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PRACTICE OF USING OPTIMAL METHODS OF INCREASING THE EFFICIENCY OF INFORMATION EXCHANGE AND DECISION SUPPORT IN THE CORPORATE MANAGEMENT SYSTEM

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Abstract
This article discusses the definition and implementation of management decision-making procedures in integrated management-based systems. In the process of intellectual support of decision-making, the determination of efficiency characteristics through a mathematical model was carried out by selecting unwanted parameters in the management system. It has also been shown that an algorithm based on a two-stage nonlinear model allows management decisions to be made. In assessing the sources of incoming information, an unambiguous model was used in the optimal organization of the process according to the decision support mechanism based on the conclusions of expert systems. According to the MATLAB application package, the research indicators were carried out experimentally.

Keywords: Decision support system, expert sytem, integrated management, tax authorities, procedure, fuzzy model.

Introduction

The management process represents the target influence of the management entity on the management entity through the consistent implementation of management functions that are aimed at achieving the goals of the organization and can generally be seen as a management decision-making process. Therefore, there is an interrelationship

between management functions and decision-making procedures, and it is difficult to distinguish them from the types of management activities.

In a tax administration based on integrated management, the level of uncertainty in the system management problem is very important because many factors are unclear. That is why it is proposed to create an expert system that uses logical reasoning procedures as data processing methods to make effective management decisions in the work.

We will solve the problem posed by the example of the tax authorities management module selected as the object of study.In a tax inspection based on an integrated management system based on a set of uncertain logic tools, the methodological approach to the formation of a methodology to support management decisions can be described as consisting of six main stages.

Step 1. In a tax inspection based on an integrated management system, it consists of defining a set of indicators that reliably reflect the level of effective management. Based on the analysis of the activities of the tax inspection, it is possible to distinguish 3 groups of key processes, each of which in turn is characterized by specific indicators and evaluated qualitatively and quantitatively. The most important of these expressions are given in Table 1.

Table 1 - Indicators for assessing the performance of tax control

№	Indicator names	Limits of change
Management of scientific and control activities		
X_1	The state of accounting and reporting in the tax authority	[0;1]
X_2	The state of static accounting and reporting in the tax authority	[0;1]
X_3	Replenishment of the budget of the Republic of Uzbekistan (RU) with tax, fees and other obligatory payments	[0;1]
Management of office and field audits activities		
X_4	Compliance with tax legislation by taxpayers	[0;1]
X_5	The effectiveness of cameral audits	[0;1]
X_6	Effectiveness of on-site inspections	[0;1]
Analytical and forecasting management		
X_7	Indicative indicator of receipts to the budget of RU	[0;1]
X_8	Compliance with the forecast of revenues to the budget of the RU	[0;1]
X_9	Budget losses due to the provision of benefits by a taxpayer	[0;1]
X_{10}	Effectiveness of activity of tax inspectorate	[0;1]

Step 2. In this process, linguistic variables are identified. In modeling the performance management system in the tax inspection, the estimates of all indicators and two terms for each variable can be used to form a knowledge base based on fuzzy logical methods: L - low level of development of indicators, H - high level of development.

Step 3. This process is the definition of membership functions. To reduce uncertainty, it is necessary to create membership functions for all uncertain terms of input and output variables in order to make an adequate classification of all indicator levels. First, it is necessary to determine the possible range of input factors and the resulting index, then the general form of the membership functions of the indefinite terms of all variables is determined. Each term of a linguistic variable with a number of corresponding terms has a specific membership function, so they need to be interpreted in detail. Table 2 shows the sections in terms of unwanted variables.

Mathematically, the fuzzy set (X_1-X_10) and the output variables (UKD, KVP, APD, UPR) also have the following form for membership functions:

$$A = \left\{ \begin{array}{c} x_1, \mu(x_1), x_2, \mu(x_2), x_3, \mu(x_3), x_4(x_4), \\ x_5, \mu(x_5), x_6, \mu(x_6), x_7, \mu(x_7), x_8(x_8) \\ x_9, \mu(x_9), x_{10}, \mu(x_{10}), x_{\text{UDK}}, \mu(x_{\text{UDK}}), x_{\text{KVP}}(x_{\text{KVP}}) \\ x_{\text{APD}}, \mu(x_{\text{APD}}), x_{\text{UPR}}, \mu(x_{\text{UPR}}), \end{array} \right\}$$

where x_1 is the symbol of the corresponding linguistic variable;

μA (x_i) is a membership function that assigns some values from the interval [0,1] to each corresponding linguistic variable;

x_1, μ (x_i) is the corresponding spear of the indefinite set A;

A - Many taxpayers.

Step 4. It consists of developing a set of rules. An expert system based on uncertain knowledge should have a methodology for making such decisions so that management decisions made based on the system's initial data are most effective.

The table provides a set of rules for assessing the state of indicator management of analytical and forecasting activities (Table 2).

Table 2 - Rules framework for the uncertain inference system for analytical and forecasting performance management indicators

The rule / x_i	X_7	X_8	X_9	X_{10}	x_i	NN
1	High level of indicator	High level of indicator	High level of indicator	High level of indicator	W_1^B	High level of indicator
2	Low level of indicator	Low level of indicator	Low level of indicator	Low level of indicator	W_1^B	Low level of indicator
3	Low level of indicator	Low level of indicator	Low level of indicator	High level of indicator	W_2^B	
4	Low level of indicator	Low level of indicator	High level of indicator	Low level of indicator	W_3^B	
5	Low level of indicator	Low level of indicator	High level of indicator	High level of indicator	W_4^B	
6	Low level of indicator	High level of indicator	Low level of indicator	Low level of indicator	W_5^B	
7	Low level of indicator	High level of indicator	Low level of indicator	High level of indicator	W_6^B	

8	Low level of indicator	High level of indicator	High level of indicator	Low level of indicator	W_7^B	
9	Low level of indicator	High level of indicator	High level of indicator	High level of indicator	W_8^B	
10	High level of indicator	Low level of indicator	Low level of indicator	Low level of indicator	W_9^B	
11	High level of indicator	Low level of indicator	Low level of indicator	High level of indicator	W_{10}^B	
12	High level of indicator	Low level of indicator	High level of indicator	Low level of indicator	W_{11}^B	
13	High level of indicator	Low level of indicator	High level of indicator	High level of indicator	W_{12}^B	
14	High level of indicator	High level of indicator	Low level of indicator	Low level of indicator	W_{13}^B	
15	High level of indicator	High level of indicator	Low level of indicator	High level of indicator	W_{14}^B	
16	High level of indicator	High level of indicator	High level of indicator	Low level of indicator	W_{15}^B	

Step 5. Model parameters are adjustable. This parameter should be made based on information that is of low and high importance to the tax office. The effectiveness of a management decision can be significantly increased if existing statistical materials are used to optimize the model.

Step 6. Management decision-making processes. Once the model is built and its parameters are adjusted, the model is used on the basis of calculated input indicators and expert opinions to support management decision-making in the tax office. When the final quantitative values are determined in the form of some real number for the initial fuzzy variable, this step is considered complete using the center of gravity method.

The results of the calculation of variable management of accounting and control activities in a tax office based on an integrated management system yielded the following result.

$$y = \frac{\int_{min}^{max} x * \mu(x)dx}{\int_{min}^{max} \mu(x)dx} = \frac{\int_{0,25}^{0,75} x * 0{,}4dx}{\int_{0,25}^{0,75} 0{,}4dx} = \frac{\frac{(0{,}4 * x)^2}{0{,}4 * 2}\Big|_{0,25}^{0,75}}{0{,}4 * x\Big|_{0,25}^{0,75}} = \frac{0{,}2 * (0{,}5625 - 0{,}625)}{0{,}4 * (0{,}75 - 0{,}25)} = 0{,}5.$$

This means that in this case (UKD = 0.5) the accounting and control performance management indicator does not require management decisions. The use of this expert system allows for effective management decisions to be formed using uncertain conclusions, which have a direct impact on the tax inspection management system.

The method of drawing an indeterminate conclusion of the expert system is carried out, as well as using the MATLAB tool using a set of indeterminate logic tools.

The description of the problem is structured as follows: In order to make management decisions, it is necessary to assess the level of management of the system by determining its capabilities and security (Figure 1). In the first stage of implementation of the methodology, a system of indicators is formed, which determines its development and describes the situation depending on the factors. To do this, the study identified 10 input indicators that reflect the management processes in the tax inspection.

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The data for each X_1 input indicator (accounting report and reporting status at the tax authority) provided during the accessory function determination phase and the corresponding directions of the values that the process of correlation is acceptable are shown in Figure 3. This reflects the creation of two ambiguous terms, such as "Low Level of Development" (Low), "High Level of Development" (High), in the range of 0 to 1 for each variable. A trapezoidal curve was selected as the type of distribution in the membership functions according to the formalization performed.

The semantic spaces for the remaining nine input variables (X_1-X_10) are formed in the same way.

In the next stage of the functional algorithm, the output variables are identified, the presented model has four of them, the first three correspond to the system indicators: accounting and control activities (UKD), office management and external audits (KVP), analytical and forecasting the seeker forms a single management decision relative to the level of activity management (APD) and the fourth to the management decision support system (UPR).

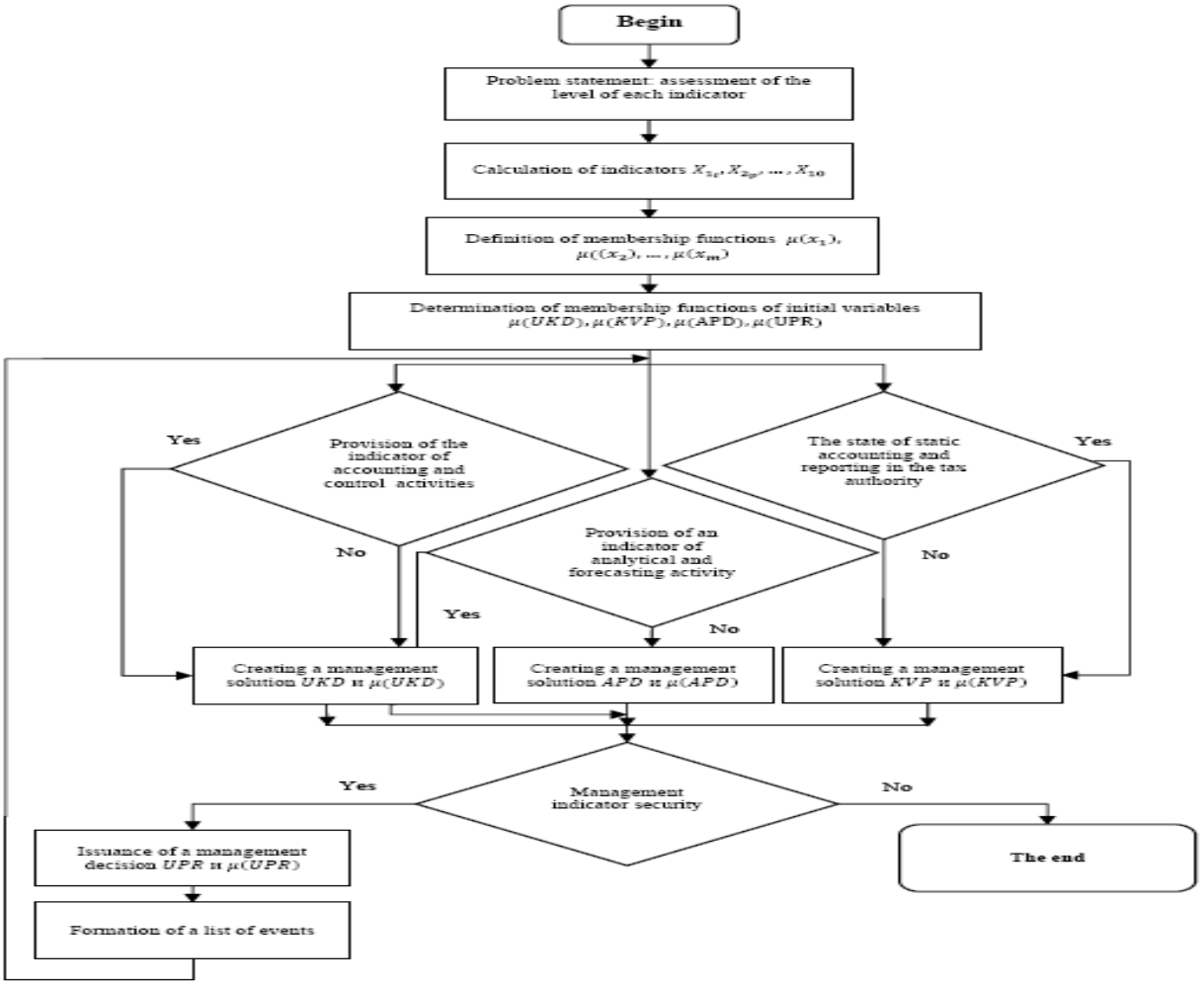

Figure 1 - Algorithm for supporting functional management decisions based on the application of the logical theory of uncertainty

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The developed model is two-stage and consists of the following stages: the study is carried out using the input variables (X_1-X_10) presented in the first stage, and the general level of management development in the second stage. The system of tax inspection based on the integrated management system is defined by the variables "UKD (учетно-контрольная деятельность)", "KVP (камеральные и выездные проверки)", "APD (аналитическая и прогнозная деятельность)", "UPR (управленческих решений)". The structure of the ambiguous model for making management decisions is presented in the form of a logical conclusion tree (Figure 2).

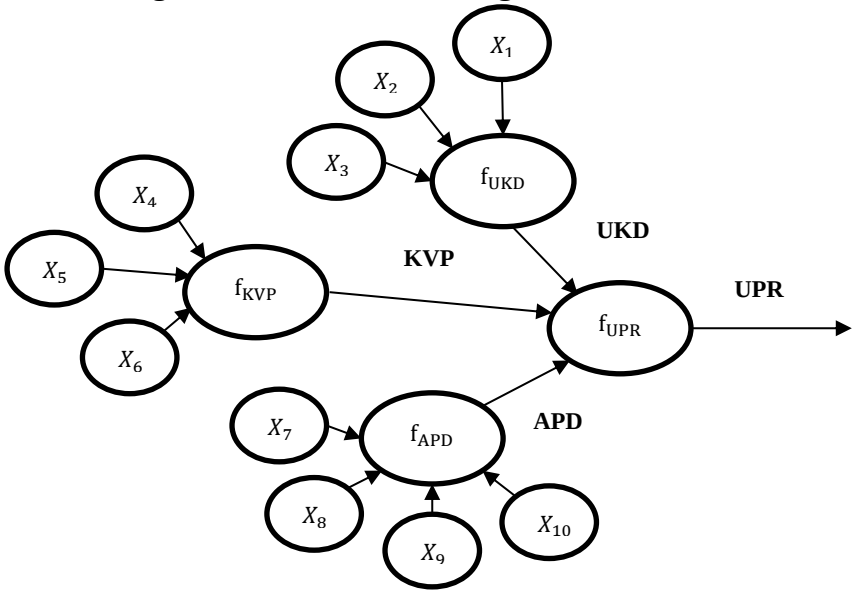

Figure 2 - The structure of the fuzzy decision-making model

The next step in the management decision support methodology is to formulate production rules that allow the tax inspectorate to most effectively assess each component of the management system and justify management decisions. We use the Mamdani algorithm to generate the value of an APD variable built according to certain rules of uncertain inference.

```
Rule_1: IF X7 is low AND X8 is low AND X9 is low AND X10 is low, THEN APD is low;
Rule_2: IF X7 is low AND X8 is low AND X9 is low AND X10 is high, THEN APD is low;
Rule_3: IF X7 is low AND X8 is low AND X9 is high AND X10 is low, THEN INF APD is low;
Rule_4: IF X7 is low AND X8 is low AND X9 is high AND X10 is high, THEN APD is low;
Rule_5: IF X7 is low AND X8 is high AND X9 is low AND X10 is low, THEN APD is low;
Rule_6: IF X7 is low AND X8 is high AND X9 is low AND X10 is high, THEN APD is low;
Rule_7: IF X7 is low AND X8 is high AND X9 is high AND X10 is low, THEN APD is low;
Rule_8: IF X7 is low AND X8 is high AND X9 is high AND X10 is high, THEN APD is low.
Rule_9: IF X7 is high AND X8 is low AND X9 is low AND X10 is low, THEN APD is low;
Rule_10: IF X7 is high AND X8 is low AND X9 is low AND X10 is high, THEN APD is low;
Rule_11: IF X7 is high AND X8 is low AND X9 is high AND X10 is low, THEN INF APD is low;
Rule_12: IF X7 is high AND X8 is low AND X9 is high AND X10 is high, THEN APD is low;
Rule_13: IF X7 is high AND X8 is high AND X9 is low AND X10 is low, THEN APD is low;
Rule_14: IF X7 is high AND X8 is high AND X9 is low AND X10 is high, THEN APD is low;
Rule_15: IF X7 is high AND X8 is high AND X9 is high AND X10 is low, THEN APD is low;
Rule_16: IF X7 is high AND X8 is high AND X9 is high AND X10 is high, THEN APD is high.
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Figure 3 shows a set of rules reflecting the level of control of the tax office performed in the MATLAB vague inference rule editor.

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The fuzzy management model developed in the tax inspectorate allows for the replacement of specific values for each of the specific indicators. The program generates a fuzzy generalization result based on the input data, as well as calculates the exact value of the desired indicator using the diffusion method. A summary of the blurred result of the output variable in evaluating the input parameters is shown in Figure 4.

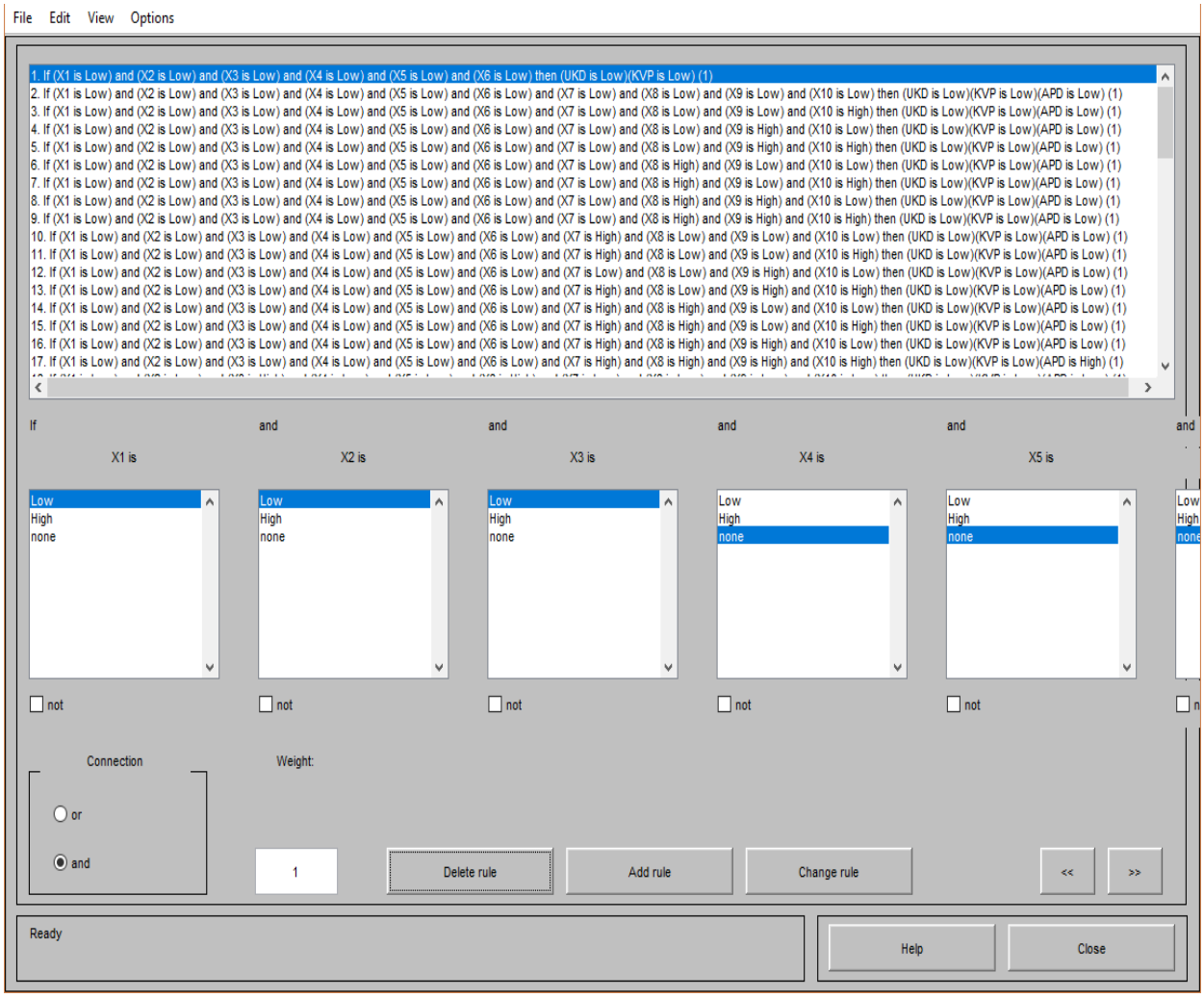

Fig. 3 — Editor of the rules for drawing vague conclusions

The constructed fuzzy management model in the tax office provides an opportunity to substitute specific values for each of the specific indicators. The program generates a fuzzy generalization result based on the input data, and also calculates a clear value of the desired indicator using the defuzzification method. The output of the fuzzy result of the output variable when evaluating the input parameters is shown in Fig. 4.

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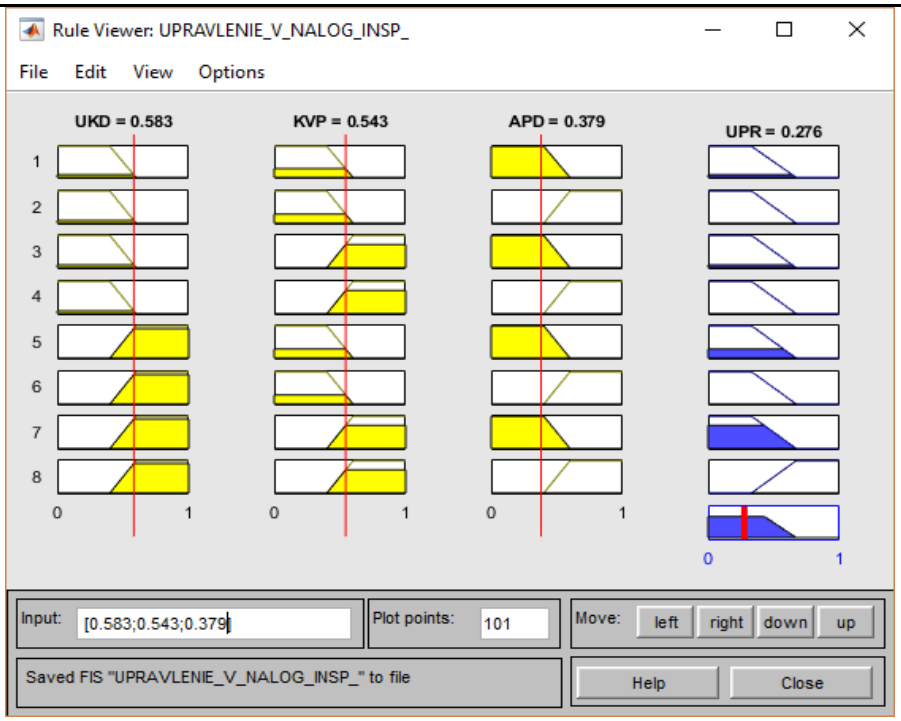

Fig. 4 - Results of the analysis of the level of development of the management decision support system in the Tax Inspectorate

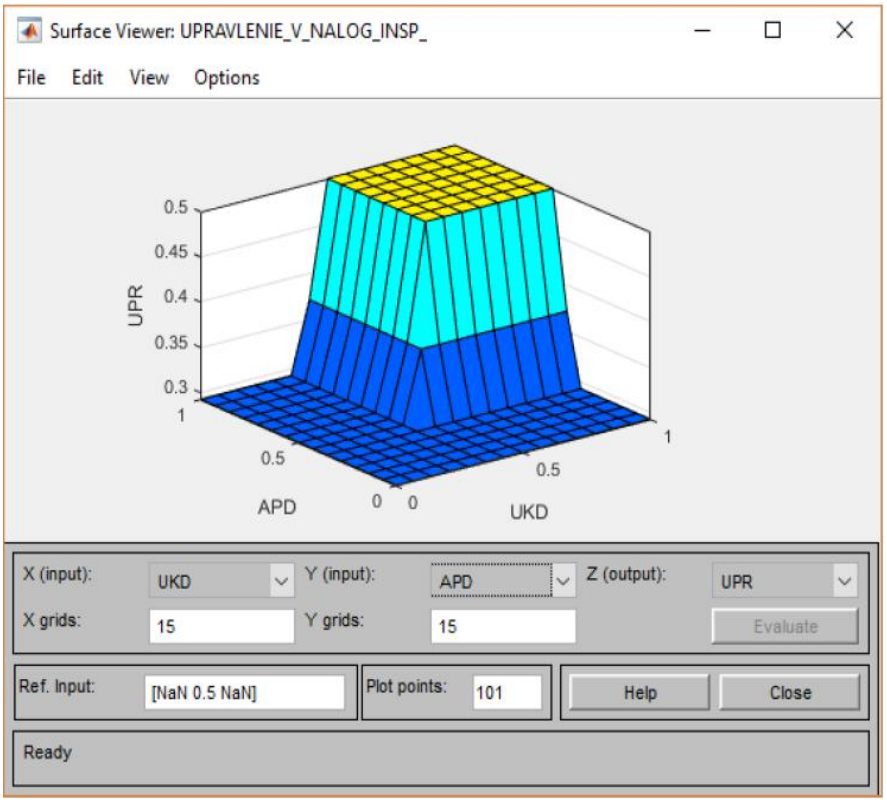

Fig. 5 - Input dependence of the output variable

The correlation presented reflects the effect of the selected indicators on the level of the result of the state of the management system in the tax inspection. The next stage of the functional algorithm is to formulate measures to improve the management system of the tax inspection, in other words, to identify a list of management decisions that are insufficient for each indicator of the system in accordance with the data obtained. The value of the generalized indicator of the level of management of the system in the tax inspection (Table 5), as well as suggestions for improving the relevant indicator are expressed.

The adequacy of the fuzzy inference systems is checked by re-testing the uncertain model and comparing the results of the obtained model with the possible real results. Thus, the priority of the system development is to implement a functional algorithm for the management decision support module of the information management system in the tax inspection based on the integrated management system.

In summary, the functional activity of the information management system in the tax inspection, including the scheme of interaction of the information management system with the external environment and the functional scheme of ensuring the performance of the functions of the tax inspection, was analyzed. but also to make management decisions as a result. A methodological approach to the formation of a methodology to support management decision-making in the tax inspection allows to respond in a timely manner to the changing conditions of the external and internal environment. The Tax Inspectorate has developed a functional management algorithm that reflects the sequence of actions from the selection and calculation of incoming indicators to management decisions. Based on a two-step uncertain model, this algorithm allows management decisions to be made. Effective management in a tax inspection based on an integrated management system involves ensuring targeted management impact both within the inspection structure and between the inspection and its external environment. The process of drawing vague conclusions in the process of intellectual decision-making is a topical process.

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