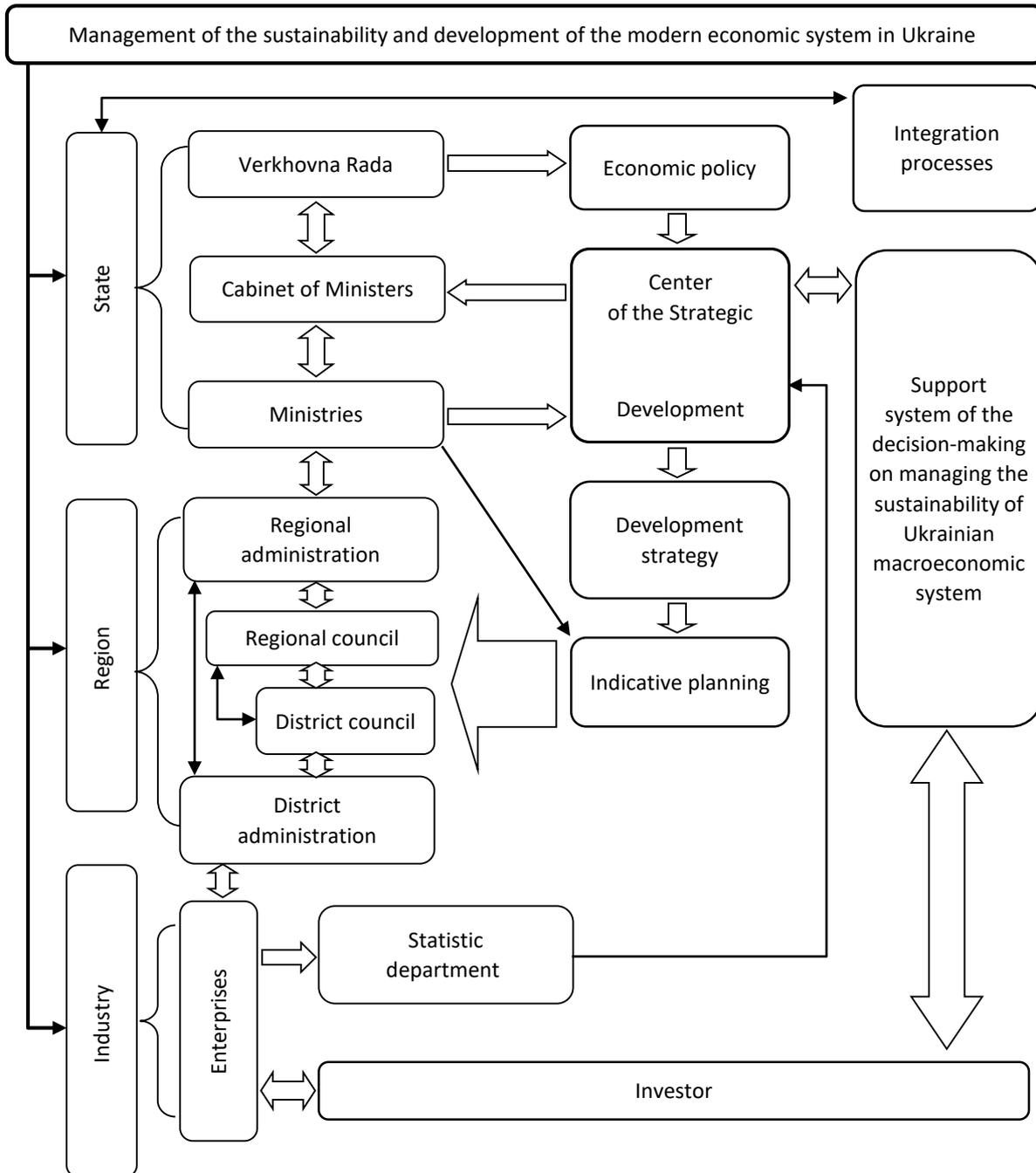
**Figure 2.** Forecasting the sustainability of Ukrainian economy

2005–2016 (Oficialniy sait Ministerstva economichnogo rozvitku i torgivli Ukraini), the authors identified quantitative and qualitative factors that have an impact on the sustainability of the macroeconomic system. These factors are formed into the following groups: 1) budgetary and financial (the size of the revenue part of the state budget of Ukraine; the size of the deficit of the state budget of Ukraine; the size of the state debt of Ukraine; the amount of money in circulation; the NBU discount rate; the level of inflation; the size of international reserves of Ukraine; Dow Jones index, level of “shadow economy”); 2) social (unemployment rate; average monthly salary; average amount of subsistence minimum per one able-bodied person; average monthly pension; number of pensioners; price of the basket; consumer price indices for goods and services; number of registered crimes; minimum wage; one-time assistance at birth of the first child; index of human development); 3) political (level of confidence in the authorities; stability of power; completeness of political programs; relations between Ukraine and other countries; the possibility of elections and change of power); 4) economic and production (gross domestic product; volume of sold industrial products; volume of agricultural production; volume of manufactured construction products; export of goods; import of goods; foreign trade balance; cargo turnover; passenger turnover; turnover of retail trade) (Petuhova, 2014; Ilchenko & Glushko, 2017); 5) energy-ecological (volume of produced electricity; volume of petroleum raw material processing; volume of oil transportation; oil production volume; gas trans-

portation volume; volume of consumed electricity; gas production; payment for consumed electricity; payment for consumed natural gas by all categories of consumers; emissions of pollutants into the air); 6) force majeure (natural disasters; the possibility of wars; international sanctions against Ukraine; the possibility of terrorist acts; the level of man-made disasters; the level of epidemiological threats).

Using these factors of influence, the authors developed an economic-mathematical model for determining the Ukrainian economy sustainability based on the fuzzy logic theory and the method of optimization – the genetic algorithm (Kozlovskiy, 2010). The theory of fuzzy logic for modeling the sustainability of the Ukrainian economic system is proposed to be applied for the first time. The use of fuzzy logic is effective where there is a lack of formal formalization of the input variables (input parameters), where the conclusions (statements) of the experts dominate, made in the linguistic (verbal) form. In addition, the theory of fuzzy sets and fuzzy logic allows us to operate incomplete statistical information, based on which the sustainability of the Ukrainian economy will be determined.

Using the developed economic-mathematical model with updating of statistical information for 2005–2016, an experiment was conducted to determine and predict the sustainability of the Ukrainian economy for the period up to 2020. The simulation results obtained on the basis of the expert values of development factors for 2005–2016 before and after optimization are shown in Figure 2.



**Figure 3.** Organizational structure of the model for managing the sustainability of the Ukrainian economy as the basis of investment development

The results of the prediction have shown that under the current situation in Ukraine (as of March, 1 2017), the sustainability of the domestic macroeconomic system in 2017–2020 will be at the level of absolute instability.

Based on the developed economic-mathematical model for determining the sustainability of the

Ukrainian economy, a model for managing the sustainability and development of the Ukrainian economic system is presented (Figure 3).

The main element of the presented organizational structure of the model for ensuring sustainability and development of the modern economic system in Ukraine is the Center for Strategic

Development, which develops a strategy for the development of the economic system based on its strategic economic potential. Next, with the help of indicative planning, implementation of the developed strategy at the regional and sectoral levels is carried out. At the sectoral level, the strategy is implemented by restructuring and seeking reserves to increase strategic economic potential – as noted by Kozlovskiy (2010).

In the process of managing the sustainability of the economic system, the decision-making support system (DSS) is used, which provides the

Center for Strategic Development (CSB) with predictive information on the level of sustainability of the current macroeconomic system in Ukraine.

Investments are a key factor that can ensure the growth of Ukraine's economy as well as its sustainability in the coming years. In Figure 3 it is proposed to attract foreign investors who will be able to reduce their own economic risks by investing their own capital in the Ukrainian economy using the decision support system and the Center for Strategic Development.

## CONCLUSION

The advantage of the proposed organizational structure for managing the sustainability of the Ukrainian economic system is in the fact that the Center for Strategic Development must coordinate the actions of all institutions of state power, which will reduce the possibility of conflicts of interest between economic systems of regions, industries, enterprises, various institutions of power, etc.; make it impossible to duplicate individual functions in the activities of these institutions and delay the resolution of the problems that arise. That is, it will be practically impossible to make a situation where the errors that objectively arise in the process of managing the development of economic systems, due to the lack of effective control by the state in a timely manner or not at all, are rectified and, as a result, are repeated again.

The Center for Strategic Development will provide information to central government about the real state and development of Ukraine's economic system, and take into account possible changes in external and internal conditions of the Ukrainian economy functioning; it will be possible to predict the future level of sustainability of the Ukrainian economic system and to manage it. This enables all other economic actors to timely and adequately react to possible changes in the sustainability of the Ukrainian economy and to make adequate managerial decisions.

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