REVIEW

by Prof. Dr. Radoslav Dakov Yoshinov – IMI-BAS
on the dissertation of Zornitsa Agresimova Dimitrova on the topic "Models and software architectures of decision support systems", presented for the acquisition of the educational and scientific degree of "Doctor" in the doctoral program "Informatics",
professional field 4.6. Informatics and Computer Science

According to Order No. 339/22.12.2025 of the Announcer of IICT-BAS, I have been elected to be a member of the scientific jury, and according to the minutes of the first meeting, I have been appointed to prepare a review. For this purpose, I have received all the documents submitted by the applicant under the procedure.

ACTUALITY AND KNOWLEDGE OF THE STUDIED PROBLEM

The presented dissertation deals with topical and interesting topics related to multi-criteria decision-making. Multi-criteria decision-making methods offer mathematically based approaches to multi-criteria and alternative problems, covering discrete and continuous problems. The use of such methods and models provides a systematic approach to evaluating alternatives, while taking into account multiple criteria that are often contradictory. There are often situations where experts have different competencies, and the solution sought has requirements to meet key indicators of available objective characteristics. These features determine the need to develop modifications that will not only increase the precision and objectivity of the decision taken, but also facilitate the process of evaluation and structuring the decision-making task. To ensure the practical applicability of these types of models, it is appropriate to implement them in appropriate applications. Taking into account the relationship between decision support models and software architectures, a comprehensive understanding of both decision-making processes and the software tools implementing these models is necessary.

From the review, as well as from the published results on the topic of the dissertation, it can be established that the PhD student is well aware of the nature of the

problems studied. Further proof of this is the number of literature sources used, as well as experiments conducted proving the operability of the proposed modifications of the well-known method of weighted sum and method of weighted work.

ANALYTICAL CHARACTERISTICS

The dissertation has a total volume of 143 pages and is structured as follows: title page, table of contents, list of abbreviations used, introduction, 4 chapters, conclusion-summary of the results obtained, contributions, list of publications on the dissertation, declaration of originality of the results and bibliography.

On p. 34 defines the purpose of the dissertation research, namely "to propose models and software architectures of decision support systems". To achieve this goal, 8 tasks have been formulated.

In Chapter 1, an analysis of decision-making methods and software architectures for the implementation of web applications is made. Various concepts and classifications of multi-criteria analysis methods are presented. Special attention is paid to the weighted sum method and the weighted work method. A comparison is made between the two methods and some of their modifications are considered. The different concepts for the implementation of software architectures, as well as architectural styles and templates are analyzed. Based on the analyzes carried out, conclusions have been determined, on the basis of which the purpose and objectives of the dissertation research have been formulated.

Chapter 2 describes the proposed modifications to the weighted sum method and the weighted product method, motivated by the need for a more precise and relatively objective formation of group or individual decision-making. The first modification takes into account the differences in the competence of experts in relation to different criteria, and the second modification introduces the use of objective data, combined with the preferences of experts. In the third modification, a new type of weighting coefficients has been introduced for the alternatives, based on key criteria that are critical requirements of the specific task. The purpose of these coefficients is to achieve suppression or amplification of aggregate results, which imparts non-compensatory characteristics to the weighted sum and weighted product models. This reduces the number of subjective assessments and focuses on the importance of key requirements. The proposed modification concerns both methods and changes both the algorithm for their use and the mathematical models.

Chapter 3 contains a description of the proposed and designed two different software architectures of decision support systems. Based on the designed two architectures for the same system, an analysis of the appropriate technologies for implementation, as well as the operating environment, was made, taking into account the technological requirements, the expected workload and the context of use. The modifications already described have been used, on the basis of which a combined and generalized mathematical model have been formulated, which determine the core of the business logic for decision-making. A generalized algorithm of mathematical models is proposed, and key steps from it are described with pseudocode. The functionality of the decision assistance system is designed through adapted UML diagrams. Roles, functional requirements and use cases of the system are defined, as well as necessary forms and sequence of interaction with the system.

Chapter 4 presents the experiments with the proposed modifications to the algorithm for use and the models of the weighted sum method and the weighted product method. The experiments are conducted with three different test tasks, and for each of them separate scenarios are formulated, implemented with the same objective input data and parameters of the task.

ABSTRACT AND AUTHOR'S REFERENCE

The presented abstract in Bulgarian and English faithfully reflects the content of the dissertation and comply with the requirements of the Law on Plagiarism and Copyright. From the submitted declaration of originality, as well as from the publications on the topic of the dissertation, it can be determined that the described results are a personal work of the author. The result of the check for plagiarism on the strikeplagiarism.com website shows the following results: Similarity Factor 1: 2.25% and Similarity Factor 2: 0.43%.

ASSESSMENT OF COMPLIANCE WITH THE MINIMUM NATIONAL REQUIREMENTS AND WITH THE ADDITIONAL REQUIREMENTS UNDER ART. 1A, PARA. 2 OF THE REGULATIONS FOR THE PROTECTION OF PERSONS WITH DISABILITIES

On the topic of the dissertation research, 5 publications in English are presented. In 4 of the publications, the PhD student is the first author. Three of the publications are with SJR, and the other 2 are indexed in Scopus. Both the national minimum requirements for the professional field 4.6 and the specific requirements of IICT-BAS

for the acquisition of the PhD degree are satisfied, as out of the required 30 points, the PhD student has 84 points.

CONTRIBUTIONS OF THE PHD STUDENT

I accept the contributions of the PhD student, without the last one, which refers to an attached result. I appreciate the contributions as scientific and applied, leading to the enrichment of existing knowledge, reformulated as follows:

1) A modification of the algorithm and mathematical models of the weighted sum method and the weighted product method in the conditions of group decision-making, taking into account the different areas of competence of the LVR, is proposed by introducing weighted competence coefficients for each criterion.
2) A modification of the algorithm for the implementation of the weighted sum method is proposed, formalizing the generation of estimates for the alternatives. The modification is valid for group and individual decision-making.
3) A modification of the algorithm and mathematical models of the weighted sum method and the weighted product method is proposed, formalizing the generation of coefficients that give an advantage in the overall presentation of the alternatives. The modification is valid for group and individual decision-making
4) A generalized algorithm and combined mathematical models combining the proposed modifications of the two methods are proposed.
5) Two software architectures (three-layer and serverless) are proposed to implement a decision support system that satisfies various non-functional requirements.

CRITICAL REMARKS AND RECOMMENDATIONS

The dissertation work is well balanced. I have the following question for the PhD student:

1. What are the main advantages and disadvantages of three-layer and serverless architectures? What use cases are they suitable for?

CONCLUSION

The results obtained on the topic of the dissertation convincingly show that the PhD student **Zornitsa Agresimova Dimitrova** has the necessary theoretical knowledge and practical skills in the field of informatics and computer science, as well as proven abilities for independent scientific research. the specific conditions for acquiring scientific degrees and for occupying academic positions at IICT-BAS. The results obtained on the topic of the dissertation research are sufficient grounds to give a categorically positive assessment of the presented dissertation and I **propose to the esteemed Scientific Jury to award to Mag. Zornitsa Agresimova Dimitrova the educational and scientific degree "Doctor" in the doctoral program "Informatics", professional field 4.6. "Informatics and Computer Science".**

На основание
ЗЗЛД

Date 30.01.2026

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