OPINION

By **Prof. DSc Ivan Dragov Trenchev**
regarding the doctoral 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 "doctor" in the professional field 4.6. Informatics and Computer Science

1. Relevance and Significance of the Topic

The relevance of the doctoral dissertation stems from several interrelated contemporary trends that shape the development of information systems, the management of complex processes, and decision-making under conditions of uncertainty and multi-factor complexity.

First, modern organizational, economic, engineering, and social systems are characterized by increasing complexity, large volumes of heterogeneous data, and the presence of multiple—often conflicting—criteria. In this context, classical intuitive or single-criterion decision-making approaches are insufficient, which makes multi-criteria decision-making methods not merely useful, but essential.

Second, despite the widespread application of fundamental methods such as the Weighted Sum Method and the Weighted Product Method, practical experience shows that their classical formulations do not adequately reflect the real conditions under which decisions are made. In real-world scenarios, decision-makers possess different levels of expertise across individual criteria, and part of the input data has an objective nature and should not be assessed entirely subjectively. It is precisely here that a significant scientific and applied gap emerges, which is addressed by the present research.

Third, digital transformation and the extensive adoption of web-based and distributed software systems impose additional requirements on decision support tools. The need for accessibility, scalability, security, and integration with other information systems requires these methods to be implemented through appropriate software architectures. This transforms the problem from a purely mathematical one into an interdisciplinary challenge, combining methods from operations research and software engineering.

In this context, the doctoral dissertation is particularly relevant, as it does not limit itself to theoretical refinement of existing models, but proposes a comprehensive approach that includes:

- modifications of classical decision-making methods that account for the competence of decision-makers;
- mechanisms for combining objective data with individual preferences;
- architectural solutions for implementing these models in web-based decision support systems.

An additional argument for the relevance of the research is its direct applicability in a number of contemporary domains such as e-commerce, selection of technological platforms, managerial and strategic decision-making, engineering projects, and group decision-making in expert environments. This renders the results of the dissertation practically relevant not only for the academic community, but also for real-world practice.

2. Structure and Logic of the Dissertation

The dissertation is logically structured and includes an introduction, four main chapters, a conclusion, formulated contributions, a list of publications, and an extensive bibliography. The total volume of 143 pages, including 24 tables and 53 figures, fully complies with the requirements for a doctoral dissertation.

The exposition is consistent, clear, and well-argued, and the author demonstrates an excellent ability to link theoretical concepts with their practical implementation.

3. Scientific and Applied Contributions

The dissertation achieves significant scientific and scientific-applied results that are contributory in nature and enrich existing research in the field of multi-criteria decision-making and decision support systems.

The scientific contributions are primarily expressed in the development of new modifications of classical decision-making methods, namely the Weighted Sum Method and the Weighted Product Method. The proposed modifications account for differences in the competence of decision-makers across individual criteria through the introduction of competence weighting coefficients, which leads to more realistic and objective aggregation of individual evaluations in group decision-making.

A substantial scientific contribution is also the formalization of a mechanism for generating evaluations of alternatives, combining the use of objective data with the individual preferences of

decision-makers. By decomposing criteria into measurable options, the traditional problem of subjective score assignment is overcome, thereby expanding the applicability of the method in both individual and group decision-making contexts.

The introduction of corrective coefficients that provide advantage in the overall performance of alternatives based on predefined critical characteristics should also be regarded as a scientific contribution. This approach enables targeted modeling of priorities that, in practice, are often inadequately represented by classical weighting schemes.

A scientific-applied contribution is the development of a generalized algorithm that integrates all proposed modifications into a unified logical decision-making framework. The algorithm is formalized through pseudocode and serves as a basis for subsequent software implementation, ensuring reproducibility and applicability of the obtained results.

A significant practice-oriented contribution is the design and implementation of two functional prototypes of a decision support system, based on different software architectures—a monolithic three-tier architecture and a serverless architecture. These prototypes demonstrate the feasibility of integrating the proposed mathematical models into real web-based applications that meet contemporary requirements for accessibility, scalability, and security.

An additional scientific-applied contribution is the conduct of extensive numerical experiments, through which a comparative analysis between classical and modified methods is performed. The obtained results convincingly demonstrate the effectiveness, robustness, and practical applicability of the proposed models in realistic scenarios.

In summary, it can be concluded that the dissertation contains original scientific and scientific-applied contributions that extend existing theoretical frameworks and offer viable solutions with high practical value.

4. Publication Activity

The results of the dissertation have been validated through five scientific publications indexed in Scopus, some of which are published in journals with an SJR ranking. This attests to the international visibility and scientific merit of the achieved results.

5. Critical Remarks and Recommendations

The critical remarks are primarily of a recommendatory nature and do not diminish the overall value of the dissertation. Possible directions for further development include:

- broader testing of the models in real organizational or industrial environments;
- extension of the analysis to other multi-criteria decision-making methods;
- more detailed discussion of the scalability of the proposed architectures.

6. Conclusion

The doctoral dissertation of Zornitsa Agresimova Dimitrova represents a completed, independent, and scientifically significant study that contains original scientific and scientific-applied contributions. The author demonstrates profound theoretical knowledge, skills in mathematical modeling, and excellent preparation in the field of software engineering.

Based on the above, I conclude that the dissertation fully meets the requirements of the Academic Staff Development Act of the Republic of Bulgaria and its implementing regulations, and I propose that the Scientific Jury award Zornitsa Agresimova Dimitrova the educational and scientific degree **"Doctor"** in the doctoral program "Informatics", professional field 4.6. "Informatics and Computer Sciences".

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