



REVIEW

of PhD thesis for acquiring the educational and scientific degree "Doctor" in: field of higher education 3. Social, economic and legal sciences, professional field 3.8 Economics, scientific specialty "Economics and Management (Agriculture)"

Author of the PhD thesis: Dafinka Vasileva Grozdanova, part-time PhD student at the Department of Economics at the Agricultural University, Plovdiv

Topic of the PhD thesis: "Economic assessment and future prospects for the use of unmanned technologies supporting ecological orientation and precision agriculture in Bulgaria."

Reviewer: Assoc. Prof. Dr. Petya Dobrinova Atanasova, Trakia University - Stara Zagora, higher education area 3. Social, economic and legal sciences, professional field 3.8 Economics, scientific specialty "National economy (incl. regional economy and history of the national economy)", appointed as a member of the scientific jury by Order No. RD-16-560/29.04.2026 of the Rector of the Agricultural University, Plovdiv

1. Information about the PhD student.

The PhD student Dafinka Vasileva Grozdanova was born in 1979. She completed her secondary education in 1998 at the "Konstantin Velichkov" Mathematical High School, Pazardzhik. In 2004, she completed higher education with a Master's degree in Plant Protection at the Agricultural University, Plovdiv. In 2010, she completed a Master's degree in Theology and Teacher (Pedagogy) of Religion at Sofia University "St. Kliment Ohridski", and in 2011, she completed a Master's degree in National Security and Defense at the "Georgi Stoykov Rakovski" Military Academy - Sofia. In addition, for the period 2011 - 2018, the doctoral student has acquired certificates of proficiency in English and completed training courses in various professional areas. In 2019, she was enrolled as a part-time doctoral student by Order RD-26-104/18.12.2018 of the Rector of the Agricultural University, Plovdiv in the scientific specialty "Economics and Management", in the professional field 3.8 "Economics" at the Department of Economics, Faculty of Economics. By Order RD-26-38/04.04.2023 of the Rector of the Agricultural University, Plovdiv, the doctoral student was enrolled with the right to defense.

2. Relevance of the problem.

The topic of the dissertation is important and relevant. In the context of increasing

globalization of markets, limited resources and the predominance of environmentally-oriented policies, the need to conduct economic research on the modernization of the agricultural sector in the country and, more specifically, the implementation of unmanned technologies in precision agriculture in Bulgaria is justified. The climate changes that have occurred in recent years, extreme weather events, and the shortage of labor undoubtedly lead to reduced productivity. The use of innovative technological solutions will contribute, on the one hand, to higher economic efficiency, respectively competitiveness of Bulgarian farms, and on the other, to intelligent (smart) land management and compliance with environmental standards for sustainable agriculture. In the dissertation, the doctoral student examines unmanned systems, autonomous or remotely controlled technological platforms that should perform tasks without an operator on board, but through sensor control, communication technologies and software algorithms.

3. Purpose, tasks, hypotheses and research methods.

The formulated goal of the dissertation is to analyze and evaluate various unmanned technologies used in agriculture in the context of external influencing factors and to identify future development prospects in accordance with the environmental policies of the European Union and the basic principles of sustainable development.

The object of the study is the agrarian sector of the Republic of Bulgaria, with a focus on crop production, and **the subject** is the economic efficiency, applicability and future prospects for the development of unmanned technologies as a tool for sustainable management in precision agriculture.

The tasks set in the dissertation work fully correspond to the purpose of the research and correspond to the topic. They are reduced to: current analysis of theoretical and political prerequisites for the digitalization of agriculture; review of scientific research on the topic; economic analysis of the implementation of unmanned technologies in corn production; effectiveness of new technological solutions compared to conventional ones; study of existing attitudes among agricultural producers; identification of factors affecting the implementation of unmanned technologies and development of development scenarios.

The main research thesis is that "the implementation of unmanned technologies creates prerequisites for increasing economic efficiency, sustainability and resource optimization in crop production, with the extent of their application depending on economic, institutional and technological factors."

The approach and methodology of the study, on the one hand, allow achieving the main goal of the dissertation work and solving the tasks set, and on the other hand, demonstrate a high level of scientific research. The complex analysis is justified by an integrated analytical approach, including various aspects of the study, formed in four blocks:

- technological, presenting possible technological solutions with specific functionality;
- economic, analyzing indicators of costs, productivity, resources invested and expected return;
- ecological and social, examining the consequences on the environment and the

participation of human resources;

- institutional, taking into account the impact of the existing and implemented state policy in the agricultural sector.

This comprehensiveness of the research, covering the challenges facing agriculture in the country, demonstrates the doctoral student's high level of depth in the issues of the dissertation.

4. Visualization and presentation of the results obtained.

The dissertation consists of an introduction, an exposition in 4 (four) chapters, a conclusion and a list of references from 160 (one hundred and sixty) sources. The text includes 24 (twenty-four) figures and 27 (twenty-seven) tables, which present the results of the analyses and research conducted.

The introduction defines the main elements of the work: object and subject of the study, research thesis, goal, tasks that follow, as well as the methodology used in the analytical part.

First chapter is theoretical and examines the conceptual and normative foundations of unmanned technologies in agriculture. The need to develop an integrative analytical model is substantiated, through which to trace the interrelationships between technologies, economic results and the institutional environment. In addition to the significant benefits of the implementation of unmanned technologies, the restrictive lines that hinder the economic efficiency and practical applicability of innovative technological solutions are comprehensively described. Economic, technological, institutional and regulatory aspects that would influence the process are examined, justified with solid argumentation from cited scientific literature.

Chapter Two presents the methods used in the dissertation. It should be noted that the study combines quantitative and qualitative methods of analysis. Regarding the processed data, both primary information was used - obtained through a questionnaire survey among farmers, field observations and organized demonstration experiments, as well as secondary data, including published statistical information, scientific literature and specific institutional documents. The conceptual framework of the study is consistent with the concept of sustainable development imposed by the European Union, aimed at increasing resource efficiency, protecting natural resources and strengthening social sustainability in the agricultural sector.

Third chapter is the analytical part of the work, an empirical assessment of unmanned technologies in corn production in Bulgaria. After performing analyses, the opinion was drawn that the hybrid model, including technological innovations and conventional mechanization, is the most economically effective for soil cultivation when growing the selected crop. The use of unmanned equipment for selected activities in agriculture leads to the highest degree of cost optimization.

Moreover, in subsequent studies on the quality of the production result, it was found that the innovative technique, characterized by higher precision of agrotechnical operations, ensures compliance with processing deadlines and contributes to predictable and correct implementation of key activities for the sector. In a positive aspect of the implementation of unmanned technologies, the presented analysis of the impact on soil resources should also be noted. The study summarizes the significance of the presented innovative technique for reducing soil compression; for overlapping

and drift losses, for more precise application of preparations and fertilizers and lower energy intensity. The conducted survey results in a positive attitude among respondents for the implementation of drones as a more realistic prospect in the short term and agrorobots in the long term, due to financial and administrative barriers.

The empirical results from the third chapter highlight the high potential of unmanned technologies for increasing economic, production and environmental efficiency in the agricultural sector of Bulgaria, but also the need for an adequate institutional environment, financial and training support, according to the scale of individual agricultural organizations.

Chapter Four formulates the strategic perspectives and models for the implementation of unmanned technologies in Bulgarian agriculture. Innovative solutions contribute to the optimization of production and management processes, and the transformation of the agricultural sector should unite existing technological capabilities, business logic and targeted institutional support. The SWOT analysis performed highlights a significant differentiation of farms according to their structural characteristics, and this trend predetermines the implementation of innovative technological solutions through more flexible organizational forms. Analyzing the main categories of risk that exist when introducing innovative technological solutions is of essential importance. The proposed risk profile serves as the basis for a scenario model for the development of unmanned technologies in agriculture in Bulgaria. It is substantiated that successful integration does not depend on a dominant factor, but on the complex functioning of scientific application, human and financial resources and regulatory security.

From the types of models for the implementation of unmanned technologies presented and analyzed in detail, it is summarized that the effectiveness depends on the choice of an appropriate model according to the specifics of technological, economic and institutional factors in order to achieve resource optimization and sustainable development in the agricultural sector.

The presented author's tool for assessing the applicability of unmanned technologies at the farm level indisputably proves the high significance of the dissertation work and scientific competence in organizing research tasks. The results obtained have been transformed into an applicable analytical model that can contribute to the gradual transformation of traditional agricultural holdings into innovative, competitive organizations applying the principles of modern sustainable development.

5. Discussion of the results and literature used.

After conducting a comprehensive study, the PhD student concluded that "unmanned technologies can become a real tool for modernization, resource efficiency and competitiveness of Bulgarian agriculture", but the regulatory environment, financing, organized training, cooperation in the sector, as well as strategic planning should be taken into account.

The hybrid model was identified as the most suitable for Bulgarian agriculture, according to which unmanned technologies should be used selectively for identified activities with high added value, while conventional production mechanization should be maintained for basic field operations.

Limiting barriers are high technological costs and the lack of highly competent personnel for operational work, as well as available management capacity. These conclusions provide grounds for recommendations to support the process of implementing unmanned technologies at three levels: *at the institutional level* - to update the regulatory framework; *at the sectoral level* - to focus on new cooperative forms of using innovative technology in production activities; *at the agricultural level* - to focus on individual justified work programs, taking into account the specific characteristics of the organizations.

The list of references includes 160 sources, all in English. There is a comprehensive literature review on the topic of the dissertation with rich content. Basic scientific research, regulatory documents, reports and other publications directly related to the implementation of unmanned technologies in agriculture are indicated. This gives reason to note that the PhD student is very well versed in publicly available information on the issues of the dissertation work.

6. Contributions of the dissertation work.

As a result of the dissertation research conducted, contributions have been made in the following directions:

Scientific and theoretical contributions

- An integrated conceptual framework for analyzing the implementation of unmanned technologies in agriculture has been developed and the theoretical understanding of the role of the institutional environment in the implementation of innovations has been enriched.

- It has been proven that the implementation of unmanned technologies does not follow a universal model and a theoretical framework for a hybrid model of technological integration has been proposed to manage risk and economic efficiency.

- The theoretical understanding of the relationship between precision agriculture and unmanned technologies has been expanded.

Scientific and applied contributions

- Developed: an author's tool for assessing the applicability of various technological alternatives at the farm level and a scenario model for the development of unmanned technologies in Bulgarian agriculture, including four alternative scenarios that reflect different combinations of institutional support, economic profitability and technological readiness.

- A matrix for selecting technological solutions according to the type of agricultural holding has been created, which offers a differentiated approach to the implementation of unmanned technologies depending on the scale, resources and organizational capacity.

- Rich empirical material on the attitudes, barriers and investment readiness of agricultural producers has been systematized and analyzed.

- Recommendations for the sustainable implementation of unmanned technologies at three levels - institutional, sectoral and economic have been proposed and substantiated.

7. Critical notes and questions.

The research in the dissertation is precisely structured and presented. The PhD student demonstrates good skills in interpreting the opinions of various authors on the topic, processing the information obtained and presenting the results obtained in appropriate graphic and tabular material. Constructive proposals regarding the implementation of unmanned technologies in the agricultural sector are substantiated.

I would recommend, based on the accumulated research and expert experience, to continue scientific research on the issue under consideration and, if possible, to assist in the wider popularization of the results obtained among agricultural holdings with a view to their implementation and increasing competitiveness.

I have the following question: Has the PhD student come across information regarding the proportion or pace at which agricultural holdings are implementing unmanned technologies in their production activities in Bulgaria?

8. Published articles and citations.

4 (four) publications are listed on the topic of the dissertation, of which the first 3 (three) were developed in co-authorship with the scientific supervisor Assoc. Prof. Dr. Minko Georgiev and 1 (one) in a larger team of authors:

1. Grozdanova, D., & Georgiev, M. (2021). Balance between the European Union and Bulgarian legislation as regards the agricultural land versus food sovereignty. In Proceedings of the XVII International May Conference on Strategic Management (IMCSM21) (pp. 267–277).

2. Covid-19 Measures. Institutional “Errors”, Transaction Costs and Adaptation in the Agriculture. (2021). Bulgarian Journal of Agricultural Economics and Management, 66(1), 21-31.

3. Georgiev, Minko and Grozdanova, Dafinka, Acquisition and Inheritance of Agricultural Land in Bulgaria - From Fragmentation Towards Consolidation (November 25, 2020). Journal of Agricultural and Environmental Law, Vol. 15 No. 29, pp. 66-84.

4. Georgiev, M., Grozdanova, D., Ivanova, B., Beluhova-Uzunova, R., & Shishkova, M. (2022). Agricultural land, rent seeking and transaction costs. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 22(2), 345–351.

The mentioned articles have been published in prestigious journals: Bulgarian Journal of Agricultural Economics and Management, Journal of Agricultural and Environmental Law, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development and Contemporary Journal of Economics and Finance.

It should be noted that there is visibility in world-renowned databases of scientific information: one publication in Scopus and one in Web of Science, and citations are also noticeable, which testifies to the significance of the results derived.

The presented abstract objectively reflects the structure and content of the dissertation work.

CONCLUSION:

Based on the various research methods learned and applied by the PhD student, the correctly conducted experiments, the generalizations and conclusions made, I believe that the presented dissertation meets the requirements of the Law on the Protection of Scientific and Technological Research of the Republic of Bulgaria and the Regulations of the Agricultural University for its application, which gives me reason to evaluate it **POSITIVELY**.

I would like to propose to the esteemed Scientific Jury to also vote positively and award **Dafinka Vasileva Grozdanova** the educational and scientific degree "**Doctor**" in the scientific specialty "**Economics and Management (Agriculture)**".

Date: 21.05.2026 г.
Yambol

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