

REVIEW

by Prof. Stanimir Kunchev Zhelezov PhD

regarding a dissertation thesis for awarding the educational and scientific degree "Doctor" (PhD),
field of higher education: 4. Natural Sciences, Mathematics and Informatics,
professional direction: 4.6 Informatics and Computer Sciences,
doctoral program "Informatics"

Author of the dissertation thesis: **Dielza Shani Berisha**

**Topic: Optimization Strategies and Algorithms for solving Health System
Problems During a Pandemic**

1. General description of the presented materials.

The review has been prepared in accordance with Order No. 176/29.06.2026 of the Director of the Institute of Information and Communication Technologies (IICT) at the BAS, by which I have been appointed as a member of the scientific jury for a procedure for the defense of a dissertation thesis for awarding the educational and scientific degree "Doctor"(PhD) to the PhD student Dielza Shani Berisha on the topic " Optimization Strategies and Algorithms for solving Health System Problems During a Pandemic".

The presented set of materials meets the requirements in Art. 8 of the regulations on the specific conditions for acquiring scientific degrees and occupying academic positions at the Institute of Information and Communication Technologies of the BAS.

2. Information about the PhD student and the dissertation thesis.

The PhD student has been trained in the doctoral program "Informatics" at IICT-BAS in a part-time form. She was discharged with the right of defense by Order of the Director of IICT-BAS No. 73/27.03.2026.

I do not know the PhD student and I have no joint publications with her.

The provided dissertation thesis has a volume of 166 pages and 22 pages of appendices. It consists of an introduction, four chapters, a conclusion, a list of publications on the topic, a declaration of originality of the results, and a bibliography. The work presents 36 figures, 58 tables, and 125 relevant literary sources.

The main objective of the dissertation is to develop and evaluate an integrated hybrid decision support framework that combines epidemiological forecasting, optimization-based resource allocation, and discrete event simulation to improve health system performance during pandemic conditions. The framework links SEIR-based epidemiological modeling, parameter

adaptation supported by k-nearest neighbors, mixed-integer linear programming, and discrete event simulation into a single coherent workflow.

workflow.

The structure of the dissertation thesis is logically sound and consistent:

In **the introduction**, the focus and the main objective are formulated. To achieve this objective, eight tasks are defined.

In **the first chapter**, a systematic and critical review of optimization strategies, mathematical models, and decision support frameworks developed to address the challenges facing health systems during pandemics is presented. The literature review in this chapter focuses attention on epidemiological forecasting, optimization of healthcare operations, coordination of supply chains, equity-oriented distribution, and simulation-based evaluation. Five research tasks are also formulated.

The second chapter presents the methodological foundation of the dissertation and introduces an Integrated Hybrid Decision Support Framework (IHDSF) for healthcare system optimization during a pandemic. The scope of the proposed model is aimed at regional health coordination.

The empirical focus of **the third chapter** is directed towards building a structured dataset that can support the later computational modules of the dissertation. The dataset combines epidemiological, demographic, and health information at the municipal level. Its purpose is to prepare the case study of healthcare in Kosovo related to COVID-19 for computer analysis.

The fourth chapter examines how forecasting epidemiological demand, hospital capacity allocation, and simulation-assisted evaluation can support healthcare decision-making during pandemic conditions. The presented experiments evaluate the effectiveness of forecasting, resource utilization, hospital coordination strategies, and operational resilience under alternative healthcare scenarios. The results also show the limitations of the model.

In **the conclusion**, the main results of the research are summarized and the scientific and scientific-applied contributions are formulated.

3. Evaluation of the obtained results.

The dissertation thesis represents an independent, logically structured, and methodologically sound scientific study with a clear practical orientation. The set goal has been fulfilled, and the tasks have been implemented in full volume during the research.

In view of the above, I consider that the dissertation meets the requirements of the Development of Academic Staff in the Republic of Bulgaria Act (DASRBA) and the Regulations for the application of DASRBA (RPDASRBA). There are no data for plagiarism in the publications and the dissertation under the current procedure.

4. Evaluation of the scientific and scientific-applied contributions.

The research results enrich the existing scientific field with new knowledge, and the contributions in the dissertation can be summarized as:

- Integrated hybrid decision support framework.
- Context-aware approach for SEIR-kNN demand estimation.
- Hospital allocation model based on MILP.
- DES-based layer for operational validation.
- Contribution to the empirical study of COVID-19 in Kosovo.
- Integrated evaluation methodology based on KPIs.
- Decision support contribution oriented towards sustainability, sensitivity, and fairness for resource-constrained health systems

5. Evaluation of the publications on the dissertation.

The PhD student has approbated parts of her dissertation thesis in four scientific publications, two of which are indexed in SCOPUS. Three of the scientific publications are joint with the scientific supervisor and one is independent.

These publications form a total sum of points for the indicators of group G equal to 44 points, which are sufficient to cover the minimum national requirements for the educational and scientific degree "Doctor"(PhD) in professional direction 4.6 "Informatics and Computer Sciences".

6. Evaluation of the abstract.

The presented abstract has a volume of 51 pages and reliably reflects the content of the dissertation thesis and complies with the requirements of DASRBA and the Regulations on specific conditions for acquiring scientific degrees and occupying academic positions at IICT.

7. Critical remarks and recommendations.

I have no significant critical remarks regarding the presented dissertation thesis and the materials to it. I recommend the PhD student to continue the initiated research, as the topic has a high degree of applicability and broad prospects for development. The obtained results should be published in editions indexed in Web of Science and SCOPUS.

8. Conclusion.

I consider that the presented dissertation thesis meets the requirements of the Development of Academic Staff in the Republic of Bulgaria Act, the Regulations for the application of DASRBA, and the Regulations on the specific conditions for acquiring scientific degrees and occupying academic positions at IICT-BAS.

The PhD student demonstrates deep theoretical knowledge in the specialty of the doctoral program "Informatics", a high level of terminology mastery on the subject of the work, and proven capabilities for independent scientific research.

The achieved results give me reason to fully and convincingly give a positive assessment and recommend to the respected Scientific Jury to award the educational and scientific degree "Doctor"(PhD) to Dielza Shani Berisha in Professional Direction 4.6 "Informatics and Computer Sciences" under the Doctoral Program "Informatics".

Date: 1.09.2026

City of Shumen

Prepare

