

Volodymyr Dudnyk,  
Hryhoriy Tikhonov,  
Dmytro Rudenko

## DEVELOPMENT OF A COMPREHENSIVE METHOD FOR ASSESSING THE EFFICIENCY OF HUMAN RESOURCES STAFFING OF ORGANIZATIONAL AND STATE STRUCTURES

*Hierarchical construction of the human resources system, constant change in the forms and methods of armed struggle requires taking into account a large number of factors. At the same time, each of the factors is described by evaluation indicators of different origin and measurement units. This, in turn, requires the use of modern and proven mathematical apparatus, which is capable of processing a large array of various types of data with a given reliability of management decision making in a short period of time. In the course of the conducted research, classical methods of analysis were used to solve the problem of analyzing the conditions and factors affecting the effectiveness of the human resources staffing system. The theory of artificial intelligence was also used to process various types of data in the course of evaluating the effectiveness of the human resources staffing system. The object of the research is the system of staffing with human resources. The subject of the research is the effectiveness of the system of staffing with human resources. In the research, the development of a complex method for evaluating the effectiveness of staffing the organizational and state structures with human resources was carried out. The novelties of the research are:*

- evaluation of the possible risks of disruption of the task of staffing with human resources in the responsibility area;
- determination of influence of indicators of the effectiveness of the human resource recruitment system on each other;
- determination of influence of a group of indicators for evaluating the efficiency of the human resources system on a separate indicator.

*It is expedient to implement the specified method in algorithmic and program software while researching the state of the system of staffing with human resources during the formation of new or additional staffing of existing organizational and state structures.*

**Keywords:** *system of staffing with human resources, research methods, intelligent management methods, organizational and state structures.*

Received date: 19.02.2023

Accepted date: 04.04.2023

Published date: 10.04.2023

© The Author(s) 2023

This is an open access article

under the Creative Commons CC BY license

### How to cite

Dudnyk, V., Tikhonov, H., Rudenko, D. (2023). Development of a comprehensive method for assessing the efficiency of human resources staffing of organizational and state structures. *Technology Audit and Production Reserves*, 2 (2 (70)), 30–33. doi: <https://doi.org/10.15587/2706-5448.2023.276638>

## 1. Introduction

In the modern conditions, ensuring the appropriate level of defense capability of any country largely depends on the effectiveness of staffing the armed forces (AF) with personnel who, according to their quality indicators, would meet the requirements of the assigned tasks. Nowadays, solving the tasks of equipping the Armed Forces of Ukraine with quality personnel is more relevant than ever.

With the independence of Ukraine and the beginning of the formation of its own armed forces, the problem of staffing them with high-quality personnel became one of the main problems faced by the military leadership of our country. The full-scale armed aggression of the Russian Federation on the territory of Ukraine only exacerbated the existing problems with staffing the organizational and

personnel structures of the Ukrainian Defense Forces with human resources.

The works [1–5] provide a retrospective overview of changes in the forms and methods of armed struggle and outline the main directions of development of the informational component of modern military conflicts. It is also stated in these works that it is the informational component that will increase the efficiency and reliability of decision making by the officials who make them. It is noted that the evaluation of the effectiveness of staffing with human resources can be solved precisely with the help of artificial intelligence methods. Conducting the formation of new organizational and staff structures revealed a number of shortcomings in the staffing of human resources [1–5]:

- the legal problems related to the imperfection of Ukrainian legislation;

- the problems of recruiting and training personnel;
- the problems of financing the formation of new organizational and state structures;
- the problems are related to the informational and psychological influence on the part of the Russian Federation aimed at disrupting the implementation of measures for the formation of new organizational and state structures.

In such conditions, it is necessary to change the revisions of the existing approaches for staffing with human resources. This, in turn, requires the use of a modern and proven mathematical apparatus capable of processing a large array of various types of data in a short period of time with a given reliability of making management decisions [6–10].

The existing approaches to the management of the human resource recruitment system are narrowly focused and directed to the research of only certain issues and do not allow [6–10]:

- comprehensively and in a short time identify and assess the risks of non-fulfillment of human resources tasks;
- carry out processing of various types of data with different units of measurement, different in origin and sources of information extraction;
- identify new and non-typical risks of non-fulfillment of the task of staffing with human resources;
- comprehensively assess the influence of indicators of the effectiveness of the human resources staffing system on each other;
- evaluate the impact of a group of indicators on a separate indicator of the effectiveness of the human resources staffing system.

All of this requires a review of approaches to assess the effectiveness of the human resources staffing system.

Taking into account the above, the purpose of the research is to develop a comprehensive method for assessing the effectiveness of staffing of organizational and staff structures.

*The object of the research* is the system of staffing with human resources.

*The subject of the research* is the effectiveness of the system of staffing with human resources.

## 2. Materials and Methods

In the course of the research, let's use:

- classical methods of analysis – to solve the problem of analyzing the conditions and factors that affect the effectiveness of the human resources staffing system;
- the theory of artificial intelligence – for the processing of various types of data in the course of evaluating the effectiveness of the system of staffing with human resources.

## 3. Results and Discussion

**3.1. Development of a comprehensive method for evaluating the effectiveness of human resources staffing of organizational and state structures.** To evaluate the effectiveness of staffing with human resources on areas of responsibility, it is necessary to take into account external and internal components.

*The external components*, which are not affected and which need to be taken into account in this research include:

- region's ability to provide human resources;
- activities of state (local) authorities and law enforcement agencies in the performance of tasks of staffing with human resources;
- socio-political situation in the area of implementation of measures for staffing with human resources;

- financial provision of human resources staffing activities;
- provision of mobilization needs with human resources;
- use of human resources in the process of notification, collection and delivery to organizational and state structures.

*The internal components include* the readiness of the structural divisions that organize the implementation of human resource recruitment measures, which includes the following components:

- personnel – staffing, moral and psychological state;
- preparedness – the training of the personnel and the coherence of the actions of the personnel unit that carries out the staffing of human resources;
- security – an informational and analytical support for staffing events with human resources; provision of serviceable standard weapons and military equipment, and the provision of usable material and technical devices.

While staffing organizational and state structures that are being staffed or formed again, there may be risks associated with failure to complete the mobilization task fully. Risk is an inevitable factor accompanying the functioning or development of any complex system or process.

Assessing the risks of non-fulfillment of the task of human resources makes it possible to identify, evaluate, monitor and eliminate risks before and during their transformation into problems, thus, the disruption of the task of human resources in the area of responsibility.

The main stages of assessing the risks of non-fulfillment of the task of staffing with human resources are:

- identification of risks of non-fulfillment of the task;
- analysis of the risks of failure to complete the task;
- planning measures to counteract risks at each level of risk management;
- monitoring the risks of non-fulfillment of the task of staffing with human resources.

The above determines the need for a comprehensive evaluation of the process of human resources staffing in the specified area of responsibility.

For this purpose, the research proposed an appropriate method of comprehensive evaluation of the effectiveness of staffing with human resources, which consists of the following sequence of actions:

*Step 1. Input of initial data.* Initial data about the state of staffing with human resources in the area of responsibility are entered.

*Step 2. Evaluation of information and analytical support for human resources staffing.* On the basis of the developed method for evaluating information and analytical provision, the state of information and analytical provision of staffing with human resources is evaluated [6].

*Step 3. Assessing the risks of non-fulfillment of the task of staffing with human resources in the area of responsibility.*

In accordance with the considered requirements, a risk assessment procedure is proposed in the aspect of ensuring the fulfillment of the task of staffing with human resources in the territory of responsibility, which is based on the method of fuzzy modeling and is aimed at reducing external and systemic (internal) factors [8].

To evaluate the interrelationships of system factors that affect the effectiveness of human resources recruitment tasks, let's use a fuzzy cognitive model (FCM), Fig. 1 [9].

In Fig. 1, the following designations are used, which are given in Table 1.

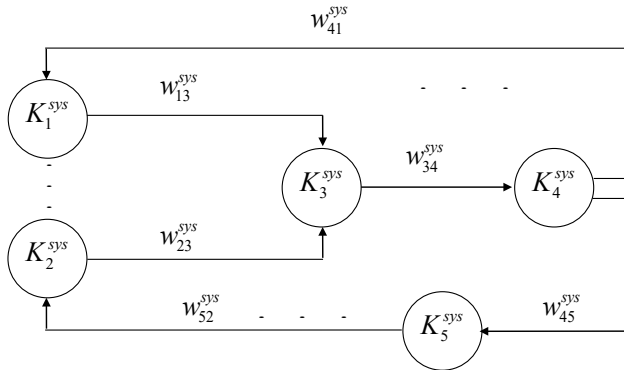


Fig. 1. A variant of the structure of the fuzzy cognitive model, which reflects system factors and the relationships between them

Table 1

Conventional definitions used in the work

Designations	The physical meaning of the designation
$K_i^{sys}$	is a set of concepts characterizing the system factors of the system of human resources staffing (process, problem), $i = 1, \dots, I$
$K_j^{dan}$	is a set of concepts characterizing the identified sources (dangers of occurrence) of the risks of disruption of staffing with human resources, $j = 1, \dots, J$
$K$	is a set characterizing the composition of the structure of a fuzzy cognitive model for assessing the interrelationships of system factors of the human resources staffing system
$w_{ij}$	is the range of values of the direct influence of one concept on another, $[-1, 1]$
$N$	is the number of input concepts for the output concept $K_j$
$W^{sys}$	is a fuzzy adjacency matrix
$V^{sys}$	is a fuzzy adjacency matrix of positive connections

This model makes it possible to obtain initial data for determining the impact of system factors on the sources (dangers of occurrence) of risks using fuzzy models based on fuzzy neural production of ANFIC networks.

At the verbal level, the task of assessing the interrelationships of the system factors of the human resources system, which can be described in the following form:

1) assignment of a set of concepts  $K_i^{sys}$ , which characterize the system factors of the system of human resources staffing;

2) assignment of a set of concepts  $K_j^{dan}$ , which characterize the identified sources (dangers of occurrence) of risks in the system of staffing with human resources;

3) formation of the structure of a vague cognitive model for assessing the interrelationships of system factors  $K = (K^{dan}, K^{sys})$  of the system of staffing with human resources;

4) description of the state or meaning of the concepts of the human resources recruitment system based on a scale of real numbers limited in the range  $[-1, 1]$ ;

5) determination of the method and setting the value of the direct influence of the concepts of the human resources system on each other  $w_{ij}, K_j^{sys} = w_{ij}K_i^{sys}$ ;

6) determination of the method of accumulation of the direct influence of several concepts of the human resources system on one  $K_j^{sys} = K_j^{sys} + \sum_{i=1}^N w_{ij}K_i^{sys}$ ;

7) determination of the mechanism of the indirect influence of the concepts of the human resources system

$K_i \xrightarrow{l} K_q: d_l = (K_i, K_{z_1}, K_{z_2}, \dots, K_{z_l}, K_q), l = 1, \dots, m$ , where  $m$  is the possible number of paths between concepts  $K_i$  and  $K_q$ ;

8) building a model of the dynamics of the human resources system:

$$K_j^{sys}(t+1) = K_j^{sys}(t) + \sum_{i=1}^N w_{ij}K_i^{sys}(t).$$

**3.2. Research results and discussion.** The development of a complex method for evaluating the effectiveness of staffing organizational and state structures with human resources was carried out.

The specified method is proposed for the use during the settlement of military conflicts at the stage of deployment of new organizational and staff structures. This will allow to increase the efficiency of data processing, transmission and the reliability of decisions by the people, who make them.

However, the developed method additionally:

- evaluate possible risks of disruption of the task of human resources staffing in the area of responsibility;
- determine the impact of the performance evaluation indicators of the human resource recruitment system on each other;
- determine the influence of a group of indicators for evaluating the efficiency of the human resources system on a separate indicator.

The limitations of the mentioned research include:

- time limits for the transmission of informational messages in the system of detection and identification of challenges and threats to the national security of the state;
- the need for a primary base of destructive influences on the national security system.

It is expedient to implement the specified method in algorithmic and program software while detecting and identifying challenges and threats to the national security of the state in conditions of hybrid destructive influence.

The directions of further research will be aimed at the development of the method of intellectual management of the system of staffing human resources of organizational and state structures.

#### 4. Conclusions

In the research, the development of a comprehensive method for assessing the effectiveness of human resources staffing the organizational and state structures was carried out.

The results of the research will be useful for:

- development of new algorithms for managing the human resource recruitment system;
- substantiation of recommendations on improving the efficiency of the system of staffing with human resources;
- creation of promising technologies for increasing the efficiency of management of the human resources recruitment system;
- development of new and improvement of existing models, methods of management of the human resource recruitment system.

#### Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal,

authorship or otherwise, that could affect the research and its results presented in this paper.

### Financing

The research was performed without financial support.

### Data availability

The manuscript has no associated data.

### References

1. Shishatekii, A. V., Bashkirov, O. M., Kostina, O. M. (2015). Rozvitok integrovanih sistem zv'iazku ta peredachi danikh dla potreb Zbroinikh Sil. *Ozbroennia ta viiskova tekhnika*, 1 (5), 35–40.
2. Timchuk, S. (2017). Methods of Complex Data Processing from Technical Means of Monitoring. *Path of Science*, 3 (3), 4.1–4.9. doi: <http://doi.org/10.22178/pos.20-4>
3. Sokolov, K. O., Hudyma, O. P., Tkachenko, V. A., Shyiatyi, O. B. (2015). Main directions of creation of IT infrastructure of the Ministry of Defense of Ukraine. *Zbirnyk naukovykh prats Tsentru voienno-stratehichnykh doslidzhen*, 3 (6), 26–30.
4. Shevchenko, D. G. (2020). The set of indicators of the cyber security system in information and telecommunication networks of the armed forces of Ukraine. *Suchasni informatiini tekhnologii u sferi bezpeki ta oboroni*, 38 (2), 57–62. doi: <https://doi.org/10.33099/2311-7249/2020-38-2-57-62>
5. Makarenko, S. I. (2017). Perspektivy i problemnye voprosy razvitiia setei svyazi spetsialnogo naznacheniiia. *Sistemy upravleniia, svyazi i bezpasnosti*, 2, 18–68. Available at: <http://sccs.intelgr.com/archive/2017-02/02-Makarenko.pdf>
6. Zuiiev, P., Zhyvotovskiy, R., Zvieriev, O., Hatsenko, S., Kuprii, V., Nakonechnyi, O. (2020). Development of complex methodology of processing heterogeneous data in intelligent decision support systems. *Eastern-European Journal of Enterprise Technologies*, 4 (9 (106)), 14–23. doi: <http://doi.org/10.15587/1729-4061.2020.208554>
7. Brownlee, J. (2011). *Clever algorithms: nature-inspired programming recipes*. LuLu, 441.
8. Gorokhovatsky, V., Stiahlyk, N., Tsarevska, V. (2021). Combination method of accelerated metric data search in image classification problems. *Advanced Information Systems*, 5 (3), 5–12. doi: <http://doi.org/10.20998/2522-9052.2021.3.01>
9. Meleshko, Y., Drieiev, O., Drieieva, H. (2020). Method of identification bot profiles based on neural networks in recommendation systems. *Advanced Information Systems*, 4 (2), 24–28. doi: <https://doi.org/10.20998/2522-9052.2020.2.05>
10. Rybak, V. A., Shokr, A. (2016). Analysis and comparison of existing decision support technology. *System analysis and applied information science*, 3, 12–18.

✉ **Volodymyr Dudnyk**, PhD, Associate Professor, Department of Leadership of Troops (Forces) in Peacetime, The National Defence University of Ukraine named after Ivan Cherniakhovskiyi, Kyiv, Ukraine, e-mail: [dudnikvd55@gmail.com](mailto:dudnikvd55@gmail.com), ORCID: <https://orcid.org/0000-0003-1985-4068>

-----  
**Hryhorii Tikhonov**, PhD, Associate Professor, Head of Department of Leadership of Troops (Forces) in Peacetime, The National Defence University of Ukraine named after Ivan Cherniakhovskiyi, Kyiv, Ukraine, ORCID: <https://orcid.org/0000-0003-1941-744X>

-----  
**Dmytro Rudenko**, The National Defence University of Ukraine named after Ivan Cherniakhovskiyi, Kyiv, Ukraine, ORCID: <https://orcid.org/0009-0001-5192-8373>

-----  
 ✉ Corresponding author