OPINION

by Dr. Nina Dimitrova Dimcheva,

Associate Professor at the Dept. of Physical Chemistry, Faculty of Chemistry, the University of Plovdiv "Paisii Hilendarski"

on a Dissertation for the award of the educational and scientific degree "Doctor"

Field of higher education: 9. Security and Defense

Professional direction 9.1 National Security

Doctoral program "National Security".

Author: ***Kostadin Rangilov Bakov***

Topic: ***"Cyberbiosecurity as an Element of the National Security System".***

Scientific Advisors:

Prof. Dr. Ilia Nikolov Iliev – Plovdiv University "Paisii Hilendarski", Faculty of Biology;

Assoc. Prof. Dr. Ivan Dimitrov Stanchev – Plovdiv University "Paisii Hilendarski", Faculty of Economics and Social Sciences (FESS).

1. General Presentation of the Procedure and the Doctoral Candidate

By Order No. РД-22-1702 dated 18.07.2025 of the Rector of Plovdiv University "Paisii Hilendarski" (PU), I have been appointed as a member of the scientific jury to ensure the procedure for the defense of a dissertation on the topic "Cyberbiosecurity as an Element of the National Security System" for the award of the educational and scientific degree "Doctor" in the field of higher education 9 Security and Defense, professional direction 9.1 National Security, doctoral program "National Security". The author of the dissertation is ***Kostadin Ranghelov Bakov*** – doctoral candidate at the Department of Political Sciences and National Security with scientific supervisors Prof. Dr. Ilia Iliev and Assoc. Prof. Dr. Ivan Stanchev from Plovdiv University "Paisii Hilendarski".

The set of materials presented by Asst. Kostadin Bakov in electronic form and paper copy complies with Art. 36 (1) of the Regulations for the Development of the Academic Staff of PU and includes the following documents:

– Application to the Rector of Plovdiv University for the initiation of the procedure for the dissertation defense;

– Curriculum Vitae in European format;

– Protocol from the Department Council related to the reporting of readiness for the initiation of the procedure and the preliminary discussion on the dissertation;

– Dissertation;

– Abstract;

– List of scientific publications on the topic of the dissertation;

– Copies of scientific publications (full text;

– Declaration of originality and authenticity of the submitted documents;

– Certificate of compliance with the specific requirements of the respective faculty;

– Opinion from the preliminary discussion of the dissertation.

The doctoral candidate has submitted 3 full-text scientific publications in English, two of which are published in journals indexed and abstracted in the global databases Scopus and Web of Science, and one in a specialized scientific journal from the National Reference List.

2. Relevance of the Topic

The concept of "cyberbiosecurity" emerged as a term over the last 8 years, reflecting the intersection between cybersecurity and biosecurity, with its primary task being the protection of digital biological or biomedical data (health status, genetic information, processes, or materials of viral, microbial, plant, or animal origin—including human) from malicious software. In this context, cyberbiosecurity represents a crucial element of the National Security system and has as its main objective the safeguarding of the bioeconomy.

Considering this, I assess the research problem addressed in the dissertation: the lack of a concept for ensuring cyberbiosecurity, as well as a structure responsible for its implementation within the National Security system, as highly relevant both in scientific and applied aspects.

3. Understanding the Problem

From the thorough review of existing specialized literature, it is evident that the doctoral candidate has delved into the specifics of molecular-biological and biomedical research, familiarized themselves with part of the toolkit for these studies, has an overview of the methods and systems for implementing cybersecurity, and possesses practical experience in the field of National Security, from which I conclude that they have deeply engaged with the essence of the researched subject. The conclusions drawn from the literature review are adequately formulated, and the goals and tasks set for the dissertation cover an entire field whose development is anticipated not only on a national and European scale but also globally.

4. Research Methodology

The research is conducted in three main stages: exploratory, central, and concluding stages. During the first stage, the research problem is analyzed from the perspective of technical and technological levels in the two leading fields—information technology and molecular biotechnology. The second stage is related to the elaboration of the conceptual foundations of a platform for building a cyberbiosecurity system, while the third, concluding stage summarizes the results and formulates the main conclusions. The methodology of the scientific research is appropriately chosen, utilizing

a combination of theoretical, empirical, and statistical methods. The results are competently interpreted, and an adequate response is given to the research tasks formulated in the dissertation.

5. Characteristics and Evaluation of the Dissertation and Its Contributions

The dissertation consists of 221 pages, illustrated with 69 tables and 63 figures. The literature review references 195 contemporary sources, 35 of which are in Bulgarian, covering the period from 1976 to 2025. The dissertation includes three surveys discussed in the text, along with the processed results.

The dissertation is organized as a monograph and includes the following main sections: Introduction, six chapters, titled: "National Security and Its Resource Provision"; "Current Legal Issues in Regulating Processes for Assessing and Protecting Against Biological Threats"; "Biosecurity and the Ethics of Public Health Arising from Biological Threats"; "Cyberbiosecurity for the Protection of the Bioeconomy"; "Results from Empirical Research"; "Analysis of Data in Synchronizing Physical Security and Cybersecurity in Digital Societies"; Conclusion, Contributions, References, and Appendices.

In the introductory section, the concept of cyberbiosecurity is defined, and the emergence and development of this new, multi- and interdisciplinary field are traced. The object and purpose of the scientific research are defined, and the main tasks to be addressed in the dissertation are outlined.

The first chapter examines the essence of National Security and the factors influencing its level. The significance of information as a strategic resource in protecting national security is explored.

The second chapter is dedicated to the legal framework concerning protection against biological threats and the ethical norms that should be adhered to in contemporary biological research, with the aim of ensuring biological safety for humanity.

The third chapter of the dissertation focuses on biosecurity as a concept, its history, and the ethical norms of public health arising from biological threats. Key principles for classifying biological threats are derived, and several questions are raised regarding the ethical norms to be followed in preventing, preparing for, and responding to biological threats.

The fourth chapter of the dissertation provides a detailed description of how cyberbiosecurity is viewed as a protection for the bioeconomy and analyzes cybersecurity systems in biotechnological production, while also outlining the prospects for the development of this field. Special emphasis is placed on tools for detecting potential biological threats—portable analytical devices for detecting or monitoring levels of potentially hazardous substances, known as biosensors.

The fifth chapter presents the results of empirical research, the analysis of which is refracted through the ethical norms that should be followed in collecting and processing sensitive information.

The sixth chapter is dedicated to the processing of large databases in synchronizing physical and digital security. Attention is given to the methodology of synchronization, practical models of

synchronization, and a concept for interaction between physical security and cybersecurity is proposed.

In the conclusion section, an analysis of the research results is conducted, and based on this, specific measures for improving cyberbiosecurity are proposed, related to legislative, technological, educational, and other measures.

The "Contributions" section summarizes the main results of the research, with the findings providing answers to the research tasks. They largely reaffirm the importance of the measures that should be taken to safeguard cyberbiosecurity.

Based on the research, three main scientific and applied contributions are formulated, which I fully accept without any reservations.

6. Evaluation of Publications and Personal Contribution of the Doctoral Candidate

A total of three publications in English reflect the results discussed and analyzed in the current dissertation. Two of the articles are in journals with impact factor and quartile, while the third is in a journal from the National Reference List, as follows:

- a review article in Cosmetics (2025), IF = 3.9; quartile Q1 – 25 pts.

- a review article in Acta Microbiologica Bulgarica (2024), IF = 0.135; quartile Q4 – 12 pts.

- a research article in the journal "Security and Defense" (2024) – 10 pts.

In the first publication, the doctoral candidate is part of a multidisciplinary team of authors. In the second publication, he is on the second place, and in the third, he is the sole author. Due to the short time elapsed since the publication of the works – less than a year, a list of citations by other authors is not provided. The cumulative impact factor of the publications by Asst. Prof. K. Bakov exceeds 4, which is a testament to the high quality of the research.

According to the Law on the Development and Promotion of Scientific Research in Bulgaria, the National minimum requirements for obtaining doctoral degree are 30 points. The scientometric indicators of the doctoral candidate exceed this minimum, with a total of 47 points. The results of the research on the topic of the dissertation have been presented in 5 reports at 1 international and 3 national conferences. The doctoral candidate is the sole author in one of the publications (which is in the field of National Security) and positioned as the second author in an interdisciplinary study related to the topic, which gives me reasonable believes that he has made a significant contribution not only to the conducted research but also to its formulation.

7. Abstract

The abstract is 32 pages long, accurately reflects the main results and contributions of the dissertation, and meets the specific requirements of Plovdiv University "Paisii Hilendarski."

8. Recommendations for Future Use of the Dissertation Contributions and Results

I have no critical remarks or recommendations regarding the dissertation or its abstract. My view is that the dissertation of Asst. Prof. K. Bakov represents a highly innovative example of an inter-

and multidisciplinary dissertation, in which a productive interaction between political and natural sciences is vividly demonstrated in the favor of our National Security. I hope that the scientific and applied contributions formulated in this dissertation will soon find practical application in the national security system of the country and the region.

CONCLUSION

The dissertation contains scientific and applied results that represent an original contribution to science and meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for the Implementation of LDASRB, and the corresponding Regulations of Plovdiv University "Paisii Hilendarski".

The dissertation demonstrates that the doctoral candidate **Kostadin Ranghelov Bakov** possesses in-depth theoretical knowledge and professional skills in the scientific specialty of National Security, showcasing qualities and abilities for independent scientific research.

Due to the above, I am convinced to give my **positive assessment** of the research presented in the reviewed dissertation, abstract, achieved results, and contributions, and I propose to the esteemed scientific jury **to award the educational and scientific degree of "Doctor"** to Kostadin Ranghelov Bakov in the field of higher education: 9. Security and Defense, professional direction 9.1. National Security, doctoral program "National Security".

19.08.2025 Member of the scientific jury:

(signature)

/Dr. Nina Dimcheva, Assoc. Prof./