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Identification of Farmers' Barriers to Implement Sustainable Management Practices in Olive Groves

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Abstract: Current European agriculture policies and strategies are aimed to boost the transition from the predominant conventional to a more environmentally friendly agriculture model. As part of this, it is crucial to identify the barriers that exist to implementing crop-specific management practices so that appropriate mitigating steps to overcome these can be executed. Participatory action research, where farmers are research actors rather than objects, is essential to identify the main barriers farmers have to face. The objective of this study was to identify the main barriers to the adoption of a combination of sustainable management practices in olive cropping in Southern Spain. A 20-item questionnaire was designed and responded to by 200 Spanish olive farmers. Exploratory and confirmatory factor analyses were used to assess the factor structure. The final best fit model included 14 items that were grouped in the following four barriers or facilitators: "lack of training/formation", and "lack of economic/policy support" as barriers; "wellbeing–nature connection" and "environmental impact awareness" as facilitators. The mean scores on the different factors were higher than the theoretical mean, so the identification of the two barriers and the two facilitators for implementing sustainable practices was robust. Farmers, especially women, are concerned about their knowledge limitation in implementing sustainable management practices, which opens a window of opportunity for specific actions (i.e., training and demonstrative events) to be taken for accomplishing the agriculture sector transformation.

Keywords: olive grove; barriers; sustainability; questionnaire; training

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1. Introduction

Agriculture is a core human activity that is inextricably linked to natural processes such as soil fertility, water recycling, and pollination, and both nature and agriculture are progressively being harmed by the negative effects of climate change [1]. Additionally, unsustainable agriculture is a big threat to biodiversity, has a detrimental impact on the quality of soil and water, and contributes significantly to climate change [2].

Technological innovations have led to the specialisation of farmers to a limited number of products while supplies, processing and marketing were delegated to cooperatives or industry and retail. While this has been successful in ensuring food security in Europe, it has been accompanied by a series of environmental and social downsides. Indeed, unsustainable agricultural practices and land use have boosted negative impacts on the environment and the preservation of natural resources (soil, water and air) and are the cause of habitat fragmentation and biodiversity loss [3].

Currently, there is a growing consensus among researchers, farmers, policy makers and society in general that farming systems, which are increasingly perceived as unsustainable from an environmental (biodiversity, depletion of natural resources), economic (costly), social (impact on farmers and society) and a climate impact point of view, need to be re-designed, mainly through: (i) diversification, to become more resilient against climate change and stresses, (ii) better adaptation to local conditions, and (iii) reduced reliance on the use of external inputs [4].

The EU, not oblivious to the need to promote alternative agricultural models, has initiated different strategies to boost alternative agricultural production systems at farm and landscape scales. As an example, the Farm to Fork and Biodiversity 2030 strategies have paved the way for a fair, healthy and environmentally-friendly food system that contributes to protecting nature and reversing ecosystem degradation [5]. These strategies recognise the imperative need to reduce dependency on plant protection products, reduce excess fertilisation, increase ecological based farming, improve animal welfare, and reverse biodiversity loss.

Sustainable cropping and farming system aims to substitute the use of external inputs by the delivery of ecosystem services that are provided through targeted use of agro-biodiversity across different levels (genetic, species and habitat) and scales (field, farm, landscape), which is lacking in specialised agriculture [6]. As the farming sector in the EU is today quite specialised, re-diversifying or adopting agricultural practices that are inspired by knowledge-intensive and ecological processes represents a major change [7]. This shift requires the development of technical solutions that are customised to farmers' needs in local contexts, but at the same time economically, technically and socially viable.

Sustainable cropping systems are well aligned with one of the six transformations necessary for achieving the Sustainable Development Goals (SDGs) and the objectives of the Paris Agreement [8], which aimed to achieve sustainable food (land water and oceans) and more efficient and resilient agricultural systems [9], by using a combination of agricultural practices that better protect biodiversity and ecosystems and ensure food chain supply.

SUSTAINOLIVE project aims to enhance the sustainability of the olive oil farming sector through the implementation and promotion of a set of innovative sustainable management solutions that are based on agro-ecological concepts and on the exchange and co-creation of knowledge involving multiple actors and end-users of the olive oil sector. Improving the sustainability of these Mediterranean agro-ecosystems needs to foster the implementation of sustainable technological solutions (STSs).

There are constraints to climate change adaptation due to insufficient funding, inadequate technological know-how, institutional capacity and lack of understanding of climate change issues [10,11]. These problems require the development of systems thinking to reach solutions, and the challenge lies in finding specific tools that help us understand complexity, design better policies, facilitate individual and organizational learning, and catalyse personal changes necessary to create a sustainable society [12]. In order to foster STSs implementation, an adequate participatory framework is essential to understand the main barriers to the STSs implementation by farmers, which require: (i) the identification of the main constraints and/or the potential facilitators and (ii) the design of specific strategies to overcome these constraints or barriers.

Several studies have pointed out different obstacles to adopting new and best agriculture practices, such as the high cost of the implementation, the farmers' attitude and social norms and peer pressure, among others [13–15]. Farmers' reluctance to implement a combination of new and novel agriculture practices could emerge from many different reasons of economic, social and political nature. These barriers prevent a change in farmers' behaviour and can be overcome by key facilitators [16]. In order to achieve an agro-ecological transition in the agriculture sector, specific actions need to be taken to improve farmers' willingness. For this, it is necessary to design actions based on evidence to overcome the barriers and create bridges that accelerate the transformation.

The olive tree (*Olea europaea* L.) has been grown in the Mediterranean region for centuries. Olive farming is relevant at socioeconomic and cultural levels in many of the producer countries', avoiding rural depopulation and influencing natural rural landscapes [17]. Spain is the highest olive oil producer worldwide, accounting for nearly 43% of the total olive oil world production. The Andalusian region (Southern Spain) accounts for about 1.5 million hectares and about 80% of Spanish production [18].

Traditional olive orchards were identified as diverse agro-ecosystems. However, the agriculture intensification process since the 80′s led to the development of vast monoculture areas, which brings an unsustainable crop not only from the socioeconomic dimension (profit reduction) but the environmental (erosion, water pollution and biodiversity losses), too [19]. However, there has been progress in the knowledge of different sustainable agricultural practices and in their effectiveness (among others: [20,21], farmers have not been able to embrace them massively.

The objective of this study was to identify the main barriers to the adoption of a combination of sustainable management practices in olive cropping.

2. Materials and Methods

2.1. Literature Searching

The use of bibliographic reviews and articles is the primary and common strategy to identify obstacles that farmers encounter when they intend to modify their regular agricultural practices (Figure 1). Masud et al. [22] revealed that the likelihood of farmers' adaptation practices implementation increased with farm experience, education, and income level, being the most significant factors. However, these authors also found that farmers identified several barriers, such as high cost of farm inputs, unpredictable weather, insufficient water resources, uncertainties of weather information, inadequate agricultural extension officers, and the absence of credit facilities and agricultural subsidies.

Liebman et al. [23], in an extensive review aimed to find the rationale on the deviations of the business-as-usual management practices on the recommended GAP (Good Agricultural Practice), identified the following constraints:

(i) Inadequate policy instruments to selectively reward particular growing practices or discourage others; (ii) insufficient commercial incentives to encourage changes in cultivation practice; (iii) a shortage of extension facilities for training farmers in GAP and enabling them to make informed decisions on cultivation measures.

Concerning olive groves, Aznar-Sánchez et al. [15] found seven main barriers (lack of information, costs, risk aversion, characteristics of the farm and sustainable practices, macro factors, and cultural barriers) and five facilitators (technology, farmer training, environmental awareness, incentives, and social pressure) for the adoption of sustainable soil management practices. Further, most of the farmers perceived the likely effect on farm profitability as a barrier to implementing sustainable practices [24].

Moreover, there is growing evidence that environmentally significant actions increase with affective attachments to and identification with nature and place (nature relational value) [25]. Thus, any endeavour to move to sustainable agriculture methods should consider the farmer's relationship with nature and their environmental awareness [26].

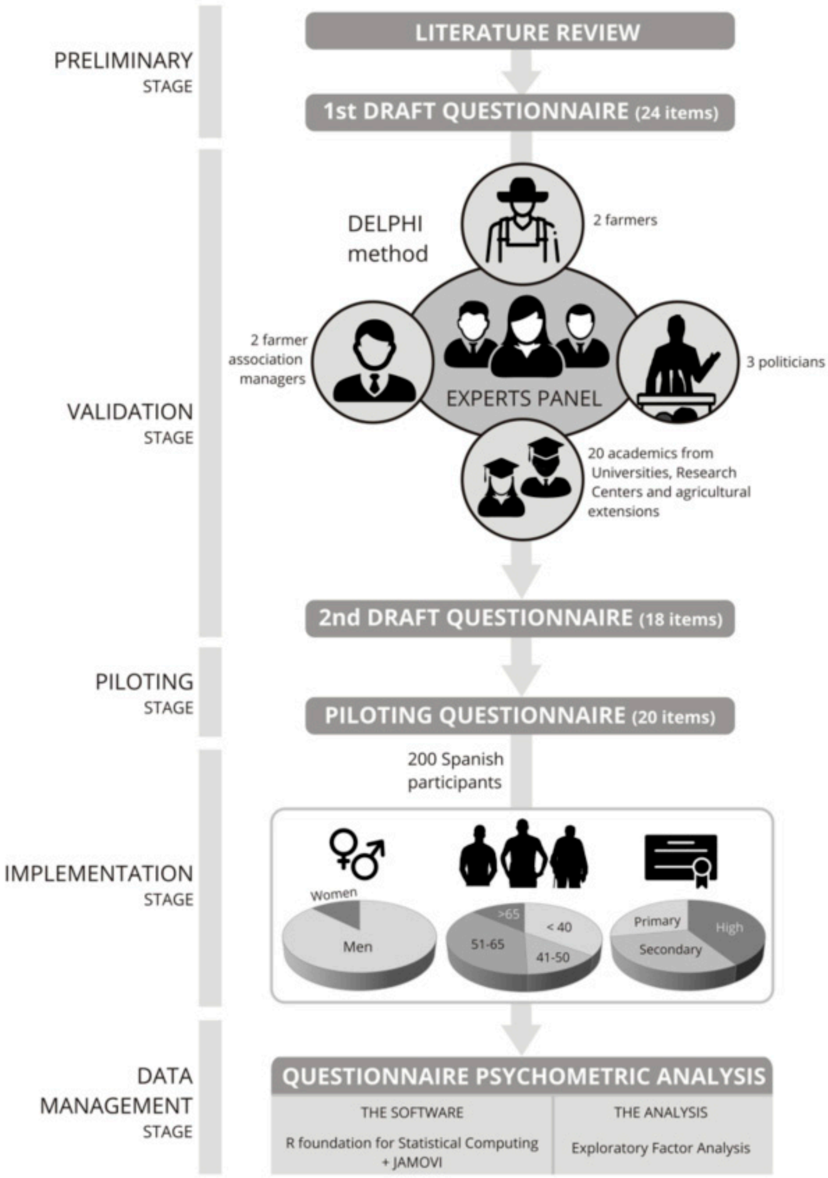

Figure 1. Schematic summary of the methodology used (Source: own elaboration).

2.2. Expert Panel for Pre-Filtering the Questionnaire

A panel of experts (Delphi) was set up in order to obtain qualitative information essential for the detection of barriers such as lack of information and training, detachment between wellbeing and ecosystem services, insufficient financing, social rejection towards the environmental movement, economic obstacles, and policy obstacles. This panel consisted of 27 experts with different expertise and skills in the olive oil sector and included 2 farmers, 2 farmer associations managers, 3 politicians, 20 academics from Universities, Research Centres and agricultural extensions, and people without higher education degrees to check for clarity and ease of understanding, of Spain, Portugal, Italy, Greece, Tunisia and Morocco, which altogether account for 77.6% of the olive oil production worldwide [27]. The initial questionnaire had 24 items. This pool of items was administered to the expert panel for their consideration. Each item was scored based on its relevance and understanding (clarity). Items that were similar to other items, not relevant, ambiguous or rarely endorsed were excluded from the items pool. When items used different words to refer to the same barrier, just one item was selected, or the items were rephrased into a single new item. In addition, the expert panel then added items not yet covered that were known to be important for the implementation of combination of sustainable management practices.

Open boxes were available to facilitate the inclusion of new items raised by experts. Those items that have been marked as relevant and were sufficiently clear by at least 70% of the experts were kept. We kept the wording of the item as long as it was classified as clear by at least 70% of the experts. The experts' feedback was used to delete, add and rephrase items to create the questionnaire for piloting.

2.3. Questionnaire Piloting

A new questionnaire was generated with 18 items. A piloting and validation process was conducted between February and March 2020. The results of the pilot process contributed to improvements in the design of the questionnaire by equilibrating the items distribution among initially selected dimensions and writing the items in the same way (affirmative statements). The questionnaire included 20 items covering four initial dimensions (policy obstacles or impediments, lack of training, wellbeing-sustainability connection, and environmental awareness) (Appendix A).

2.4. Questionnaire Implementation

Data collection took place between March to September 2021 during face-to-face meetings. Data were tabulated and coded for statistical analysis. The Likert scale was coded as: Strongly disagree = 1; Partially disagree = 2; Partially agree = 3; Strongly agree = 4. The 4-point Likert rating scale was applied because of; (i) the expected lower cognitive demand for participants with different degrees of formal education when completing the surveys and (ii) the lack of differences in the psychometric properties of the scales using 4, 5 or 6 categories [28]. In the descriptive analysis, the means and standard deviations, or median and interquartile ranges for ordinal and quantitative variables, and the frequencies and percentages for categorical variables were calculated.

The total sample consisted of 309 participants, splitted into 200 (64.7%) participants from Spain, 69 (22.3%) from Greece, 20 (6.5%) from Portugal, 10 (3.2%) from Italy, and 10 (3.2%) from Morocco. Most of the participants were male (n = 260, 84.1%). A total of 37.9% (n = 117) were under 40 years old, followed by 30.4% (n = 94) between 51 and 65 years old, 22.3% (n = 69) between 41 and 50 and 9.4% (n = 29) over 65. Considering the educational level, 112 participants (41.7%) had reached higher education, followed by 112 (36.2%) with secondary education and 68 with primary education (22.1%).

2.5. Spanish Sample Descriptive

Due to low sample size stemming from some of the participating countries, the sample for this study was limited to the 200 participants from Spain. The sample size was consistent with the recommended sample size when conducting CFA [29] and was higher than the minimum sample size required by the number of items in the questionaries [30]. The participants that answered the questionnaires came from different provinces, mainly from the southeast (Figure 2). Most of the participants were male (n = 175, 87.50%). A total of 37% (n = 74) was between 51 and 65 years old, followed by 35.5% (n = 71) under 40 years old, 14% (n = 28) between 41 and 50 and finally 13.5% (n = 27) over 65. Educational level for 82 participants (41%) was higher education, followed by 62 (31%) with secondary education and 56 with primary education (28%).

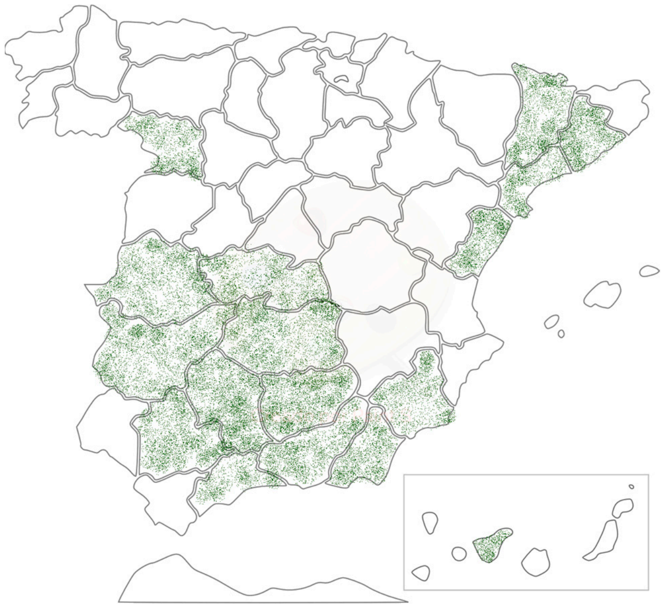

Figure 2. Coloured areas represent the Spanish provinces from which the questionnaire participants come (Source: own elaboration).

2.6. Data Analysis

All calculations were performed using algorithms of the metaphor package embedded in R (R Foundations for Statistical Computing, Vienna, Austria) as well as the software JAMOVI (https://www.jamovi.org (accessed on 22 May 2022). According to recommended best practices by [31], we used exploratory factor analysis (EFA) on the entire dataset to assess the factor structure of the study data. An EFA was performed on the entire dataset and for the 20 questions using parallel analysis. Scree plot, using the Promax oblique rotation (estimation model: Minimum residual) for factor extraction, was applied.

Factor cross-loadings lower than 0.32 or a cross-loading with less than a 0.15 difference between their primary and secondary factors were eliminated [31]. With the use of these criteria, problematic items were gradually eliminated until EFA resulted in a satisfactory factor structure. Goodness of fit was tested using the Non-Normed Fit Index (NNFI, also called the Tucker–Lewis Index), with values above 0.90 considered acceptable. Residual statistics were tested using the root mean square error of approximation (RMSEA), with values less than 0.08 considered acceptable.

Internal consistency was assessed by calculating Omega McDonald's indexes, with a score of 0.7 or higher being considered satisfactory [31]. The effect sizes were interpreted using the criteria of Cohen [32]: small (less than 0.49), medium (0.50–0.79) and large (greater or equal to 0.80).

Confirmatory factor analysis (CFA) was used to test whether measure of barriers to implementing sustainable practices were consistent with a researcher's understanding of the nature of that construct [33] based on the findings in the EFA. CFA was carried out using the method of diagonally weighted least squares (DWLS) using a polychoric correlation matrix because data were ordinal (1–4). We reported the following indices: chi-square (χ^2), Satorra Bentler Chi-square (S-B χ^2), robust root mean square error approximation (R-RMSEA), robust comparative fit index (R-CFI), and standardized root mean square residual (SRMR). For RMSEA, values less than 0.06 indicate a good fit model [34]. The R-CFI value indicates good fit with values greater or equal to 0.95 [35], while the SRMR values are good with lower values to 0.08, and it is considered acceptable when values approach 0.10.

3. Results

3.1. Exploratory Factor Analysis

The initial exploratory factor analysis (EFA) with the 20 items showed an overall K-M-O of 0.71, and Bartlett's test was significant ($p < 0.001$) (See Table 1).

Table 1. Factor Loadings original solution with 20 items.

	Factor					
	1	**2**	**3**	**4**	**5**	**Uniqueness**
7	0.88					0.34
8	0.76					0.36
16	−0.65					0.54
18	0.44					0.56
13		0.91				0.22
20		0.53				0.65
4		0.48				0.83
3		0.37				0.68
2		0.19				0.88
5			0.73			0.58
17			0.67			0.46
14			0.49			0.57
15			0.49			0.73
12				0.76		0.56
11				0.62		0.52
10					0.59	0.54
6					0.57	0.60
1					0.44	0.76
19					0.41	0.68
9					0.30	0.80

Note. 'Minimum residual' extraction method was used in combination with a 'promax' rotation.

Following the criterion of the lowest factor loadings and pursuing balanced factors in terms of the number of items, items with lower loadings were eliminated. Problematic items were gradually eliminated until EFA resulted in a satisfactory factor structure and adequate model fit (NNFI = 0.83, and RMSEA = 0.01, 90% CI = 0.05–0.09). Thus, items 2, 3, 11 and 12 were eliminated. As a result, the final factor structure composed of 16 items indicated a K-M-O test value of 0.69 and Bartlett's test significant ($p < 0.001$) and a percentage of explained variance of 40.6% (see Table 2).

Once the number of factors recommended based on the EFA analysis, the CFA analysis was performed, using four factors: (1) the lack of information and training; (2) the lack of policy support; (3) the recognition of the wellbeing–nature connection; (4) the environmental awareness. The CFA was performed using R software [36].

Items nine and one were removed because they showed non-standard behaviour. Item nine had the lowest factor loading, and item one had a significant cross factor loading. Item four would have been susceptible to elimination based on the EFA but was retained since it loaded adequately on the corresponding factor in the CFA (Tables 3 and 4).

Table 2. Factor Loadings in 16 items.

	Factor				
	1	**2**	**3**	**4**	**Uniqueness**
7	0.77				0.41
8	0.77				0.39
16	−0.66				0.50
18	0.52			−0.31	0.58
13		0.78			0.30

Table 2. *Cont*.

	Factor				
	1	**2**	**3**	**4**	**Uniqueness**
20		0.60			0.62
1		−0.37		−0.35	0.77
4		0.32			0.89
5			0.72		0.57
17			0.68		0.46
14			0.49		0.55
15			0.45		0.75
10				0.61	0.59
19				0.51	0.66
6		−0.35		0.46	0.66
9				0.35	0.81

Note. 'Minimum residual' extraction method was used in combination with a 'promax' rotation.

Table 3. Factor Loadings in the CFA.

Factor	Indicator	Estimate	SE	Z	*p*	Stand. Estimate
Lack of Information and Training	7	0.90	0.077	12.21	<0.001	0.81
	8	0.90	0.08	11.83	<0.001	0.81
	16	−0.63	0.07	−8.72	<0.001	−0.62
	18	0.46	0.07	6.58	<0.001	0.49
Wellbeing–Nature Connection	13	0.60	0.07	9.01	<0.001	0.81
	20	0.323	0.05	7.32	<0.001	0.62
	4	0.29	0.05	5.34	<0.001	0.43
Environmental Awareness	5	0.52	0.07	7.01	<0.001	0.57
	17	0.68	0.08	8.27	<0.001	0.68
	14	0.63	0.08	7.18	<0.001	0.60
	15	0.25	0.04	6.08	<0.001	0.50
Lack of Policy Support	10	0.87	0.21	4.14	<0.001	0.97
	19	0.33	0.10	3.39	<0.001	0.41
	6	0.27	0.08	3.18	0.001	0.28

Table 4. Test for Exact Fit and Fit Measures.

						RMSEA 90% CI		
χ^2	**df**	*p*	**CFI**	**TLI**	**SRMR**	**RMSEA**	**Lower**	**Upper**
179	71	<0.001	0.82	0.77	0.08	0.08	0.07	0.103

The factor structure with the best fit model values was formed by 14 items (Appendix B) that were grouped in the following four factors (barriers or facilitators):

- Factor 1. Lack of training/formation (barrier: items 7, 8, 16 Reverse, 18);
- Factor 2. Wellbeing–nature connection (facilitator: items 4, 13, 20);
- Factor 3. Environmental awareness (facilitator: items 5, 14, 15, 17);
- Factor 4. Lack of policy support (barrier: items 6, 10, 19).

The consistency values (Omega McDonald's) were 0.78 (Factor 1), 0.63 (Factor 2), 0.68 (Factor 3), and 0.59 (Factor 4). Factors 2 and 4 had lower consistency values. The internal consistency of the total score was acceptable (0.67). Therefore, the final factorial structure was formed by four factors, each one including three or four items (Figure 3).

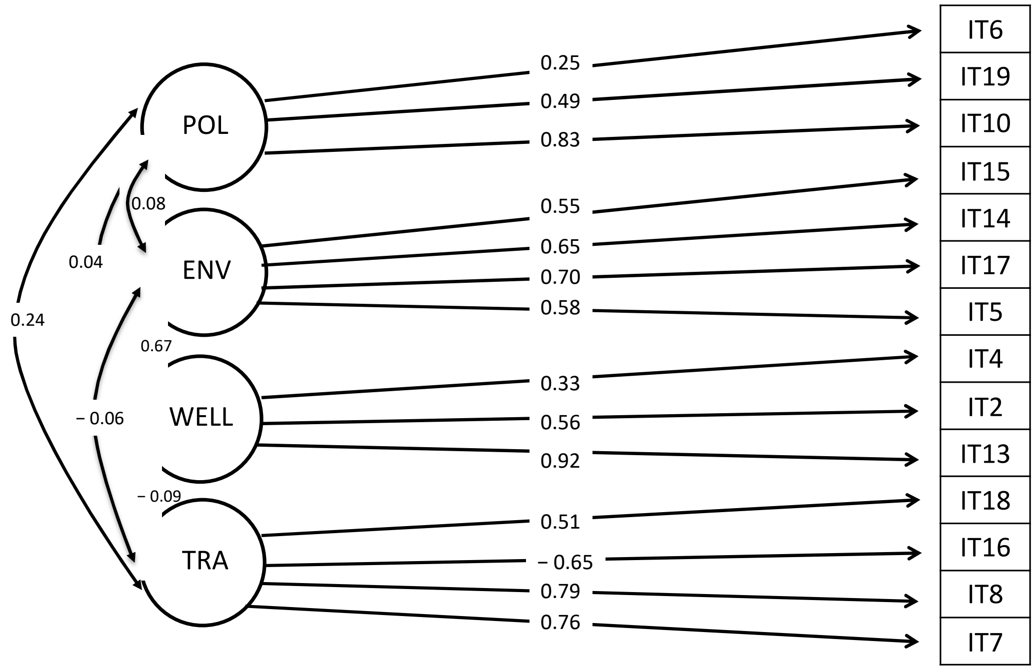

Figure 3. Path diagram representation. Plot automatically fades based on size of the parameter estimates. POL: lack of policy support; ENV: environmental awareness; WELL: wellbeing–nature connection; TRA: lack of training.

3.2. Factors Descriptive Statistic

Since all questionnaire parts were scored on a four-point Likert scale, the theoretical mean equals 2.5. We report the mean and standard deviation for each subscale:

- Factor 1. Lack of training/formation (barrier: items 7, 8, 16 Reverse, 18); Mean: 2.58 (±0.81)
- Factor 2. Wellbeing–nature connection (facilitator; items 4, 13, 20); Mean: 3.64 (±0.46)
- Factor 3. Environmental impact awareness (facilitator; items 5, 14, 15, 17); Mean: 3.18 (±0.63)
- Factor 4. Lack of economic/policy support (barrier; items 6, 10, 19); Mean: 3.41 (±0.62)

All means were higher than the theoretical mean, so there was no central tendency, and the identification of barriers and facilitators received support. Additionally, the total questionnaire score mean was 3.11 (±0.39). Therefore, the main barriers identified by farmers were the lack of training and the lack of policy support.

3.3. Gender, Age Groups and Study Level

Statistically significant gender differences with medium effect size were limited to the factor "lack of training", where women had a higher Cohen's d score (d = −0.55; Table 5). No differences between the age groups were found in any factor. Participant with lower study level (primary education) showed high scores in both barriers, "the lack of training" (Factor 1: 2.75 ± 0.78; p = 0.04) and the "lack of economic/policy support" (Factor 4: 3.58 ± 0.47; p < 0.001) comparing to the participant with higher study level (higher education; factor 1: 2.39 ± 0.84; factor 4: 3.20 ± 0.36).

Table 5. Independent Samples *t*-Test for barriers according to gender.

	Gender	N	Mean	SD	SE	Student's t	df	*p*	Cohen's d
Lack of Training/Formation	Male	163	2.5	0.47	0.244	−2.56	186	0.011	−0.55
	Female	25	2.9	0.49	0.72				
Wellbeing–Nature Connection	Male	171	3.6	0.45	0.11	−1.272	193	0.021	−0.28
	Female	24	3.7	0.32	0.22				
Environmental Awareness	Male	174	3.2	0.48	0.19	−0.873	197	0.038	−0.19
	Female	25	3.3	0.43	0.49				
Lack of Policy Support	Male	170	3.4	0.56	0.14	−2.181	192	0.087	0.04
	Female	24	3.4	0.45	0.42				

4. Discussion

The results of this study are a promising tool to identify barriers that can stop, delay or discourage people and facilitators who can boost and encourage farmers from the implementation of sustainable technological solutions in olive cultivation. The four identified dimensions were: lack of training/formation, and lack of economic/policy support as barriers; wellbeing–nature connection and environmental impact awareness as facilitators.

4.1. Identified Barriers

STSs implementation is limited by resources but also by policy and social endorsement. The Common Agricultural Policy (CAP), together with Green Deal [37], the Farm to Fork [38], and the EU Biodiversity [39] strategies, are the guiding agricultural policies and contribution to sustainability and the SDGs' achievement [40]. However, a recent report identified a few EU policy gaps showing the limitations of the SDG's accomplishment [41] and a lack of internal and external coherence of the policy's objectives. This could be the reason why the farmers can detect this lack of policy support to face the transition to more sustainable agricultural practices changes. Moreover, our results can support the demand for specific policy strategies aimed at changing the farmer's perception of policy support. For example, the CAP should provide incentives for food production that supports both health and environmental goals. Economic incentives generally have favoured expanding economic activity and, often, environmental harm [42,43]. Policy reforms that introduce incentives in line with the value of nature's contribution to people and increase sustainable land-use management would improve outcomes and reverse harmful effects. The benefits of sustainable agriculture will be easy obtained if the government and market forces support its adaptation by the farmers through various subsidies, policies and public awareness [44].

As the lack of formation and training has been pointed out as a barrier to STSs implementation, strategies focused on demonstrative and training events are essential in the farmers' innovation processes. However, technical assistance cannot be based on general recommendations and guides that are of limited applicability to the reality of local conditions or are not technically and economically feasible. This has been highlighted by new initiatives based on the basic principles of living labs, such as Agrolab. This is a practical training initiative in agro-ecology designed to engage local communities leading to a more sustainable agrarian sector where particular and specific actions are taken [45]. Therefore, specific training strategies should be implemented considering the context-specificity and the local idiosyncrasy. A dynamic training process for small farms should be promoted and would function as a channel of knowledge between the different involved stakeholders, creating new learning spaces between them [46]. The continuous training and participatory learning would help to transform the olive grove sector into a more sustainable activity. Clear examples of the benefits of using STSs in olive groves at any level (economic, environmental and social) are needed to persuade farmers to move to alternative agriculture practices.

4.2. Facilitators

The registered answers suggest that farmers have identified the connection between their health and wellbeing with the status of the environment. Moreover, they are aware of the agricultural impacts on the environment. The human mismanagement of agro-ecosystems has drastically reduced the inherently sustainable nature of ecosystems [47]. Both perceptions could be used to enhance farmers' willingness to implement STSs in an olive grove.

Apart from intrinsic values and instrumental values of nature [48], relational values emerge, for example, from the interactions between farmers and their land, a farming community and its territory, or as part of social movements working to preserve Life on Earth [49]. The connections with nature will enhance their sense of care for the soil that underpins their livelihood, the sense of responsibility (stewardship) for the agricultural landscape, and the social cohesion offered by the sense of place and relations with other farmers.

Relational values can be crucially important in making decisions about nature [50]. Considering farmers' nature connectedness is essential to understand the different ways and perspectives in which farmers value, relate and interact with nature and would allow designing specific programs to improve their willingness to embrace new STSs.

In many countries, changes in agriculture during the XX century led to an improvement in the agriculture's contribution to their economic growth but also led to biophysical (biodiversity loss, carbon sequestration reduction, water quality deterioration...) and social (aged population and threatened by a lack of generational replacement) drawbacks [51]. Sustainability is seeking to turn these deficiencies into opportunities through changing frameworks and ways of doing.

According to the results of this study, some participants are aware of the relationship between human health and wellbeing and the Natural capital status, and that is useful as a facilitator for implementing the STSs in olive groves. Moreover, facilitators could be those who take the lead in the participatory processes to spread that relationship and move others in this direction. There are studies that emphasise participation as a process where stakeholder contributions move to empowerment, equity, trust, and learning [52]. The need for collaborative learning, by which the differing perspectives of multiple stakeholders are coordinated to manage complex environmental problems, has already been outlined [53]. Thus, identification of the participants with a previous willingness is key for the participation as a successful process. Moreover, there is a need to share data and new scientific evidence on the economic benefits that farmers could also obtain by transforming and modernising their farms [54].

4.3. Study Limitations

Although the questionnaire was implemented in different countries, the small sample size in some of them precluded us from analysing invariance among countries. As a result, one drawback of this study is that the results are preliminary and limited to one particular country. Despite the fact that the study focuses on the main producer country worldwide, the pedoclimatic, socioeconomic, cultural, political and technological conditions in which olives are cultivated differ in other producing countries of the Mediterranean basin. Thus, future studies should be performed in different countries and cultures to advance our knowledge of the implementation of STSs in the Mediterranean olive grove sector.

5. Conclusions

Our study suggests very important aspects to consider in reducing barriers or fostering facilitators for the implementation of STSs in olive groves. Lack of training and policy support were the main barriers identified by olive oil farmers. These barriers could be overcome through the implementation of capacity building programs and with participatory activities, which also included policy and decision makers. Thus, they could propose and implement specific actions to support the transformation of the olive sector based on first-hand knowledge and farmers' needs, using co-design and co-creation tools. On the other hand, wellbeing–nature and environmental impacts awareness, were the main concepts by which facilitators could engage farmers to boost the implementation of sustainable practices. In this sense, activities to boost and reinforce the nature connectedness of farmers need to be implemented, scaffolding them, for instance, in the Ecosystem services framework.

Although farmers now have a higher level of training than in previous decades, they are concerned about their knowledge limitation in implementing STSs, especially for women, which opens a window of opportunity for the actions to be taken in the SUSTAINOLIVE project. For instance, although gender differences were limited to the factor "lack of training", it is crucial to record the gender of the stakeholders and the gender composition of break-out groups during future workshops and to design specific formative sessions for women. Farmers with lower education levels show higher scores in the factors of lack of training and lack of policy support. Therefore, such barriers to implementing sustainable practices in olive groves could be reduced in the future if educational progress in this sector takes place. SUSTAINOLIVE project is specifically taken action in the reduction of the lack of knowledge by producing numerous resources accessible to the farmers (https://sustainolive.eu/resources/?lang=en (accessed on 22 May 2022)).

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Appendix A. Initial Questionnaire Items

1	My economic profit will be reduced if I introduce any change in the agricultural practices on my farm
2	The administration helps me to implement and use sustainable agricultural practices on my farm
3	I would like to receive training in the use of sustainable agricultural practices
4	My health and well-being are related to the health of the natural environment
5	I believe that the current agricultural practices cause negative effects on the natural environment
6	The biggest obstacle to implementing sustainable agricultural practices is the economic cost
7	The biggest obstacle to implementing sustainable agricultural practices is my lack of knowledge and training
8	I have a lack of training in sustainable agricultural practices
9	The agricultural authorities encourage me to implement sustainable agricultural practices.
10	Subsidies should be offered to compensate for the economic losses derived from the implementation of sustainable agricultural practices.

11	More information on sustainable agricultural practices needs to be disseminated trough farmer communities and cooperatives
12	Extension services (agricultural advisory) should facilitate the implementation of sustainable agricultural practices
13	I know that my well-being will improve after the implementation of sustainable agriculture practices
14	Sustainable agricultural practices must be included as a condition for obtaining CAP subsidies (common agricultural policy).
15	Products grown with sustainable practices should carry a specific label so that consumers can identify them.
16	I know what sustainable practices are the best to be implemented on my farm taking into account its specific conditions
17	Agriculture is responsible for some of today's environmental problems
18	I need more information about the long-term benefits I will get from implementing sustainable agriculture practices
19	Local administration must help in the implementation of sustainable agricultural practices
20	Sustainable agricultural practices promote a healthy environment

Appendix B. Final Questionnaire Selected Items

Factor 1	Lack of Training/Formation
7	The biggest obstacle to implementing sustainable agricultural practices is my lack of knowledge and training
8	I have a lack of training in sustainable agricultural practices
16	I know what sustainable practices are the best to be implemented on my farm taking into account its specific conditions
18	I need more information about the long-term benefits I will get from implementing sustainable agriculture practices
Factor 2	**Wellbeing–Nature Connection**
4	My health and well-being are related to the health of the natural environment
13	I know that my well-being will improve after the implementation of sustainable agriculture practices
20	Sustainable agricultural practices promote a healthy environment
Factor 3	**Environmental Impact Awareness**
5	I believe that the current agricultural practices cause negative effects on the natural environment
14	Sustainable agricultural practices must be included as a condition for obtaining CAP subsidies (common agricultural policy).
15	Products grown with sustainable practices should carry a specific label so that consumers can identify them.
17	Agriculture is responsible for some of today's environmental problems
Factor 4	**Lack of Economic/Policy Support**
6	The biggest obstacle to implementing sustainable agricultural practices is the economic cost
10	Subsidies should be offered to compensate for the economic losses derived from the implementation of sustainable agricultural practices.
19	Local administration must help in the implementation of sustainable agricultural practices

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