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The Interplay of Pro-Innovative Behavior, Trust, and Farm Viability for Sustainability in the United Winemaking Agricultural Cooperative of Samos †

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Abstract

This study explores the complex interplay between innovation, pro-innovative behavior, social capital, and farm viability in contributing to sustainability within agricultural cooperatives. Focusing on the United Winemaking Agricultural Cooperative of Samos (UWC SAMOS), a historic cooperative on the Greek island of Samos, this research aimed to measure and operationalize these concepts using literature-derived indicators and complex indexes. A mixed-method approach was employed, collecting data via semi-structured questionnaires and in-depth interviews. The findings revealed a highly intricate relationship among these factors which quantitative analysis alone could not fully capture. The findings revealed a complex interplay, with female respondents showing better results in all the created composite indexes of our study. Surprisingly, the respondents of our sample who were more than 60 years old had the highest values in the composite indexes of pro-innovative behavior and economic viability and a relatively high value in the social capital index, and considering the educational level of the interviewees, the proportion with a Master's or an equivalent level had the highest results in the pro-innovative behavior index and trust but not in economic viability. Crucially, qualitative data highlighted the underlying mechanism of "institutionalization of cooperative members" as a significant mediating factor, explaining the weak innovation and low social trust observed. This study concludes that a holistic understanding of sustainability in agricultural cooperatives necessitates a deep integration of both quantitative measures and qualitative exploration of socio-cultural dynamics, offering a refined conceptual framework for future research and policy.

Keywords: innovation; social capital; farm viability; sustainability; cooperative; Samos island; Greece

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1. Introduction

The starting point of this research is an agricultural cooperative, which, for the purposes of this research, will be considered a network. The latter, along with cooperation

and collaboration, is associated with many benefits in terms of rural development. These include the facilitation of knowledge exchange between participants and actors. In networks, as in agricultural cooperatives, the interactions between their members, farmers and, by extension, rural households, affect their behavior towards all types of innovations and their adoption, the embeddedness of new knowledge, and the sustainability of their farms. The different types of networks are considered important sources of social capital (e.g., family, circles of friendship and acquaintance, professional and business networks, voluntary associations, etc.) and the types of relationship that matter the most (e.g., bonding/bridging/linking, strong vs. weak ties, etc.; see also [1–3]).

Individual innovation studies often assess one dimension of innovative behavior (and, as such, they do not sufficiently capture the richness of the construct of individual innovation). To address this problem, [4] developed and tested a multi-dimensional measure of individual innovation. In agriculture, one of the first approaches was provided by Rogers, according to whom "[A]n innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption" [5] (p. 12). Currently, this is challenged in favor of a systemic approach according to which new ideas are developed and implemented by people who engage in networks and make adjustments in order to achieve desired outcomes; networks are taken as social processes encouraging the sharing of knowledge and, notably, as preconditions for innovation [6].

Given that many researchers contend that no single model is able to comprehensively explain highly complex situations (see [7]), this piece of work aims to explore this complexity by focusing on relatively simple but fundamental factors. This study offers several marginal contributions to the existing literature. First, by focusing on the United Winemaking Agricultural Cooperative of Samos (UWC SAMOS), a long-standing agricultural cooperative on the Greek island of Samos, it provides crucial context-specific insights into the interplay of innovation, social capital, trust, and farm viability in a Mediterranean island setting, a context often underrepresented in global studies on agricultural sustainability. Second, our adoption of a rigorous mixed-method approach moves beyond a mere justification of quantitative data, truly integrating qualitative insights to explain complex socio-economic dynamics, such as the "institutionalization of cooperative members," which quantitative analysis alone could not fully capture. This methodological depth offers a refined approach for understanding complex relationships in agricultural contexts. Finally, by explicitly modeling and investigating the theoretical mechanisms linking these critical factors, this research contributes to refining existing theories of cooperative development and innovation diffusion in unique institutional settings and offers novel insights into how social capital and trust mediate the adoption of innovative practices and impact economic resilience at the farm level. To the best of our knowledge, these concepts have not been examined together, let alone in the case of a cooperative [8]. In parallel, assessments of the "quantity" and "quality" of trust and social capital are missing in the case of islands [9], with [10] (p. 11) pointing out that "the issue of social capital in island. . .deserves far more research attention than it has had to date." Exceptions comprise the work in [11], which showcases trust as one of the highly important elements of social capital in island communities, which facilitates social cooperation, and [12], which presents alternative visions of the "rural" by particular actors that relied on "networking" and building economic and social capital at Chios island, Greece.

2. Literature Review

Concepts and Measurement

With regard to innovation, according to [13], it can be divided into four complementary types: product innovation, process innovation, marketing innovation, and organizational innovation. Ref. [14] argued that ideas are the foundation of innovation and, as individuals

develop, communicate and adapt ideas, it is crucial to understand what motivates and enables innovative behavior. Similarly, ref. [15] asserted that the speed at which some innovations are adopted or the readiness to use them may be determined by factors such as the social status of individuals, their motivation for their acceptance, and the degree of integration of the members in a system. The literature also suggests that creativity is closely linked to innovation and therefore crucial to measure as one of the dimensions of pro-innovative behavior. Returning to networks, it should be mentioned that they are closely related to the concept of social capital. The latter is understood as "the resourcefulness of a people to respond positively, collectively and responsibly to an identified challenge" [16] (p. 32) (see also [1–3]). Social capital comprises features of social organization—networks, norms and trust—that potentially connect and enable people to act together while also providing access to valuable resources. The concept has been used in studies related to agriculture (for example, [17]) and is crucial for the promotion of the innovative ability of a network. Furthermore, ref. [18] pointed out that "soft" elements—community and entrepreneurial skills, attitudes, networks, social capital and trust—are as important as the physical conditions in explaining the economic success of rural settlements or may even counterbalance them. Nevertheless, although smallholder farmers' social capital may be effectively used to enhance innovation by building upon existing resources (communication pathways), enhancing social learning (farmers learning from farmers), and fostering interpersonal and community trust [19], social capital has been limitedly used in studying farmer cooperatives so far [8,20]. The same holds true for research related "to the activities of individual actors within agricultural co-operatives (members) and their relative roles in facilitating innovation", as well as "on how innovation spreads within formal institutional structures, such as agricultural producer cooperatives" [21].

Moreover, the literature emphasizes the critical role of trust. According to [22], while "[T]he role played by trust on economic development is not under debate", social capital has been "identified tautologically with trust". While the importance of trust in relationships is not debated, especially with reference to innovation networks (see [23]), researchers offer different arguments on the relationship between trust and social capital. Moreover, [22] argued that general trust or trust in the population as a whole is one of the most-often used proxies for social capital, an approach especially used in rural studies [24]. Furthermore, in trust literature, the notion of dispositional trust, characterized by a general tendency to accept vulnerability in relation to others, is differentiated with regard to institution-based trust, i.e., the belief that the needed conditions are in place to enable one to anticipate a successful outcome in an endeavor or aspect of one's life [25]. The first one, disposition to trust, comes from psychology and signifies the extent to which one displays a consistent tendency to be willing to depend on others [26] across a broad spectrum of situations and persons. The second one, institution-based trust, comes from sociology and implies that people can rely on others because of structures, situations, or roles that provide assurances that things will go well; therefore, it is situation-specific only [27]. Furthermore, while social trust and trust in institutions are distinct, according to [28] (p. 174), "they are frequently considered to feed into each other, and to be mutually supportive" with "explanations of social trust and trust in institutions [been] focused more on questions of civic participation". Additionally, one of the often-used proxies for trust concerns voluntarism [24]; for example, trust between professionals and volunteers is found to be key to robust emergency management [29] while also being the most important deterrent factor of crowdfunding [30].

Finally, farm viability is taken to be the ultimate farmers' objective (and one of the pillars of sustainability), in the measurement of which employment and satisfaction are also included [31]. The viability of farms has been a concern of farm studies [32] and many different approaches have been proposed to explore it (e.g., [33]). Some of these

approaches favor economic reasoning only, considering the farm only as a business that has to maximize its outputs and/or profits. Other approaches link viability, especially of family farms, to different considerations and decision-making models that include the long-term viability of the farm [33], the use of resources outside the farm, and making use of other opportunities that may be available.

3. Theoretical Framework: Interdependencies and Linkages

Understanding the complex interplay between innovation, pro-innovative behavior, social capital, and farm viability within agricultural cooperatives requires a clear theoretical foundation. These concepts are not isolated but are deeply intertwined, each influencing and being influenced by the others in a dynamic system that impacts the sustainability and resilience of the cooperative and its members.

A high level of trust among cooperative members is a critical precursor to fostering pro-innovative behavior. Trust reduces perceived risks associated with adopting new practices or sharing novel ideas [34]. When members trust each other and the cooperative's leadership, they are more willing to share information about successful or unsuccessful innovations, experiment with new methods that might initially yield uncertain results, and collectively invest in new technologies or processes [35]. Theories of social exchange [36] suggest that trust cultivates a reciprocal environment where members are more inclined to contribute to collective innovation efforts, anticipating future benefits or support. Similarly, collective action theory [37] indicates that trust can mitigate free-rider problems, encouraging members to participate in innovation initiatives whose benefits might be shared, even if individual contributions are costly. Without sufficient trust, apprehension regarding exploitation, lack of transparency, or skepticism towards new ventures can significantly impede the willingness to engage in innovative activities [38].

Furthermore, robust trust directly impacts farm viability by facilitating more efficient resource utilization and enabling collective problem-solving within the cooperative structure. High trust levels allow members to engage in joint marketing efforts, pool resources for investments in shared infrastructure (e.g., processing facilities, specialized machinery), and collaboratively address common challenges such as pest outbreaks or market fluctuations [39]. This collective efficiency often leads to reduced transaction costs, improved market access, and enhanced bargaining power, all of which contribute to the economic resilience and profitability of individual farms [40]. Moreover, trust fosters social support networks that can provide informal credit, labor, or knowledge exchange during challenging periods, thereby bolstering the resilience aspect of farm viability [41].

Social capital serves as a foundational element that underpins both pro-innovative behavior and farm viability. Bonding social capital (strong within-group ties) facilitates rapid knowledge diffusion, strengthens shared norms, and provides emotional support, making members more comfortable with internal innovation and collective risk-taking [42]. It reinforces the collective identity necessary for concerted innovation efforts. Bridging social capital (connections to external actors like researchers, suppliers, or other cooperatives) provides essential access to novel information, external resources, and diverse perspectives, crucial for introducing truly new ideas and maintaining competitiveness [43]. This infusion of external knowledge is vital for effective innovation adoption and adaptation. Lastly, linking social capital (ties to institutions and power structures) enables the cooperative to influence policy, secure funding, and gain legitimacy, significantly enhancing its capacity to innovate and create a more favorable environment for member farms' viability [44]. Ultimately, the robust networks and norms embedded within social capital reduce uncertainty, facilitate resource mobilization, and enhance collective efficacy, directly contributing to a cooperative's capacity for innovation and, consequently, the long-term viability of its member farms [45].

This conceptual framework of Figure 1 guides our investigation into how these interconnected factors contribute to farm viability and, finally, the sustainability of agricultural cooperatives.

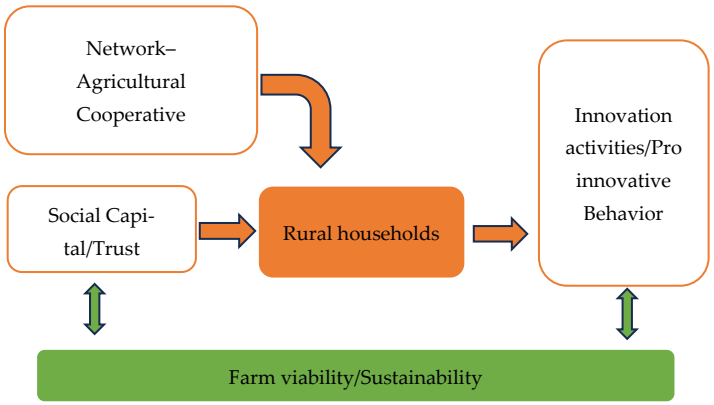


Figure 1. Conceptual framework of relationships between pro-innovative behavior, social capital/trust, and farm viability/sustainability. Source: based on [46,47], further developed by the authors.

3.1. Research Questions

Building upon this theoretical framework and addressing the identified research gaps, this study aims to answer the following specific research questions:

RQ1. *Is there an association between pro-innovative behavior, levels of trust, and economic farm viability among members of the United Winemaking Agricultural Cooperative of Samos?*

RQ2. *How do trust and economic farm viability influence members' pro-innovative behavior?*

RQ3. *How does the institutionalization of the cooperative affect these relationships?*

3.2. Paper Structure

The remainder of this paper is structured as follows: Section 4 outlines the analytical research approach, including the mixed-method research design, data collection procedures, and description of the case study. Section 5 presents the integrated quantitative and qualitative findings. Section 6 discusses these findings in relation to existing theory and offers practical implications for cooperatives and policymakers. Finally, Section 7 presents the conclusions of this study, highlights its limitations, and suggests avenues for future research.

4. Materials and Methods

4.1. Research Approach and Analysis

For the purposes of this study, we utilize (i) the [48] Domains of Creativity Scale (K-DOCS) which uses a self-report, behavior-based scale that measures everyday creativity. The scale proposed for our study, which provides a short self-report measure of general risk propensity, is (ii) the General Risk-Taking Propensity (GRiPS), representing a person's cross-situational tendency to engage in behaviors with a prospect of negative consequences such as loss, harm, or failure [49]. The authors introduce a new psychometric tool in the assessment of pro-innovative behavior: (iii) the Proactive Coping Inventory (PCI), which takes a multidimensional approach to coping [50]. The Proactive Coping Scale, consisting of 12 items, combines autonomous goal setting with self-regulatory goal attainment cognitions and behavior (see Table 1 below). Also, our research approach includes social capital in the form of trust: (i) generalized trust ("Most people can be trusted or you cannot be too careful"), (ii) particularized trust focusing on neighbors, family and friends, (iii) fairness

equity ("Most people are fair or try to take advantage of you"), and (iv) institutional trust concerning 6 organizations directly involved in the policy [51]: the National Government, Ministry of Rural Development and Food, United Winemaking Agricultural Cooperative of Samos, Directorate of Rural Economy and Veterinary of Samos (public authority), the local municipality authority, and the European Union. We also explore economic viability, number of family members in farming, years in farming, and earnings from the activities; and qualitative aspects: the types of innovation, formal social networks, the main occupation of the respondent, workers on the farm, satisfaction from farming, and farm profitability.

Table 1. Variables used in our analysis.

Aspects	Dimensions	Variables	Values
Innovation	Proposed types of innovation	Product innovation	1
		Process innovation	2
		Marketing innovation	3
		Organizational innovation	4
Pro-Innovative Behavior (PIB)	Kaufman's (2012) Domains of Creativity Scale (K-DOC) (Self-Everyday Creativity Subscale Only) [48]	Finding something fun to do when I have no money	1 = Much Less Creative 2 = Less Creative 3 = Neither More Nor Less Creative 4 = More Creative 5 = Much More Creative
		Helping other people cope with a difficult situation	
		Teaching someone how to do something	
		Maintaining a good balance between my work and my personal life	
		Understanding how to make myself happy	
		Being able to work through my personal problems in a healthy way	
		Thinking of new ways to help people	
		Choosing the best solution to a problem	
		Planning a trip or event with friends that meets everyone's needs	
		Mediating a dispute or argument between two friends	
		Getting people to feel relaxed and at ease	
	General Risk-Taking Propensity (GRiPS) [49]	Taking risks makes life more fun	1 = Strongly Disagree 2 = Disagree 3 = Neither Agree Nor Disagree 4 = Agree 5 = Strongly Agree
		My friends would say that I'm a risk taker	
		I enjoy taking risks in most aspects of my life	
		I would take a risk even if it meant I might get hurt	
		Taking risks is an important part of my life	
		I commonly make risky decisions	
		I am a believer of taking chances	
		I am attracted, rather than scared, by risk	
	Proactive Coping Inventory (PCI) [50]	I am a take charge person	1 = Not At All True 2 = Hardly True 3 = Moderately True 4 = Exactly True
		I try to let things work out on their own	
		After attaining a goal, I try to look for another more challenging one	
		I like challenges and beating the odds	
		I visualize my dreams and try to achieve them	
		Despite numerous setbacks, I normally succeed in getting what I want	
		I often see myself failing so I try not to get my hopes up too high	
		When I apply for a position, I imagine myself filling it	
		I turn obstacles into positive experiences	
		If someone tells me I can't do something, you will be sure that I will do it	
		When I experience a problem, I take the initiative in solving it	
		When I have a problem, I usually see myself in a no-win situation	

Table 1. *Cont.*

Aspects	Dimensions	Variables	Values
Trust (T)	Social trust (ST)	Most people can be trusted or you can't be too careful (generalized trust)	0–10 (low to high level)
		Most people can be trusted or you can't be too careful (particularized trust: neighbors, family, friends)	
		Most people are fair or try to take advantage of you (fairness-equity)	
	Institutional trust (IT)	National Government	0–10 (low to high level)
		Ministry of Rural Development and Food	
		United Winemaking Agricultural Cooperative of Samos	
		Directorate of Rural Economy and Veterinary of Samos	
		Municipality-Local authority	
		European Union	
	Formal Social networks (FSN)	Members of NGOs	0 = No 1 = Yes
		Voluntary work for NGOs	
Economic Viability (EV)	Main occupation	Farmer or something else (MO)	0 = No
			1 = Yes
	Employment	Workers on the farm (WF)	1 = you only 2 = you and family members 3 = you and seasonal workers 4 = employees
		Number of family members (FMs)	0 = 0 1 = 1–2 2 = 3–4 3 = >5
	Years in farming	(YF)	1 = Less than 3 years 2 = 3–5 years 3 = 6–10 years 4 = 11–20 years 5 = more than 20 years
	Satisfaction from farming	(SF)	1 = very dissatisfied 2 = dissatisfied 3 = neither satisfied nor dissatisfied 4 = satisfied 5 = very satisfied
	Earnings from the activities	Income from farming (I)	1 = <5000 2 = 5000–10,000 3 = 10,000–15,000 4 = 15,000–20,000 5 = 20,000–25,000 6 = >25,000
	Farm profitability	(FP)	0 = No 1 = No, but I can finance from income of other activity supplementary to farming 2 = Yes, from income of production and with grants and subsidies added 3 = Yes, from the income of production alone

Source: the authors (based on an international literature review).

The assumptions behind the rationale of this work are that there is a relationship between innovation, pro-innovative behavior, trust, and economic viability with respect to the members of networks of agricultural cooperatives. The methodology includes quantitative aspects of pro-innovative behavior: Domains of Creativity Scale with 11 items, General Risk-Taking Propensity with 9 items, and Proactive Coping Inventory with 12 items. All questions of social and institutional trust were measured on a 10-point Likert scale, with lower valuations revealing a lower level of trust. Lastly, participation in formal social networks was determined by asking respondents whether they were members of NGOs or had taken part in voluntary work for NGOs in the past 12 months (see Table 1).

This research was structured in five stages:

(i) A preliminary desk survey was carried out to collect general information on the case study network involving different actors related to it. The result is a database including contact details with key employees and members of the network.

(ii) For the research needs, a questionnaire was prepared, including both quantitative and qualitative items. The questionnaire comprised the following sections: (a) open-ended questions for innovation in their farms and in the cooperative; (b) personal/demographic data of the interviewee; and (c) social and economic aspects such as employment and income.

(iii) Actors from the preliminary desk survey, by using snowball sampling, were selected for an online survey with the use of a semi-structured questionnaire due to pandemic COVID-19 impacts to travel permissions.

(iv) Personal in-depth interviews were conducted with the producers and different actors of the network cooperative in order to collect mostly qualitative data to understand the relationship between the concepts of this study and the existing situation.

(v) Quantitative data were analyzed to measure innovation, trust and economic viability by selecting appropriate variables and indexes. The qualitative data were used and referred analytically in order to describe and justify the quantitative data.

For the aspects of types of innovation, pro-innovative behavior, trust, economic viability a number of dimensions and variables are used (Table 1).

Three composite indexes were calculated for pro-innovative behavior (PIB), trust (T) and economic viability (EV) with the following Formulae (1)–(3):

$$\mathrm{PIB} = \frac{\mathrm{average(K\text{-}DOC)} + \mathrm{averageGRiPS} + \mathrm{averagePCI}}{3} \quad (1)$$

where:

K-DOC: Kaufman's Domains of Creativity Scale;
GRiPS: General Risk-Taking Propensity;
PCI: Proactive Coping Inventory.

$$\mathrm{T} = \frac{\mathrm{averageST} * 0.1 + \mathrm{averageIT} * 0.1 + \mathrm{averageFSN}}{3} \quad (2)$$

where:

ST: social trust;
IT: institutional trust;
FSN: formal social networks.

$$\mathrm{EV} = \frac{\mathrm{MO} + \mathrm{WF} + \mathrm{FM} + \mathrm{YF} + \mathrm{SF} + \mathrm{I} + \mathrm{FP}}{7} \quad (3)$$

where:

MO: main occupation;
WF: workers on the farm;
FM: number of family members;
YF: years in farming;
SF: satisfaction from farming;
I: income from farming;
FP: farm profitability.

The statistical analysis was performed with the use of SPSS 26.0 software. Analysis of variance was used to identify statistically significant differences ($p < 0.05$) between the average

values of selected variables used in this analysis. In addition, Pearson's correlations ($p < 0.01$) for the values of the variables and indexes of our analysis were calculated (Table S1).

4.2. The Case Study Context

4.2.1. The Samos Island Viticultural Landscape

This study is a case study of a specific agricultural cooperative, the "United Winemaking Agricultural Cooperative of Samos (UWC SAMOS)", located on the Greek island of Samos. As part of the North Aegean Region, Samos has approximately 1400 hectares of cultivated vineyards, over 98% of which are planted with the white Samos Muscat grape variety (Muscat blanc à petits grains). While this variety is common across the Mediterranean and other parts of Greece, it is unique to Samos, where it produces the distinct, rich wines for which the island is internationally acclaimed. Samos is widely recognized as one of Greece's most famous wine-producing regions globally [52].

The island's unique terroir contributes to the quality of these wines, which are designated as Protected Designation of Origin (PDO) "SAMOS," one of Europe's oldest appellations. The vineyards are primarily located on the semi-mountainous and mountainous slopes of Mount Ampelos, at altitudes of up to 900 m. The vines, typically over 30 years old (with some exceeding 100 years), are cultivated in a non-irrigated, cup-shaped system. Many of these vineyards are situated on ancestral dry-stone terraces, built to prevent soil erosion and improve drainage. This combination of well-drained soil, a favorable microclimate, and the beneficial effect of the sea breeze allows the grapes to ripen slowly, developing the high sugar content and unique aromatic profile that define the variety.

4.2.2. The UWC SAMOS Cooperative

Founded in 1934 by local vine-growers, UWC SAMOS is one of Greece's oldest agricultural cooperatives, created to safeguard viticulture and secure producers' income. The cooperative currently includes 2200 members and manages one of the largest national wineries, with two facilities in Malagari and Karlovassi, and a total capacity of 20,000 tons (see Figure 2). UWC SAMOS is responsible for collecting the grapes, producing the wine, and marketing nearly the entire island's output, positioning Samos wine as a major international ambassador for Greek winemaking.

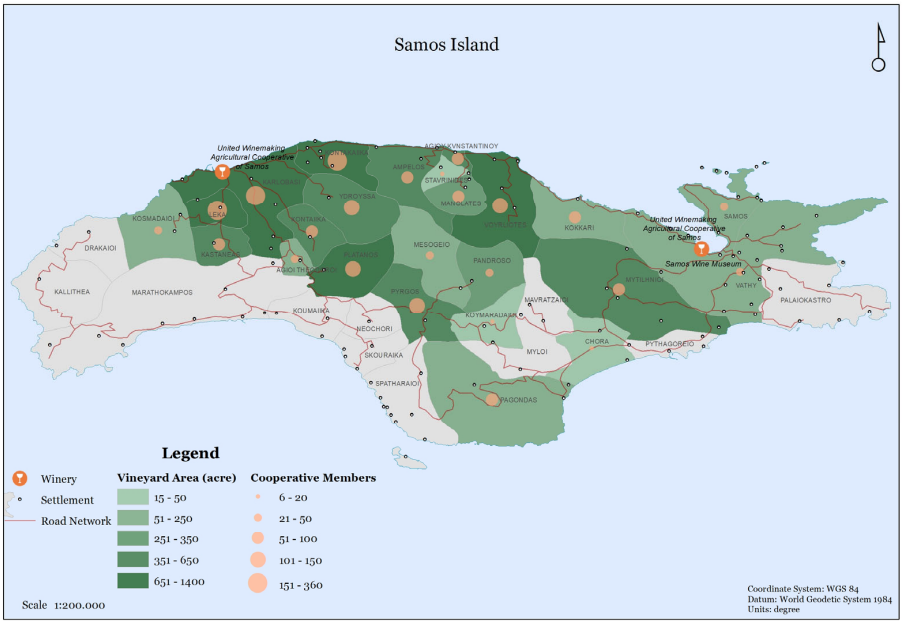


Figure 2. Cooperative members and vineyard area of Samos island.

The cooperative's history demonstrates how the collective action of vine-growers was a strategically important step for preserving their livelihood. For example, our research includes a depiction of the sun-dried grapes used to produce Samos Nectar, a wine aged for six years in oak barrels (see Figure 3). The wines have earned hundreds of international awards since their first distinction in 1937. According to its statute, UWC Samos is an autonomous, democratically governed association [53]. The members, who are all individual vine-growers, form the General Assembly, which is the supreme governing body responsible for electing the Board of Directors and the Supervisory Board [54].



Figure 3. Photo from the primary research at UWC SAMOS/sun-dried grapes (vin naturellement doux) producing Samos Nectar aged for 6 years in oak barrels.

Justification of the Case Study

This study's focus on the United Winemaking Agricultural Cooperative of Samos is a deliberate choice driven by the cooperative's distinctive characteristics, which make it an ideal context for this research. While the concepts of innovation, social capital, and trust are applicable across various organizations, their dynamics are uniquely shaped within a member-owned cooperative. First, member ownership and democratic governance fundamentally distinguish cooperatives from traditional firms. In this structure, pro-innovative behavior is not a result of a top–down management directive but is instead a product of collective action and voluntary engagement. The decision to adopt or reject innovations rests with the members themselves, making the roles of interpersonal trust among peers and institution-based trust in the cooperative's leadership especially critical. Our research investigates how these different types of trust facilitate or hinder the willingness of members to engage in the risk-taking and proactive behaviors essential for innovation. Second, a cooperative's model of shared risks and rewards creates a direct link between individual member actions and the collective economic outcome. This unique dynamic allows us to explore how a member's pro-innovative behavior directly impacts their own farm viability within the context of the larger group. Social capital, in this setting, is not just a resource; it is the very foundation that enables members to pool resources, share knowledge, and collectively respond to market challenges, thereby bolstering the long-term sustainability of the entire network. By studying these concepts within a cooperative framework, our research moves beyond a simple assessment of their presence. Instead, we analyze their functional roles and nuanced interrelationships, offering insights that cannot be fully captured in a traditional corporate setting. This approach provides a deeper understanding of the institutional mechanisms that drive innovation and sustainability in collective, member-driven organizations.

4.2.3. Research Context and Participant Selection

The research at UWC SAMOS was conducted from June to September 2021, during the high season of the harvest, to maximize respondent participation. The final sample included 86 participants, comprising cooperative members, employees, and key representatives of the Board of Directors. The selection of participants focused on individuals who were not only vine-growers but also had a role in rural development or farm-level innovation, ensuring a comprehensive perspective on the cooperative's dynamics. The high participation rate suggests a strong willingness among members to engage with this research.

5. Results

Based on the variables and indexes used in this study, the results for the measurement of the (a) types of innovation, (b) pro-innovative behavior (PIB), (c) trust (T), and, finally, (d) economic viability (EV) of the UWC SAMOS' members are presented in the sub-sections below according to the conceptual framework.

5.1. Types of Innovation

Most of the interviewees were not familiar with the concept of innovation and could not answer questions related to innovation (more than 50% of the sample). Nevertheless, a wide range of answers was recorded when they were asked to define what would be an innovation for their farms and for the cooperative in an open-ended question, which was consequently classified by the authors according to the innovation typology. In Table 2, examples of interviewees' responses and their categorization according to the typology in [13] are provided. The most important result concerns the differences in the types of innovations for the farm vs. the cooperative; more specifically, process innovation (Type 2) for the farm aggregates approximately half of the answers (50%), whereas cooperative marketing innovation (Type 3) and organization innovation (Type 4) sum up to 50% (see also Figure 4).

Table 2. Proposed innovations per type by respondents.

Types of Innovation	**For the Farm N (%)**	**For the Cooperative N (%)**	**Examples Referred**
1. Product innovation	8 (25%)	12 (32%)	• new products • new services (agritourism)
2. Process innovation	15 (47%)	7 (18%)	• new equipment • development of new applications related to information technology
3. Marketing innovation	3 (9%)	9 (24%)	• e-shop • direct selling • development of distribution network(s)
4. Organization innovation	6 (19%)	10 (26%)	• training for the members • sharing knowledge from various members and agronomists of the cooperative • broaden external relations
Total	32 (100%)	38 (100%)	

Source: field research.

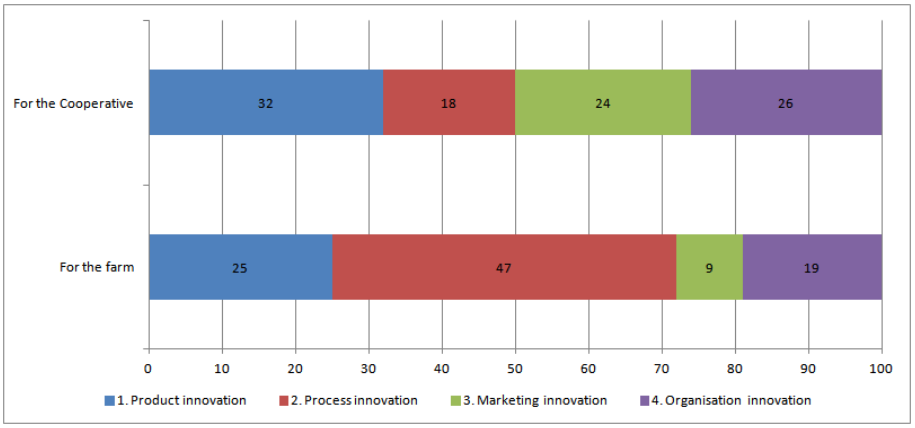


Figure 4. Proposed types of innovation for the cooperative and for the farm (% of total). Source: field research.

The low percentage of marketing innovation for their farm is, as they explained, due to the fact that they do not find it necessary as they sell their crop to the cooperative. It seems that their participation in such a collectivity, the cooperative, entails a lack of motivation for innovation in their farms; thus, a common comment on this innovation aspect was:

> "There is nothing new to do with the vineyard. It is a method that we have learned from our grandfathers."

On the other hand, the vine-growers consider wine tourism and by extent rural tourism as an important aspect of innovations pertaining the sustainability of their activity.

5.2. Pro-Innovative Behavior

For the measurement of pro-innovative behavior, three (3) factors of self-assessed behaviors were used. The results per factor are presented in Figures 5–7. As regards self-everyday creativity, more than 50% of the sample reported being highly creative and creative in all 11 items (see Figure 5). However, it is worth highlighting that self-estimation of creativity can be quite different from actual ability and it depends on how people view and report their own creativity.

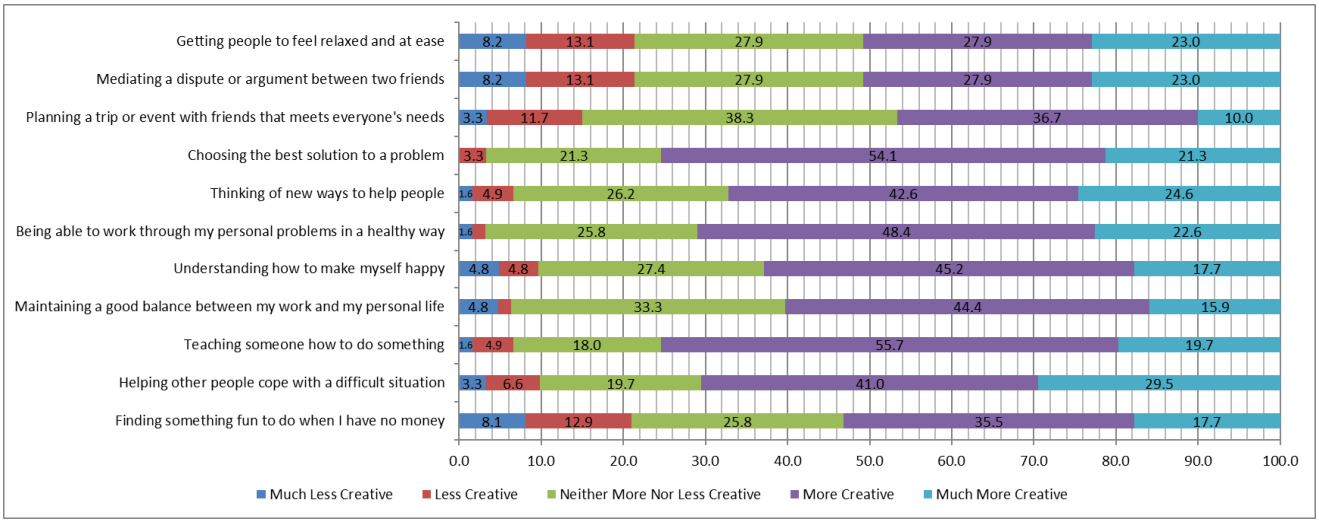


Figure 5. Kaufman's (2012) [48] Domains of Creativity Scale (K-DOC) (self-everyday creativity subscale only). Source: field research.

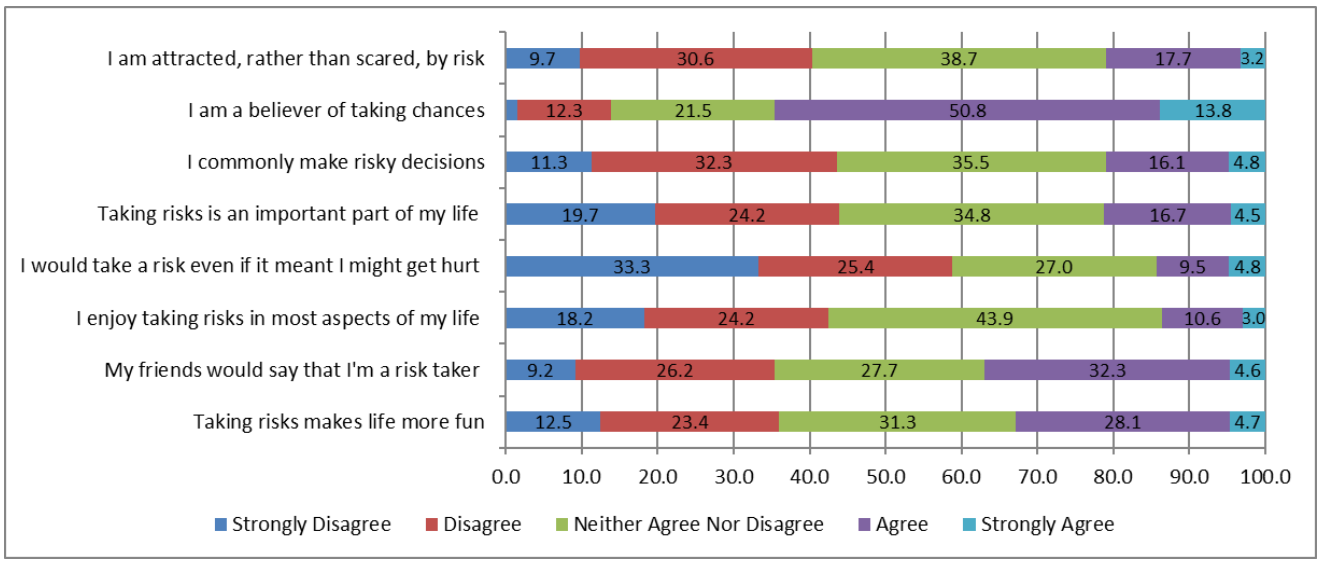


Figure 6. General Risk-Taking Propensity (GRiPS). Source: field research.

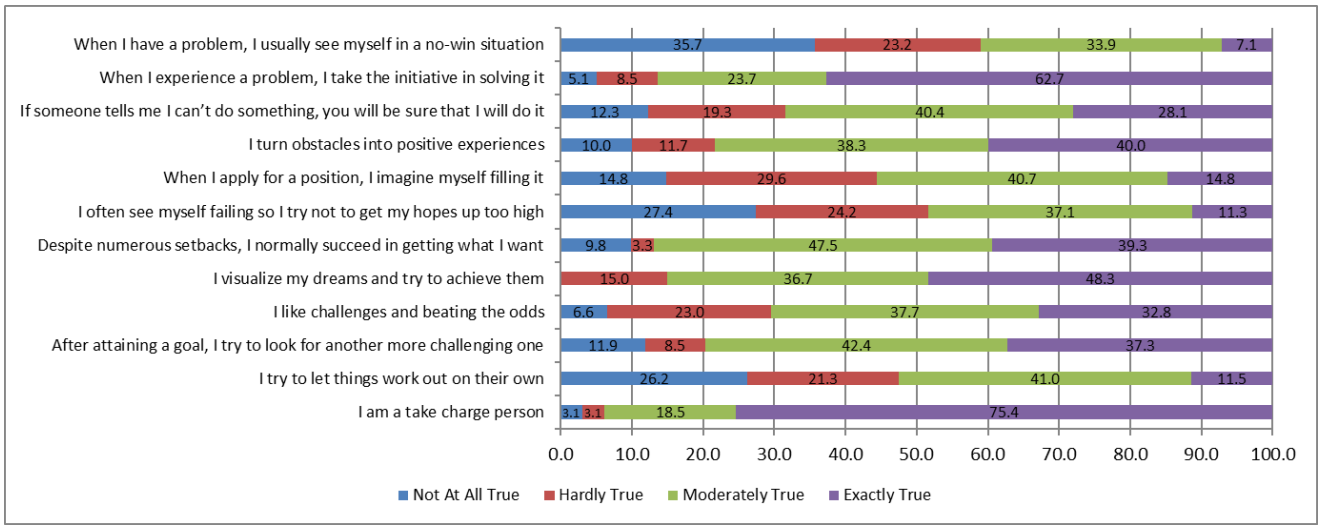


Figure 7. Proactive Coping Inventory (PCI). *Source:* field research.

As risk taking is identified as a characteristic closely linked to innovation in the present paper, we examined it through the measurement of the general risk propensity scale (GRiPS) and the results are shown in Figure 6. The overall mean of this variable (GRiPS) was 2.9 out of 5. It is important to refer that about 30% of the sample neither agreed nor disagreed with the examined items.

In addition, the responses made on a four-point scale (from 1 = not at all true to 4 = exactly true) for the Proactive Coping Inventory consisting of 12 items are depicted in Figure 7. The final composite score aggregates were, on average, 2.9 out of 4, which can be characterized as relatively high.

5.3. Trust

A composite score for social trust was created, utilizing the replies to all the questions in this category (Figure 8). Firstly, the dimension of generalized trust was explored through the question "Generally speaking, would you say that we can trust most people or should we always be cautious in our relations to other people?", yielding an average of 4.8 out of 10. Furthermore, the fairness equity was explored through the question "Do you think that

people would try to take advantage of you, if they had the chance, or would they try to be fair to you?", with its mean score being 4.5 out of 10.

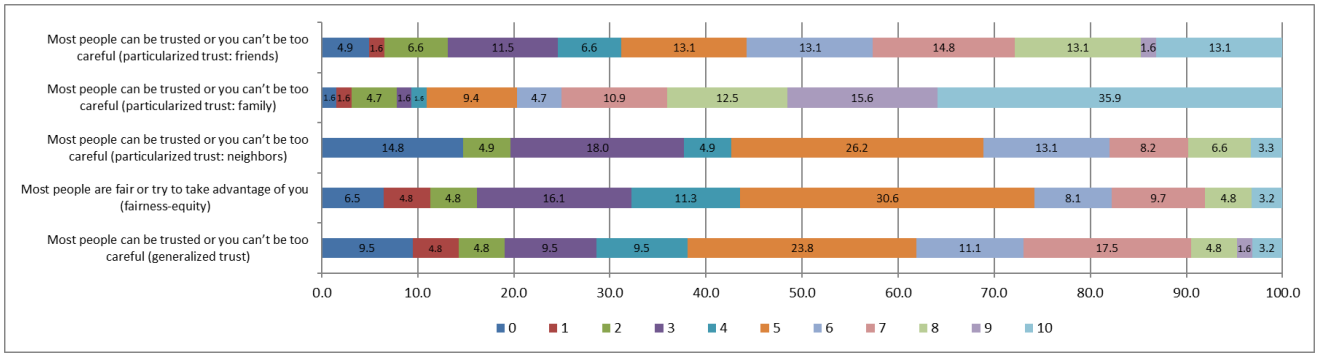


Figure 8. Social trust. Source: field research.

Analyzing the composite index of particularized trust in the neighbors, family and friends, it seems that family has the highest mean value (7.8) and neighbors the lowest (4.4); in between is the category "friends", scoring 5.8, where 0 means that "we always have to be cautious in our relations to other people" and 10 that "we can trust most people".

The level of trust in some particular institutions of the Greek society, such as the National Government, the Ministry of Rural Development and Food, the United Winemaking Agricultural Cooperative of Samos, the Directorate of Rural Economy and Veterinary of Samos, the local municipality authority and the European Union, is low. Trust in institutions is revealed by the composite score of institutional trust, the mean value of which for all six institutions amounts to 4.7 (on a 0–10 scale) (Figure 9).

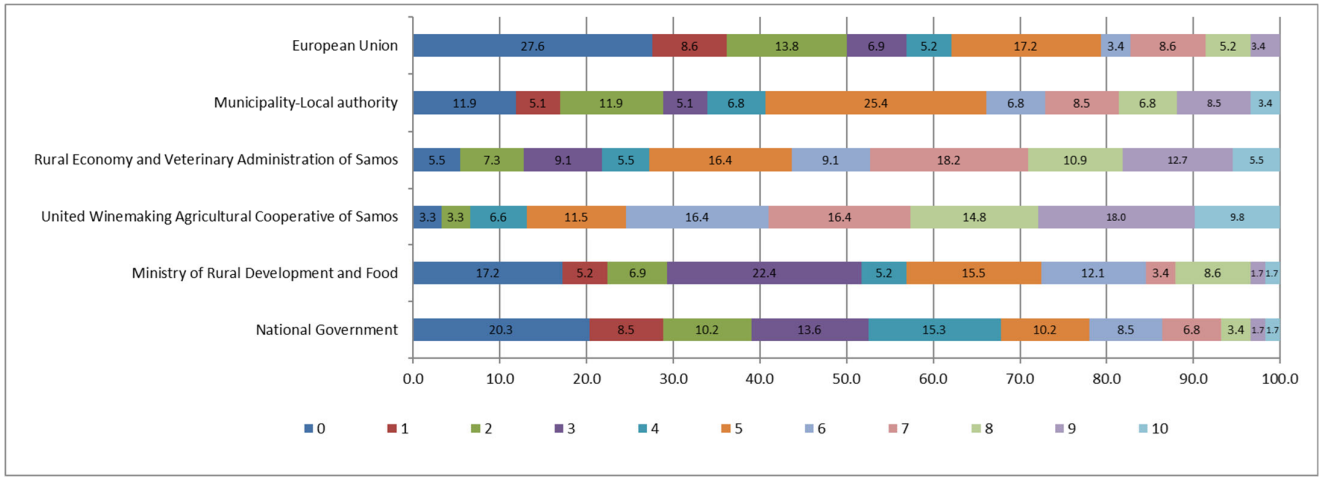


Figure 9. Institutional trust. Source: field research.

As, according to the international literature, participation in formal networks is at least one of the most important dimensions of social capital and it refers to the bridging social capital, we investigate it through the replies (yes or no) to the question "Please fill in if you have been a member or offered volunteer work during the last 12 months in an organization or association (e.g., cultural, related to sports, professional, environmental, political, women, youth)". The sample states that about 55% of the respondents have been a member of or offered volunteer work in the last 12 months in such organizations or associations.

5.4. Economic Viability

The economic viability variables, presented in Figure 10, reveal the following remarkable results:

- Only 40% of the sample stated "farmer" as their main occupation, with the remaining 60% also being engaged with other job(s), e.g., civil servant, pensioner, freelancer.
- Mainly the farmers themselves (26%) and their family (56%) work on their farm, while seasonal workers can be found only in the one fifth of the farms in the survey.
- More than 40% of the interviewees said that they worked in their farms with 1–2 to 3–4 family members.
- Around 60% began farming more than 10 years ago and another 20% started between 11 and 20 years ago.
- As regards satisfaction from farming, the respondents usually say that they are "satisfied" or "very satisfied" with their circumstances (60%), but it is rather important that 30% of the farmers are neither satisfied nor dissatisfied and another 10% are dissatisfied.
- A significant number of farms are not viable (52% of the sample has an income from agriculture od less than EUR 5000 and 29% has one between EUR 5000 and 10,000) but perhaps provide their owners with additional income in pluri-active farm households, as many of the interviewees are engaged in more than one job.
- Only 10% of the sample stated that their farm is profitable based on the income gained exclusively due to production. Most of the respondents (42%) indicated that they become profitable only if they take grants and subsidies into account, while 32% answered "no way" but they can finance their farming activity through other supplementary sources of income, and 16% claimed that their farm is clearly making a loss, which is confirmed from the answers related to income from farming.

A more detailed view of analysis of variance is also taken (see Table 3) in order to identify statistically significant differences ($p < 0.05$) between the average values of selected variables used in this analysis; gender, age group, education level and main occupation, indicate that these significant differences are few, being only identified between the variables main occupation and economic viability index.

Table 3. Descriptive statistics and average values per selected variables of the analysis*.

Variables	Values	N Total	%	Pro-Innovative Behavior (PIB)	Trust (T)	Economic Viability (EV)
Gender (N = 86)	Male	66	66	3.06	1.42	2.30
	Female	20	20	3.26	1.57	2.37
	Total	86	86	3.11	1.46	2.32
Age (N = 86)	18–30	0	0			
	31–45	28	28	3.20	1.52	2.22
	46–60	44	44	3.00	1.41	2.32
	More than 60	14	14	3.25	1.49	2.52
	Total	86	86	3.11	1.46	2.32
Education (N = 86)	Primary education	9	13	3.11	1.09	2.43
	Secondary education	21	24.4	3.09	1.47	2.28
	Post-secondary non-tertiary education	34	39.5	3.06	1.63	2.38
	Short-cycle tertiary education	13	15.1	3.18	1.54	2.00
	Bachelor's or equivalent level	15	17.4	3.22	1.33	2.39
	Master's or equivalent level	3	3.5	3.51	1.93	1.75
	Total	86	100.0	3.13	1.47	2.30

Table 3. *Cont.*

Variables	Values	N Total	%	Pro-Innovative Behavior (PIB)	Trust (T)	Economic Viability (EV)
Main occupation (N = 86)	Farmer	34	39.5	3.11	1.32	2.53 *
	Other	52	60.5	3.17	1.45	2.15 *
	Total	86	100.0	3.13	1.40	2.30 *

Source: field research. * (with gray color): statistically significant differences (analysis of variance $p < 0.05$) between values.

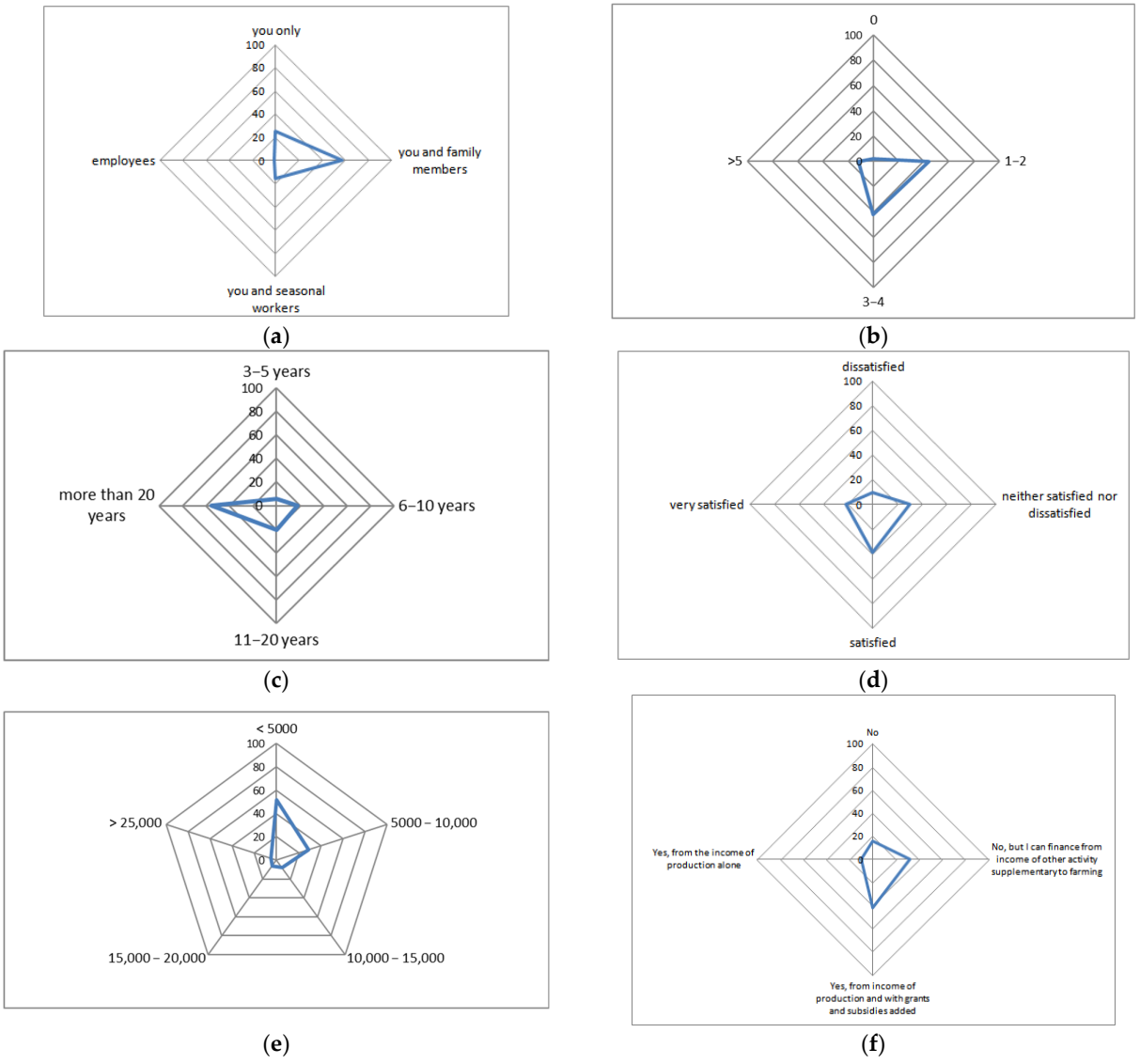


Figure 10. Economic viability variables (%). Source: field research. (**a**) Workers on the farm. (**b**) Number of family members. (**c**) Years in farming. (**d**) Satisfaction from farming. (**e**) Income from farming. (**f**) Farm profitability.

Female respondents (23% compared to 77% males in the sample) show better results compared to men in all the created composite indexes of our study. Furthermore, surprisingly, the respondents of our sample who are more than 60 years old have the highest values in the composite indexes of pro-innovative behavior and economic viability and a relatively high value in the social capital index. Perhaps these results relate to the time spent on and satisfaction that elder/experienced farmers obtain from agricultural activities. The largest age group, 46–60, has similar results but slightly lower in all composite indexes.

Considering the educational level of the interviewees, the proportion with a Master's or an equivalent level has the highest results in the pro-innovative behavior index and trust but not in economic viability. Perhaps the proportion of the sample falling into this category is extremely small, with all respondents stating other jobs as their main occupation.

Regarding Pearson's correlations ($p < 0.01$) that were calculated for the values of the variables and indexes of our analysis (Table S1), no statistically significant correlation is observed.

6. Discussion

In this paper, we examine innovation, pro-innovative behavior, which comprises the dimensions of creativity, risk-taking, and proactive personality, following a survey conducted in five European countries [55], trust and economic viability with regard to the members of a network of an agricultural cooperative based on the development of variables and indexes to measure such aspects and their interconnections.

Research on creativity, closely linked to innovation, indicates that people do not necessarily have a sharp self-insight into their own creativity [48]. People may have a high opinion of themselves because they are creative or because they have unusually high levels of self-esteem (or narcissism; see [56]). The General Risk-Taking Propensity scale (GRiPS) in [49] estimated a mean of 2.93, which is similar with our case study ($2.87 \approx 2.9$). Based on their findings, the aforementioned authors suggest that risk takers may be successful in specific domains where risk taking is required or encouraged, such as entrepreneurship.

In a similar vein, the results of our research for innovation and trust are in line with the recent work of [57] empirically testing the impact of social capital on innovation in the 13 regions of Greece (NUTS II level with data based on secondary sources). More specifically, the composite index for generalized trust has approximately the same value, i.e., 4.17 on average in the North Aegean region and 4.78 in our sample from UWC SAMOS, even though slightly different variables were used for the composite index. Also, according to [57], the region of North Aegean recorded the highest trust in institutions (Parliament, Judicial System, Police, Politician and the Political Parties) among the thirteen regions of Greece, which is quite low (mean value 3.89) compared to the UWS SAMOS' members, recording, on average, 4.73. It seems that, in our case, the replies for the trust in the three local institutions, United Winemaking Agricultural Cooperative of Samos, Directorate of Rural Economy and Veterinary of Samos, and local municipality authority (6.8, 5.8 and 4.6, respectively), affected the mean score. However, the basic hypothesis that social capital has a positive relationship with innovation has not been confirmed, in contrast with that reported in [57]. In addition, although [58,59] found that the relational dimension of internal social capital has a direct impact on employees' innovative behavior, our analysis did not confirm it with reference to the farmers and members of the cooperative. This is perhaps due to the "institutionalized members of the cooperative", or, as [60] (p. 342) described it (and later used by [61]), the "frames of meaning" existing in the minds of people, and in the social networks of which they are part "are under contestation and unstable. . .but influences how they speak and act."

The demographic characteristics of the sample (gender, age group, educational level and main occupation) were correlated per composite index produced in this study, revealing, as in [5] (p. 19),

> "One of the most distinctive problems in the diffusion of innovations is that the participants are usually quite heterophilous. . . usually on different variables knowledge and experience with an innovation, highly related to social status, education and the like".

To sum up, the respondents who are over 60 years old have the highest value in the composite indexes of pro-innovative behavior and farm viability and a relatively high value in the trust index, possibly related to the time spent on and satisfaction that elder/experienced farmers obtain from agricultural activities. Regarding the educational level of the interviewees, holding an MSc or equivalent level degree has the strongest influence on the pro-innovative behavior index and trust but not on economic viability. This probably owes to the fact that all of them state that their main occupation is outside agriculture.

Furthermore, in this study, the farmers are not only aging but also do not possess advanced digital skills. They self-estimated their skills as average (in line with the research of [62] in rural micro-enterprises), with the skills of senior/elder/experienced farmers being "none or low" (in line with findings concerning farmers in South-Eastern European countries [63]).

All these are major challenges for smallholder farmers result in their low innovation levels, with factors such as low access to technology and asymmetry in information flows. Many of the interviewees complained that:

"It is not the same for an island region to sell a product like a sweet wine".

It seems that peripheral regions are regarded as less innovative because of their lack of human capital and innovation attitudes. This is exactly what [64] (p. 1208) refers to:

> "Important drivers of innovation are absent because of their "organizational thinness" and lack of dynamic clusters and support organizations and because of their distance to other regions and external knowledge".

The results of innovation views from the respondents are in line with the research [65] in rural Greece exploring innovation support and discussing bottom–up innovative initiatives throughout the spiral of innovations, also underlining the extremely weak and fragmented nature of the Greek Agricultural Knowledge and Innovation System, which seems to be rather unique in the European Union (for more details, see also [66]). Also, in our case study, there is the human problem of managing attention, which is pointed out in [14] (p. 592), because the members of the cooperative are largely encouraged to focus on, harvest, and protect existing practices (as farmers expressed about the history of their vineyards) rather than to pay attention to developing new ideas. The more successful an organization (here, a cooperative) is, the more difficult it is to trigger people's action thresholds to pay attention to new ideas, needs, and opportunities. Consequently, the operation of the cooperative significantly determines the behavior of its members regarding innovation.

> "They can see the world only through the eyes of the cooperative as they could not imagine themselves out of it".

This is also what the authors [67] (p. 123) underline in their study on the relationship of social capital and innovation with the use of secondary data across different countries: that tight-knit groups may impose significant constraints on the members of local communities that inhibit these members' attempts to join larger, more extensive, and perhaps more innovative networks. This is perhaps what [68] characterizes as the "dark side" of social capital, which often originates from a limited geographical area, which is sometimes a neighborhood, or a city. To a great extent, social capital can be argued to be spatially sticky. Ideas and resources for community development and sustainability are readily available but finding them requires openness to innovation, an enquiring mind, and a willingness on behalf of the individuals and communities to challenge the status quo [69]. This is exactly the problem [15] refers to as the relationship between the role of the cooperative farm as an institution or group organization in the promotion of innovations and the role

of individual initiative, which is dependent on carrying cooperative democracy into effect, which, however, is not always observed. As regards [70], the dimensions of actors and knowledge and forms of viability were recognized as the most relevant.

Overall, the findings reveal a more complex relationship between the examined terms of innovation, pro-innovative behavior and economic viability towards sustainability that cannot in general be analyzed only quantitatively. Information from the qualitative methods give, in the case of the Samos cooperative, the explanation for the weak innovation and low level of social capital (as we measure them) in the "institutionalized members of the cooperative", underlying the importance of mixed-method approaches in explaining the relationship between these terms. We found many similar views among the respondents, but no significant differences in their characteristics. It seems that the cooperative acts indeed as a way of life for them and plays an important role as an institution in the economic and social life of Samos island, which means that it achieves its role as this is the idea behind cooperatives. We can parallel our findings with those of [18], which underlines that success depends on factors such as attitudes towards each other, the wider business environment, mutual assistance, and co-operation, while a lack of trust and social cohesion have adverse effects (similar to the findings of [71]).

7. Conclusions

Based initially on individual indicators—dimensions of innovation, trust (generalized trust, trust in institutions, participation in formal networks) and economic viability, this piece of work attempted their assessment at the level of a cooperative. Following, the hypothesis of a positive relation between each dimension of pro-innovative behavior, trust and economic viability was examined as well. The difficulty in statistically documenting a relationship between the individual dimensions of the examined aspects is possibly due to the number of observations, the lack of an adequate basis of time series data (not just for one year), the conditions that referred to the cooperative, and the low innovation recorded from the respondents (farmers), but also the emerging significance of other factors related to the ability to create innovation, which are very different from one case to another, and from one region to the other.

This study makes a significant contribution to the field by providing new and innovative tools for analyzing the roles of network participants as agents of knowledge and innovation. As ref. [64] contends, the analysis of innovation barriers reveals that no single "best practice" for innovation and sustainability is universally applicable. Instead, a tailored policy approach is essential to address the unique challenges and opportunities of each specific case. The scale of measurement and the level of analysis are of critical importance and can have significant influence on the diagnosis [72]. As ref. [73] (p. 95) underlines, sustainability is a global concept, and a farm is only a small subsystem that interacts in various ways with the surrounding systems. Policies at higher levels (such as national) are increasingly affecting the lower levels (such as farm). Also, it is necessary to understand that the effect of policies depends on exogenous factors, beyond the control of farmers, such as the climatic and topographic characteristics of their location, or the stage of the farm within its life cycle [74]. The selection of variables and indicators should apply to all case studies, and it should be considered whether they need to be adapted to each case study (country, context, type of farming). Shifting the target towards actors and forms of their representation, including networks of agricultural cooperatives, may represent cases of innovation activities with a considerably higher impact in the rural area [75].

Ref. [76] highlights three aspects considered key to understanding the entire system of innovation for sustainable rural development based on family farming: (i) local knowledge and experience (mostly of specific territories and experiences that are difficult to replicate

elsewhere), (ii) diversity of family farming (due to territorial links in a specific cultural and environmental context, and involvement in multiple sources of income, not only agricultural), and (iii) organization and participation of family farming. If rural actors do not have the capacity to organize their influence on the social, economic and political processes that affect them, this tends to negatively influence the dynamics of innovation aimed at sustainable rural development. Especially of note, cooperatives have a greater capacity to exert influence on the processes of innovation and facilitate participatory processes.

The methodological tools developed in this study can directly support decision-making for the effective management of cooperative networks. This analysis enhances our understanding of how to measure pro-innovative behavior, trust, and farm viability, and clarifies their roles within these networks. The results enable the formulation of targeted policy recommendations to increase trust and cooperation among network members and to improve farm viability for rural households through the creation of new agricultural and non-agricultural products and services. The insights gained will open up new scientific avenues and provide actionable strategies for disseminating information, knowledge, and innovation to researchers, policymakers, and the public. Additionally, while the current study did not employ specific network analysis methods, we recognize the significant potential for such approaches. We believe that future studies employing network methods could provide a deeper understanding of the dynamic relationships and underlying structures influencing innovation and social capital within agricultural cooperatives, serving as a compelling avenue for future research.

Supplementary Materials: The following are available online at: https://www.mdpi.com/article/10.3390/agriculture15181921/s1, Table S1: Pearson's correlation matrices for the case study.

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Institutional Review Board Statement: According to the Regulation of Principles and Operations of the Ethics and Research Integrity Committee of Aristotle University of Thessaloniki (published in July 2020: https://websites.auth.gr/ehde/wp-content/uploads/sites/65/2024/05/Regulation-EHDE-en.pdf, accessed on 14 June 2025), which was drafted in accordance with the provisions of Law 4485/2017, article 68, and Law 4521/2018, articles 21–27, the mandatory submission for evaluation by the Committee applies in the case of funded research projects. However, we confirm that all procedures performed in this study followed the guidelines Declaration of Helsinki. Any measure for personal data protection was also taken according to DPO instructions.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Dataset available on request from the corresponding author.

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