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The Key Role of Cooperatives in Sustainable Agriculture and Agrifood Security: Evidence from Greece

Stavros Kalogiannidis [1,*], Simeon Karafolas [2] and Fotios Chatzitheodoridis [3]

[1] Department of Business Administration, University of Western Macedonia, 51100 Grevena, Greece
[2] Department of Accounting and Finance, University of Western Macedonia, 50100 Koila Kozanis, Greece; skarafolas@uowm.gr
[3] Department of Management Science and Technology, University of Western Macedonia, 50100 Kozani, Greece; fxtheodoridis@uowm.gr
* Correspondence: skalogiannidis@uowm.gr

Abstract: This research investigated the role of agricultural cooperatives (ACs) in promoting sustainable agriculture and agrifood security, with a particular emphasis on Greece. A cross-sectional survey technique was employed, and data were collected from 400 farmers and professionals either employed by or associated with Greek agricultural cooperatives by administering an online questionnaire. A response rate of 96.5% was achieved. The study findings show that cooperative techniques bring about a positive shift in agrifood security and sustainable agriculture. Particularly, participants concurred that resource sharing among cooperative members increases farm productiveness and sustainability by 94.2% while improving access to credit and financial support by 91.5%. Moreover, 84.3% agreed that access to up-to-date information enhances the practice of sustainable agriculture, and 95.1% agreed that collective bargaining through cooperatives increases the prices of agricultural commodities. Regarding the application of advanced technologies in cooperative practices, 96.7% of the participants acknowledged that it improved farm efficiency. The cooperative model demonstrates how agricultural expansion may be achieved by collective bargaining, information sharing, resource sharing, and technological integration, while also considerably improving agrifood security and sustainability. These findings highlight the crucial importance of cooperatives in increasing the level of agricultural production, ensuring sustainability, and improving agrifood security in Greece.

Keywords: agriculture cooperatives; sustainable agriculture; resource sharing; information sharing; agrifood security

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1. Introduction

Agricultural cooperatives (ACs) are crucial in helping vulnerable populations, including women and youth as well as small-scale farmers [1–3]. Through business models that are robust to shocks from the environment and the economy, they enable their members on an economic and social level and provide long-term rural employment [4–6]. Membership-based rural producer groups, including unions, cooperatives, and peasant associations, may assist with reducing rural poverty. Greece's government has acknowledged this fact and has made it a top priority to support cooperatives in rural and agricultural development as a means of fostering growth that benefits farmers [7–9]. Agricultural cooperatives have been the cornerstones of agricultural development and agrifood security, contributing significantly to the reduction in poverty, enhancement of food security, and creation of job opportunities [10,11]. Different kinds of cooperatives are formed and involved in various activities as a result of the government's initiatives; these include, but are not limited to, multipurpose primary agricultural co-ops, housing cooperatives, cooperatives for saving and credit, cooperatives for the arts, and cooperatives for livestock marketing and dairy, minerals, fisheries, sugar cane, and vegetable production [12,13].

Agricultural cooperatives are widely distributed across Europe and are ingrained in the agricultural landscape in nations like France, Italy, and Spain [13–15]. These cooperatives have expanded to cover a variety of tasks, including distribution, processing, and marketing, in addition to manufacturing. Through initiatives like the Common Agricultural Policy (CAP), the European Union acknowledges the value of cooperatives in accomplishing goals related to agricultural and rural development [16]. Greece's agricultural legacy has always been based on the use of agricultural cooperatives. High-quality products, fair trading, and sustainable agricultural methods have always been Greek cooperatives' major goals. Greek agricultural cooperatives have existed for many years but now face such contemporary problems as restricted credit facilities, competition from large-scale farmers, and compliance with regulatory requirements and the choice of new technologies to remain relevant [4,17]. To understand how Greek agricultural cooperatives will be able to overcome obstacles and carry on promoting sustainable agriculture and agrifood security, a broader European and global perspective is necessary [16]. In light of the current situation of agriculture, research on the role that cooperatives play in sustainable agriculture and food security is very pertinent [18–20]. This research attempts to provide a thorough picture of the potential and difficulties encountered by Greek cooperatives by examining the historical, global, European, and Greek viewpoints. This research employed a cross-sectional survey method based on an online self-completion questionnaire concerning Greek agricultural cooperatives. As such, the difference in methodology offers a quantitative evaluation of the extent of the contribution of cooperatives in Greece, which enriches the understanding of prior studies.

This study focused on examining the role of cooperatives in promoting sustainable agriculture and agrifood security, using Greece as a case study. The study was also guided by the following specific objectives:

1. To examine the effect of resource sharing in cooperatives on sustainable agriculture and agrifood security;
2. To establish the effect of agriculture information exchange in cooperatives on the sustainability of agriculture and agrifood security;
3. To examine the aspect of collective bargaining and market access in cooperatives and its influence on the sustainability of agriculture and agrifood security.

This study adds to a better understanding of how agricultural cooperatives could support sustainable farming practices, and it offers a comprehensive analysis of the many ways that cooperatives may impact agrifood security and sustainability, with a focus on information sharing, collective bargaining, resource sharing, and the integration of modern technologies. This study's findings have important implications for those in charge of making decisions, particularly regarding policies concerning the development of rural and agricultural areas.

2. Literature Review

2.1. Theoretical Review

The current study is informed by the New Institutional Economics (NIE) framework, specifically transaction cost economics (TCE) and collective action theory as they pertain to ACs. Transaction costs were first introduced by Coase [21] in his seminal paper on the nature of the firm, where he argued that there are always new ways of organizing transactions. He believes that transaction costs represent the core of all market imperfections. It seems that market failures are often due to the inefficient use of resources, which may be solved or at least reduced by applying cooperatives or other institutions for resource allocation [21]. This argument has laid the groundwork for the formation of the cooperative as an essential mechanism to address the problem of market failure [22]. As the theory's ground rules, it is assumed that transactions involve elements of risk in their outcomes, and that agents are self-serving with limited rationality [23,24]. Institutions are cost-minimizing structures, which may be modified and dynamic due to the sources and types of transaction costs (measurable and hidden) linked to the transfer of assets or the exchange of goods and

services (from Williamson [23]). Firms can correct market inefficiencies and shortcomings through integration, which makes for efficient resource use in the long run. Companies integrate (cooperate) transactions to minimize the use of market intervention, minimize transaction costs, and correct market inefficiencies. Cooperatives are thus justified by economic theories based on their capacity and possibilities to either correct for or mitigate market failure. Similarly, people act collectively to solve social problems when they shift their focus from their self-interests to group interests, as the collective action theory by Olson [25] posits. In the context of cooperation, rewards and penalties which are incurred by each member of the group are assumed to affect the behavior of that member. Whereas the formation of a cooperative often demands common goals and transacting costs, this theory postulates that these components are not sufficient to accurately determine the effectiveness of collective action since individuals make self-interested cost–benefit calculations when participating in a group [26]. Therefore, based on the theory, the level of the success of an organization (such as a cooperative) depends on its ability to meet the concerns of the members and contain the issue of freeridership, which often arises when the number of members increases [27–30].

2.2. Resource Sharing in Cooperatives

Human interactions are frequently utilized for the dissemination of information concerning novel agricultural practices and technologies; in this context, the qualities of the informants and the structures of the networks are both critical [18]. This is of specific importance for small-scale and minority-owned rural farms, as they require access to innovative production and technological resources on the input side, in addition to market outlets, to remain competitive in comparison to larger farms. Informal networks (e.g., peer relationships) and interpersonal connections comprise the informal social networks (e.g., cooperative extension programs established by governments or institutions) to which farmers have access [3,31].

Social network theory is concerned with the interplay among nodes, which comprises organizations, businesses, and individuals [12]. Links are used to represent these exchanges [32]. On the basis of "social learning", analyses of social capital development and cultural evolution are included in the literature on information diffusion and innovation [32,33]. Diffusion of innovation often occurs as an unintended consequence of technology adoption; environments with robust social networks can enhance the efficacy of this process [17]. Moreover, cultural evolution occurs through social network-based interactions, in which community members adopt and replicate ideas or suggestions proposed by individuals considered to be authorities [4,34]. The trust that social capital embodies may be the most advantageous when utilized to address local concerns regarding the provision of public goods. Trust-based relationships are of the utmost importance for collaborative endeavors involving diverse groups, including farmer organizations representing minority and disadvantaged communities. The enhancement of their capacities with regard to regional agrifood systems and novel entrepreneurial prospects can be facilitated through collaborations between communities and farmers, as well as through interactions between institutions and individuals. It can also mitigate challenges such as food insecurity in the context of urban agriculture [35,36].

Thornton et al. [36] noted that, at this time, social network analysis (SNA) is widely utilized in numerous fields to comprehend the interrelationships between individuals and organizations, including those that are integrated into the supply chain. The nodes or foci, as well as the edges or links that delineate their connections, are descriptors for these interrelationships [34,37–39]. Although there exists a multitude of network metrics that can be calculated, the density and inter-node or intra-network distance are among the most commonly used. By employing these metrics, it is possible to assess networks against both the progression of time and against one another. SNA is utilized in the following domains: regional food system analysis; biodiversity; and forestry [6,40].

Diverse perspectives on knowledge and resource sharing among cooperative producers can be found in the existing literature. A subject that is frequently discussed concerns social processes and relationships that influence whether the exchange of knowledge among farmers is facilitated or hindered. Further building on this notion, the determinants that motivate farmers to impart agroforestry expertise obtained from extension services to their peers were examined in a study conducted by Pimbert [41]. Furthermore, the study provides evidence that informal social networks fail to facilitate the dissemination and interchange of information among agricultural practitioners. On the contrary, in terms of facilitating the exchange of seeds among producers, they exhibit superiority and greater efficiency [26].

Knowledge exchange is influenced by cooperative and competitive behaviors via the mechanisms identified by Candemir et al. [5]. Sabio et al. [42] found that cooperation between businesses positively impacts the knowledge transfer between suppliers and consumers. Furthermore, the researchers observed that as the degree of cooperation between organizations grew, so did the knowledge transfer between the two parties. Hence, an organization that cultivates a collaborative environment is presumed to attain a higher level of cooperation, thereby facilitating the dissemination of knowledge [43–46]. On the basis of the theoretical support and the supposition that knowledge sharing is influenced by cooperative behavior, it is hypothesized that knowledge sharing is positively influenced by cooperative behavior.

2.3. Agricultural Information Exchange in Cooperatives

Information is considered an essential commodity and a critical resource for development. It is an indispensable requirement that bestows success in endeavors of daily living, including agricultural pursuits. According to Kazungu and Kumburu [47], information is what every individual requires to make decisions. The exchange of information among stakeholders in the farming industry increases output and fosters agricultural progress. Identifying the information requirements is the initial step in gratifying these needs, according to Candemir et al. [5], and information-seeking processes consist of several stages preceding the identification of information sources and the acquisition of the required information. In addition, Oba and Ozsoy [12] state that information accessibility is critical to every facet of agricultural development. Consequently, they require pertinent information to effectively carry out these activities [14,38,48]. Numerous variables influence the choice of information source, such as educational attainment, income level, farm size, age, and geographic location. According to Kumar and Wankhede [38], rice farmers obtained their information from various sources, including personal experience, workshops and seminars, training, acquaintances and neighbors, the Ministry of Agriculture, agricultural magazines, extension officers, local government officials, non-governmental organizations, libraries specializing in agriculture, and posters [33,34]. In addition, the research conducted by Bognar and Gerald Schwarz [49] revealed that extension agents, friends, radio, and libraries were the primary information sources utilized by farmers to obtain agricultural data. In a similar vein, Mili and Arovuori [32] found that Turkish farmers relied heavily on information obtained from family members, neighboring farmers, extension services, input providers, and mass media. Hence, considering the individual preferences of farmers regarding specific information channels or sources, it is critical to conduct extensive research prior to selecting one that fulfils their information requirements [26].

A number of obstacles that hinder producers' access to agricultural information have been identified. For example, Pudak [50] identified several obstacles that hinder farmers' access to agricultural information. These barriers included obsolete information, a language barrier, a lack of awareness regarding the availability of various information sources, insufficient funds to purchase information, and a substandard format of the information carrier. Additionally, the research conducted by Gebremichael [6] identified several challenges that farmers face when attempting to obtain agricultural information. These encompass financial challenges, personnel or facility deficiencies, and information that is

either insufficient or irrelevant. Furthermore, Aramendi et al. [33] identified two obstacles that farmers in Uganda face when attempting to obtain agricultural information: language barriers and a dearth of cooperation from other farmers regarding the sharing of agricultural information. According to Pimbert [41], several factors impede the dissemination of agricultural information to farmers. These factors comprise the scarcity of radios and televisions, the low literacy rate among farmers, and the insufficient number of personnel who have received training in agricultural information. A study was undertaken by Luo et al. [51] to examine the information requirements and search behaviors of farmers. The results obtained from this research indicated that the primary obstacles encountered by farmers in their pursuit of information were inadequate accessibility, unreliable information, a lack of cognizance regarding the sources of information available to them, and the delayed provision of information [51,52].

2.4. Collective Bargaining and Market Access in Agricultural Cooperatives

Collective bargaining possesses the capacity to augment economic influence within the agricultural industry [42]. An example of a negotiation that could occur is with a purchaser of agricultural products. A consensus may be reached between farmers and a particular company regarding the sale of maize to that company at a price set by the farmers. Farmers could also reach a consensus to not sell any produce to a company that is making investments in technologies that will benefit foreign competitors. Long-term success may result in increased prices. With influential input suppliers, collective bargaining could be utilized not necessarily to reduce the quantity of an expensive input but to negotiate a lower price. Engaging in negotiations with seed companies regarding "technology fees" offers an evident prospect. Additionally, farmers might negotiate with suppliers to alter their conduct. One potential consequence of a strong farmer group boycotting a company whose products are priced lower in another country than in the United States is that company's seed prices remain inadequate [51].

Inquiries pertaining to working conditions and benefits present supplementary prospects. A consensus could be reached by the members of a bargaining unit stipulating that no farmer would cultivate an excess of a particular number of acres [45,53]. An alternative approach would be for proprietors to contribute to the cost of health insurance for farmers and their families through collective bargaining. Farmers could negotiate collectively with suppliers to produce safer chemicals or with equipment manufacturers to produce safer machinery [41]. A powerful agricultural organization might be able to negotiate with the government for legislation that more closely matches their objectives. A bargaining unit might advocate for advantageous trade agreements as opposed to governmental payments. Ensuring the enforcement of robust legislation pertaining to corporate agribusiness would also be a legislative priority [18].

A review of the relevant literature has uncovered a number of obstacles and limitations that hinder the implementation of sustainable supply chain management, especially for SMEs. The inability of small farmers to attain economies of scale due to their high costs and the unequal bargaining power in the food chain have heightened obstacles to market entry and resulted in diminishing profit shares. As a result, small-scale producers face financial constraints that prevent them from allocating resources towards the enhancement of their operations, such as the production of competitive goods [54]. The critical role is that of "asymmetric information" control and flow, which prevents SMEs and large enterprises from having equal opportunities [18]. This inevitably results in high production costs, weak bargaining power, and so forth, ensnaring agrofood SMEs in a "vicious" cycle (Figure 1).

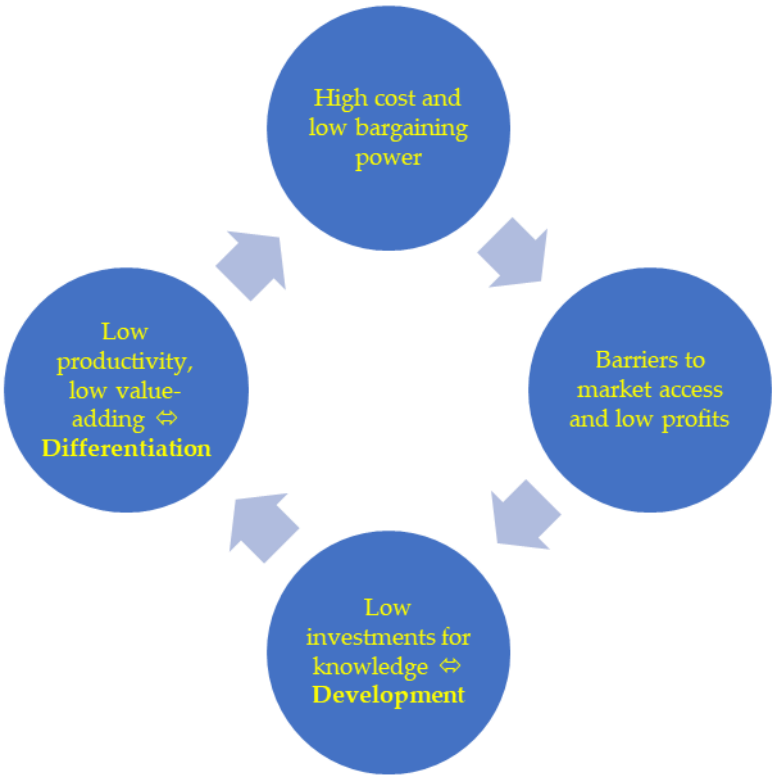

Figure 1. The "vicious" cycle of small farmers in agricultural cooperatives.

According to Pimbert [41], organization in cooperatives functions as a viable substitute for corporate mergers involving smaller farmers and larger farming conglomerates, which would not be prohibited under the majority of merger regimes. Pimbert [41] also distinguishes agricultural product supply by highlighting the inelasticity of demand, the unpredictability and unmanageability of supply, and seasonal variation. Nevertheless, farm consolidation has made only limited strides; substantial numbers of small family farms continue to operate, and numerous large farms that have consolidated a substantial amount of land remain family-owned [55,56]. Family farming has flourished in advanced economies despite the progressive expansion of agri-industrialization over the past century and government policies encouraging agribusiness enterprise [57–59].

2.5. Technological Integration into Cooperative Practices

Evaluating agricultural system technologies in terms of sustainability is a relatively new field of study [8,60]. Prior to recent times, the evaluation of agricultural technology impacts was based on a limited number of criteria that were generally unambiguous and quantifiable, including production, productivity, farm incomes, employment, and trade. It is more difficult to evaluate sustainability when environmental, social, and ethical factors are considered [18]. The interrelationships among different components of sustainability, the criteria for measuring and interpreting results, and the procedures for determining the efficacy of sustainable technologies, the most effective channels for their dissemination and adoption under varying conditions, and the associated costs and benefits, are frequently not crystal clear [2,18,61].

Technologies can facilitate the harmonization of profitable and sustainable food production requirements [42]. The primary objectives are to determine which technologies are the most effective under particular conditions and to establish and implement an appropriate incentive structure that promotes the attainment of sustainability goals while simultaneously improving worldwide welfare. This endeavor aligns with the policy principles that have been unanimously agreed upon by OECD ministers [26]. On occasion, environmental and food production objectives can be harmonized by implementing the

proper technologies. Occasionally, achieving these objectives can be accomplished by merely modifying the scale, variety, and placement of agricultural output [10,62]. However, in order to achieve this balance, it is also necessary to establish and enforce the rights and obligations of farmers with regard to the implementation of technologies and practices. This requires consideration of the current property rights distribution and the circumstances under which they are entitled to compensation or are obligated to pay (polluter pays). Significant implications follow from the attribution of property rights with regard to the distribution of wealth, income, and equity [42].

Meemken and Qaim [63] noted that technological advancements have served as the foundation for agricultural development and productivity growth. Research influences the productivity of agricultural systems through the development of novel technologies that, if suitable for the conditions of the producers, will be swiftly embraced [64]. In the past, the onus has been on researchers and extension agents to identify and incorporate environmental and economic factors into the agricultural innovation development and introduction process. Generally, this is described as a top-down procedure, in which extension workers advocate for the use of the innovation that researchers develop, and farmers adopt or reject it according to the characteristics that are most significant to them [8].

Maican and Stępień [65] noted that production increases among those who adopt enhanced technologies, resulting in continuous socioeconomic progress. Higher earnings and reduced poverty have been linked to the adoption of improved agricultural technologies, improved nutritional status and decreased prices of staple foods, increased employment opportunities and earnings for landless laborers, and lower prices of staple foods [64]. The success of the Green Revolution in Asian countries is widely attributed to the adoption of advanced technologies. Conversely, those who have not adopted the status quo struggle to sustain a subsistence level of living due to socioeconomic stagnation, which ultimately results in deprivation. A new agricultural technology that improves the sustainability of food and fiber production is thus essential for economic growth and sustainable agrifood security [4,33,66]. Over time, an individual's evaluation of a technology may transition from being solely subjective to objective, as access to information diminishes the uncertainty surrounding its performance. Nevertheless, the availability of information regarding a technology does not guarantee that every cultivator will employ it [37,67]. Technology non-adoption may also ensue from information accessibility concerns. For example, in situations where the general public has limited knowledge about a particular technology, additional information tends to generate unfavorable attitudes towards its adoption. This is likely due to the fact that more information reveals an even greater information gap, which, in turn, raises the associated risk. Consequently, it is critical to guarantee that the information is accurate, consistent, and reliable. Farmers must be informed about the existence, benefits, and applications of technology in order to embrace it.

2.6. Research Hypotheses

Hypothesis 1 (H1). *Resource sharing in cooperatives positively affects sustainable agricultural practices and enhances agrifood security.*

Hypothesis 2 (H2). *Effective information exchange within cooperatives leads to improved sustainability in agriculture and better agrifood security.*

Hypothesis 3 (H3). *Collective bargaining and enhanced market access through cooperatives significantly contribute to the sustainability of agriculture and agrifood security.*

Hypothesis 4 (H4). *The integration of modern technologies in cooperative practices positively influences sustainable agricultural development and agrifood security.*

3. Materials and Methods

3.1. Research Design

In this study, the researcher adopted a cross-sectional survey design to assess the involvement of cooperatives in enhancing sustainable agriculture and agrifood security. An online questionnaire was developed, and email was used for distributing the study; it contained both multiple-choice questions and Likert-scale questions. The researchers employed this approach to integrate the various trends as identified in the data coherently. The survey was conducted among a random pool of experts in the agriculture sector in Greece.

3.2. Sample

The approximate number of 200,000 members and professionals in Greek agricultural cooperatives that formed the target population was estimated based on the records in national and regional cooperative associations in Greece. These sources availed rich data on the overall human traffic in the agricultural cooperatives nationwide. Considering this population, the sample comprising 400 respondents was selected, focusing on the farmers and employees of a cooperative. The sample size for the study was determined using the Yamane (1973) formula [68,69] to make sure that it was adequate to represent all the students in the study, as presented in Equation (1):

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

where n is the sample size sought; N is the population; e is the level of significance; 1 is a constant.

Using a 5% (0.05) level of significance,

$$\text{Sample size}: \; n = \frac{200,000}{1 + 200,000\ (0.0025)^2} \Leftrightarrow n = 399.57 \cong 400$$

Simple random sampling was utilized to obtain the appropriate sample of this study.

3.3. Data Collection

The researcher used an online questionnaire to collect data from the selected sample. Using a five-point Likert scale, the questions were created with the study's aims in mind. In the previous agreement, the survey questionnaire was sent to the Greek farmer-members or professionals in agricultural cooperatives. The distribution was within the researchers' purview. Respondents received survey questions by email at the same time. After the survey was sent out, participants had one week (by email) to complete it. After the participation deadline, the researcher combined a raw data file from participants for data analysis. The numerous variables of this research were measured using a Likert scale consisting of agree and disagree ratings. Although a 100% response rate was not realized, an acceptable response rate of about 96.5% was realized, which gave a sound basis for analysis.

3.4. Data Analysis

The data collected using a questionnaire were coded and transferred to SPSS version 22 for analysis. SPSS (Statistical Package for the Social Sciences) is a comprehensive statistical software package used for data management, advanced analytics, and multivariate analysis, among others [70]. In this study, the data collected were analyzed and presented using descriptive statistics that provided frequencies and percentages through the use of SPSS. The data were interpreted and presented using descriptive statistics that yielded frequencies and percentages. The ANOVA (Analysis of Variance) method was used along with the R^2 (coefficient of determination) statistic and the regression coefficients (beta values) to determine the statistical significance of the regression coefficients in the model. Regression analysis was used to ascertain the general predictive power of the various independent

variables on the dependent variable under investigation. In this case, a multiple regression model was essential for determining the different predictive values (Equation (2)) [71,72]:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \quad (2)$$

where Y is the sustainable agriculture and agrifood security; β_0 is a constant (coefficient of intercept); X_1 is the resource sharing in cooperatives; X_2 is the agriculture information exchange in cooperatives; X_3 is the collective bargaining and market access in cooperatives; X_4 is the integration of modern technologies into cooperative practices; ε is the error term in the multiple regression model; $\beta_1 \ldots \beta_4$ represent the four independent variables' regression coefficients.

The null hypothesis (H0) for each predictor states that there is no significant relationship between the predictor and sustainable agriculture and agrifood security. The null hypothesis was either rejected or failed to be rejected based on the decision rule, which stipulates that if $p < 0.05$, then H0 should be rejected; otherwise, H0 is not rejected. The study's hypotheses were tested at the 5% level of significance (0.05).

4. Results

This section interprets the various conclusions acquired after analyzing data gathered from the chosen research participants.

4.1. Demographic Characteristics

The majority of research participants (70.7%) were male, and the remaining portion (29.3%) were female. Most participants (59.7%) were between the ages of 31 and 40, with just 5.5% beyond the age of 50, and only 4.3 below 30 years. A slightly larger portion of participants (49.2%) had spent 5–10 years in the agriculture sector, and only 7% had less than 5 years of experience in agriculture.

4.2. Descriptive Results

The study established the effect of resource sharing in cooperatives on sustainable agriculture and agrifood security, and the results are presented in Table 1.

Table 1. Opinions on the effect of resource sharing in cooperatives on sustainable agriculture and agrifood security.

Statement	Agree	Disagree
Resource sharing among cooperative members enhances farm productivity and sustainability	94.2%	5.8%
Cooperative members are willing to share resources (e.g., equipment, seeds) with each other	71.4%	28.6%
Resource sharing within cooperatives leads to a reduction in production costs	56.4%	43.6%
Cooperative resource sharing contributes to better access to credit and financial support	91.5%	8.5%
Resource sharing in cooperatives positively impacts agrifood security in the region	56.2%	43.8%
Sustainable farming practices are more achievable through cooperative resource sharing	79.9%	20.1%

Source: authors' elaboration.

According to the findings in Table 1, the majority of survey participants (94.2%) agreed that resource sharing among cooperative members enhances farm productivity and sustainability. Among cooperative members, a significant portion (71.4%) were amenable to sharing resources, such as seeds and equipment. This need to participate is essential to cooperative success because it fosters a sense of community and shared accountability. It is crucial to remember, nevertheless, that around 28.6% of respondents disagreed with this statement, suggesting that there can be challenges or barriers to resource sharing in certain cooperatives. The majority of participants (56.4%) agreed that production costs are reduced when resources are pooled among cooperatives. Based on this finding, cooperative resource sharing might have a favorable economic impact by optimizing resource usage. Those 43.6% of respondents who disagreed may provide examples where resource sharing does not

always result in cost reductions, perhaps due to inefficiencies or mismatches in resources. More than half (91.5%) believed that cooperative resource sharing has led to greater access to credit and financial aid. A total of 56.2% of respondents thought that resource sharing in cooperatives increases local agrifood security, while 43.8% of respondents disagreed. This discrepancy suggests that a variety of factors, including the particular conditions and traditions of each cooperative, can influence the relationship between agrifood security and cooperative resource sharing. Notably, a significant proportion of participants (79.9%) believed that collaborative resource sharing increases the accessibility of sustainable farming practices. This aligns with the broader notion that cooperatively exchanging resources and information facilitates the implementation of sustainable practices.

This study established the effect of agriculture information exchange in cooperatives on the sustainability of agriculture and agrifood security, and the results are presented in Table 2.

Table 2. Results on agriculture information exchange in cooperatives.

Statement	Agree	Disagree
Information exchange within cooperatives is an essential source of knowledge for sustainable farming	100%	0.0%
Cooperative members actively engage in sharing agricultural information and experiences	51.2%	48.8%
Access to up-to-date agricultural information improves the adoption of sustainable practices	84.3%	15.7%
Cooperative information exchange contributes to better pest and disease management.	70.3%	29.7%
The exchange of market-related information helps cooperative members make informed decisions	64.3%	35.7%
Information exchange leads to increased awareness of agrifood security issues among cooperative members	63.5%	36.5%
Cooperative information sharing enhances the resilience of agriculture in the region	79.3%	20.7%

Source: authors' elaboration.

As highlighted in Table 2, information exchange within cooperatives is considered an important source of knowledge in sustainable farming, since all the respondents agreed (100%) with the statement. On the aspect of cooperative members participating in the sharing of agricultural information and experience, 51.2% of them supported the statement while 48.8% of them opposed it. This means that although the exchange of information is acknowledged, its spate seems to vary within the cooperatives, maybe due to the level of communication technology or cultural differences within them. Most of the respondents (84.3%) strongly believed that up-to-date information increases the rate of the practice of sustainable farming skills and thus the need for the constant updating of information. But perhaps the 15.7% who disagreed operate in cooperatives where information is either stale or not sufficiently relevant to the members, suggesting that there is a lack in this area that has to be filled to ensure that all members gain equally. Information exchange also has its significance, where 70.3% of the respondents were of the view that cooperation leads to better pest and disease management. However, the 29.7% that disagreed may imply that, in some cooperatives, the information that is being provided is not well implemented because the quality of the information or the way it is disseminated is wanting. Also, 64.3% of respondents strongly agreed and 35.7% disagreed with the assertion that the "sharing of market-related information enables members to make informed decisions". This implies that there could be issues with regard to the access to and/or the effective use of market information. Finally, this study finds that most of the participants (79.3%) support the view that cooperative information sharing increases the stability of agriculture across their region, in support of cooperatives' overall role in agricultural sustainability in the region. But these discrepancies indicate that while information exchange is important, it is not uniformly beneficial and needs fine-tuning to enhance the cooperatives' experience.

This study assessed the aspect of collective bargaining and market access in cooperatives and its influence on the sustainability of agriculture and agrifood security, and the results are presented in Table 3.

Table 3. Opinions on collective bargaining and market access in cooperatives and their influence on the sustainability of agriculture and agrifood security.

Statement	Agree	Disagree
Cooperative collective bargaining raises agricultural commodity prices	95.1%	4.9%
Cooperative members' access to a variety of marketplaces had increased as a result of their combined efforts	71.5%	28.5%
Collective bargaining helps in negotiating favorable terms with suppliers and buyers	59.7%	40.3%
Increased market access through cooperatives positively impacts farm income	69.7%	30.3%
Market access through cooperatives contributes to agrifood security by ensuring a steady demand for produce	91.7%	8.3%
Cooperative bargaining and market access are essential for the sustainability of agriculture	35.6%	64.4%

Source: authors' elaboration.

The results in Table 3 show that the vast majority of the research participants (95.1%) agreed that cooperative collective bargaining raises agricultural commodity prices. This broad agreement implies that members understand the important role that cooperatives play in securing fair pricing for their farm products. This is encouraging for the cooperatives' capacity to use price negotiations to improve the financial security of its members. Second, 71.5% of participants agreed that cooperative members' access to a variety of marketplaces had increased as a result of their combined efforts. Collective bargaining is helpful in negotiating advantageous terms with suppliers and purchasers, according to 59.7% of participants. Even while this percentage is less than those for the first two claims, it still shows a significant degree of agreement. It implies that members think cooperatives help to enhance the conditions under which agricultural goods are sold and inputs are purchased, which helps to increase farmers' total profitability. Furthermore, 69.7% of participants agreed that cooperatives' expanded market access had a favorable effect on agricultural revenue. The fact that 91.7% of participants thought that market access via cooperatives ensures a consistent demand for products, which helps with agrifood security, is one of the most noteworthy results. Furthermore, 64.4% of participants disagreed with the notion that cooperative bargaining and market access are necessary for agriculture to be sustainable, whereas just 35.6% of participants agreed.

The study examined the effect of integrating modern technologies into cooperative practices, and the results are presented in Table 4.

Table 4. Opinions on integrating modern technologies into cooperative practices and its influence on sustainable agricultural development and agrifood security.

Statement	Agree	Disagree
The integration of modern technologies in cooperative practices enhances farm efficiency	96.7%	3.3%
Cooperatives that invest in technology experience improved crop yields.	74.5%	25.5%
Modern technologies reduce the environmental impact of farming within cooperatives	40.5%	59.5%
Technology adoption leads to cost savings for cooperative members.	51.7%	48.3%
Technology-integrated cooperatives have better access to online markets.	83.5%	16.5%
The use of technology in cooperatives is essential for ensuring agrifood security.	35.6%	64.4%

Source: authors' elaboration.

Table 4 shows that the majority of research participants (96.7%) agreed that incorporating contemporary technology into cooperative operations improves agricultural efficiency. The high degree of agreement indicates that members are aware of how technology might improve agricultural practices inside cooperatives. Significantly, 74.5% of respondents said that investing in technology increases agricultural production for cooperatives. This suggests that a sizable proportion of participants thought that increased agricultural output may result from the use of technology. A significant 59.5% of respondents disagreed with the 40.5% who felt that farming in cooperatives had less of an environmental effect due to contemporary technology. This disagreement emphasizes the need for further research on the particular environmental advantages and difficulties of technology adoption in cooperatives. A total of 51.7% of respondents, or somewhat more, believed that using

technology in cooperatives saves members money. Remarkably, 83.5% of participants agreed that cooperatives with technological integration have superior access to online marketplaces. This high degree of agreement is indicative of the perception that technology makes it easier to access markets, which may be essential for cooperatives looking to expand their consumer bases. Merely 35.6% of participants concurred that using technology in cooperatives is crucial to guaranteeing agrifood security. This finding suggests that a sizeable percentage of participants may be skeptical regarding the clear connection between technology and agrifood security, which may point to the need for more research and awareness in this area.

This study also identified the different outcomes resulting from sustainable agriculture and agrifood security.

Figure 2 shows that a majority of respondents (48.4%) said that higher food production is the most important result of sustainable agriculture and agrifood security. This implies that a considerable rise in food production has resulted from the policies and procedures implemented in Greece, perhaps including enhanced farming methods, better resource management, and cooperative farming arrangements. A total of 24.2% of respondents then mentioned increased food availability and affordability as a major result of agrifood security and sustainable agriculture. This suggests that cooperative initiatives in conjunction with sustainable agriculture methods have increased food accessibility for the general public, perhaps via lower costs or improved routes of distribution. Moreover, according to 14.7% of participants, climate change resistance has been significantly improved by sustainable agriculture. In light of global climate change, this includes the capacity to tolerate and adjust to climatic changes and environmental problems. Additionally, 6.7% of respondents pointed to a decrease in the use of chemicals in agriculture. The enhancement of crop diversity, as noted by 4.3% of respondents, is another positive outcome. Diverse crops contribute to a more resilient and sustainable agricultural system, reducing the dependency on single-crop varieties and enhancing biodiversity. A small percentage (1.7%) noted other benefits, such as reduced food waste, the preservation of crop varieties, and the provision of safe and healthy food.

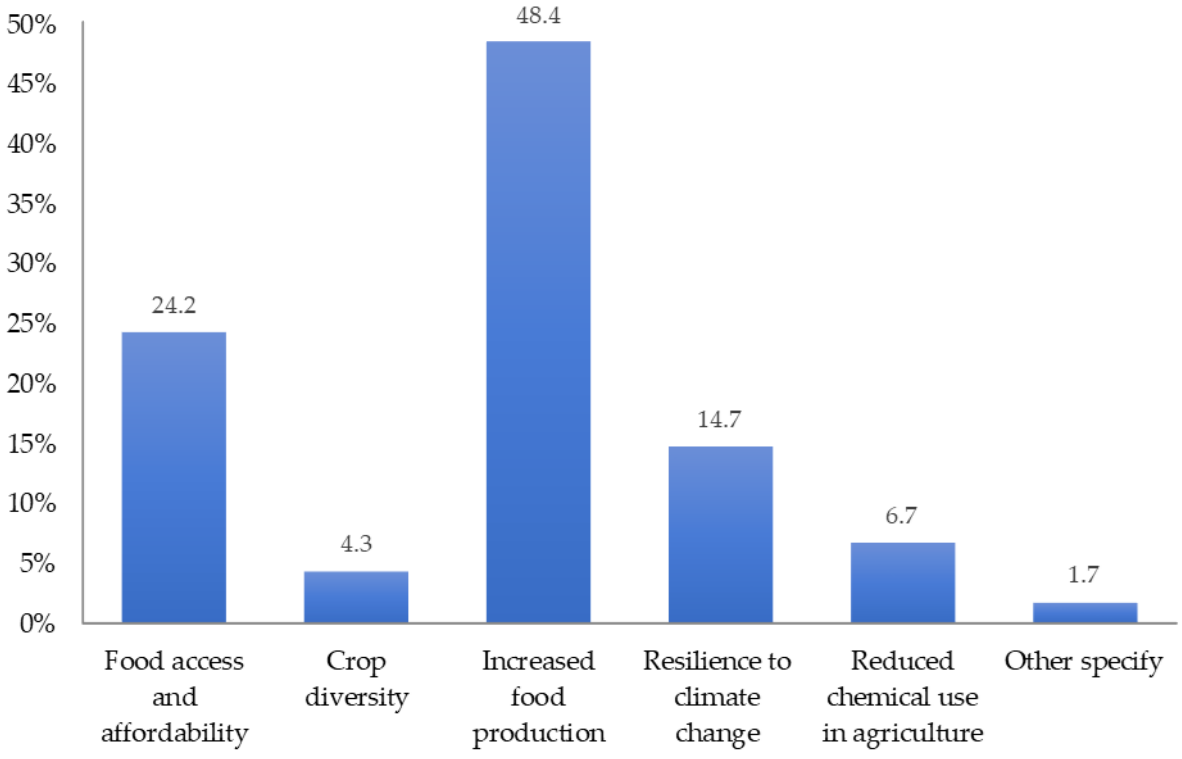

Figure 2. Outcomes of sustainable agriculture and agrifood security.

4.3. Results of Regression Analysis

Regression analysis helped to ascertain the extent to which sustainable agriculture and agrifood security is predicted by the different aspects of agriculture cooperatives, and the results are presented in Table 5. The positive multiple correlation coefficient (R) of 0.814 indicated that the four independent factors were favorably associated with sustainable agriculture and agrifood security. Furthermore, the R-Square value reveals that the four independent factors result in a 69.1% change in the general sustainability of agriculture and agrifood security.

Table 5. Summary of regression analysis model.

Model	R	R-Square	Adjusted R-Square	Std. Error of the Estimate
	0.814 [a]	0.691	0.679	0.1372

[a] Predictors: (constant): resource sharing in cooperatives, agriculture information exchange in cooperatives, collective bargaining and market access in cooperatives, the integration of modern technologies into cooperative practices.

A one-way ANOVA was conducted to determine whether the linear regression model matched the data well, or whether the four independent variables of this study were excellent predictors of the dependent variable. Since F (4386) = 52.413, $p < 0.05$, the model was deemed a satisfactory match for the data (Table 6).

Table 6. Analysis of Variance (ANOVA) for predicting sustainable agriculture and agrifood security.

Model	Sum of Squares	Df.	Mean Square	F	Sig.
Regression	36.040	4	18.361	52.413	0.016
Residual	30.108	382	0.027		
Total	66.148	386			

Dependent variable: sustainable agriculture and agrifood security. Predictors (constant): resource sharing in cooperatives, agriculture information exchange in cooperatives, collective bargaining and market access in cooperatives, the integration of modern technologies into cooperative practices.

The model's unstandardized coefficients were investigated to determine the role of cooperatives on sustainable agriculture and agrifood security.

The standardized coefficient shows in Table 7 the proportionate contribution of each independent variable to the dependent variable in terms of the standard deviation of the model. However, it is not an exact measure of the extent to which each individual predictor accounts for the dependent-variable variability. However, the R^2 of 0.691 is more appropriate to assess the proportion of the total variance in sustainable agriculture and agrifood security explained by the whole model. For instance, the estimated coefficient for resource sharing in cooperatives is 0.281, meaning that for every increase in resource sharing by one unit, there would be a corresponding increase of 0.281 units in sustainable agriculture and agrifood security. This predictor is statistically significant with a T value of 3.736 ($p < 0.01$). The standardized coefficient (beta = 0.397) reveals the resource sharing importance comparatively to the other predictors, but it provides no information on how much variability in sustainable agriculture and agrifood security results from resource sharing only. Likewise, the coefficient for agriculture information exchange in cooperatives is 0.186, which indicates that for each unit change in information exchange, there would be a change of 0.186 units in sustainable agriculture and agrifood security. This predictor is also a statistically significant t = 9.195, $p < 0.01$, while the beta of 0.213 indicates the relative influence and not the proportion of variance accounted for. The coefficient for collective bargaining and market access in cooperatives is 0.192, which means that the model predicts a 0.192 unit increase in sustainable agriculture and agrifood security. This predictor is statistically significant with T = 11.411, $p < 0.01$, but the beta of 0.142 shows the relative size of the predictor in the context of the model. Finally, the integration of modern technologies into cooperative practices has an estimate of 0.342, which implies a positive and substantial

influence on the promotion of sustainable agriculture and the security of agrifoods. This predictor has a very high level of statistical significance, with T = 13.511, $p < 0.01$. The relative impact is again measured by the standardized coefficient (beta = 0.282) and not the coefficient of determination.

Table 7. Regression coefficients and significance levels for predicting sustainable agriculture and agrifood security.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.318	0.136		2.438	0.016
Resource sharing in cooperatives	0.281	0.057	0.397	3.736	0.003
Agriculture information exchange in cooperatives	0.186	0.067	0.213	9.195	0.021
Collective bargaining and market access in cooperatives	0.192	0.049	0.142	11.411	0.002
Integration of modern technologies into cooperative practices	0.342	0.049	0.282	13.511	0.000

Dependent variable: sustainable agriculture and agrifood security.

The first hypothesis (H1) suggests that resource sharing in cooperatives positively affects sustainable agricultural practices and enhances agrifood security. This is supported by the regression coefficient (B = 0.281, $p = 0.003$), which indicates a significant positive effect. Resource sharing likely leads to the more efficient use of inputs, reduced costs, and the ability to implement more sustainable farming practices due to pooled resources. The second hypothesis (H2) posits that effective information exchange within cooperatives leads to improved sustainability in agriculture and better agrifood security. The coefficient (B = 0.186, $p = 0.021$) confirms this positive relationship. Information exchange can include sharing best practices, innovative farming techniques, and market information, all of which contribute to more sustainable and productive agricultural practices. Hypothesis three states that collective bargaining and enhanced market access through cooperatives significantly contribute to the sustainability of agriculture and agrifood security. The model shows a strong positive effect (B = 0.192, $p = 0.002$), suggesting that cooperatives' ability to negotiate better terms with suppliers and buyers and access larger markets is crucial for sustainable agriculture and ensuring agrifood security. Hypothesis four posits that the integration of modern technologies into cooperative practices positively influences sustainable agricultural development and agrifood security. The highest coefficient in the model (B = 0.342, $p = 0.000$) strongly supports this hypothesis. Modern technologies can include advanced irrigation methods, sustainable energy sources, and precision farming techniques, all of which significantly boost agricultural sustainability and agrifood security.

5. Discussion

This study aimed at evaluating the contribution of cooperatives towards sustainable agriculture and agrifood security in Greece. There are several branches of specialized knowledge that farmers' production activities within a cooperative project require; the cooperative is the institution that defines and integrates all the specialized knowledge. In this case, each of these specialized groupings is a practice; thus, the producers in addition to the co-op divisions are also a practice [53]. The boundaries of the agricultural cooperative include related fields of knowledge, which are relevant to a specific practice in agriculture. From this point of view, the agricultural cooperative can be viewed as a community of communities (of practices), a sense-making organization that facilitates the exchange between different communities by providing the rules of engagement. The principles and values of the cooperative are used by agricultural cooperatives as a basis on which the community is built. Another suggestion is that an identity is required for the formation of an innovative production system [33].

Acquisition of knowledge and information is crucial in the advancement of the agriculture industry [51,52]. To be able to plan what they are to do, which technology to use and, lastly, when and where to market their crops and livestock, farmers require vital information. Therefore, it can be concluded that there is a positive correlation between

agriculture progress and knowledge. To obtain agricultural security and self-sufficiency and to attain their full production capacity, farmers require quality information [7]. This is one of the important roles that cooperatives have in the disbursement of loans for agriculture. To improve agricultural production and advance social and economic development, the aforesaid cooperatives have been assigned the responsibilities of procuring materials for industries, extending technical advice, supplying agricultural inputs, organizing the procurement, marketing, and processing of agricultural produce, and providing credit facilities to agricultural workers, craftsmen, and producers. For the purpose of giving long-term loans to farmers in an effort to finance capital improvements and land development, cooperative land development organizations have been established. However, there is also a certain degree of conflict towards the disclosure of information between people and institutions, since information is regarded as a valuable asset. Since collaboration is crucial for information exchange, cooperative conduct may be helpful in this context [34]. Pimbert [41] states that knowledge can only be acquired through collaboration. In a study by Kalfas et al. [45], cooperation and knowledge sharing in a credit union were examined and showed that cooperation does depend on cooperation in a competitive organizational environment, and that cooperation is a necessity to bring about knowledge sharing. Economic sustainability is vital for any community to achieve long-term growth and development. This is achieved through the provision of employment opportunities, access to credit facilities, and market opportunities for small-scale producers by cooperatives. By availing affordable products and services, increasing members' incomes, and decreasing poverty, cooperatives assist in combating poverty [10,37,73]. As for the issue of agrifood security, it can be stated that sustainability is one of the most critical components of sustainable development. Cooperatives embrace such programs as a way of promoting sustainability in agriculture among its members. They advocate for the adoption of clean energy sources, the minimal generation of waste, and organic farming practices. Moreover, cooperatives ensure ethical production and consumption, since they ensure that their products are made sustainably for the environment [41,74–77].

This study provided findings showing that resource sharing among cooperative members improve farm output and sustainability considerably. This goes in tandem with the findings of earlier research that resource pooling in cooperatives was attributed to optimum resource utilization and low costs of production [24,45]. The tendency of the participants to overemphasize the positive effects of resource sharing is in line with Gebremichael [6], who also noted such effects on the cooperatives in Ethiopia. However, it is noteworthy that a relative number of respondents did not share this opinion, which may point to the existence of certain barriers or inefficiencies in some of the cooperatives, as described by Candemir et al. [5]. This may be arising from a lack of trust, poor management, or the unfair distribution of gains within the cooperatives. Subsequent studies should explore these barriers in depth and suggest strategies to combat them in order to enable every member to gain the maximum possible advantage from the sharing of resources.

This study established that communication in cooperatives plays a vital role in effective agricultural practice and food security in the sector. This confirms the literature by Kumar and Verma [38] and Bognar and Gerald Schwarz [49] that stipulates that the timely acquisition of appropriate information is central to success in agriculture. This study also supports Mili and Arovuori's work [32], which states that proper information sharing improves pest and disease control and market decisions. The overwhelming emphasis on the significance of the information exchange makes it imperative for cooperatives to establish sound communication channels. These platforms can help in spreading the word on best practices, new technologies in farming, and market information in a bid to enhance the production and sustainability of agriculture. Collective bargaining and market access through cooperatives were revealed to affect farm income and agrifood security. The positive impact of collective bargaining in achieving better prices and other terms is also consistent with the findings of Pimbert [41], who also reported the same in other studies. The high percentage of participants who appreciated the role of market access

through cooperatives is in line with the study conducted by Dhillon and Moncur [29] on the participation of cooperatives in extending market opportunities for smallholder farmers. However, some participants disagreed about the effectiveness of collective bargaining and market access for the sustainability of agriculture, and one participant mentioned that the effectiveness of these strategies requires further research to understand under which conditions they are most helpful. Subsequent studies should establish variables that affect the effectiveness of collective bargaining in various sectors of agriculture and come up with ways of increasing its effectiveness.

Cooperative practices were noted to have received a boost through the integration of modern technologies into agricultural practices. This finding agrees with the conclusions of Branca et al. [18] and Kashiwagi and Kamiyama [78] that point at technological development in agriculture as a determinant of overall productivity. The subjects of the study recognized that technology helped them to increase their yields and access online markets for their products, which accords with the literature on the positive effects of technology on agriculture [64,65]. Nonetheless, participants were divided on the effects that modern technologies had on the environment. Some of the participants were aware of the positive impact of technology on the negative impacts on the environment, while others had negative perceptions of technology. This indicates that there is a need to continue conducting studies to identify the effects of technology on the environment and to encourage the use of technologies that are helpful to the economy and have a positive impact on the environment as well.

The multiple correlation coefficient is 0.814 and is positive, which confirms these findings and shows a close relationship between the independent variables and sustainable agriculture and agrifood security. The R-Square value is equal to 0.691, which indicates that the model has high explanatory characteristics. These outcomes highlight the importance of resource sharing, information exchange, collaboration in purchasing, and technology application in improving agrifood security and the sustainability of agriculture. More so, the regression analysis showed that resource sharing within the cooperatives is positively related to sustainable agriculture and agrifood security ($B = 0.281$, $p < 0.01$). This aligns with the conclusion made by Ahmed and Mesfin [30] that states that cooperatives help to improve members' welfare by providing resources and minimizing transaction costs. Likewise, the flow of agricultural information within cooperatives also enhances sustainability and agrifood security ($B = 0.186$, $p < 0.01$), and other researchers have also opined that information is crucial for agriculture [46]. To sum up, the current research not only supports the findings of previous studies but also enriches the body of knowledge by presenting concrete findings regarding the Greek context. Thus, the results point to the significance of cooperation arrangements in enhancing long-term agriculture practices and agrifood availability. It will be useful for future works to continue to investigate the issues pointed out in Section 2.2. Resource Sharing in Cooperatives, and to determine the actual impacts of the technology implementation on the cooperative environment. Finally, these findings should inform policymakers in designing policies for financing agricultural cooperatives so that they are capable of contributing to sustainable development and food security.

6. Conclusions

This study assessed how Greek cooperatives promote agrifood security and sustainable agriculture. In this light, this study provides evidence that cooperatives positively impact agricultural production, resilience, and food security by promoting pooled access to resources, information, markets, and technology. Cooperative membership also implies the sharing of resources in a way that boosts farm productivity and sustainability, and it implies access to credit and other forms of support. This kind of approach not only increases the yields of agricultural produce but also promotes sustainable methods of farming. Accessible and timely information in cooperatives enhances the adoption of sustainable practices and the management of pests and diseases and increases the awareness of agrifood security. Open communication increases the flow of information on best practices and effective solu-

tions within cooperatives, thereby improving the sustainability of agricultural practices. Cooperatives through bargaining and better market access greatly affect farm income, the prices of commodities, and agrifood security through guaranteed markets for the produce. In general, cooperatives' bargaining power with suppliers and buyers improves market conditions and provides farmers with better capital security. The incorporation of advanced technologies in cooperative practices enhances the productivity and output of agriculture. Hence, the advancement in technology, if embraced by cooperatives, will lead to increased productivity and improved market access, which, in turn, will promote agriculture and food security. The research objectives were well responded to. The practice of cooperation in resource sharing, information exchange, bargaining power, and technology transfer has revealed the effectiveness of sustainable agriculture and agrifood security, including the role of cooperatives in agricultural advancement and food security improvement.

6.1. Implications and Recommendations

Theoretical Implications: This study contributes to the New Institutional Economics (NIE) paradigm, including transaction cost economics (TCE) and collective action theory. It reaffirms the fact that cooperatives are capable of averting market failures, minimizing transactions costs, and facilitating collective action, thus providing an empirical backing to the theoretical view that defines cooperatives as institutions that correct market imperfections and improve resource mobilization.

Practical Implications: Subsidies, tax incentives, and other support measures should be provided to the formation and functioning of agricultural cooperatives by policymakers. Efficient and more reliable information dissemination mechanisms in cooperatives can improve market intelligence and the uptake of best practices. Increasing the use of contemporary technologies in cooperative activities increases the efficiency and sustainability of agricultural purposes.

Political Implications: At the political level, this study implies that governments should appreciate and encourage the involvement of cooperatives in the attainment of national and regional policies in agriculture. Optimizing policies, funding, and legislations for cooperatives will improve the ability of these institutions to boost sustainable agriculture and food security. Cooperatives can be used as an instrument by political leaders to fight rural poverty, enhance food security, and stimulate community development.

Managerial Implications: From a managerial point of view, the leaders within the cooperative should ensure that everyone within the organization is a sharer. Communication should be enhanced in order to ensure the provision of information and information on best practices. Cooperative managers should consider incorporating modern technologies to enhance the productivity and sustainability of the cooperatives. Education and training help cooperative members to become knowledgeable and skilled in order to exploit new technologies and practices.

6.2. Areas for Further Research

Further research is required to examine the challenges and obstacles cooperatives face when attempting to share resources, and to propose workable solutions to these problems, as the results indicate that, despite the research emphasizing the benefits of resource sharing, there is still some resistance to it.

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References

1. Zlati, M.L.; Florea, A.M.; Antohi, V.M.; Dinca, M.S.; Bercu, F.; Fortea, C.; Silvius, S. Financing Romanian Agricultural Cooperatives' Investments for the 2023–2027 Horizon. *Sustainability* **2023**, *15*, 2306. [CrossRef]
2. Heyl, K.; Ekardt, F.; Roos, P.; Garske, B. Achieving the nutrient reduction objective of the Farm to Fork Strategy. An assessment of CAP subsidies for precision fertilization and sustainable agricultural practices in Germany. *Front. Sustain. Food Syst.* **2023**, *7*, 1088640. [CrossRef]
3. Santos-Larrazabal, J.; Basterretxea, I. Intercooperation, flexicurity and their impact on workers: The case of Fagor Electrodomésticos. *Ann. Public Coop. Econ.* **2022**, *93*, 607–635. [CrossRef]
4. Semou, V.; Sergaki, P.; Tremma, O. Measuring the Economic Contribution of Agricultural Cooperatives to the National Economy: The Case of Greece. *Open Agric. J.* **2022**, *16*. [CrossRef]
5. Candemir, A.; Duvaleix, S.; Latruffe, L. Agricultural cooperatives and farm sustainability—A literature review. *J. Econ. Surv.* **2021**, *35*, 1118–1144. [CrossRef]
6. Gebremichael, B.A. The Role of Agricultural Cooperatives in Promoting Food Security and Rural Women's Empowerment in Eastern Tigray Region, Ethiopia. *Dev. Ctry. Stud.* **2014**, *4*, 96–109.
7. Ma, W.; Marini, M.A.; Rahut, D.B. Farmers' organizations and sustainable development: An introduction. *Ann. Public Coop. Econ.* **2023**, *94*, 683–700. [CrossRef]
8. Grillotti Di Giacomo, M.G.; De Felice, P. COVID-19 pandemic: Warning for the sustainability of European agri-food systems. *Belgeo* **2022**, *4*, 1–25. [CrossRef]
9. Gkatsikos, A.; Natos, D.; Staboulis, C.; Mattas, K.; Tsagris, M.; Polymeros, A. An Impact Assessment of the Young Farmers Scheme Policy on Regional Growth in Greece. *Sustainability* **2022**, *14*, 2882. [CrossRef]
10. Trivellas, P.; Mavrommati, S.; Anastasopoulou, A.; Grapas, C.; Kallikantzarou, E. Agro living Labs: Creating innovative, sustainable, resilient and social inclusive food systems. *IOP Conf. Ser. Earth Environ. Sci.* **2023**, *1185*, 012036. [CrossRef]
11. Beaudoin, C.; Joncoux, S.; Jasmin, J.-F.; Berberi, A.; McPhee, C.; Schillo, R.S.; Nguyen, V.M. A research agenda for evaluating living labs as an open innovation model for environmental and agricultural sustainability. *Environ. Chall.* **2022**, *7*, 100505. [CrossRef]
12. Oba, B.; Ozsoy, Z. Unifying nature of food: Consumer-initiated cooperatives in Istanbul. *Soc. Bus. Rev.* **2020**, *15*, 349–372. [CrossRef]
13. Gervasi, O.; Murgante, B.; Maria, A.; Chiara, A.C.R.; Scorza, F.; Karaca, Y.; Torre, C.M. Computational Science and Its Applications—ICCSA 2023 Workshops. In *Proceedings of the 23rd International Conference on Computational Science and Its Applications, ICCSA 2023*; Gervasi, O., Murgante, B., Taniar, D., Apduhan, B.O., Braga, A.C., Garau, C., Stratigea, A., Eds.; Springer Cham: Lesvos Island, Greece, 2023.
14. Namanya, B. Farmer Mobilization through Agricultural Cooperatives and Farmers Welfare in Western Uganda: A Case of ACPCU Ltd. *Int. J. Curr. Sci. Res. Rev.* **2022**, *5*, 248355932. [CrossRef]
15. OECD. Promoting Investment Climate Reforms in Morocco's Agri-Food Sector; Rabat, Morocco, 2021. Available online: https://policycommons.net/artifacts/3838187/promoting-investment-climate-reforms-in-moroccos-agri-food-sector/4644079/ (accessed on 28 April 2024).
16. European Parliament. *Ensuring Food Security and the Long-Term Resilience of EU Agriculture*; European Parliament: Strasbourg, France, 2019.
17. Marcis, J.; Bortoluzzi, S.C.; de Lima, E.P.; da Costa, S.E.G. Sustainability performance evaluation of agricultural cooperatives' operations: A systemic review of the literature. *Environ. Dev. Sustain.* **2019**, *21*, 1111–1126. [CrossRef]
18. Branca, G.; Cacchiarelli, L.; Haug, R.; Sorrentino, A. Promoting sustainable change of smallholders' agriculture in Africa: Policy and institutional implications from a socio-economic cross-country comparative analysis. *J. Clean. Prod.* **2022**, *358*, 131949. [CrossRef]
19. Kalogiannidis, S.; Syndoukas, D. The Impact of Agricultural Extension Services on Farm Output: A Worldwide Viewpoint. *Res. World Agric. Econ.* **2024**, *5*, 96–114. [CrossRef]
20. Lu, Y.; Zhang, Y.; Hong, Y.; He, L.; Chen, Y. Experiences and Lessons from Agri-Food System Transformation for Sustainable Food Security: A Review of China's Practices. *Foods* **2022**, *11*, 137. [CrossRef]
21. Coase, R.H. The Nature of the Firm. *Economica* **1937**, *4*, 386–405. [CrossRef]

22. Pereira, J.R. Producer Cooperatives: A Transaction Cost Economic Approach. *SSRN Electron. J.* **2014**, 1–22. [CrossRef]
23. Ouchi, W.; Williamson, O.E. Markets and Hierarchies: Analysis and Antitrust Implications. *Adm. Sci. Q.* **1977**, *22*, 540. [CrossRef]
24. Kalogiannidis, S.; Chatzitheodoridis, F. Strategic communication and sustainable agricultural competitiveness: A Greek case study. *Int. J. Sustain. Agric. Manag. Inform.* **2023**, *5*, 96–114. [CrossRef]
25. Olson, M. *The Logic of Collective Action: Public Goods and the Theory of Groups*; Harvard University Press: Cambridge, MA, USA, 1965; ISBN 0674537513.
26. FAO; IFAD; UNICEF; WFP; WHO. *The State of Food Security and Nutrition in the World 2023: Urbanization, Agrifood Systems Transformation and Healthy Diets across the Rural–Urban Continuum*; FAO: Rome, Italy, 2023; ISBN 978-92-5-137226-5.
27. Bokoumbo, K.; Berge, S.; Johnson, K.A.; Yabi, A.J.; Yegbemey, R.N. Cooperatives and sustainability: The case of maize producers in the plateaux region of Togo. *Heliyon* **2023**, *9*, e17345. [CrossRef] [PubMed]
28. Sikwela, M.M.; Mushunje, A.; Fuyane, N. The role of cooperatives in empowering smallholder farmers to access markets: A case study of Eastern Cape and KwaZulu Natal cooperatives in South Africa. *Int. J. Dev. Sustain.* **2016**, *5*, 536–552.
29. Dhillon, R.; Moncur, Q. Small-Scale Farming: A Review of Challenges and Potential Opportunities Offered by Technological Advancements. *Sustainability* **2023**, *15*, 15478. [CrossRef]
30. Ahmed, M.H.; Mesfin, H.M. The impact of agricultural cooperatives membership on the wellbeing of smallholder farmers: Empirical evidence from eastern Ethiopia. *Agric. Food Econ.* **2017**, *5*, 6. [CrossRef]
31. Joseph, L.; Stephenson, M.O.; Zanotti, L.; Ricot, S. Sustainable agriculture and food sovereignty in Haiti: Sharing knowledge and shaping understanding of food systems at the University of Fondwa. *Front. Sustain. Food Syst.* **2023**, *7*, 1230763. [CrossRef]
32. Mili, S.; Arovuori, K. The Struggle to Sustain Agriculture in EU Southern Neighbourhood Partners: Improving Data and Policies. *EuroChoices* **2023**, *22*, 50–57. [CrossRef]
33. Oñederra-Aramendi, A.; Begiristain-Zubillaga, M.; Cuellar-Padilla, M. Characterisation of food governance for alternative and sustainable food systems: A systematic review. *Agric. Food Econ.* **2023**, *11*, 18. [CrossRef]
34. Mindlin, Y.; Novikov, M.; Ignatyeva, O. Clusters and cooperatives as a tool of sustainable food security: A comparative analysis. *IOP Conf. Ser. Earth Environ. Sci.* **2022**, *1043*, 012038. [CrossRef]
35. Spielman, D.J. *Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review*; Division Discussion Papers; International Food Policy Research Institute: Washington, DC, USA, 2005.
36. Thornton, P.K.; Loboguerrero Rodriguez, A.M.; Campbell, B.M.; Kavikumar, K.S.; Mercado, L.; Shackleton, S. *Rural Livelihoods, Food Security and Rural Transformation under Climate Change*; Global Commission on Adaptation: Rotterdam, The Netherlands; Washington, DC, USA, 2019.
37. Bose, S.; Al-Jabri, O.S.; Osman, N.M.; Al Habsi, S.H.; Al Shidi, R. Role of small and medium enterprises and agricultural cooperatives in promoting sustainable agriculture for rural development and food security. *Amity J. Agribus.* **2017**, *2*, 1–21.
38. Kumar, V.; Wankhede, K.G.; Gena, H.C. Role of Cooperatives in Improving Livelihood of Farmers on Sustainable Basis. *Am. J. Educ. Res.* **2015**, *3*, 1258–1266. [CrossRef]
39. Sridhar, A.; Balakrishnan, A.; Jacob, M.M.; Sillanpää, M.; Dayanandan, N. Global impact of COVID-19 on agriculture: Role of sustainable agriculture and digital farming. *Environ. Sci. Pollut. Res.* **2022**, *30*, 42509–42525. [CrossRef]
40. Nyawo, P.H.; Olorunfemi, O.D. Perceived Effectiveness of Agricultural Cooperatives by Smallholder Farmers: Evidence from a Micro-Level Survey in North-Eastern South Africa. *Sustainability* **2023**, *15*, 10354. [CrossRef]
41. Pimbert, M. Transforming food and agriculture: Competing visions and major controversies. *Mondes Dev.* **2023**, *199–200*, 361–384. [CrossRef]
42. Sabio, R.P.; Lehoux, P.; Rastoin, J.L. Characterizing food systems to better understand their vulnerabilities: A case study in Québec and São Paulo. *Renew. Agric. Food Syst.* **2023**, *38*, e25. [CrossRef]
43. Malindretos, G.; Sardianou, E.; Briana, M. Farmers' Perception on Contract Farming in the Post-COVID Era: Empirical Study in Greece. *Sustainability* **2023**, *15*, 14696. [CrossRef]
44. López-Felices, B.; Velasco-Muñoz, J.F.; Román-Sánchez, I.M.; Ángel Aznar-Sánchez, J. Socioeconomic and technical factors determining the adoption of hedgerows around greenhouses in southeast Spain. *Agric. Econ.* **2023**, *69*, 212–222. [CrossRef]
45. Kalfas, D.; Kalogiannidis, S.; Papaevangelou, O.; Chatzitheodoridis, F. Assessing the Connection between Land Use Planning, Water Resources, and Global Climate Change. *Water* **2024**, *16*, 333. [CrossRef]
46. Bochtis, D.; Benos, L.; Lampridi, M.; Marinoudi, V.; Pearson, S.; Sørensen, C.G. Agricultural Workforce Crisis in Light of the COVID-19 Pandemic. *Sustainability* **2020**, *12*, 8212. [CrossRef]
47. Kazungu, I.; Kumburu, N.P. Agripreneurship as a panacea for food security in Tanzania: A systematic review. *Heliyon* **2023**, *9*, e13305. [CrossRef]
48. Richards, T.J.; Klein, K.K.; Walburger, A.M. Principal-Agent Relationships in Agricultural Cooperatives: An Empirical Analysis from Rural Alberta. *J. Coop.* **1998**, *13*, 21–34. [CrossRef]
49. Bognar, J.; Schwarz, G. *Sustainable & Resilient Value Chains*; SHERPA Position Paper; SHERPA Rural Science–Society-Policy Interfaces: Brussels, Belgium, 2023; Available online: https://rural-interfaces.eu/wp-content/uploads/2023/05/SHERPA-Position-Paper-Resilient-Sustainable-Value-Chains.pdf (accessed on 12 May 2024).
50. Puđak, J.; Šimleša, D. Is Social Entrepreneurship Better for Workers? The Influence of Work Experience in Croatian Social Cooperatives on Perceived Well-Being. *Rev. Sociol.* **2020**, *50*, 7–30. [CrossRef]

51. Luo, J.; Han, H.; Jia, F.; Dong, H. Agricultural Co-operatives in the western world: A bibliometric analysis. *J. Clean. Prod.* **2020**, *273*, 122945. [CrossRef]
52. Barbu, M.; Delabre, I. *Report on Sustainability in Agri-Food Value Chains: Case Studies from the Mediterranean Regions and the Middle East*; Agricultural Voices Syria; Falmer: Brighton, UK, 2021; Available online: https://agricultural-voices.sussex.ac.uk/wp-content/uploads/2021/07/Report-on-Sustainability-in-Agri-food-Value-Chains_-Barbu-Delabre-2021.pdf (accessed on 14 April 2024).
53. Sundram, P. Food security in ASEAN: Progress, challenges and future. *Front. Sustain. Food Syst.* **2023**, *7*, 1324368. [CrossRef]
54. Izuchukwu, A.; Erezi, E.; David Emeka, E. Assessing the Impact of Farmer-to-Farmer Communication Networks on Knowledge Sharing and Adoption of Sustainable Agricultural Practices in Africa. *Int. J. Agric. Earth Sci.* **2023**, *9*, 58–76. [CrossRef]
55. Llewellyn, R.S.; Brown, B. Predicting Adoption of Innovations by Farmers: What is Different in Smallholder Agriculture? *Appl. Econ. Perspect. Policy* **2020**, *42*, 100–112. [CrossRef]
56. Nera, E.; Paas, W.; Reidsma, P.; Paolini, G.; Antonioli, F.; Severini, S. Assessing the Resilience and Sustainability of a Hazelnut Farming System in Central Italy with a Participatory Approach. *Sustainability* **2020**, *12*, 343. [CrossRef]
57. Kalogiannidis, S.; Kalfas, D.; Patitsa, C.; Chalaris, M. Relationship between Climate Change and Business Risk: Strategies for Adaptation and Mitigation: Evidence from a Mediterranean Country. *Wseas Trans. Environ. Dev.* **2024**, *20*, 276–294. [CrossRef]
58. Tuyen, M.C.; Sirisupluxana, P.; Bunyasiri, I.; Hung, P.X. Perceptions, Problems and Prospects of Contract Farming: Insights from Rice Production in Vietnam. *Sustainability* **2022**, *14*, 12472. [CrossRef]
59. Wollni, M.; Zeller, M. Do farmers benefit from participating in specialty markets and cooperatives? The case of coffee marketing in Costa Rica 1. *Agric. Econ.* **2007**, *37*, 243–248. [CrossRef]
60. Gai, M.; Yang, Q. Synergistic study of the green efficiency and economic resilience of agriculture from a sustainable development perspective: Evidence from Northeast China. *Environ. Sci. Pollut. Res.* **2023**, *30*, 77568–77592. [CrossRef] [PubMed]
61. Reinhardt, T. The farm to fork strategy and the digital transformation of the agrifood sector—An assessment from the perspective of innovation systems. *Appl. Econ. Perspect. Policy* **2023**, *45*, 819–838. [CrossRef]
62. UNIDO. UNIDO Directorate of SDG Innovation and Economic Transformation; United Nations 2023. Available online: https://www.unido.org/news/unido-global-town-hall (accessed on 10 April 2024).
63. Meemken, E.-M.; Qaim, M. Organic Agriculture, Food Security, and the Environment. *Annu. Rev. Resour. Econ.* **2018**, *10*, 39–63. [CrossRef]
64. Tabe-Ojong, M.P.J.; Aihounton, G.B.; Lokossou, J.C. Climate-smart agriculture and food security: Cross-country evidence from West Africa. *Glob. Environ. Chang.* **2023**, *81*, 102697. [CrossRef]
65. Stępień, S.; Maican, S. *Small Farms in the Paradigm of Sustainable Development*; Michalska, M., Ed.; Wydawnictwo Adam Marszałek: Toruń, Poland, 2020; ISBN 9788381802505.
66. Daum, T. Mechanization and sustainable agri-food system transformation in the Global South. A review. *Agron. Sustain. Dev.* **2023**, *43*, 16. [CrossRef]
67. Lepe, M. The Role of Agriculture Cooperatives and Farmer Organizations on the Sustainable Agricultural Practices Adoption in Uganda. Master's Thesis, Ghent University, Ghent, Belgium, 2021.
68. Yamane, T. *Statistics, An Introductory Analysis*, 2nd ed.; Harper and Row: New York, NY, USA, 1967.
69. Singh, A.S.; Masuku, M.B. Sampling techniques & determination of sample size in applied statistics research: An overview. *Int. J. Econ. Commer. Manag.* **2014**, *2*, 1–22.
70. McCormick, K.; Salcedo, J. *SPSS Statistics for Data Analysis and Visualization*; John Wiley & Sons: Hoboken, NJ, USA, 2017.
71. Kalogiannidis, S.; Kalfas, D.; Papaevangelou, O.; Chatzitheodoridis, F.; Katsetsiadou, K.-N.; Lekkas, E. Integration of Climate Change Strategies into Policy and Planning for Regional Development: A Case Study of Greece. *Land* **2024**, *13*, 268. [CrossRef]
72. Kalogiannidis, S.; Kalfas, D.; Chatzitheodoridis, F.; Lekkas, E. Role of Governance in Developing Disaster Resiliency and Its Impact on Economic Sustainability. *J. Risk Financ. Manag.* **2023**, *16*, 151. [CrossRef]
73. Li, S.; Huo, X. Estimating the effects of joining cooperatives on farmers' recycling behaviors of pesticide packaging waste: Insights from apple farmers of China. *Ciência Rural* **2023**, *53*, e20220229. [CrossRef]
74. Tsoulfas, G.T.; Trivellas, P.; Reklitis, P.; Anastasopoulou, A. A Bibliometric Analysis of Short Supply Chains in the Agri-Food Sector. *Sustainability* **2023**, *15*, 1089. [CrossRef]
75. Ahmadpour, A. Effective Factors on Application of Sustainable Agricultural Practices by Paddy Farmers (Case of Rural Production Cooperatives Members). *Int. J. Agric. Manag. Dev.* **2016**, *6*, 81–91.
76. Park, J.L.; Friend, D.B.; Manley, M.T.; Boyd, B.L. Leadership in agricultural cooperatives. In *Handbook of Research on Cooperatives and Mutuals*; Edward Elgar Publishing: Cheltenham, UK, 2023; pp. 135–147. ISBN 9781802202618.
77. Sdrolias, L.; Semos, A.; Mattas, K.; Tsakiridou, E.; Michailides, A.; Partalidou, M.; Tsiotas, D. Assessing the Agricultural Sector's Resilience to the 2008 Economic Crisis: The Case of Greece. *Agriculture* **2022**, *12*, 174. [CrossRef]
78. Kashiwagi, K.; Kamiyama, H. Effect of adoption of organic farming on technical efficiency of olive-growing farms: Empirical evidence from West Bank of Palestine. *Agric. Food Econ.* **2023**, *11*, 26. [CrossRef]