

Digitalization in Personnel Management: the Possibilities of Fuzzy Logic

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ABSTRACT

The focus of the study is on the need and possibilities of digitizing personnel management procedures and processes, in particular, the staff selection processes and the selection of motivation ways. Fuzzy inference toolkit is recognized as adequate to the specifics of solving these tasks, which makes it possible to implement digitalization procedures in the context of a rapidly expanding information space. The presented results of use demonstrate the possibility and confirm the practical significance of the choice made.

Keywords

Digitalization, fuzzy logic, personnel, personnel management, selection, motivation

1. INTRODUCTION

Digital transformation of business, accompanying the widespread development of Industry 4.0, leads to the digitalization of the entire global economy. Its globalization, integration with politics, society, leads to significant changes in the labor market.

The fundamental uncertainty that accompanies the widespread development of Industry 4.0, concerns the extent, to which labor is replaced by automation. According to estimates by the McKinsey Global Institute, up to 50% of workflows will be automated in the world by 2036. This will lead to a significant release of staff, a reduction in the number of jobs requiring medium qualifications, and an increase in the difference in wage levels [1].

At the same time, the introduction of modern digital tools in all spheres of life contributes to the emergence of new professions and jobs that did not exist previously - IT is an auditor, Big Data administrator, Big Data analyst, architect of intelligent control systems, etc.

In such a situation, it is important to foresee this variability of the criterion space of personnel selection and motivation tasks, using the capabilities of artificial intelligence and digitalization of decision-making processes. Thus, it is possible to realize this by digitizing these processes and procedures from the standpoint of fuzzy logic.

2. RESEARCH

Indeed, in the conditions of digitalization of economy, traditional methods and practices of solutions will not always allow for the speed of the changes to be taken into account. As a result, fuzzy logic tools can be recognized as adequate to the specifics of modern selection tasks, which makes it possible to implement the personnel selection procedure in the context of rapid expansion of the information space. Thus, solving the issue of personnel selection in the conditions of digitalization of the economy, it is advisable to refer to the conceptual foundations of the theory of fuzzy sets and fuzzy logic, laid down by the American mathematician Lotfi Zaden in "Fuzzy sets" in 1965 [3, 4, 5]. In order to formalize fuzzy information, the concept of fuzzy sets, a function of belonging to an arbitrary element of a

universal set to a fuzzy set, was introduced in the considered theory to build mathematical models.

In addition, the thesaurus of the theory of fuzzy sets and fuzzy logic included the concepts of fuzzy and linguistic variables, fuzzy knowledge base and fuzzy logic inference.

Used tools, formalizing fuzzy linguistic variables, opened the possibility of performing usual logical operations, denoted in the form of a fuzzy logic inference. The developed basic algorithms for fuzzy inference (Mamdani, Tsukamoto, Larsen, Sugeno), including certain specified parameters, allowed to implement its stages in an ambiguous manner [2].

In turn, the existing software and applied products (such as Matlab, CubiCalc, WINROSA, FIDE) will allow digitization of the selection procedures themselves. The results and possibilities of digitization of staff selection procedure carried out from the position of fuzzy logic are shown in Figure 1:

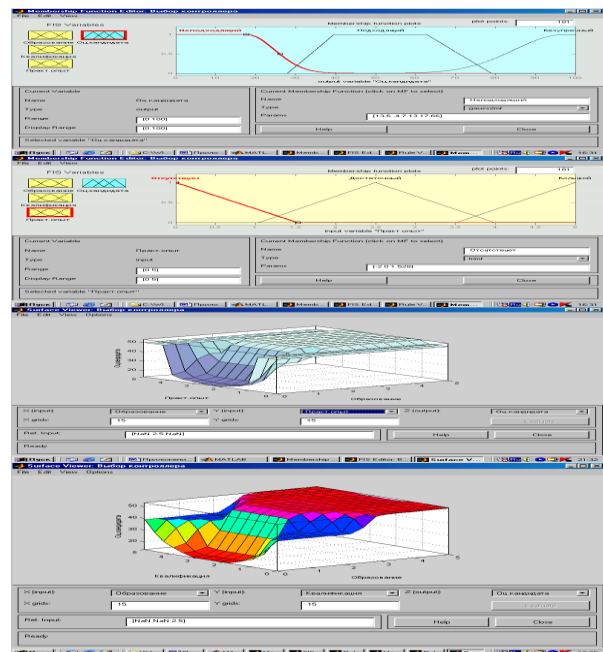


Fig. 1. Digitization of the Procedure "Staff Selection" Using the Fuzzy Inference Method with the Matlab Fuzzy Inference System

For the sake of simplicity, "education", "qualification" and "practical experience" were chosen as criteria for evaluating candidates and the corresponding input linguistic variables.

As an output, the variable "Candidate Evaluation" was introduced, the range of its change was set from 0 to 100%, and the term set of its values was formed.

Based on the experts' estimates, the relationship between the input and output variables entered was determined, implemented by a set of six production logic PR rules:

Pr1: If the education is secondary, and the qualification is low, and there is no practical experience, the candidate's assessment is inappropriate.

Pr2: If the education is secondary, and the qualification is acceptable, and the practical experience is sufficient, the assessment of the candidate is inappropriate.

Pr3: If the education is higher, and qualification is acceptable, and practical experience is sufficient, then the candidate's assessment is appropriate.

Pr4: If the education is higher, and the qualification is high, and the practical experience is large, then the candidate's assessment is appropriate.

Pr5: If the education is special-higher, and the qualification is high, and the practical experience is large, then the candidate's assessment is impeccable.

Pr6: If the education is specialized higher, and qualification is acceptable, and practical experience is sufficient, then the candidate's assessment is appropriate.

The scheme of choosing the method of motivation may have a similar appearance. Refinements refer to changes in the content of input parameters associated with the replacement of criteria for evaluating candidates for the criteria for evaluating employees, the corresponding changes in input variables and the output variable "Candidate Evaluation" by the variable "Method of motivation". Accordingly, the recommended composition and values of linguistic variables will look like (Table 1):

Table 1. Input and output linguistic variables of the task "Choosing a way to motivate staff"

Linguistic variable name	Linguistic variable values
<i>Input linguistic variables</i>	
"Efficiency"	"Medium", "High", "Brilliant"
"Organization"	"Medium", "High", "Brilliant"
"Initiative"	"Satisfactory", "Good", "Excellent"
"Perseverance"	"Weak", "Moderate", "High"
"Conscientiousness"	"Medium", "High", "Brilliant"
<i>Output linguistic variable</i>	
"Motivation method"	"Send to refresher courses", "Send to the conference", "Reward diploma", "Thank you", "Promote"

With the changes made, you can enter clear values for input variables. The relationship between the input and output variables entered can also be defined by a set of production logical PR rules:

Pr1: If working capacity is average, and organization is average, and initiative is satisfactory, and perseverance is weak, and good faith is average, then the method of motivation is: send to refresher courses.

Pr2: If the efficiency is high, and the organization is average, and the initiative is good, and the perseverance is moderate, and the conscientiousness is average, then the way of motivation is: send to the conference.

Pr3: If the efficiency is high, and organization is high, and initiative is good, and perseverance is high, and conscientiousness is brilliant, then the method of motivation is to reward with a diploma.

Pr4: If the efficiency is high, and organization is high, and initiative is high, and perseverance is satisfactory, and good faith is high, then the method of motivation: to declare gratitude.

Pr5: If the performance is brilliant, and the organization is brilliant, and the initiative is excellent, and the perseverance is high, and the conscientiousness is brilliant, then the method of motivation is: to promote.

As a result, by continuing the formation of fuzzy production rules corresponding to the content of the task, it is possible to digitize the process of determining the directions of employee motivation.

In this way, reflecting the general semantic formulation of the problem of choice, using linguistic representations corresponding to the methods of reasoning and making decisions by man, the apparatus used made it possible to digitize the choice of a specialist and the method of his motivation. The Matlab Fuzzy Logic Toolbox module was used, which has great potential in terms of selecting the type of membership functions, fuzzy inferential composition. Fuzzy Logic Toolbox graphical tools provided an opportunity to visually observe the process of preparing and making a decision by implementing the developed operations, graphically displaying intermediate and final results.

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