

Ministry of Education and Science of Ukraine
Sumy State University. Faculty of Economics and Management
Sumy Local Youth NGO "Council of Young Scientists"

21st International Scientific Conference
"Economics for Ecology"
ISCS'2015



Економіка для екології

Матеріали

XXI Міжнародної наукової конференції

(Україна, Суми, 6–7 травня 2015 року)

Суми
Сумський державний університет
2015

APPLICATION OF FUZZY SETS FOR DETERMINING THE LEVEL OF SUSTAINABLE DEVELOPMENT OF UKRAINE

Olena Pidberezna

*National Technical University of Ukraine "KPI", Kiev,
Ukraine*

The problem of achieving the sustainable development conditions requires appropriate coordinated actions of many subjects' of the economic-productive activity. Herewith, an important component of this complex action is to provide the acceptable level of the State's economic security (ECS) and its individual areas because achieving the sustainable development conditions requires, above all, rational organization of economic activity.

Public Policy for National ECS should include [1]:

- description and classification of internal and external threats;
- identifying and monitoring the factors that characterize the stability of sustainable development of the State;
- determination of criteria and parameters that characterize the national economic interests and meet the requirements of national ECS;
- national ECS policy which is aimed to coordinate the activities of public authorities and government to secure the ECS at the national, regional and global levels.

The threats are considered as a set of conditions and factors, as well as conjunctures that significantly increase the risks of a subject's life.

For Ukraine's areas' assessment according to the ECS terms the following three methods are mainly used: the scalarization method, the cutting-plane method and the method of discriminant analysis. All the given above approaches have one significant drawback - they require a clear classification of the situation to a particular security class (depending on the security indicators values and their boundary levels).

In the crisis it is quite important to develop integrated methodological approach accounting the properties of uncertainty and multicriteriaity in problems of ECS.

Herewith, multicriteriaity can be considered as one of the form of displaying the uncertainty of the development conditions and complex systems functioning (purposes' uncertainty). Another feature is the diversity of ratings by the criteria. To solve the problem of ECS it is necessary to the most properly recognize a situation of management decision making.

Herewith, information describing the knowledge about the system and the situation is formulated the most adequately by using fuzzy concepts, fuzzy definitions and fuzzy logic.

Thus, the given above led us to a necessity of considering the methodological basis of the fuzzy sets theory (FS) for Ukrainian's ECS level assessment.

This method involves creation of expert systems for pattern recognition. The decision about referring the security indicators to a particular class the experts make on the basis of their understanding of the required security level and the consequences of deviation from this level. In fact, while making a responsible decision the expert usually operates not only with formal concepts, expressed by a number or numerical formula, but also with some logical conclusions that can be expressed as: "If there are certain conditions ..., then the situation can be assigned to the following class". To process this kind of expressions a special system, which is based on the methods of the fuzzy sets theory and fuzzy expressions, is developed[1, 2]. This is achieved by introducing a membership function (MF) of fuzzy parameters, which takes values from 0 to 1. Its approximation to 1 means more confidence in expressions and more significant level of its implementation. It is appropriate to use exponential functions, as follows:

$$f(x) = \exp[b(x-c)^2],$$

where b and c - parameters of the function that determine its form.

The proposed mathematical description corresponds to the information nature and reflects its fuzziness. On the basis of experts' or expert groups' statements a database, that describes the situation classes, is formed for all ECS indicators. Thus, any current or predicted situation can be assigned to a particular class by comparing it with already known data, which was entered into the database.

In general fuzzy set characteristic is the membership function (MF). Fuzzy set is called the set of ordered pairs or corteges of form $\langle x, \mu(x) \rangle$, where x - element of the universe, $\mu(x)$ - (MF) which assigns to each element a real number in the interval $[0, 1]$, that characterizes the element grade of membership to fuzzy set. The larger the MF value, the more universal set element corresponds to the fuzzy set properties.

There are many types of curves to determine the MF. The most common MF is triangular, trapezoid and Gaussian function[1].

This function is preferable due to its three following properties:

- 1) its similarity to the accumulation;
- 2) limitation of values that are necessary to comply with the MF properties;
- 3) infinite definition domain, which greatly simplifies the algorithmic solutions while programming operations on fuzzy subsets.

Using the ranking of indicators the priority directions of emerging the economy from the crisis can be determined. Thus, the created system accurately and properly formalizes knowledge about the object of research, which, in turn, facilitates communication with experts; provides an opportunity with a minimum scope of knowledge to solve problems on the analyzed object properties.

References:

1. Караєва Н.В. Застосування методу нечітких множин для визначення рівня економічної безпеки України / Н.В. Караєва, Л.О. Левченко, О.Д. Верченюк // Держава та регіони. – 2011. – №2. – С.101-106.
2. Ризик-менеджмент суб'єктів енергетичного ринку як складова механізму забезпечення енергетичної безпеки : монографія / Н.В. Караєва, І.І. Гусєва, В.О. Бараннік, А.О. Савицька; за заг. ред. Н.В. Караєвої. – К.: Софія-А, 2012. – 256 с.