SUMMARY
of the doctoral thesis entitled:

RESEARCH ON THE USE OF INFORMATION SYSTEMS IN AGRICULTURAL PRODUCTION MANAGEMENT

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The current stage of the evolution of information systems in agricultural activity is marked by a rapid and extensive adoption of digital technologies, which transforms the way farmers manage and optimize agricultural production, as a result of the fact that advanced technologies, such as the Internet of Things (IoT), artificial intelligence (AI), big data and drones, are increasingly being integrated into agricultural operations to collect and analyze real-time data, to more accurately monitor soil conditions, climate, plant and animal health, providing valuable information for informed decision making.

In this context, the present doctoral thesis is intended to be a valuable scientific approach that allows both the measurement of the current stage of the application of digitization and the level of use of IT systems within agricultural holdings in Romania, as well as a way to identify the perception of farmers regarding their role in increasing the profitability of the undertaken activity. In this way, based on the research results, I intended to formulate conclusions and proposals that would be useful both to decision-makers, when they establish policies and support measures for an agriculture that must benefit from the latest technologies, adapted to the modern world, but also to farmers, and last

but not least to the developers of digital systems who must adapt their products to the needs of those active in the agricultural field.

The work is structured in 6 chapters, including conclusions.

In Chapter 1 entitled COMPUTER SYSTEMS AND THEIR ROLE IN BUSINESS DEVELOPMENT I defined the computer systems and their characteristics, as well as the current stage of their evolution in the agricultural activity which is marked by a rapid and extensive adoption of digital technologies, that transforms the way farmers manage and optimize agricultural production. Advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data and drones are being integrated into agricultural operations to collect and analyze real-time data and provide deep insights about agricultural trends and performance, supporting more efficient strategies and a sustainable production. In addition to these advantages, digital systems face different vulnerabilities, which have been presented in order to address them proactively and to reduce the risks associated with the security of information systems, so as to improve resilience against these threats.

In agriculture, vulnerabilities in IT systems can compromise critical data, affecting production and food safety. Protecting agricultural information systems is important both to ensure the continuity of operations and to prevent economic losses, as well as to maintain the trust of farmers and consumers in the digital technologies used in agriculture.

In chapter 2, entitled THE ROLE OF DIGITALIZATION AND THE USE OF INFORMATION SYSTEMS IN INCREASING THE PROFITABILITY OF AGRICULTURAL FARMING, I attempted to identify the impact that the introduction of innovative technologies and practices have on the activities carried out in the agri-food sector. In addition to a detailed inventory of these systems and a presentation of the history of digitization in agriculture that highlighted the fact that they have evolved significantly over the years, from basic records management systems to advanced technologies, transforming this industry and how agricultural activities are effectuated, which contributed to increasing efficiency, profitability and sustainability, I tried to identify what is the dimension of digitization and the use of IT systems on a global, European and national

level. This analysis allowed me to see that although there is a growth in internet access and in the use of digital technologies, both globally and nationally, we still have a long way to go, especially in rural areas and among small farms. Given that the economic impact of digital technologies in agriculture is profound and widespread, it is important to ensure that the benefits of digitization are also accessible to small farms, promoting an equitable distribution of economic prosperity in the agricultural sector, which I have tried to implement, precisely as a measure of awareness, but also to identify the needs of farmers.

To the same extent, I considered that the use of subsidy systems and financial support granted both through community and global policies, and their correct targeting to farmers can constitute important elements that contribute to the acceleration of the introduction of information systems in modern farm technologies, which is why I addressed this aspect in the last subchapter, of chapter 2 of the doctoral thesis.

Chapter 3 of the work was dedicated to describing the purpose, objectives and research methodology. Thus, starting from the fact that through this doctoral thesis I proposed to measure the respondents' perception concerning the importance of the use of agricultural software and digitalization within agricultural holdings, but also to identify the barriers and facilitators in the adoption of agricultural software, I set myself as objectives: Identifying the degree of knowledge of farmers regarding the need to implement agricultural software; Assessing the rate of adoption by farmers of agricultural software and identifying their demographic and operational characteristics; Evaluating the benefits perceived by farmers regarding the use of software; Identifying obstacles and barriers preventing farmers from adopting agricultural software; Determining the specific functionalities that farmers find essential or useful in agricultural software and Making recommendations to software developers, policy makers and other stakeholders on improving the adoption and use of agricultural software.

The research methodology combined quantitative and qualitative methods. In order to measure the scientific production and the concerns in this field, which allowed me to identify both the topics of interest and the research gaps, I chose bibliometric analysis as the method, and to

measure the respondents' perception, I used questionnaires, which were then processed using several statistical methods.

To determine the degree of digitization of the member states of the European Union, I used both the analysis of existing statistical data in national and European databases, such as Eurostat and the national statistical offices, as well as estimation methods.

In order to measure the respondents' perception regarding the use of digitization and IT systems within agricultural holdings, I used the questionnaire, which was applied both with the help of the Google Forms application and face-to-face discussions. The analysis of the collected data first of all assumed the establishment of the research sample. Because at the level of the whole country there are differences regarding the activity profile of agricultural holdings, but also regarding the structure of crops, I proposed to particularize the case study, applying the questionnaire in the South-Muntenia region, including Argeş, Călăraşi, Dâmboviţa, Giurgiu, Ialomiţa, Prahova and Teleorman. A total of 397 respondents responded, but only 376 of the responses were validated, as a result of the fact that not all questionnaires were correctly and completely completed. Research results were centralized, analyzed and presented using Microsoft Excel and IBM SPSS Statistics software. Descriptive statistics were also used to describe and summarize the data sets, which allowed me to identify relevant information about central tendencies, data distribution and variability.

The statistical methods used were the T-Test, which allowed me to test the research hypotheses and verify the validity of the results obtained; One-Way ANOVA (Analysis of Variance) which is an extension of the two-sample T-Test; The Hi-Square test of independence, I used it to test if there is a significant relationship between two categorical fields; The Pearson correlation, I used it to evaluate the strength and direction of the linear relationship between two analyzed quantitative variables; cluster analysis, which allowed me to explore the data and identify its structure.

In chapter 4 entitled ANALYSIS OF THE DIGITALIZATION LEVEL OF AGRICULTURAL FARMING IN THE COUNTRIES OF THE EUROPEAN UNION, I wanted to provide a reference point for evaluating the future

impact of the implemented policies and technologies, starting from the idea that this will allow not only continuous monitoring, but also a rapid adaptation of digitization strategies according to developments in the agricultural sector.

At the same time, I considered that this analysis is important for understanding and contextualizing the research on farmers' perception regarding the digitalization of agriculture, being useful both for determining the current level of adoption of digital technologies and for identifying regional and national differences. Other important aspects are: evaluating the impact of policies and initiatives; identifying trends and technological advances; correlation of data with farmers' perception; informing decision makers and researchers; and so on.

Starting from the statistical data published at the European level, but also by the statistical institutes of the European countries, I performed both an analysis of the number of farms, showing a decrease of their number for the period 2018-2022, which I perceived as a tendency to consolidate small farms into larger and more economically efficient units.

Since at the level of the European Union there is no centralized data on the number of farms that apply digitization in their activities, I used the data on the degree of application of digitization in the agriculture of the member states to estimate the number of agricultural holdings, because I considered that this aspect is essential for obtaining a clear and up-to-date image of the agricultural sector, but also for the foundation of effective policies within this sector of activity, as well as for its sustainable development. The reasons for estimating these data were related to several aspects, such as: the existence of gaps in this activity sector (not all countries have complete and updated data collection systems); the rapid evolution of the agricultural sector (agriculture is a dynamic sector, influenced by economic, political and climatic factors, and data are collected at long intervals - through agricultural censuses - which may not reflect rapid changes); the need for planning and forecasting (to plan and forecast agricultural and economic policies, it is essential to have the most up-to-date and accurate data possible).

The main fields of application of digitization within the agricultural holdings that were analyzed were: the use of precision agriculture, GIS, robots, farm management systems or data analysis.

The analyzed data allowed me to identify a clear trend towards the digitization of agriculture in the EU, finding that farms are increasingly adopting digital systems, using data analysis systems to optimize operations, GIS systems or agricultural robots. The adoption of these technologies will certainly contribute to long-term benefits, including increased production, reduced costs and improved agricultural sustainability.

In Chapter 5 entitled MEASURING THE PERCEPTION OF FARMERS REGARDING THE ROLE OF INFORMATION SYSTEMS IN INCREASING THE PROFITABILITY OF AGRICULTURAL FARMING the research started by conducting a bibliometric analysis with the aim of identifying the scientific concerns in the field of digitization of agriculture, to evaluate the evolution of interest in this theme, to identify the emerging themes and innovative technologies, but also to follow the research gaps, with the purpose of turning my attention to this direction.

The databases consulted were Scopus and Web of Science, the consultation being performed at the beginning of the doctoral internship, and then at the end of it, so that the data are updated. I carried out the last consultation between 1-5.05.2024, starting from the clear definition of the objectives and research questions in order to understand the context and the field of interest. After identifying the most frequent terms used in the field, I performed preliminary searches to evaluate the relevance and volume of the results. Next, I adjusted the key terms based on the results obtained, eliminating the irrelevant ones, thus arriving at several keywords: "digital agriculture", "precision agriculture", "smart agriculture", "agricultural software", " profitability", "agricultural technologies", "perception of farmers". Based on the database consultation, I decided that the most suitable terms for the pursued objective were: "digital agriculture", "software" and "profitability". Thus, after successive searches in the Scopus database, although I started with 11,782 articles, I found that there are only 16 articles that address these very important aspects. Therefore, I found that although the topic of

digital agriculture, agricultural software, intelligent agriculture is a topical one, it is quite little exploited, which is why I decided that the research topic is one that deserves to be reached. Regarding the farmers' perception of the digitization of agriculture, I identified only 5 articles, which confirms that a research on this aspect is not only useful, but also necessary for agriculture in general, and for the Romanian one, in particular. The software used for data processing and interpretation was VOSviewer, a specialized software for building and viewing bibliometric networks.

Next, in order to measure the farmers' perception regarding the importance of digitization and IT systems used in agriculture, I used the questionnaire, which allowed me to determine the profile of the respondents as a result of the analysis of the frequency and the weight of the answers to the characteristic questions, thus giving me a clear picture of the distribution and segmentation of the respondents according to the demographic, socio-economic and occupational characteristics, and which also allowed me to create the profile of the farms or agricultural holdings that they own or exploit.

The application of the questionnaire was carried out in the period 1.01.2023 – 30.09.2023, the number of questions included in the questionnaire was 20, these being structured in 2 sections, namely: establishing the socio-demographic variables of the respondents; respondents' perception regarding the use of software. Research results were centralized, analyzed and presented using Microsoft Excel and IBM SPSS Statistics software.

The research performed within the doctoral thesis allowed me to formulate CONCLUSIONS AND RECOMMENDATIONS. The research showed that demographic variables, such as education level and age, significantly influence the use of agricultural software, with farmers with a higher level of education being more likely to use these tools, as well as younger farmers. On the other hand, gender does not significantly influence the use of software, but urban farmers are more likely to use digital technologies compared to rural farmers. Farmers using agricultural software perceive significant benefits in terms of time savings and efficient use of resources, which are positively associated

with perceptions of better planned activities and reduced operational costs. I also found a strong correlation between the use of agricultural software and the perception of improved overall farm productivity. The analysis of correlations also led me to a series of important conclusions, which should be exploited by software developers, but also by decision-makers when developing strategies and development programs for this sector.

I consider that the novelty element of this doctoral thesis is precisely this hybrid approach that allowed me not only to identify the existing trends and gaps in the specialized literature, but also to corroborate them with the real perceptions and experiences of farmers, giving me a holistic and up-to-date perspective on the impact of digitization in agriculture.

The research was distinguished by its comprehensive methodology that combined theoretical and empirical analysis, allowing me to make a significant contribution both academically and practically, by highlighting how the adoption of digital technologies influences the efficiency and profitability of agricultural holdings in various geographic and economic contexts.