REVIEW

by Assoc. Prof. Georgi Nikolov Cholakov, PhD
Plovdiv University „Paisii Hilendarski“

of a dissertation for the award of the educational and scientific degree **"Doctor"**

in: field of higher education: 4. "Natural Sciences Mathematics and Informatics"

professional field: 4.6. "Informatics and Computer Sciences"

doctoral program: "Informatics”

Author: Todor Atanasov Todorov
Title: *Risk Analysis under Conditions of Smart Agriculture*
Scientific Supervisor: *Prof. Stanimir Nedyalkov Stoyanov, PhD*
Plovdiv University “Paisii Hilendarski”

1. General description of the submitted materials

By Order No. РД-22-1032 of 19.5.2026 of the Rector of Plovdiv University “Paisii Hilendarski”, I was appointed a member of the scientific jury for the procedure concerning the public defense of a dissertation entitled *“Risk Analysis under Conditions of Smart Agriculture”* for the award of the educational and scientific degree Doctor in Field of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.6. Informatics and Computer Science, Doctoral Programme Informatics. The author of the dissertation is Todor Atanasov Todorov, a full-time doctoral student at the Department of Computer Systems, under the scientific supervision of prof. Stanimir Nedyalkov Stoyanov from Plovdiv University “Paisii Hilendarski”.

The set of materials submitted by Todor Atanasov Todorov complies with Article 36 (1) of the Regulations for the Development of the Academic Staff of Plovdiv University “Paisii Hilendarski” and includes the following documents:

- an application to the Rector of Plovdiv University “Paisii Hilendarski” for the opening of a dissertation defense procedure;
- a curriculum vitae in European format;
- protocol from the department council, related to the reporting of readiness to open the procedure and the preliminary discussion of the dissertation;
- the dissertation manuscript;
- an abstract of the dissertation;

– a list of scientific publications related to the dissertation topic;
– copies of the scientific publications;
– a declaration of originality and authenticity of the submitted documents.

The doctoral candidate has submitted two publications.
The submitted documents meet the requirements of the Academic Staff Development Act in the Republic of Bulgaria and its implementing regulations for the award of the educational and scientific degree Doctor.

2. Brief biographical information about the doctoral candidate

Todor Atanasov Todorov is a full-time doctoral student in the doctoral programme Informatics at the Department of Computer Systems, Faculty of Mathematics and Informatics, Plovdiv University "Paisii Hilendarski", enrolled in 2018. His educational and professional background is interdisciplinary and combines competencies in the fields of informatics, banking, and data analysis. He holds a Master's degree in Computer Technologies with the professional qualification Economist–Informatician from Plovdiv University "Paisii Hilendarski", as well as a Master's degree in International Economic Relations from the University of National and World Economy. During the period 2022–2023, he also obtained a qualification in Pedagogy of Teaching Informatics and Information Technologies. His professional experience is in the banking sector, where he has held expert and managerial positions related to credit analysis, risk assessment, and work with corporate clients; he has also served as a part-time lecturer at the Faculty of Mathematics and Informatics. These biographical data demonstrate practical experience and purposeful academic preparation relevant to the topic of the dissertation.

3. Relevance of the topic and appropriateness of the stated goals and objectives

The problem addressed in the dissertation is highly relevant both from a scientific and from a scientific-applied perspective. Scientifically, its relevance arises from the need to explore the possibilities for integrating approaches from the fields of financial analysis, risk management, informatics, and intelligent information systems in the modelling of processes in contemporary agriculture. The development of smart agriculture imposes new requirements on the methods for identifying, assessing, and forecasting financial risk in agricultural enterprises under the influence of production, market, climatic, and institutional factors. In this sense, the topic addresses a significant and insufficiently explored interdisciplinary problem related to the construction of a more comprehensive and formalized framework for risk analysis.

From a scientific-applied perspective, the relevance of the study is also clearly expressed, as it is aimed at designing the architecture of a module for the identification and analysis of financial

risks within the ZEMELA platform. Its practical significance is determined by the need for agricultural enterprises and the structures associated with them to have tools for more reliable risk assessment based on the combined use of agrarian, climatic, and financial data. The specific objectives formulated in the dissertation are relevant and subordinate to the main aim of the study. They include theoretical clarification of the nature of financial risks in the agricultural sector, analysis of existing electronic systems and digital solutions, and development of a mathematical model for risk identification. This gives me grounds to accept that both the problem itself and the specific research tasks have been formulated in accordance with current scientific research and with the real needs of practice.

4. Understanding the problem

The aim of the dissertation is clearly defined, and eight main tasks have been formulated for its achievement. Both the dissertation itself and its bibliography, comprising 102 diverse sources, show that the literature used serves as a basis for constructing an original research framework. It is particularly positive that the literature review covers not only classical positions in the field of financial risk, but also contemporary studies related to smart agriculture, digital platforms, and data analysis.

This gives me grounds to conclude that the doctoral candidate is well acquainted with the current state of the problem and makes creative use of the available scientific material. In summary, it may be stated that the problem area has been thoroughly studied.

5. Research methodology

The research methodology has been appropriately selected and is adequate to the stated goal. It consistently includes theoretical analysis, comparative examination of existing solutions, development of a mathematical model, implementation of a prototype system, and its testing. The methodological approach chosen in this way makes it possible to provide a well-grounded response to the research tasks and to achieve both theoretical and practical results.

The doctoral candidate has successfully justified and developed a conceptual and architectural model for the identification of financial risks, based on an event-oriented approach and integration into the existing smart agriculture platform ZEMELA.

6. Characteristics and evaluation of the dissertation

The dissertation comprises 131 pages and is structured into an introduction, four chapters, a conclusion, contributions, publications, and bibliography.

The introduction argues for the need for an adequate assessment of financial risk not only for agricultural producers, but also for the institutions financing them and, more generally, for the economy as a whole. It also substantiates the need to develop methodological and architectural solutions for integrating financial risk models into existing information platforms.

The first chapter presents an analytical review of financial risks and the role of electronic systems in agriculture, outlining the relationship between digitalization and the need for more effective risk management. It examines the main types of financial risks, as well as the roles of digitalization and insurance.

The second chapter discusses the theoretical foundations of financial and agrarian risks, systematizing the main concepts, characteristics, and approaches to their management in agricultural enterprises.

The third chapter is devoted to the development of a mathematical model for financial risk identification, examining the different spaces that constitute the model.

The fourth chapter presents the software implementation of the proposed solution through the development, integration, and testing of a prototype system within the ZEMELA platform.

The conclusion summarizes the obtained results and outlines directions for future development.

A favorable impression is made by the summaries of the conclusions added after each chapter. Overall, the results presented in the dissertation are sufficient to substantiate the formulated findings and the stated contributions within the framework of the objectives set and the chosen research approach. The literature sources used, the developed model, and the proposed integration with the ZEMELA platform provide grounds for assessing the dissertation as a work of both scientific and scientific-applied character.

7. Contributions and significance of the development for science and practice

The contributions are of both scientific and scientific-applied character. The following may be classified as scientific contributions:

- The development of a formal model for the identification of financial risks in agriculture, based on an event-oriented approach in which financial risks are represented as compositions of agronomic, climatic, and financial events;

- The proposal of a formal integration framework for combining agronomic, climatic, and financial data, which extends traditional approaches to financial analysis and allows for more accurate and timely risk identification under conditions of smart agriculture;
- The presentation of a conceptual possibility for reducing information asymmetry between agricultural producers, financial institutions, and insurers through the use of a shared event-based information environment.

The following may be classified as scientific-applied contributions:

- The designed architecture of a module for the identification and analysis of financial risks, integrated within a smart agriculture platform;
- The developed methodology for early warning of financial risk, which uses automated rules and event operators and enables timely response in the event of critical financial conditions;
- The proposed practically applicable mechanism for supporting decision-making on the part of agricultural producers through the visualization and interpretation of financial-risk events in real time.

As possible directions for future development, the dissertation points to the expansion of the set of risk analysis models and the integration of regulatory and ESG indicators into the financial risk analysis system.

8. Assessment of the publications related to the dissertation

Two co-authored publications in English have been presented for the dissertation. They were submitted in proceedings of international scientific forums over the last two years, published in IEEE editions. Of these, the second publication is directly related to the dissertation, as it addresses the modelling of financial risks under conditions of smart agriculture and reflects substantial ideas closely related to the main subject of the study. The first publication is thematically more distant and is focused on blockchain models (which are also discussed in the dissertation), but it also testifies to the doctoral candidate's scientific activity in the field of information technologies and applied models.

The submitted publications may be positively assessed and are sufficient to meet the requirements of the procedure, while also being indicative of the doctoral candidate's participation in publication activity on issues related to the professional field. Particular importance should be attached to the publication devoted to modelling financial risk in smart agriculture, since it reflects results directly related to the dissertation.

9. Personal contribution of the doctoral candidate

From the content of the dissertation, the abstract, and the submitted publications, it may be concluded that the dissertation work is mainly the result of the doctoral candidate's own efforts. His personal contribution is evident in the selection and formulation of the research problem, in the systematization of the theoretical foundation, in the development of the model for financial risk identification, and in the implementation of the proposed software solution. I consider that the main results and the formulated contributions in the dissertation are, to a significant extent, the personal achievement of the doctoral candidate. The participation of other researchers in individual publications does not cast doubt on the independent character of the dissertation.

10. Abstract

The submitted abstract has been prepared in accordance with the requirements regarding content and form and correctly reflects the main provisions of the dissertation. It presents the relevance of the study, the aim, object and subject of the study, objectives, structure of the dissertation, the main results, and the formulated scientific and scientific-applied contributions.

11. Critical remarks and recommendations

The presented study has its undeniable merits; however, I would also make several recommendations.

It would be beneficial for the proposed model and the implemented prototype to be validated on a broader set of real-world data, which would allow for a more convincing assessment of their practical applicability and the robustness of the obtained results.

Furthermore, the section devoted to the software implementation could benefit from a more detailed technical presentation of the knowledge base, the inference engine, and the interaction among the individual system components. Such an elaboration would enable a clearer assessment of the prototype's potential for further development and practical implementation.

These recommendations do not in any way diminish the overall positive assessment of the dissertation.

12. Recommendations for the future use of the dissertation contributions and results

It is advisable for the prototype to be tested in a real-world environment in order to confirm that, when operating with actual data, the model produces the expected results.

The developed model for the identification and analysis of financial risk could find practical application in the further development of smart agriculture platforms intended to support agricultural producers, financial institutions, insurers, and other stakeholders in the assessment and management of risk.

In addition, the results of the study may serve as a foundation for future scientific research related to the expansion of the applied models, the incorporation of additional data sources, and the further refinement of forecasting and early-warning mechanisms.

CONCLUSION

The dissertation contains scientific, scientific-applied, and applied results that represent an original contribution to science and comply with the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria, its rules for the application, and the Regulations for the Development of the Academic Staff of Plovdiv University “Paisii Hilendarski”.

The doctoral candidate undoubtedly possesses profound knowledge and skills in the field of information technologies and the specialty of Informatics, as well as high qualification in the financial sector, and also demonstrates the ability to conduct independent scientific research.

In view of the above, I give my **positive assessment** of the dissertation. I propose that the esteemed scientific jury award the educational and scientific degree of Doctor to Todor Todorov in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6 Informatics and Computer Sciences, doctoral programme “Informatics”.

5.6.2026

Reviewer: .....
/Assoc. prof. Georgi Cholakov, PhD/