O P I N I O N

on a dissertation for obtaining an educational and scientific degree of "Doctor"

Field 5. Technical Sciences

Professional direction 5.2. "Electrical Engineering, Electronics, and Automation"

Scientific specialty: "Application of the principles and methods of cybernetics in various fields of science".

Author of the dissertation: **Mag. Ekaterina Spasova Tsopanova**

Topic of the dissertation: **THE INFLUENCE OF THE SUBJECTIVE FACTOR IN DECISION-MAKING SYSTEMS**

From Prof. Dr. Eng. August Yordanov Ivanov, Institute of Robotics - BAS.

1. Description of the dissertation and its materials

The dissertation consists of 4 chapters, a reference to the main contributions, a list of publications related to the dissertation, and a list of literature used from 151 sources (84 in Latin script; 67 in Cyrillic). The text contains 156 pages;

Publications related to the dissertation - two in full text in English;

The abstract is 55 pages long and adequately reflects the dissertation.

I believe that the materials presented provide a clear idea of the candidate's development and his creative achievements.

2. Relevance of the dissertation, aim, and objectives

The dissertation addresses a current issue, namely the study of motivation and attempts to incorporate it into decision-making systems. The research is relevant, especially in the context of modern information technologies. As their development progresses, it becomes clear that the role of the subjective factor not only does not decrease but in certain application areas, it even increases.

The role of the science studying human behavior - psychology - is increasing. It is observed that precise mathematical models, created in an attempt to adequately describe real objects and processes - on the one hand, and the informal descriptions of these processes within psychology on the other, gradually begin to converge. This leads to qualitative changes in views on how decision-making processes exactly proceed.

The subject of the scientific research is the possibility of building a human-machine decision-making system taking motivation into account.

The aim of the dissertation is to investigate the influence of the subjective factor, particularly motivation, in decision-making systems. To achieve this goal, the following *tasks* are defined:

- To analyze the types of motivation and the main motivational models.
- To analyze decision support systems.
- To analyze discrete decision-making systems taking motivation into account.

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- To implement a numerical example of a discrete decision-making system taking motivation into account.

3. Level of understanding of the problem's state and creative interpretation of the literary material.

The high level of understanding of the state of the problem being solved, as well as the good creative interpretation of the literary material from the literature review, is impressive.

4. Correspondence of the chosen research methodology to the aim and objectives of the dissertation with the achieved contributions.

I believe that the formulated aim and objectives fully correspond to the achieved scientific-applied and applied contributions.

5. Activities and Contributions of the dissertation.

In the first two chapters, the candidate has made a comparative analysis of different types of motivation, motivational theories, and models. An extensive, multi-layered overview, a multidisciplinary and systematic description of concepts from decision theory are presented.

The third chapter describes discrete decision-making systems taking motivation into account. Concepts of sets, graphs, and network flows are discussed.

In character, the contributions in this work can be defined as a successful way to find an optimal approach to analyzing the influence of certain fundamental factors. They can be divided into:

Scientific-Applied:

> ➤ A grouping of motivational theories based on a comprehensive review has been proposed with the aim of considering their influence on decision-making systems or supporting these decisions. Preference has been given to motivations related to the work of operators in real-time management systems.
> ➤ It has been observed that the most suitable are generalized network flows with coefficients for increasing or decreasing flows on individual edges. Through them, models for decision-making can be created using elements from motivation theory, graphs, and flows on them. These edge coefficients reflect the influence of motivation on decision-making.
> ➤ The possibilities of the proposed generalized network flow for modeling psychological processes with a broader scope than motivation have been indicated.

Applied:

> ✓ A numerical example of a discrete decision-making system taking motivation into account has been implemented.
> ✓ It has been observed that in most cases, motivation fits best into discrete decision-making systems.
> ✓ It has been established that discrete decision-making systems based on network flows allow for relatively accurate and adequate modeling of discrete decision-making systems when considering motivation.
> ✓ The functionality of the proposed discrete generalized network flow with coefficients for amplification and reduction of their influence has been suggested and demonstrated in decision-making systems with motivation based on a numerical example.

In terms of significance, these contributions primarily occupy a place in realizing specific approaches to analyzing and optimizing decision-making processes or supporting these decisions with consideration of various types of motivation.

I accept the formulated contributions in the dissertation work.

6. Evaluation of Publications:

Two separate articles have been presented as part of the dissertation. Both works stand alone. I consider these publications sufficient in terms of the Law for the Development of the Academic Staff in the Republic of Bulgaria and the validation of the results of the work. In this way, the main ideas in the dissertation are protected.

7. Opinions, Recommendations, and Notes:

Some remarks and recommendations can be made regarding the dissertation:

In the bibliography, it would be beneficial to number all listed sources to facilitate their citation within the dissertation text.

The achieved results in the dissertation should be classified according to types of contributions for clarity and organization.

It is advisable that future research results be disseminated through publications referenced and indexed in globally renowned databases of scientific information.

These remarks and recommendations do not detract from the accomplishments of the dissertation in any way.

The abstract is entirely based on the dissertation work, with no introductions or data that have not been addressed or discussed in the dissertation. The contributions and conclusions in the abstract are the same as those in the main material.

I declare that I have no joint publications with the author.

8. CONCLUSION:

In conclusion, it is considered that the examined dissertation deserves a high rating. It ranks prominently for its proposed scientific-applied and applied contributions in efforts to create an optimal approach to addressing the complex task of studying the influence of the subjective factor and particularly motivation in decision-making systems. Based on this, it is firmly believed that the work fully meets the requirements for a dissertation to obtain an educational and scientific degree of "Doctor" in the Field 5. of Technical Sciences, Professional direction 5.2. "Electrical Engineering, Electronics, and Automation", Scientific specialty "Application of the principles and methods of cybernetics in various fields of science". Therefore, a positive vote is cast for this decision.

Date: 21.03.2024

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