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Assessment of Factors Constraining Organic Farming Expansion in Lis Valley, Portugal

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Abstract: Organic farming can play an important role in rural development and food production, by reinforcing the trend toward sustainable agriculture and its purpose of ecosystem conservation. The agribusiness of organic farming is particularly relevant in family farming, given the labor availability and the short marketing circuits. The innovative techniques of organic farming, namely with soil fertility, weed and pest control, opens a wide range of possibilities in its development and extension. The expectation of organic farming profitability in small-scale family farming, supported by known successful examples, were the theme of a field study on Lis Valley Irrigation District to assess the constraints to its expansion in order to outline the procedures for the acquisition of technical knowledge, the adaptation of technologies, the support for the conversion of production models, and the specialized training of farmers for action. Results revealed that the: (i) farmer's land structure, (ii) their mature age, (iii) low education level, and (iv) markets, are the main constrains for organic farming development. Furthermore, other uncertainties were identified, namely: (i) the certification process, (ii) the knowledge of new technologies, especially of crop protection, and (iii) the marketing problems to guaranteeing profitability. This study concludes that organic farming has significant potential for development in the Lis Valley and that the efforts and resources of the various stakeholders, namely the state, need to be harmonized to deliver effective support to farmers to promote organic farming that prioritizes: (i) rural development policies, (ii) supporting land restructuring, (iii) modernization of irrigation, (iv) stimulation of young farmers, (v) conversion and implementation of innovative technologies, (vi) the organization of farmers for better productive efficiency, and (vii) to facilitate market access.

Keywords: irrigation; Operational Groups; organic agriculture; rural development; rural reparcelling; land tenure

1. Introduction

Organic farming (OF) is an agricultural production system that sustains the demands of production of healthy and safe food, with no significant dependence on chemical fertilizers, using organic matter and bio-fertilizers, cultivating with reduced tillage, environmentally safe pest management and the adoption of integrated farming systems [1]. OF has the potential to contribute to rural development and food production, allowing in many situations a good compromise between farmer income, productivity, food quality and the conservation of natural resources [2,3], and thus, an important agribusiness for farmers, owing to the premium returns from organic products [4]. Although the problem of food production is too complex to be solved exclusively through the production model, in some situations OF can be a part of the solution. In fact, OF not only has the potential to trigger rural development, but also to respond to the concerns and demands of modern society regarding food security and safety, and the social and environmental role of agricultural systems, which has been witnessed worldwide, for example in Iran [5], Syria [6], and Europe [7]. OF can also meet the mitigation measures imposed upon agriculture by climate change emergencies, through practices such as tillage, composting, soil carbon sequestration, and energy offsets [8,9]. Other examples of circular economy with environmental benefits include the nutrients recycling of agricultural wastes and by-products, as well as the use of local and renewable energy sources [10,11].

One of the most difficult agronomic aspects of OF is crop protection, given the restrictions upon the use of most synthetic pesticides. Regarding weeds, the usual OF practices for effective control often use a combination of (i) mechanical control, (ii) crop rotation, to reduce weed potential [12], (iii) application of bio-herbicide products [13], and (iv) flaming [14]. Solutions for pests and diseases control should only resort to pesticides and genetically resistant varieties authorized by official entities, for example the European Union (EU) [15,16]. A feature of this production mode, compared to the conventional one, is lower production efficiency, higher cost and higher labor requirements, resulting in an increased risk level, which can surpass the yield incomes of OF products.

Soil fertility maintenance is ensured through the use of certified organic fertilizers and slow acting minerals [17,18], which provide sustainable nutrient cycles [19], being particularly valued those derived from composting residues or by-products from agricultural, livestock, industrial or forestry activities. Soil conservation maintaining high levels of organic matter and organic-based nitrogen relies on the use of green manure and winding, and on biological nitrogen fixation [1]. Composting, using organic remains not only feeds the soil and the most demanding crops, but also reduces the impacts of waste disposal, improves soil quality and minimizes soil losses and allows carbon sequestration. Thus, soil management on OF systems can have considerable and positive effects on the control of greenhouse gas (GHG) emissions [10] and plays a key role in the conservation of fertility and biological biodiversity, beyond the productivity itself [20].

Cultivation is another aspect that requires changes from conventional practices. Conservation tillage techniques are very important in OF [21], as well as some practical issues [22], allowing, among other advantages, the increase of phosphorus availability and soil nitrogen content [23]. The choice of varieties is a criterion to be considered for better fertilization efficiency, as exemplified by [24] for rice. Crops rotation is used to better harness soil nutrient capacity and also to prevent phytosanitary problems and, consequently, decreasing pesticide needs [1]. Mulching could be effective suppressing weeds, when retained on the soil surface [25], and at the same time, providing organic matter to the soil. Flaming and cultivation, despite being effective tools when used together, should be considered as two of the many tools in the toolbox of integrated weed management [14]. Precision agriculture technologies, such as robotic weeding and band steaming for weed management, could contribute to efforts to cope with pests and weed management, also reducing the labor demand [26].

Europe has 14.6 million hectares of OF [27], and the European policy is encouraging OF expansion [28], in parallel with an increasing demand for organic products fulfilling effective certification standards [29,30], although there are several conditioning factors, like economic or crop protection [31]. There are many examples of higher profitability in OF than in conventional farming, despite the fact that the former exhibits a reduction in physical yields, and it is offset with the higher appreciation and valorization of the market [32–37].

In Portugal, there are three governmental action plans: the National Strategy for Organic Farming [38], the Action Plan for the Production and Promotion of Organic Products [39], and the National Strategy for Green Public Procurement 2020 [40], demonstrating the relevance given to OF, and the feasibility in various productive areas of agriculture and livestock. The OF enables stimulation of agricultural activity, as it allows the supply of highly valued new products to the market, boosting regional economic activity and rural development. OF can also take advantage of the development dynamics promoted by the development of irrigated land in Portugal [41], especially since the most profitable crops are irrigated. In addition, in areas of minifundium, or smallholding farms, the intensification of production is crucial for reasons of farm economic profitability. Therefore, the promotion of OF in Portugal needs the mitigation of the main weaknesses of this production mode, identified by the Portuguese Government [39]: (i) the difficulty in the supply of national organic products to accompany the growth of domestic demand, with the consequent increase in imports; (ii) insufficient production factors for OF (fertilizers, phytopharmaceuticals, seeds) available at high prices, associated with scarce information; (iii) lack of infrastructures to enable the supply concentration; (iv) insufficient organization of producers, which is reflected in weak negotiating strength and difficulties in regulating the market, in case of seasonal surpluses; (v) low representation of the OF in the usable agricultural area; (vi) weak organic livestock production and insufficient slaughtering capacity; (vii) lack of qualified professionals and offers of research and development (R&D); (viii) very high prices of organic foods for consumer; (ix) weak investment by the economic agents in concerting marketing strategies; (x) insufficient technical ministerial structure dedicated to organic production, which is reflected in the lack of statistical data on this sector.

The expectation of OF profitability in small family farming, supported by the successful examples previously mentioned worldwide, led to the development of the present study, applied to the Lis Valley Irrigation District. It addresses the issue of conversion from conventional to OF, including choosing and evaluating the most appropriate technologies, the productive paradigm change process, and the way farmers act and decide. This research objective is the assessment of constraining factors on OF expansion and outline the procedures for the acquisition of technical knowledge, the adaptation of technologies, the support for the conversion of production models, and the specialized training of farmers for this action.

2. Materials and Methods

2.1. Study Area

The study area is located in the Lis Valley Irrigation District (LVID), which is a public irrigation district, located in the Coastal Center of Portugal (coordinates 39°51′22.1″ N 8°50′56.1″ W), belonging to the Leiria Administrative District (Figure 1), and managed by the LVID Water User's Association. The total area is about 2000 ha, mainly with modern alluvial soils of high agricultural quality, although some have poor drainage conditions. The main crops grown in the LVID include forage maize, forage grass, horticultural, orchards and rice [42].

The predominant climate in the Lis River watershed results from Mediterranean and Atlantic influences. The Mediterranean influence is reflected mainly in summer, as a result of the high temperatures and sunshine and the absence of precipitation. The Atlantic influence is characterized by the predominant winter front surfaces which, moving from west to east, are responsible for most of the precipitation. A hot summer with virtually no rainfall is opposed to a winter with mild temperatures but very rainy (Figure 2). Annual average temperature is 15.9 °C and annual average precipitation is 790 mm. According to the Köppen climate classification, the climate in the LVID is Cbs type and is characterized essentially by temperate and mild summers and winters with mild temperatures. Rainfall is concentrated mainly from October to March and its average values decrease from the headwaters of the Lis Valley basin towards the coastal region [43].

A particular feature of this study area is a high heterogeneity regarding the field parcels size and their spatial distribution. The structure of the on-farm parcels property is characterized by a majority of small parcels, with an average of 0.20 ha (Table 1), this aspect being an effective constraint to

the field irrigation modernization and agriculture development and sustainability. This problem is being mitigated through an informal reparcelling of the fields carried out by farmers, through renting the properties [44].

(**a**) (**b**)

Figure 1. Location of the Lis Valley Irrigation District in Portugal (**a**), and in the center region (**b**). (source: Google Maps, https://maps.google.pt).

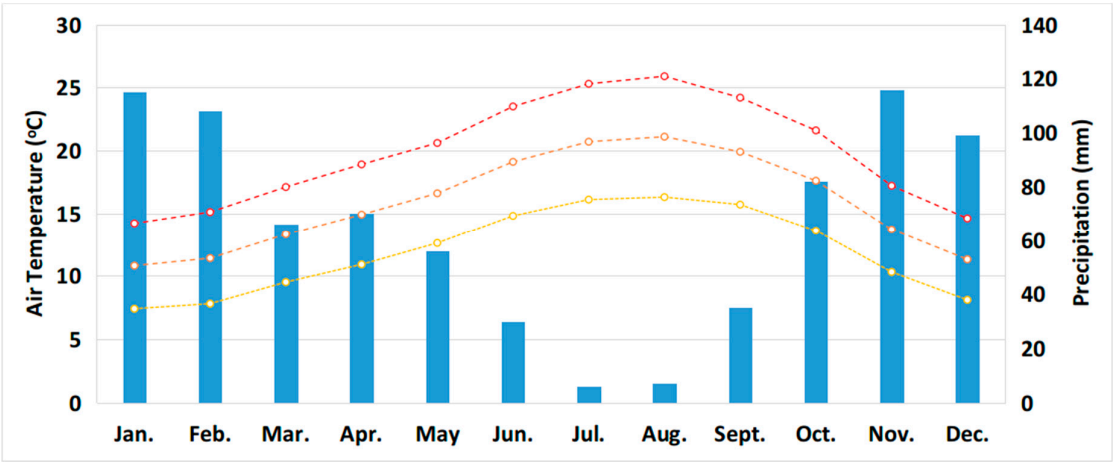


Figure 2. Monthly average climatic data for Leiria region (adapted from [45]); Precipitation (blue) and Maximum (red), Average (orange) and Minimum Temperature (yellow).

Table 1. Number of parcels per area classes in the LVID.

Area Classes (ha)	Number of Parcels	%
below 0.1	4157	39.1
0.1–0.5	5909	55.5
0.5–1.0	402	3.78
1.0–5.0	163	1.53
5.0–20	6	0.06
above 20	2	0.02
Total	10,639	100

Source: [42].

Since 2011, Portuguese exports of vegetables, plants, roots and tubers have had sustainable growth of 11% per year, that growth being in the Central Region of 14%, and in the Leiria district of 10%; however, it fluctuates over the period analyzed [46]. Edible vegetables, plants, roots and tubers accounted for 23% of plant exports; the Central Region, in 2017, represented 29% of national horticultural exports and the Leiria region 2%. Therefore, a high export potential for vegetables can be expected, making it worth investing in vegetable production in the LVID, as the fruit and vegetable sector grew 23% between 2016 and 2017, representing around 937 million euros in 2017 [46].

2.2. Assessing the Constraint Factors to Adopting Organic Farming

The methodology to assess the constraint factors for OF expansion in the LVID was based on inquires directed to farmers. For this purpose, a questionnaire was developed to obtain the following information: sociodemographic data, relevance and motivation of agricultural activity, ownership and exploitation of field parcels, markets and productions, willingness to adopt OF and corresponding required support (Appendix A). Landowner surveys were conducted by interview in person, after a prior contact with respondents, from March to April 2019.

The particular aspects of land characteristics were considered for the inquiry design. As the inquires covered the owners of farms, composed of field parcels, their initial pre-characterization was required in order to plan the choice of samples. The area of each parcel was obtained from the land registry by the LVID Water User's Association, which allowed the total area owned by each farmer to be determined. The stratification of farms according to their areas was required due their non-uniformity (dominance of the smaller ones). This resulted in three classes: (i) farms with areas larger than 8.5 ha, hereinafter referred to as "Large"; (ii) farms with areas smaller than 25 m^2, designated as "Small", and (iii) farms with intermediate area, generally with areas lower than 2 ha, referred to as "Medium". The size of samples per class was determined through a statistical analysis performed according to the normal distribution [47]. Thus, about 20 owners per class were selected for the interview.

The collected data were analyzed using the IBM SPSS Statistics 25.0 software. To evaluate the strength of the association between the analyzed variables (farm size, age, gender, relevance of agricultural activity, educational level, production destination, sales channels, type of market, willingness to adopt OF), Pearson coefficient correlation (r) was used when those variables followed a normal distribution, and the Spearman coefficient (ϱ) otherwise, since it is not sensitive to the distribution asymmetry [47–49].

3. Results

3.1. The Farmers: Social Features, and Attitudes Regarding Agricultural Activity

The sociodemographic data of respondents (class age, gender and educational attainment frequencies and farm size class) are synthetized in Table 2 and Figure 3. Most respondents are over 50 years old (75.5%), 35.1% of whom are over 65 years old, that applies for both genders. The majority (84.2%) are males (Table 2). It is worth highlighting the low level of education (54.4% only attended up to the 4th grade), which is associated with the high age group of respondents, i.e., about 35% of respondents were more than 65 years old (Figure 3). These figures are lower than those obtained from the Farm Structure Survey [50], held in 2017, which found out that 54.6% of the individuals were over 65 years old. However, these values are in accordance with the 2009 Agricultural Census [51], regarding the characterization of the agricultural producer: "type agricultural producer is male, he is 63 years old" and "only completed the 1st cycle of basic education".

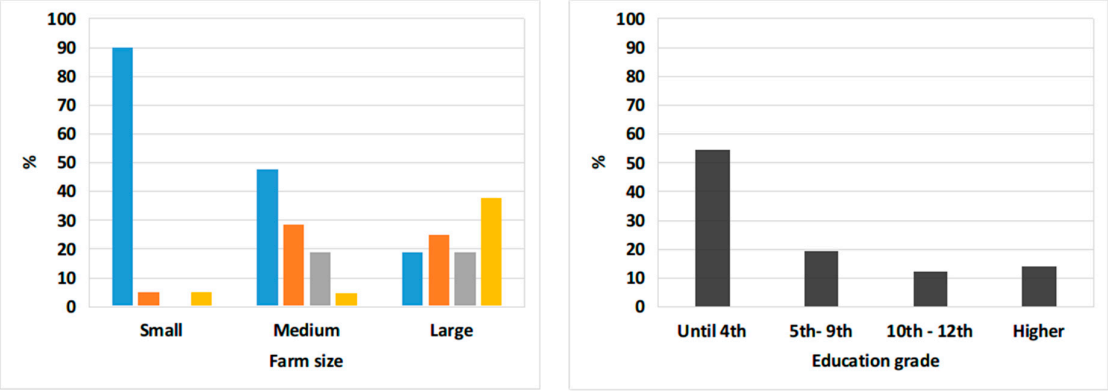
Agricultural activity plays a secondary role for more than half of respondents (57.9%). The income earned allows the farmers to add extra gain to the main activity because they rent their parcels or have another activity in a different economical sector. "Not relevant" answers include landowners who farm for self-consumption or choose not to cultivate the fields. Most smallholders considered the agricultural activity as a secondary role (Figure 4). This confirms the importance of family farming in Portugal and the self-consumption of the agricultural structure [52]. There is a weak positive

correlation (5% significance level) between the relevance of agricultural activity and the farm size classification ($r = 0.301$; $\varrho = 0.328$). As the size of the farms decreases, agricultural activity loses relevance as the main activity and becomes a secondary one.

Table 2. Relative frequency (%) of age and gender of respondents by the farm size.

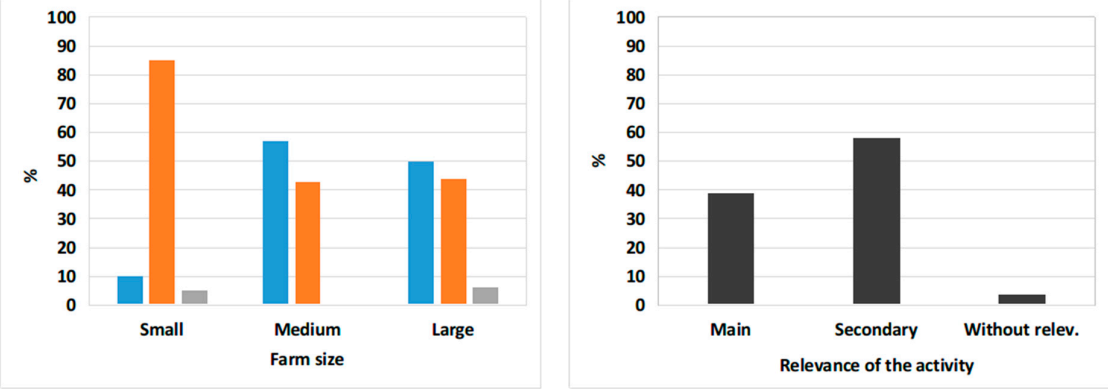
Age (Years Old)	Total of Farmers				Male Gender				Female Gender			
	S[1]	M[1]	L[1]	Total	S	M	L	Total	S	M	L	Total
20–40	5.0	23.8	12.5	14.0	2.1	10.4	4.2	16.7	0.0	0.0	0.0	0.0
41–49	0.0	19.0	12.5	10.5	0.0	6.3	2.1	8.3	0.0	11.1	0.0	11.1
50–64	35.0	38.1	50.0	40.4	12.5	14.6	12.5	39.6	11.1	11.1	33.3	55.6
above 65	60.0	19.0	25.0	35.1	20.8	6.3	8.3	35.4	22.2	11.1	0.0	33.3

[1] Farm size: S, Small (lower than 25 m²); M, Medium; L, Large (over 8.5 ha).



(**a**) (**b**)

Figure 3. Relative frequency (%) of educational level of respondents by: (**a**) the farm size (Until the 4th grade, blue; 5–9th grade, orange; 10–12th grade, grey; Higher education, yellow), and (**b**) the overall responses. Farm size: Small (lower than 25 m²), Medium, Large (over 8.5 ha).



(**a**) (**b**)

Figure 4. Relative frequency (%) of relevance of agricultural activity of respondents by: (**a**) the farm size (Main activity and source of income, blue; Secondary activity that supports family income, orange; Without relevance, grey), and (**b**) the overall responses. Farm size: Small (lower than 25 m²), Medium, Large (over 8.5 ha).

The farmers' motivation for the practice of agriculture is mainly explained (in 73% of the responses) by the combination of several factors: (i) it is a family activity (30% of the answers); (ii) the owner has the possibility to continue a business that already existed in the family; (iii) the existence of land, inherited or acquired, that is intended to be monetized; (iv) they are landlords who rent the parcels, and the benefit they get from the land is the financial income and not the agricultural activity

itself; and (v) the family farming encompasses elements associated with family values, such as solidarity, continuity and commitment. These results revealed that family farming is identified with entrepreneurial skills, ownership and risky behavior, resilience and individual achievement. Regardless of the size of the agricultural enterprise, the prevalence of family-ownership in the Lis Valley is a potential factor for the continuity of future agriculture, because of the skills provided in situ to the next generations, as referred to by other studies [53,54].

3.2. The Farms: Ownership, Exploitation and Markets

Results regarding the land possession and exploitation of the parcels show the following agrarian structure: owner and farmer, 54.4%; owner and not farmer, 19.3%; loan (free installment loan) and farmer, 10.5%; landlord and lessee, 14.0%; and owner and lending, 1.8%. In the context of land tenure, the use of the parcels is as follows: (i) 78.2% are cultivated by the owner; (ii) 12.7% are rented; (iii) 5.5% are partially cultivated by the landlord and leased; and (iv) 3.6% left as fallow. Landlords want to maintain land tenure in the future, as it is currently an issue of critical concern.

Renting land has a great tradition in the LVID. The reasons pointed out by landlords for renting their parcels include: (i) they do not want to sell the fields, because they have heirs to inherit the land; (ii) the selling price offered does not please them; (iii) they have a great emotional attachment to the land; (iv) they have other activities and sources of income; (v) there is a feeling that the land is a guarantee for the future; and, lastly, (vi) they do not need the money from the sale.

The tenant's reasons for renting the parcels comprehend: (i) difficulties in paying the price set by the seller; (ii) renting has become a form of traditional land use and they do not feel the need to own the property; (iii) they have other activities besides agriculture, which is a secondary one, and so do not feel stability for ownership; (iv) there is a strong variability in the choice of crop and productivity, and the renting provides greater freedom to choose the parcels than their ownership; (v) the difficulty of obtaining manual labor, especially in horticulture, (vi) constraints about the area to be cultivated, since it is sized according to the staff; (vii) it is easier to detach from the land, avoiding it becoming a burden, if agriculture becomes unprofitable; and (vii) agriculture requires a lot of physical effort. The 19.3% figure of "pure" renting, excluding the combined renting and ownership, clearly denote the impact of this form of exploitation of the parcels.

The results of the surveys about the destination of production, related to farm size and age, are presented in Table 3. Among landowners or tenants there is no predominant answer regarding the yield fate in relation to the other groups, because the intermediate scenario of "selling one part of production, the other being for own consumption" mitigates the difference that exists between sales of all production (43.5%) and production for self-consumption (32.6%). The correlation between the destination of production and the size of the holdings is weak positive (5% significance level) (r = 0.282; ϱ = 0.314). As the size of the farms becomes smaller, production tends to be for self-consumption. There is also an average positive correlation between age and production destination, with significance at the 5% level (r = 0.433; ϱ = 0.432), as older farmers tend to produce for self-consumption (19% of variation in production destination is explained by age).

Table 3. Relative frequency (%) of production destination by relevance of agricultural activity, farm size, and age of respondents.

Destination of the Production	Total	Relev. Activity [1]			Farm Size [2]			Farmer Age (Years Old)			
		Ma.	Sec.	WR	S	M	L	20–40	41–49	50–64	≥65
Market only	43.5	76.2	16.7	0.0	16.7	70.6	45.5	83.3	75.0	44.4	22.2
Partly to market	23.9	19.0	29.2	0.0	27.8	23.5	18.2	16.7	0.0	27.8	27.8
Self-consumption	32.6	4.8	54.2	100	55.6	5.9	36.4	0.0	25.0	27.8	50.0

[1] Relevance of activity: Ma., Main; Sec., Secondary; WR, Without relevance. [2] Farm size: S, Small (lower than 25 m^2); M, Medium; L, Large (over 8.5 ha).

The analysis of results of the destination of production related to the relevance of the owners' activity, show that those who have their main activity in agriculture sell all production, and conversely, in the secondary level, production is mainly for self-consumption (Table 3). There is a

significant positive correlation between these parameters (1% of significance level) (r = 0.646; ϱ = 0.651), where 42% of the variation in the destination of production is explained by the relevance of agricultural activity.

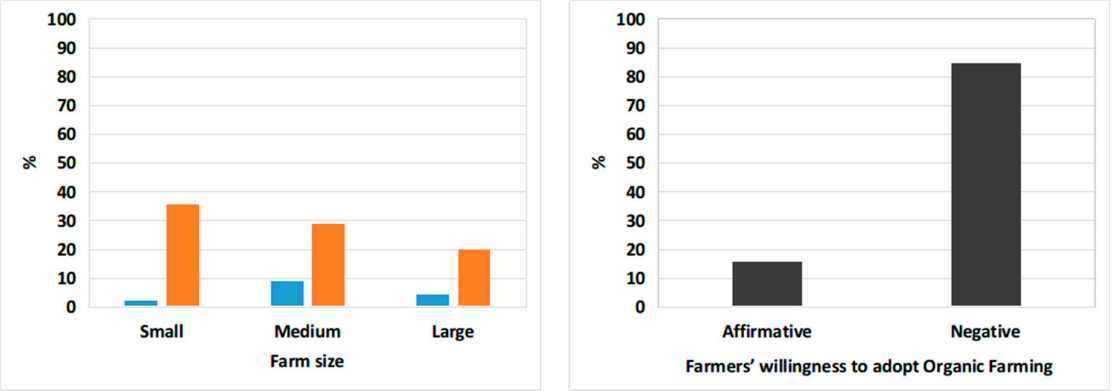
Sales channels and type of market were also questioned, and the results are shown in Table 4. Owners were asked to choose the two main sales channels, referring to whether they correspond to the domestic, foreign market, or both. Most farmers (77%) sell directly to the final domestic consumer, and no one sells exclusively to foreign markets. Therefore, it can be concluded that in the Lis Valley short supply chains predominate. It is important to note that sales to large retailers do not exist, which may be due either to the low production values, not justifying this choice; or, to the selling price for this channel, which will not compensate, compared to alternative marketing channels. It would be important to further analyze the specific relationship of marketing channels with OF.

Table 4. Relative frequency (%) of sales channels by type of market.

Sales Channels	Only Domestic Markets	Domestic and Foreign Markets	Total
Final consumer	73.3	80.0	77.1
Small retailers	10.0	20.0	11.4
Cooperatives or wholesalers	13.3	0.0	8.6
Large surfaces	0.0	0.0	0.0
Other producers	3.3	0.0	2.9

3.3. Main Limiting Factors for Organic Farming Expansion

One crucial aspect of the results is that most of the respondents (84%) were not interested in switching to OF, regardless of the farm size classes they belong to, although this resistance is higher in smaller sized farmers than in medium and larger ones (Figure 5). The main farmers decision factor (Table 5) that determine the changing to OF is the public support (57.6%), particularly required during the conversion period. The other relevant factors are related with the market, through higher production prices (20.3%), and the guarantee of outlets (15.3%). The farmers with an affirmative willingness to adopt OF valued these two market factors.



(**a**) (**b**)

Figure 5. Relative frequency (%) of farmers' willingness to adopt Organic Farming by: (**a**) the farm size, (Affirmative, blue; Negative, orange), and (**b**) the overall responses. Farm size: Small (lower than 25 m²), Medium, Large (over 8.5 ha).

Table 5. Relative frequency (%) of main decision factors governing farmers' willingness to adopt organic farming, by farm size.

	Small Farms		Medium Farms		Large Farms		Total
Main Decision Factors	**A** [1]	**N** [1]	**A**	**N**	**A**	**N**	
Public support	0	13.6	1.7	18.6	0	23.7	57.6
Assurance of market outlets	3.4	1.7	5.1	3.4	0	1.7	15.3
Market prices	3.4	1.7	6.8	5.1	1.7	1.7	20.3
Expand cultivated area	0	0	1.7	1.7	0	3.4	6.8

[1] A, affirmative; N, negative farmers' willingness to adopt OF. Farm size: Small (lower than 25 m^2), Medium, Large (over 8.5 ha).

It should be noted that, presently, farmers produce quality agri-food products in integrated mode, subject to certification. This system aims at sustainable agriculture through the adoption of good agricultural practices, including crop protection methods, while mitigating risks to human health and the environment, with the least possible disruption to agricultural ecosystems [55]. The possibility of adopting OF implies a new certification and compliance with stricter rules on the use of production factors, a situation that contributes to the attitude that is averse to change.

The farmers willing to convert to OF highlighted the following keywords: the price; incentives; the benefit to the health of living beings and the environment; and the ease of change due to the size of the parcels. In turn, those who had negative answers, referred to: production for animal feed; small yield; reduced size of parcels; consumer non-differentiation between different modes of production; constraints of application of pesticides; low productivity of OF yield; perception of cross-contamination between parcels and the environment; and low availability of manual labor required by the OF.

Finally, results allow concluding that the main factors limiting the choice for OF conversion were: (i) size of the fields—due to their small size and discontinuity, which makes OF certification difficult, as it limits the application of ecological lanes and corridors, mechanization, and affects the risk of cross contamination; (ii) forage production—being intended for animal feed; note that products of animal origin imply a complex certification, obliging the certification of the whole agri-food chain, therefore making OF forage unappealing; (iii) markets—considering that 77% of respondents sell to the final consumer and about 81% sell to the domestic market (e.g., to the small local retail or directly to the consumer in the so-called short chains), they do not feel the need to convert to another mode of farming because the consumer would not overvalue the OF product; (iv) farmers' age—as age progresses, the farmers become more averse to change, favoring young and better-educated farmers. In conclusion, OF has significant potential for stimulating rural development in the Lis Valley and the efforts and resources of the various stakeholders need to be harmonized to deliver effective support to farmers.

4. Discussion

The results obtained in this study relative to the LVID concerning the land, demographic and socioeconomic characteristics highlight a number of difficulties in relation to agricultural modernization and the adoption of OF. The constraints to OF development, mainly related to the land and social profiles, include: (i) the land structure of the farms, such as the small sized parcels and their geographical dispersion, or the small-sized farms; (ii) the land use, by the landowner or by the lessee, that affects their prospect to make long term investments; and (iii) the age and training of farmers, which impacts their predisposition to adopt more advanced and complex technologies, or to take greater risks. Land ownership is a fundamental issue, because it hinders long-term OF investments, and also the predisposition for the conversion to OF, given the return uncertainty. In fact, the legal requirement of a minimum of three years conversion time for certification of OF vegetables [55], makes the profitability of this transition period crucial.

The major number of fields (78%) of the LVID are cultivated by the owners, which in itself is a good indicator. The fact that the landowners cultivate the land is an important aspect. However, the smallholding situation with very small fields (see Table 1), being 94.6% of the fields lower than 0.5 ha, results in very strong constraints on development. There are several reports (e.g., Murray and McGrath [56], Ruhf and Wagner [57]) of studies carried out on the issues of investment, land cost, land ownership, and return on investment related to land valuation. Regarding land ownership and the barriers to sustainable agriculture, Carolan et al. [58] concluded that the tenant uncertainty is a barrier to sustainable agriculture and that joint work between landowners and tenants is required to reduce that uncertainty and ensure continued investment. Ciaian et al. [59] point out that, although the sale value of agricultural land is higher than the lease value, sales are encouraged due to the security investment they convey, because transferring all property rights to the new owner allows easier access to credit, as land can be given as collateral. In most European Union (EU) countries, the rental market appears to be more important than the sales market and a large part of the agricultural area is leased. According to Ciaian and co-authors [59], Portugal in 2007 had one of the lowest leased land rates in EU, under 25% of the used agricultural area (UAA). The positive influence of age and education on entrepreneurship in OF is a central issue, where generational renewal plays a particularly important role for innovation and development [60]. Younger farmers with higher academic and agricultural background have more resources to manage new technologies and deal with the most demanding market competition contexts, creating new development models around the OF concept, based on shared projects with related topics, such as the green and circular economy [61,62].

The LVID farmers marked a clearly negative predisposition to the adoption of OF where the main factor was the problem of insufficient public support (Table 5, 58% of responses), relevant in the conversion period required by the certification process. Therefore, all public actions that facilitate the conversion phase will have a significant effect on promoting OF, through farmers' decisions with their consequent multiple benefits on rural development and food security.

Certification is the procedure to guarantee compliance with obligations under the law safeguarding the achievement of the OF objectives [63], and it has gained increasing attention worldwide, being essential to provide a safe assurance to the market of the compliance with OF principles and standards [64]. The somewhat complex process of obtaining certification includes many challenges ahead and the process in itself affects the decision to convert a conventional farm [65]. There are several examples that demonstrate these difficulties, like in Spain [37], or in Germany [66]. Before starting the OF activity, the farmer must prepare a preliminary assessment to identify the contamination risky areas, the historical context of fertilization and pesticides, and to perform chemical analyzes to the soil and water. The transition period until the OF certification will depend on the actual soil and water conditions, and the type of crops grown. In general, this period takes, at least, three years. This lag time has significant costs to be supported by the farmer, due to loss of yield and uncertainty about conversion efficiency. This microeconomic framework explains the need for public support for this process, justified to compensate for this inevitable loss of farm income.

Results of these studies also showed that marketing is a main decision factor (vd. Figure 5, assurance of market outlets, plus market prices, correspond to 35.6%), and highlighted the importance of short marketing circuits to solve this issue. On the other hand, the role of small family farming also promotes the OF feasibility because it facilitates access to local markets for greater flexibility and smaller size. The organization of production is a very important aspect for the OF viability and competitiveness [67]. The characteristics of family farming give them special aptitude for OF, namely for vegetables production, due to their labor flexibility and availability [68,69]. The Portuguese government considered small family farming very important to the OF development, due to their weight in terms of national number of farms (242.5 thousand farms, 94% of total), using 54% of utilized agricultural area (UAA) and 80% of total agricultural labor [70]. The Family Farming Statute emphasized the need to support the creation of proximity markets and short circuits and the creation of a specific public procurement regime for proximity agrifood products [52]. Family farms can exploit the opportunity of short circuits that demonstrate social, economic, and environmental

advantages [71,72], especially in the EU, although the results depend to a great extent on each situation [73]. Gonçalves [74] reported the high potential for OF of small family farming with a positive impact on the development of the traditional irrigation systems in the Center and North of Portugal, by linking agriculture with landscape, environment, and nature conservation, and by valuing specific agricultural products, such as aromatic and medicinal plants, through the economic activity of rural tourism and regional cuisine.

A comparative analysis of the OF practice in Portugal and in other European countries, namely Spain, Italy and Greece, also in a Mediterranean climate, and in the Czech Republic, with a different temperate-continental climate, based on published statistical data, is presented in Table 6. In the EU, 11.9 million ha are occupied with OF, 61% of which with the dominant crop, pastures and forages for biological livestock. The importance of these crops varies significantly from the Czech Republic (84.2%) to Italy (27.6%). In Portugal, the permanent pastures and forage crops occupy 58.3% of the OF production area, mainly located in the Southern continental region and in Azores Island. Conversely, the representativeness of vegetable crops per country is much smaller, almost without expression in the Czech Republic (0.1%) to an area over 60,000 hectares in Italy (2.6%). Greece, Portugal and Spain (0.5% to 0.7%) all together grow these types of crop in 27,251 ha. It is worth noting that in Greece, olive and vineyard crops, although with little expression in the cultivated area, show significant profitability [75].

In these countries, the average area per farm surpasses 50 ha, except in Greece. In fact, there is a tremendous variability in the farms size, from 7.5 ha in Greece to 180 ha in Czech Republic. The Portuguese average size (110 ha) also results from a great variance in the farms size between regions, as in the South of the country there are extensive production systems, while in the Center and North minifundium prevails. Comparing these national data with the LVID, it can be seen that: (i) the size of the plots is much smaller than in the South of Portugal, with the production of rainfed permanent pastures not being viable; (ii) the difficulties in opting for animal production in OF have the impact of not having converted pasture and forage areas, the most representative with an occupation is about 60% of the irrigated area. In line with this, a new perspective on the OF production system of the countries emerges, if this information is crossed with the percentage of farms with less than 2 ha (Greece, 50.6%; Portugal, 46.1%), contrasting with Spain and Italy and the Czech Republic (10.3%). The average size of the farms in the LVID is about 0.64 ha, characteristic of a minifundium area, which is possibly a relevant aspect restricting the OF development in the LVID.

Concerning the farmers' age, the OF holders are older than non-organic farmers. The age of farms managers with and without organic area are strikingly different: farmers younger than 55 represent 61% of the organic sector, whereas they represent only 45% of the conventional sector, overall in the EU [76]. The OF farmers under 35 years old only represent 0.2% of farmers in Portugal, a lower ratio than the Spanish or the Italian ones (1.3% and 2.1%, respectively) (Table 6).

Regarding the markets, Spain and Italy have a higher annual demand of OF products (42 and 52 euros *per capita*), and Portugal, the lowest values of this set of countries (2 euros per capita*),* with a organic share of 0.2%. These data highlight the relationship between the market demand and the reduced stimulus to the expansion of OF in Portugal.

Table 6. Organic farming statistics of five European countries (Portugal, Spain, Italy, Greece, Czech Republic) regarding the cultivated area (all crops, permanent grassland, fresh vegetables); farm area; farmer's age and market.

Country	Area of Organic Farming							Farmers	OF Market	
	All Crops [1]		Permanent Grassland [1]		Fresh Vegetables [2]		Farm Average [3]	Farms < 2 ha	Below 35 Years Old [4]	Spending Per Person [1]	Organic Share [1]
	ha	% [a]	Ha	% [b]	ha	% [b]	ha	% [c]	% [d]	€ [e]	% [f]
Portugal	253,786	7.0	147,323	58.3	3,276	0.7	110	46.1	0.2	2	0.2
Spain	2,083,173	8.9	1,085,338	52.8	22,105	0.7	62	26.3	1.3	42	2.8
Italy	1,908,653	15.4	544,048	27.6	60,732	2.6	50	27.5	2.1	52	3.2
Greece	410,140	5.0	200,663	55.9	1,870	0.5	7.5	50.6	nd	6	nd

Czech Rep.	520,032	12.2	424,090	84.2	260	0.1	180	10.3	nd	9	0.9

OF, Organic Farming; [a] Relative to the total agricultural area; [b] Relative to the total OF area; [c] Relative to the total number of OF farms; [d] Relative to the total number of farmers in OF mode; [e] Euros *per capita*, per year; [f] Relative to all food and drinks sold per year; Data source: [1] [27] (2017 data); [2] [77] (2018 data); [3] [76] (2015 data); [4] [78] (2000 data); nd, no data available.

The OF development in the LVID should include actions to support the farmers, like those to promote organic products such as the representation of producers in national and international exhibitions, the development of a communication plan to locate organic production or marketing units of mobile applications, and involving regional public purchases [38,39]. These strategies can help organic product marketing and their appreciation by the consumer, being the lever element for the development of this production mode. In addition, further actions to support farmers are foreseen, especially for certification, technical support and marketing, involving farmers and water user's associations, research entities and the ministry of agriculture. Lis Valley agriculture is fully dependent on the irrigation infrastructures, and aiming at its development, the National Irrigation Plan [79] foresees its modernization. To support water management and farm competitiveness through innovative practices, namely those of OF, an operational group project is in action [80,81].

5. Conclusions

Organic farming can play an important role in rural development by reinforcing the penchant for sustainable agriculture and its role for ecosystem conservation. The effectiveness of OF could be particularly relevant in areas of family farming, taking advantage of the increased availability of labor and the value of short marketing circuits.

It was concluded that the farmer's land structure, low education level and high age, constrains organic farming development. Also, farmers face a number of uncertainties that explain the low adherence to this production mode, namely the certification process, the technical knowledge of new technologies, especially crop protection, and the problems of marketing and guaranteeing profitability.

It is also concluded that the role of the state is clear in prioritizing rural development policies and the promotion of OF through support for land restructuring, modernization of irrigation, stimulation of young farmers, conversion and implementation of innovative technologies, and the organization of farmers for better productive efficiency and market access.

Finally, the study concludes that organic farming has significant potential for stimulating rural development in the Lis Valley and that the efforts and resources of the various stakeholders need to be harmonized to deliver effective support to farmers.

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Appendix A

Table A1. Farmers questionnaire.

Question	Response Options
Farmer age and gender	
Farmer educational level	Until 4th grade, 5–9th grade, 10–12th grade, Higher education
Relevance of agricultural activity	Main activity and source of income, Secondary activity that supports family income, Without relevance
Motivation for agriculture practice	Family activity, Continue a family business, Existence of land intended to be monetize, Landlord that wants to rent the parcels, Family farming solidarity and commitment
Land possession and exploitation of the parcels	Owner and farmer, Owner and not farmer, Loan (free installment loan) and farmer, Landlord and lessee, Owner and lending
Production destination	Market only, Partly to market, Self-consumption
Market	Only domestic, Domestic and foreign, Only foreign
Sales channels	Final consumer, Small retailers, Cooperatives or wholesalers, Large surfaces, Other producers
Willingness to adopt organic farming	Affirmative, Negative
Main decision factors to adopt organic farming	Public support, Assurance of market outlets, Market prices, Expand cultivated area
Additional comments	

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