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GENERALIZATION OF UNCERTAINTY CONDITIONS FOR MODELING AND DECISION MAKING IN ECONOMY

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Abstract — The concept of "uncertainty" is generalized. Various classifications of uncertainty and its role in modeling and decision making in the economy are considered. An analysis of Methods that consider uncertainty factors is made.

Key Terms — Uncertainty, modeling, classification of uncertainty.

The main method of investigation in the study of economic systems is the method of modeling. The need to take into account the uncertainty in the modeling of economic systems due to the following objective factors as the complexity and inaccuracy of information on economic processes; remote sources of economic information from decision's-makers; discrepancies between the interests of the reporters and the persons for whom the information is intended; requirements of reliable and high-quality information. At the same time, an important feature of decision-making processes is the need to take into account the influence of uncertain factors and the consequences of alternative choices that are available for choice. That is why, economic and mathematical models with uncertainty are of great practical importance in decision making. These models provide for the structuring of the problem, the generation of new ones, and thus partially fill in the incompleteness of the original data available to the researcher. This is especially relevant in the current conditions of functioning and development of economic

systems, characterized by the variability of factors of both the external and internal environment, which cause uncertainty.

Summarizing the existing definitions of the concept of "uncertainty", it is recommended to understand uncertainty as a fundamental characteristic of ensuring the decision-making process with the necessary information. On the other hand, uncertainty is the lack of information about the conditions in which the economic system will operate the inability to predict these conditions. Uncertainty is associated with the risk of action at all levels of economic system management [1, 2].

There are different types of uncertainty in the process of functioning socio-economic system. The causes of uncertainty in the functioning of economic systems, which are factors of uncertainty, should be grouped into several groups, namely:

- 1) not deterministic of the processes that take place in society in general and in economic activity in particular
- 2) lack of comprehensive information in the decision-making process or poor analysis of existing information
- 3) the influence of subjective factors on the results of the analysis (skill level, hiding some information, misinformation, etc.).

The higher the uncertainty, the more difficult to be applied for decision-making tools.

It should be noted that in economics there are many classifications of uncertainty. One

of them is characterized by the following three classification features:

1) the degree of occurrence of uncertainty is divided into complete uncertainty (the probability of an event close to 0), partial uncertainty (the probability of an event is in the range from 0 to 1) and full certainty (the probability of an event close to 1). It should be noted that in the decision making process, complete certainty is not often encountered, complete uncertainty is almost never encountered, and partial - most probable. In the case of partial uncertainty, the task is to select the most optimal option from several alternatives, which are usually constructed on the basis of economic instruments, and optimized on the basis of different criteria. However, economic operators do not have complete information about the state of the system to obtain the optimal solution and sufficient conditions to account for all data [3];

2) according to the object of uncertainty, it is subdivided into technical (it is uncertainty, which is caused by a person or organization of people);

3) depending on the methods of determining uncertainty distinguish its two types - uncertainty associated with values in the economy (statistical or measurable) and uncertainty associated with the lack of knowledge about certain phenomena or their consequences (non-statistical or immeasurable, a priori). If the researcher has statistical uncertainty, then they say that the decision is made in terms of risk, if it is non-statistical, then the decision is made in conditions of uncertainty; the most common is a mixed type of uncertainty.

It is advisable to supplement the features of uncertainty classification with the following:

environmental uncertainty (external and internal), measurement inaccuracy, ambiguity in the meaning of words or content.

Another classification of uncertainties [4] and their sources are presented in Table 1.

Table 1

Uncertainty classification

Kinds of uncertainty	Characteristic of the type of uncertainty	Sources of uncertainty
Perspective uncertainty	The emergence of unforeseen factors that affect the effectiveness of the processes; the unknown of the future	The difficulty of obtaining background information, the complexity of technological processes, political factors
Retrospective uncertainty	Lack of information about the behavior of the object in the past	Loss of information, inability to recover it, storage inefficiency
Technical uncertainty	Inability to predict the results of the decisions taken	Subjective decision-making, error of forecasting methods, rounding, simplification
Stochastic uncertainty	The result of the probabilistic nature of the processes and phenomena under study	Specificity of processes and phenomena
Uncertainty of the environment	Full or partial ignorance of the natural conditions in which the decision will be made	Naturalness and unpredictability of natural phenomena
The uncertainty of targeted counteraction	Occurs in a conflict situation of two or more parties when one of the parties does not have information about the	Countering parties, different goals

	motives and nature of the opponent's behavior	
Objective uncertainty	Ambiguity and sometimes inability to choose one goal when making a decision	Different goals
Uncertainty of conditions	Insufficient or complete lack of information on the conditions under which the decision will be made	Loss of information, inability to recover it, storage inefficiency
Linguistic uncertainty	From a mathematical point of view, terms, concepts, phrases are not sufficiently described or do not have a clear interpretation	Qualitative, not quantitative, verbal presentation
Action uncertainty	Decision making uncertainty, multiple action options, goal may be one, several, or they are not accounted for	The specifics of the area

The analysis of factors and sources of uncertainty in the decision-making process determines the choice of methods in the approaches that allow to take into account these factors.

In general, uncertainty should be divided into physical and linguistic. Physical ambiguity is divided into chance and inaccuracy, and linguistic arises in the form of ambiguity in the meaning of words and the ambiguity of meaning. It was the linguistic uncertainty that led to the development of the theory and the need to use fuzzy logic. The theory of fuzzy sets allows us to describe fuzzy concepts and knowledge, operate on that knowledge, and draw fuzzy conclusions.

Modeling due fuzzy logic can be used for complex processes when there is no simple mathematical model; if the subject matter or process expertise can only be formed in linguistic form. These systems should not be used if the desired result can be obtained in any other way or if the object or process already found adequate, easily researched mathematical model.

The problem of decision making under uncertainty is the choice of a rational decision, formed under the influence of defined and uncertain factors, which are quantitatively and qualitatively described by the signs.

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