O P I N I O N

on a dissertation for awarding the educational and scientific degree "Doctor" in the professional field 4.6 "Informatics and Computer Science", doctoral program "Informatics"

Author of the dissertation: Zornitsa Agresimova Dimitrova

Dissertation topic: Models and Software Architectures of Decision Support Systems

Scientific supervisor: Prof. Daniela Ivanova Borissova, D.Sc.

Member of the scientific jury: Prof. Dr. Magdalena Zlatkova Garvanova, Head of the Department of Information Systems and Technologies, University of Library Studies and Information Technologies (ULSIT)

In accordance with the Order of the Director of the IICT–BAS No. 339/22.12.2025, I am approved as a member of the scientific jury under this procedure. At the first meeting of the scientific jury, held on 23.12.2025, I was selected to write an opinion and received a full set of documents in electronic format.

1. General characteristics of the dissertation

The *aim* of the dissertation research is to develop models and software architectures for decision support systems, integrating methods for multi-criteria analysis, with a particular emphasis on the weighted sum method (WSM) and the weighted product method (WPM). The topic is relevant and significant, combining theory and practical implementation through web-based applications.

The *objectives* of the study are related to: 1. Analysis of the existing WSM and WPM methods and the main architectural styles and templates for web applications. 2. Proposal for a modification of the algorithm and models of WSM and WPM, taking into account the competence of decision-makers according to various criteria.

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3. Modification of the WSM to formalize the generation of estimates for the alternatives by combining objective data with the preferences of the decision-makers. 4. Modification of WSM and WPM to formalize weighting coefficients giving priority to key criteria. 5. Development of a generalized algorithm and combined mathematical models combining the proposed modifications. 6. Design of various software architectures satisfying the contradictory requirements of the decision support systems. 7. Implementation of prototypes of decision support systems in accordance with the designed architectures. 8. Determination of practical applicability through numerical tests and experiments on real tasks, etc.

The purpose and objectives of the scientific research have been realized in full. A complex methodological design is used, which includes theoretical analysis and synthesis, mathematical modeling, algorithmic design, UML modeling, software prototyping, and experimental validation through numerical tests and comparative analysis of results.

2. Structure of the dissertation

The dissertation is logically structured into an introduction, four main chapters, a conclusion, contributions, a list of publications and a bibliography. The work has a total volume of 143 pages, appropriately illustrated with 53 figures and 24 tables. 143 current and relevant literature sources are used.

Chapter I presents an analysis of multi-criteria decision-making methods, with a focus on WSM and WPM, as well as an overview of concepts, architectural styles, and templates for web-based decision support systems. *Chapter II* describes the proposed modifications to the WSM and the WPM, including the competence of the decision-makers by criteria, formalizing the generation of assessments through objective data, and introducing preference factors for key assessments. The modifications are presented with mathematical models and algorithms. *Chapter III*

designs two different architectures of the decision support systems – three-layer monolithic and serverless, combining the proposed modifications into a generalized algorithm and UML diagrams for functionality and roles (administrator, decision-maker, and system role). *Chapter IV* presents experimental studies on the developed models and algorithms through three test tasks, demonstrating the effectiveness and practical applicability of modifications in real conditions.

3. Scientific and scientific-applied contributions

The dissertation contains a significant number of clearly formulated scientific and scientific-applied contributions, which I fully accept. Among them, I would highlight the following:

1. Original modifications of the weighted sum and weighted product methods have been developed, considering the different competences of decision-makers on individual criteria.

2. A formalized approach to generating estimates for alternative scenarios by integrating objective data and subjective preferences is proposed.

3. Preference coefficients for alternatives have been introduced according to key criteria that give non-compensatory properties to models.

4. Combined and generalized mathematical models and algorithms have been developed, integrating the proposed modifications into a single framework for decision-making.

5. Two different software architectures of a decision support system have been designed and implemented – three-layer, monolithic and serverless – demonstrating the practical applicability of the proposed models.

6. Experimental studies have been carried out, and a working prototype of the decision support system has been developed, through which the effectiveness and applicability of the proposed solutions in real scenarios have been validated, etc.

The dissertation makes a significant and original contribution to the field of decision-making, offering innovative methods and models of high scientific and practical value. The author successfully develops modifications of the classical weighted sum method and weighted product method, considering the different competence of experts, and introduces a formalized approach to integrating objective data and subjective preferences. The introduction of preference coefficients imparts non-compensatory properties to the models, and the combined mathematical algorithms create a comprehensive framework for effective decision-making. Especially impressive are the implemented software architectures and the working prototype, which demonstrate the practical applicability and effectiveness of the proposed solutions in real situations.

4. Publications on the dissertation

On the topic of her dissertation, Zornitsa Dimitrova has provided 5 scientific publications in English in refereed and indexed editions in Scopus and/or Web of Science – 1 article in a journal and 4 reports from prestigious international conferences, 3 of which are with SJR.

Among the reputable scientific journals indexed in Scopus and/or Web of Science, I would highlight: WSEAS Transactions on Business and Economics, Modelling and Development of Intelligent Systems, Computer Information Systems and Industrial Management, etc.

The reference in Scopus, made on 29.01.2026, reveals that the Hirsch index (excluding self-citations) is h=2, which indicates good citation and high quality of the scientific work of this young specialist.

On the same date, the number of visible publications in Scopus was 21, and in Web of Science – 11, which is an indisputable proof of the scientific productivity of

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the PhD student and her potential for further academic development and affirmation as a promising scientist and researcher.

In conclusion, I can say that the publications under the procedure meet and exceed the minimum requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Implementation of the LDASRB and the Regulations of the IICT–BAS for the Implementation of the LDASRB.

5. Abstract

The abstract in both versions (in Bulgarian and English) faithfully reflects the structure and content of the dissertation and corresponds to the requirements of the Law and its Regulations.

6. Presence or absence of plagiarism

In the materials and publications submitted for review, I have not found plagiarism or other illegal use of someone else's intellectual work, which once again confirms the originality, authenticity and personal contribution of the author to scientific research. The attached protocol of the StrikePlagiarism anti-plagiarism software also supports this finding.

7. Critical remarks, recommendations, and questions

I have no critical comments and questions, but rather a recommendation Zornitsa Dimitrova to continue to publish in scientific journals, indexed and refereed in the world databases with scientific information such as Scopus, Web of Science, IEEE, etc., in order to achieve wide publicity of their scientific research, as well as to actively pass on their expertise and skills to the younger generations – students, researchers, specialists, and scientists.

8. Final assessment

The dissertation is an independent, original, and significant scientific research. The results achieved have both theoretical and practical value and categorically prove the high scientific competence of the doctoral student. The dissertation meets all the requirements and criteria of the LDASRB, the Regulations for the Implementation of the LDASRB and the Regulations of the IICT–BAS for the Implementation of the LDASRB, which is why *I vote positively* with confidence and recommend to the respected scientific jury to award Zornitsa Agresimova Dimitrova the educational and scientific degree of "Doctor" in professional field 4.6 "Informatics and Computer Science", in the doctoral program "Informatics".

29.01.2026

Sofia   /Prof. Ma