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How Do Agricultural Education, Advisory, and Financial Factors Affect the Adoption of Precision Farming in Greece? †

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Abstract: The purpose of this paper is to conduct an empirical investigation of the theoretical and literature-based constructs related to the adoption of precision agriculture (PA) practices by young farmers. For this research, primary and secondary data are used. The sample includes 220 young farmers. Among the results of this research, farmers are aware of the positive effects of technology systems in agriculture. Also, young farmers seem to be familiar with precision agriculture and have already adopted some of its methods, but the high cost of investment prevents farmers from adopting such technology. Innovative technologies and production methods can help young farmers to be competitive in the worldwide market.

Keywords: young farmers; precision agriculture; agricultural education; agricultural advisory; financial factors

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1. Introduction

Today, the increased use of chemicals and fertilizers and agricultural mechanization have created imbalances in natural resources. Increasing farm income and optimizing yields with a minimum of resources and financial inputs are major challenges for sustainable agriculture. Technology and data-driven decision making play important roles in the management of farms, along with the application of knowledge, skills, and experiences. Utilizing production resources efficiently and adopting advanced technologies are key to maximizing production. Maximizing profits while operating within the constraints of accessible resources is a fundamental priority for businesses. These resources encompass financial and credit assets, material support essential for production, and the requisite skills needed for the workforce to carry out their tasks effectively [1].

Precision agriculture (PA) can address this challenge. Precision agriculture, as a tool enabling farmers to enhance land management efficiency, exerts a significant and diverse influence on farm management practices. Global trends indicate a projected surge in the adoption of precision agriculture over the next four years, resulting in a doubling in the market value from USD 17.41 billion in 2022 to USD 34.1 billion by 2026 [2].

Information technology is used in precision agriculture to improve the accuracy of quantity, quality, timing, and location information when applying and utilizing inputs in agricultural production, thereby reducing seed, fertilizer, water, and pesticide costs; increasing yields; and increasing profitability [3]. Precision agriculture is also used to increase agricultural production in several ways [4]. Tools based on GPS technologies, information technology, farm management and economic knowledge, and sensor and application technologies are available [5].

The European Union, following the latest revision of the Common Agricultural Policy, encourages farmers to produce high-quality agricultural products using environmentally friendly farming practices [6]. To achieve these goals, it is necessary to import technology

into agriculture. A one-way road to increase farming efficiency and minimize environmental impact seems to be the challenge of adopting precision agriculture technologies.

The purpose of this study is to conduct an empirical investigation of the theoretical and literature-based constructs related to the adoption of precision agriculture (PA) practices by young farmers, as young farmers are better equipped to interpret new information and to search for suitable tools to support production [7,8].

2. Methods

The study area was the Central Macedonia region. The sampling frame of the survey included the years 2020–2021. In the first stage, stratified random sampling was applied with a proportional distribution of the sample between the Regional Units of the Region. Each Regional Unit of the Region of Central Macedonia was considered to correspond to a layer. In the second stage of sampling, simple random sampling was applied with systematic selection according to the lists of beneficiaries of the grant programs. The study population was defined as young farmers (under 40 years old) who live in the Region of Central Macedonia. A total of 220 questionnaires were collected, which were filled out through personal interviews. Given the population of 1732 young farmers, this constitutes a satisfactory sample size for a margin of error of $\pm 5\%$ and a confidence level of 1% ($z = 2.58$). For the purposes of research, primary and secondary data were used.

This study focuses on young farmers (under 40 years old) because they constitute a dynamic group of individuals willing to adopt innovation—an integral part of the Greek rural community with a vital role to play in improving the competitiveness of the Greek agriculture sector. The questionnaire included questions related to views and attitudes on innovation related to PA, information and communication technologies (ICTs), agriculture education, information about the environment, and the cost of adopting the PA technology.

3. Results and Discussion

The results analysis shows that young farmers have a remarkable level of information regarding new technologies and innovations in general while presenting positives in the adoption of innovations. The main findings are presented below:

Attitudes towards innovation in agriculture

A proportion of 95.7% of the sample are familiar with innovation in agriculture, which is of particular importance because they are the ones who are expected to adopt innovations. It turns out that young farmers are more innovative.

Attitudes towards PA

A proportion of 56.9% of farmers have some information about PA. However, many of the farmers apply systems that fall within the concept of PA without knowing it. As for the benefits of PA, farmers seem to recognize most of them.

Attitudes towards ICTs

According to the results, most young farmers in the sample (94.5%) know what ICTs are.

Attitudes towards agricultural education

A proportion of 60.4% of young farmers believe that education has an important role. During recent years, respondents attended training programs. The rest of the young farmers attended compulsory training before 2017 when they joined the program. In addition to this mandatory program, "Young Farmers" was attended by 9 out of 10 participants. A proportion of 89.7% of young farmers attended some training in the last five years. A proportion of 25.2% joined seminars for computer learning, while a small percentage were trained in youth entrepreneurship. The majority of young farmers (77.2%) state that knowledge serves daily needs.

Attitudes towards information/advisory

A proportion of 75.6% of the farmers believe in the importance of information/advisory services. The most important sources of information for young farmers in the sample are the specialized information; they trust mainly agronomists of the local Directorate of Rural De-

velopment (31.7%) and less private agronomist-researchers (21.3%) and agronomist-trades of agricultural supplies (15.9%).

Attitudes towards the environment

Almost all farmers (93.3%) say that they are concerned about the environment. Most farmers are recognizing the negative effects of conventional agriculture practiced today.

Attitudes towards the cost of adopting the PA technology

A proportion of 82.3% of the farmers believe that financial factors prevent young farmers from adopting PA. The high investment cost and the high maintenance costs are barriers regarding PA.

4. Conclusions

A significant challenge in sustainable agriculture involves achieving maximum crop yields and boosting farm income while minimizing the use of resources and financial investments, as well as ensuring the protection of the environment. Precision Farming (PF) technologies can play a crucial role in tackling this challenge. The implementation of Precision Farming (PF) has become feasible due to advancements in various technologies, including geographic information systems, global navigation satellite systems (GNSSs), remote sensing (RS), satellite imagery, ground sensors, and components of mobile computing and telecommunication [8]. Despite the benefits of PF, these technologies are currently not widely adopted by farmers and, especially, by the elderly. Younger farmers are generally more receptive to innovative ideas and are more inclined to incorporate new technologies into their farming practices [9].

Having realized the everyday changes in the methods of production, processing, and marketing of agricultural products, government agencies should draw up strategic directions for the development of the agricultural sector in a timely manner. Also, they need to develop agricultural research on a modern basis, with emphasis on the fields of ICTs, marketing and management, and other scientific fields. At the same time, they should develop the technological infrastructure and prepare the farmers, train them in modern information and communication technologies, and investigate production methods such as precision agriculture. Thus, the following is highly recommended: (a) the creation and provision of specific incentives for the acceptance and use of information and communication technologies; (b) the development of appropriate infrastructure to support the use of ICTs in agriculture, with appropriate networking equipment and know-how; (c) the configuration of the integrated educational program; (d) the improvement and development of advisory services; (e) and the subsidy of the new technologies regarding PA.

This study is not without limits. In this paper, Precision Agriculture (PA) is treated as a unified concept, yet there exists a considerable body of information indicating that adoption rates differ significantly for various types of Precision Farming (PF) technologies. Nevertheless, it is important to note that the current study should be seen as an initial assessment of PF adoption within Greek farms. In this context, it serves as a foundational point for future research endeavors, which can delve into more specific Precision Agriculture Technologies (PATs) and their adoption patterns.

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