



## OPINION

on a doctoral dissertation submitted for the award of the educational and academic degree of "**Doctor**" in: field of higher education 3. Social, Economic and Legal Sciences, professional direction 3.8 Economics, academic speciality "**Economics and Management (Agriculture)**"

**Author of the doctoral dissertation:** Dafinka Vasileva Grozdanova, part-time doctoral student, Department of Economics, Agricultural University, Plovdiv

**Title of the doctoral dissertation:** "Economic Assessment and Future Prospects for the Use of Unmanned Technologies Supporting Ecological Orientation and Precision Agriculture in Bulgaria"

**Reviewer:** Prof. Dr Vanya Georgieva, Professor at Agricultural University - Plovdiv in the field of higher education 3.0 Social, Economic and Legal Sciences, professional direction 3.8 Economics, academic speciality Accounting, Control and Analysis of Economic Activity, appointed pursuant to Order No RD-16-560/29.04.2026 of the Rector of Agricultural University - Plovdiv as a member of the scientific jury

### 1. Relevance of the research problem.

The doctoral dissertation is devoted to the economic assessment of unmanned technologies (drones and agro-robots) in crop production, and more specifically in maize cultivation in Bulgaria - a topic of considerable scientific and practical relevance. In the context of the European Green Deal, the Farm to Fork Strategy, and the CAP 2023-2027, the pursuit of technological solutions for improving resource efficiency and reducing the environmental footprint of agriculture is a priority at both national and European level. Despite growing interest in the digitalisation of the agricultural sector, applied research into the specific economic effects of introducing unmanned technologies under Bulgarian farming conditions remains limited. It is precisely this research gap that underpins the significance of the topic, and the choice of maize as the model crop is methodologically well justified.

### 2. Aims, objectives, hypotheses, and research methods.

The aim of the dissertation is clearly formulated: to carry out an economic assessment of unmanned technologies in precision agriculture in Bulgaria and to analyse the prospects for their development in the context of European sustainability policies. The research thesis holds that the adoption of unmanned technologies creates the conditions for improving economic efficiency and resource optimisation, whereby the degree of application is determined by economic, institutional, and technological factors. Seven specific objectives have been formulated, covering theoretical analysis, economic assessment, comparative analysis, empirical investigation, and scenario modelling.

The methodological approach is integrated and comprises: quantitative methods (comparative analysis of direct costs and transaction costs, production function, questionnaire survey with a  $\chi^2$  test), structural top-down and bottom-up approaches for analysing the institutional environment and economic behaviour, strategic methods (SWOT, scenario modelling, backcasting, ABCD, the Five Levels framework), and an original instrument for self-assessment of the applicability of technologies at farm level. The diversity of methods is entirely commensurate with the complexity of the subject under investigation and provides a multi-faceted perspective on the problem.

### **3. Visual presentation and communication of results.**

The doctoral dissertation is structured in four chapters and comprises 195 pages, 27 tables, and 24 figures. The visual presentation of results is of a sound academic standard: the figures illustrate conceptual models, research design, and production functions, whilst the tables systematise the comparative economic analyses, SWOT matrices, and scenario assessments. The results of the questionnaire survey conducted amongst agricultural producers are presented by means of charts. The original self-assessment instrument is illustrated with a real-world farm case study (Table 27), which enhances its practical applicability.

The text is formatted in accordance with BDS ISO 7144:2011, citations follow the APA standard, and the bibliography comprises 162 entries drawn from academic articles, reports, and EU regulatory documents.

### **4. Discussion of results and bibliography.**

The research findings are presented in a logically coherent and analytically well-grounded manner. The comparative analysis of direct costs demonstrates that, in the case of spraying and fertilisation, unmanned technologies yield substantial savings - at 60% substitution these reach approximately €100/ha, and at 80% substitution approximately €134/ha. Particularly significant is the finding regarding transaction costs: the choice between own investment and a technology-as-a-service model proves to be a decisive factor for profitability, especially for small and medium-sized farms. The environmental analysis confirms that more precise application of crop protection products reduces pressure on soil and water resources.

The empirical questionnaire survey reveals a positive attitude towards drones among agricultural producers, albeit conditional upon financial support and training. The strategic analysis identifies the hybrid model - combining conventional mechanisation

with unmanned technologies - as the most realistic transitional option for Bulgaria. The bibliography is current, relevant, and well integrated into the overall exposition.

## **5. Contributions of the doctoral dissertation.**

### *Scientific contributions*

1. Systematisation and updating of the conceptual apparatus relating to unmanned technologies in agriculture, including the clarification of definitions for drones and agro-robots in the context of precision and sustainable farming.
2. Development of an integrated methodological approach for the economic assessment of unmanned technologies, combining direct cost analysis, transaction cost analysis, an empirical questionnaire survey, and strategic analytical tools.
3. Development of an original instrument for the self-assessment of the applicability of unmanned technologies at farm level, based on a linear model with a weighted sum of economic, environmental, and social criteria aligned with the UN Sustainable Development Goals.
4. Identification of key structural regularities in the relationship between farm size and the economic rationale for introducing unmanned technologies in maize production.

### *Scientific and applied contributions*

1. Development of four scenarios and standard models for the adoption of unmanned technologies according to the type and scale of agricultural holding, providing practical guidance for farmers and institutions.
2. Formulation of differentiated recommendations at institutional, sectoral, and farm level for promoting sustainable agriculture in the context of CAP 2023-2027.
3. Empirical investigation of the attitudes and readiness of maize producers in Bulgaria to adopt unmanned technologies, providing an evidence base for policy decisions.

## **6. Critical remarks and questions.**

The research is concentrated on maize production, which limits the direct applicability of the findings to other major crops in Bulgaria (sunflower, wheat). I should like to ask the doctoral candidate whether she considers the results for maize to be valid for other arable and industrial crops as well, or whether she believes that a separate analysis for each of them would be necessary.

## **7. Published articles and citations.**

In connection with the doctoral dissertation, the candidate has published four academic works with a combined total of 41 points. Of these, three articles appear in peer-reviewed and indexed journals: one in Scopus and two in Web of Science, and one paper in an edited collective volume. The publications are co-authored with the academic supervisor, Assoc. Prof. Dr Minko Georgiev.

The submitted abstract accurately reflects the structure and content of the doctoral dissertation.

### **CONCLUSION:**

On the basis of a thorough analysis of the doctoral dissertation by Dafinka Grozdanova, I may conclude that the work meets the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria and the Regulations of Agricultural University for its application. The doctoral candidate demonstrates in-depth theoretical knowledge, the capacity for independent research, and applied thinking. The results obtained and the conclusions drawn are well grounded and possess both scientific and practical value. The original instrument developed for assessing the applicability of unmanned technologies constitutes a genuine applied contribution. I therefore assess the doctoral dissertation **POSITIVELY**.

I take the liberty of proposing that the honourable Scientific Jury likewise votes positively/negatively and awards/does not award Dafinka Grozdanova the educational and academic degree of "Doctor" in the academic speciality "Economics and Management (Agriculture)".

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Plovdiv

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