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Economic and Social Sustainability through Organic Agriculture: Study of the Restructuring of the Citrus Sector in the "*Bajo Andarax*" District (Spain)

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Academic Editor: Sean Clark

Received: 30 June 2016; Accepted: 6 September 2016; Published: 12 September 2016

Abstract: Over 1000 hectares of citrus fruits crops are grown in the Bajo Andarax district in Almeria (Spain). The withdrawal of EU subsidies for conventional production led to a drastic loss of economic profitability of the holdings and, consequently, the abandonment of most of the conventionally managed farms of the district. In this context, a restructuring of the citrus sector from conventional to organic farming was implemented as a strategic measure to achieve the long-term sustainable development of the holdings. This study examines the citrus sector of the district and performs a comprehensive evaluation of the economic sustainability of this shift from conventional to organic production. In addition, the impact of the restructuring of the sector on the social sustainability both at the farm level and at the municipality level is studied. The results of the study are of interest to other agricultural areas of compromised profitability in which a shift towards organic production can represent a viable alternative for the economic and social sustainability of the holdings.

Keywords: economic sustainability; social sustainability; citrus farming; organic agriculture; sustainable development

1. Introduction

The ability of any sector to support a defined level of development is directly linked to the fulfillment of the principles of sustainability [1]. Sustainability is a three-dimensional concept that encompasses economic, environmental, and social aspects [2]. In this context, the shift from conventional to organic farming practices can contribute to the sustainability of those areas that would be otherwise at risk of abandonment, as reported by other authors [3].

Spain has a long tradition in citrus fruit agriculture and has increased its total production in recent years. The country's annual 7 million tons of citrus fruit production (3000 million €) is surpassed only by China, Brazil, the USA, India, and México [4].

In 2015, Spain dedicated 299,518 hectares to citric crops, 7020 of which were farmed organically. Oranges are the most commonly grown citrus fruit in the world, and this also holds true for Spain, where 148,777 hectares were grown last year [5].

The Bajo Andarax district of Almería accounts for 1080 hectares of citric fruit crops, over half of which are dedicated to the so-called "white" varieties of lesser organoleptic quality, which are largely unsuitable for fresh produce but are in great demand for juice (Figure 1). The lack of alternative sources of employment in the area means that the need to maintain these crops is not only a major economic concern, but also a social priority.

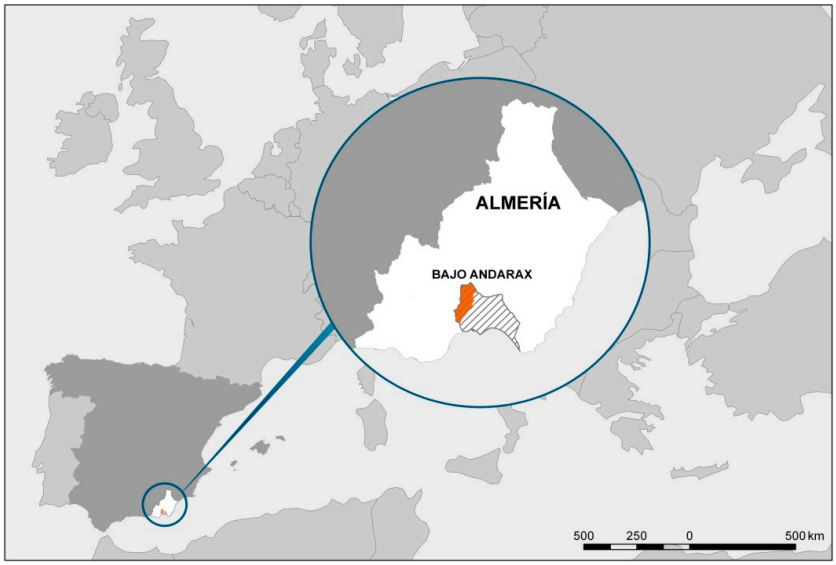

Figure 1. Intensive areas of organic citrus in the Bajo Andarax district (Almería). In red, the municipalities of Santa Fé de Mondújar and Gador, which are the object of the present study.

Most villages in this district enjoy limited options for economic growth, have a very aged population, and suffer from high unemployment rates [6]. From an environmental point of view, citrus crops also play an important role in the semi-arid surrounding landscape, since without them desertification would progress in the area.

Traditionally, citrus farming in the region received economic subsidies for transformation from the former common organization of the market (COM). However, the reform of the common organization of the citrus market led to a drastic change in the economic prospects of the farming sector of the Bajo Andarax district. Indeed, with aid awarded according to the area of cultivated land (350 €/ha) rather than the volume of production, a substantial gap between actual production and the aid received led to a sharp decline in the profitability of the orange plantations, with an overall drop of profitability of 60%. This decrease in profitability, in turn, resulted in the abandonment of the majority of the conventional "white" orange plantations and the socio-economic collapse of the district.

In this context, the Agricultural Processing Society (*Sociedad Agraria de Transformación*, or SAT, by its acronym in Spanish) "SAT Cítricos del Andarax" played a major role in the restructuring of the citrus sector in the Bajo Andarax district. A "*Sociedad Agraria de Transformación*" is a cooperative-type association of independent farmers with both economic and social objectives, and to which the totality of the production of the farmers is allocated. Since the further exploitation of conventional varieties was deemed economically unfeasible, the diversification into higher-value crops was considered the best alternative for the majority of the small and medium-sized farms of the district as a means to guarantee not only the socio-economic feasibility of the holdings, but also the reform of the sector in line with a climate-smart agricultural approach [7].

Purchasing preferences of European consumers have shifted in the last decades towards the consumption of natural products with little presence of chemical agents. In this context, sales of organically farmed produce have climbed to 3% of the total marketed produce from practically null, and are expected to double in the coming years [8]. Organic farming is increasing its share of the world food market and receives growing support from agricultural policies concerned with sustainability [9,10]. Despite the fact that the desire for sustainable agriculture is universal [11], there is no consensus on how to achieve such an ambitious goal [12]. Organic farming has been considered in prior research as an important means to ensure sustainable development [1]. In this context, organic farming is viewed as a means to produce food through the integration of cultural, biological, and mechanical practices aimed at preserving natural resources, biodiversity, animal welfare,

and human health [13]. In addition, organic products are greatly appreciated by an increasing share of consumers, who consider them of higher quality, mainly due to the lack of chemical products used during the production or conservation phase, which, in turn, allows a more sustainable and environmentally friendly supply chain [14,15].

Taking into account that organic farming has been shown in other cases to result in higher economic and financial results than conventional farming, due to both reduced labor input and greater market appreciation [3,16–18], SAT Cítricos del Andarax performed a thorough analysis of the legislation regulating organic farming in Europe in order to study the feasibility of a shift of the conventionally-managed farms of the district, which were in a situation of semi-abandonment, towards organic farming. In general terms, organic farming requires the avoidance of GMO and ionizing treatments, as well as of synthetic chemical products (such as pesticides, herbicides, fertilizers, waxes, and preservatives) in the cultivation, handling, and commercialization of produce. In the context of a shift towards organic farming, the SAT plays a major role in regulating the use of numbered labels or seals of quality that certify the produce's organic production, which are awarded after the control by the Organic Farming Committee and its authorized control bodies has taken place.

The application of EU regulations regarding organic farming was a priority for the Bajo Andarax citric plantations. Interestingly, the previous state of semi-abandonment of the plantations due to the economic unfeasibility of the holdings facilitated the shift to organic farming, since it is mandatory in any organic certification scheme to verify that the holdings under consideration have not been subjected to the aggressive use of fertilizers, herbicides, and plant protection treatments.

In the Bajo Andarax district, the municipalities of Santa Fé de Mondújar and Gádor have the highest density of organic citrus farming (90% of the total) of the district. SAT Cítricos del Andarax, in turn, plays a considerable role in the citric sector at the district level. Indeed, SAT Cítricos del Andarax sells over 85% of the district's citrius production, and its associates manage 450 hectares of certified organic farming inside the district and another 240 hectares in other territories.

The present work analyzes the suitability of conversion from conventional to a totally organic production scheme in the Bajo Andarax district of Almería (Figure 2). It also studies the recent changes in marketing focus, from selling "white" varieties to the fruit juice industry to the fresh marketing of organic farm oranges, which provide 40% more return than conventional citrus sales thanks to the increased demand for organically farmed citrus in the EU. This higher demand made it possible for SAT Cítricos del Andarax to start a new business line in organic orange juice, which boosts the added value of the members' crops by using the discards from both fresh market citrus and white varieties for juice.

Figure 2. Organic oranges in the Bajo Andarax district of Almería (Spain).

2. Materials and Methods

Two municipalities were considered in our study, namely, Gádor and Santa Fe de Mondújar. The selection of these municipalities was based on three criteria. First, these municipalities account for more than 85% of the production of citrus in the Bajo Andarax district and are therefore highly representative of the citrus sector in this area. Second, both territories are neighboring municipalities, thus guaranteeing similar agronomic and geoclimatic conditions (Table 1). Finally, SAT Cítricos del Andarax accounts for 66.78% of the employment provided by private companies in these municipalities [19], which, in turn, provides ideal conditions for the study of the impact of the farmers' association on the economic and social sustainability of the territory.

Table 1. Agronomic and geoclimatic frame conditions of the study.

Municipality	Altitude (m)	Surface (km^2)	Annual Rainfall (mm)	Climate	Main Crops	Watering Regime
Gádor	166	87.7	249	Continental Mediterranean	Orange	Flood Irrigation
Santa Fe de Mondújar	217	34.9	271			

2.1. Economic Sustainabilty

The analyzed data comprised 44 plantations producing the two main varieties of orange in the area (navelina and castellana) under both conventional and organic cultivation systems (Table 2). Due to the difficulties of carrying out an entirely random sampling of the farms, a stratified sampling that guarantees the validity of the sample [20] was performed according to the number of surveyed plots in the region and their typology.

Table 2. Sample distribution according to type of crops and variety.

Crop Type	Orange Variety	Sampled Surface (ha)	Number of Sampled Farms
Organic farming	Navelina	6.7	13
	Castellana	9.7	14
Conventional farming	Navelina	2.2	4
	Castellana	6.4	13
	Total	**25**	**44**

The sample consisted of 44 plots which make up 25 of the 1080 orange crop hectares in the district and featured no newly-built farms, as the aim of the study is to analyze the changes triggered by the restructuring of the sector from the old plantations to organic farming. The sample was initially expected to cover 50 hectares, but only 25 of these were found to include adequate cost management mechanisms. Nonetheless the 44 plots surveyed represent a valid sample of the number of the surveyed plots, with a 12.09% margin of error and a 95% level of confidence. All of the farms under consideration had grown conventional orange crops for at least 10 years prior to the start of the study.

Both conventional and organic farms in this sample use conventional flood irrigation and have an average area of under one hectare. The predominant planting pattern is 6 m × 4 m between trees for the navelina variety and 6 m × 6 m for the castellana variety. All plantations combine "white" varieties of castellana oranges, which are intended for the processing industry, and navelina oranges for the fresh market.

The economic sustainability of the cropping systems has been assessed by means of appropriate indices, as previously employed in the literature [3,16,17]. Table 3 summarizes the indicators of economic sustainability employed in the study.

Table 3. Economic sustainability indicators employed in the study.

Indicator	Measure	Source
Net Present Value Internal Rate of Return Discounted Cost-Benefit Rate	Profitability of the investment	Testa et al. [3] Sgroi et al. [16] Sgroi et al. [17]
Discounted Pay-Back Time	Return period of an investment	

An economic analysis was performed in order to determine the Net Present Value (NPV), the Internal Rate of Return (IRR), the Discounted Cost-Benefit Rate (DCBR), and the Discounted Pay-Back Time (DPBT), in accordance with the methodology proposed by Sgroi et al. [16].

The Net Present Value (NPV) was calculated by the difference between the discounted gross income values generated during the investment life of the project or investment and the corresponding fixed costs [21] by means of the following formula:

$$\text{NPV} = \sum_{I=0}^{n} \frac{GI_i - FC_i}{(1+r)^i} \quad (1)$$

where *GI* represents the gross income, *FC* are the fixed costs, *n* corresponds to the lifetime of the investment, and *i* and *r* are the year under consideration and the discount rate, respectively. In this formula, *GI* is calculated as the difference between gross production value and variable costs. In our study, the lifetime of the investment was 25 years and the discount rate is set to 5%, considering market conditions. By employing this criterion, an investment is deemed convenient if the NPV is positive; in the case of two alternative investment projects, the one providing the highest NPV is to be chosen [16,22].

The Internal Rate of Return (IRR) is the discount rate at which NPV equals zero, i.e., the discount rate at which the discounted benefits are equal to the discounted costs [16]. By using this criterion, an investment is deemed convenient if its IRR exceeds the chosen alternative discount rate [23].

In addition, the Discounted Cost-Benefit Rate (DCBR) was calculated to assess the economic sustainability of the cropping systems. The DCBR is defined as the ratio between the discounted gross income values generated during the investment life and the corresponding fixed costs. The following formula is employed to calculate the DCBR:

$$\text{DCBR} = \frac{\sum_{I=0}^{n} \frac{GI_i}{(1+r)^i}}{\sum_{I=0}^{n} \frac{FC_i}{(1+r)^i}} \quad (2)$$

According to this economic indicator, a ratio greater than 1 reveals a financially convenient investment [24] since the sum of the gross revenue provided by the investment exceeds the sum of the fixed costs.

Finally, the economic indicator DPBT has been employed in the study. DPBT corresponds to the number of years for which the sum of the discounted gross income equals the sum of the fixed costs [25].

In order to determine these indicators, an analysis of the information from the representative sample of plots in the study was performed by identifying the structure of costs and revenues of each farm. To this end, the structure and quantification of costs, income, and timeframe based on the methodology proposed by Juliá and Server [26] was employed.

Income was defined as the average settlement price of conventional and organically farmed navelina and castellana varieties over the last two years, for which internal price data of SAT Cítricos del Andarax was used.

The timeframe to analyze the profitability of both organic and conventional farms was set at 25 years. All farms were farmed by using conventional farming methods for the first 11 years

(years 1 to 11). Then, a two-year period was established for the conversion from conventional to organic farming (years 12 and 13); during this period, the farms were adapted to meet the administrative requirements for the certification of organic production, which was then obtained at the end of year 13. Finally, the farms were completely managed with organic production methods during the last 12 years of the study (years 14 to 25).

2.2. Social Sustainability

A substantial body of research has been developed in the last years with regard to the environmental and economic dimensions of sustainability. However, less attention has been paid in the literature to the social dimension of sustainability [2]. In addition, literature devoted to social sustainability is highly focused on specific research contexts, thus hindering the attainment of an integrative, all-encompassing framework of social sustainability [27].

Social sustainability was assessed in our study by selecting a number of indicators proposed in the literature for which relevant quantitative data was available. Table 4 summarizes the indicators of social sustainability employed in the study. The differentiation between internal (i.e., at organization level) and external (i.e., at the territory level) social sustainability dimensions proposed by Van Calker et al. [28] was employed as a first classification criterion. Farm-level data was collected and analyzed to evaluate those indicators related to internal social sustainability, whereas municipality-level data was employed for the assessment of external social sustainability.

The study of the impact of the restructuring of the sector led by SAT Cítricos del Andarax on the social sustainability of the municipalities was possible due to the very high degree of interdependence between the farmers' association and the socioeconomic conditions of the territory since the association accounts for 66.78% of the employment of private companies in these municipalities [19].

Table 4. Social sustainability indicators employed in the study.

Scope	Indicator	Source	Measure
Internal social sustainability	Educational attainment	Dillon et al. [29]	Increase of the percentage of qualified personnel in the association
	Employment creation	Manara and Zabaniotou [30]	Increase of the number of workers in the association
	In-house training	Amaral and La Rovere [31] Veldhuizen et al. [32]	Increase of the number of on-the-job training hours per worker and year
	Workforce gender balance	Mani et al. [2]	Increase of the percentage of female personnel in the association
External social sustainability	Employment	Amaral and La Rovere [31]	Increase of unemployment rate
	Education level	Weingaertner and Moberg [27] Amaral and La Rovere [31]	Increase of the proportion of population with secondary or tertiary education

In order to determine the impact of the restructuring of the sector on social sustainability, the evolution of these indicators was assessed during a 10-year period between 2001, the last year in which conventional farming was practiced, and 2011, a representative year of full organic production for which statistical data was available. This methodology allowed a direct comparison between the indicators of social sustainability in the period of conventional production and those obtained during organic-only production.

Data for the assessment of the internal social sustainability was obtained from the historical record of SAT Cítricos del Andarax. In addition, the evolution of the social sustainability indicators of the farmers' association during the period of study was compared to the evolution of the same indicators in the two immediate geographic aggregation levels, i.e., the province of Almería and the region of Andalusia. This provided a valuable comparison with the reference territories and allowed the

drawing of meaningful conclusions with regard to the evolution of the social sustainability indicators in other reference territories in which the farmers' association had no influence.

Statistical datasets for these territories were obtained from the Multi-territory Information System of Andalusia (*Sistema de Información Multiterritorial de Andalucía*, SIMA, by its acronym in Spanish) published by the Andalusian Institute of Statistics and Cartography of the Regional Government of Andalusia [33]. Unemployment rates at the regional and provincial levels were obtained from the historical series of the National Institute of Statistics (*Instituto Nacional de Estadística*, INE, by its acronym in Spanish) of the Spanish Ministry of Economy and Competitiveness [34].

Among the internal social sustainability indicators, education attainment was assessed as the increase during the period of study of the percentage of qualified personnel, defined as the proportion of personnel with secondary or tertiary education in the association. This result was then compared to the same measure in the province of Almería and in the region of Andalusia. As a further indicator of internal social sustainability, employment creation was determined as the increase of the number of workers in the organization over the period of study. This, in turn, was compared to the same measure in the two immediate geographic aggregation levels, i.e., at the provincial and regional level. In addition, in-house training was evaluated as the increase of the number of on-the-job training hours per worker and year in the association, for which the most recent data until 2015 could be used. No statistical data was available for this indicator at the provincial and regional level. Finally, workforce gender balance was calculated as the percentage of female personnel in the association, which was then compared to the same measure at the two immediate geographic levels.

External social sustainability was assessed by evaluating the evolution of the employment and the education level between 2001, the last year of conventional production, and 2011, a representative year of full organic production. In order to evaluate the evolution of the employment in the municipalities under consideration, statistical datasets of the evolution of the unemployment rate during the period of study were processed and compared to the evolution of the unemployment rate at both the provincial and regional level. Finally, the education level was evaluated by determining the increase of the proportion of the population with secondary or tertiary education in the study area during the period from 2001 to 2011 and comparing it with the evolution of the same measure at the provincial and regional levels.

3. Results

3.1. Economic Sustainability

3.1.1. Cultivation Costs

The cost structure analysis of the sample shows that the average cultivation costs in the region are lower than those of other areas [9,35]. Despite this relative cost advantage, low selling prices and the lack of economic profitability after the withdrawal of the public subsidies resulted in the abandonment of the conventional citrus farms of the region.

Table 5 shows the cost structure of the surveyed plantations with detail of the actual costs, yields, and income as obtained from the internal datasets of SAT Cítricos del Andarax in the surveyed farms. To this end, the cost structure proposed by Caballero, de Miguel and Juliá [36] has been employed and adapted to represent the results for the two varieties under consideration. Marked differences can be observed for both fixed and variable cost structures.

Regarding variable costs, we should highlight the lower annual cost of conventional crops (2185 €/ha) compared to organic crops (4147 €/ha for navelina and 3470 €/ha for castellana). The variable cost of conventional farming is 47% and 37% lower than the organic farming of navelina and castellana varieties, respectively. As regards the type of cost, conventional farming proves to be more economical in terms of variable costs, especially with respect to irrigation and fertilizers. This is partly due to the fact that organic fertilizers are more expensive than conventional synthetic ones. Moreover, no phytosanitary products were used under conventional management practices due to the

state of semi-abandonment of the surveyed plots. On the other hand, plant-health treatments in organic farming are limited to mineral oils (mostly used in navelina crops destined for fresh consumption) and diammonium phosphate (used in fly traps).

Table 5. Cost structure of the orange crop in the Bajo Andarax (€/ha).

	Conventional Crops				Organic Crops			
	Navelina (Processing)	**%**	**Castellana (Processing)**	**%**	**Navelina (Fresh Market)**	**%**	**Castellana (Processing)**	**%**
Irrigation	489	18	489	18	794	15	794	18
Fertilizers	284	10	284	11	728	14	512	11
Phytosanitary products	-	-	-	-	337	6	120	3
Cropping practices	468	17	468	18	761	14	761	17
Workforce	893	33	893	34	1.464	27	1.220	27
Others	51	2	51	2	63	1	63	1
Variable Costs (Total)	**2185**	**81**	**2185**	**82**	**4147**	**77**	**3470**	**77**
Annual Cost of Working Capital	**64**	**2**	**64**	**2**	**121**	**2**	**101**	**2**
Plantation repayment instalments	91	3	54	2	91	2	54	1
Interest on the plantation	57	2	34	1	57	1	34	1
Repayment instalments on the capital facilities	38	1	38	1	38	1	38	1
Interest on the capital of the facilities	24	1	24	1	24	0	24	1
Costs of replacement and maintenance of the facilities	65	2	65	2	65	1	65	1
Rent of the land, taxes, and others	187	7	187	7	587	11	487	11
Quality certifications	-	-	-	-	225	4	225	5
Fixed Costs (Total)	**462**	**17**	**402**	**15**	**1087**	**20**	**927**	**21**
Total Annual Costs	**2711 €/ha**	**100%**	**2651 €/ha**	**100%**	**5355 €/ha**	**100%**	**4498 €/ha**	**100%**

Source: Internal data of SAT Cítricos del Andarax based on the cost structure proposed by Caballero, de Miguel and Juliá [36].

The remaining cost factors covering cropping practices and labor are higher for organic crops due to the special attention they require, in particular the navelina variety which is intended for fresh consumption.

In order to determine the annual cost of working capital, we have considered the volume of variable costs to be financed according to crop type and variety. We have assumed an average interest of 5% for seasonal loans and an average reimbursement period of seven months.

The fixed costs shown in this table are annual and do not depend on production volume. Such is the case of farming costs, which cover grafting, removal, or substitution of orange trees and associated labor costs. They also include investment in new irrigation channels or the maintenance of existing channels, average annual renting of the plantations (which varies depending on farming system and orange variety), and payment of immovable property tax.

3.1.2. Profitability and Expected Income

Table 6 illustrates the returns by crop type and variety as obtained from the actual results from surveyed plots during the period of study. Farms yielded similar volumes of produce during the

transition and organic-only periods, despite the lack of synthetic fertilizers of the latter, due to the fact that the trees in the surveyed farms had reached their maturity and therefore full production capacity.

Table 6. Returns by crop type and variety by age of the plantation.

Variety: Navelina					
Period (Years)	**Production Method**	**Target Market**	**Weighted Average Annual Production (kg/ha)**	**Weighted Average Annual Price (€/kg)**	**Weighted Average Annual Returns [1] (€/ha)**
1 to 11	Conventional	Processing industry	27,038	0.0605	1636
12 to 13	Transition	Processing industry	33,200	0.0605	2009
14 to 25	Organic	Fresh market	33,200	0.2575	8549
Variety: Castellana					
Period (Years)	**Production Method**	**Target Market**	**Weighted Average Annual Production (kg/ha)**	**Weighted Average Annual Price (€/kg)**	**Weighted Average Annual Returns [1] (€/ha)**
1 to 11	Conventional	Processing industry	39,331	0.0605	2379
12 to 13	Transition	Processing industry	42,200	0.0605	2553
14 to 25	Organic	Processing industry	42,200	0.1265	5338

[1] Deducting harvesting costs, transportation, fees, and the SAT operational program.

Under conventional crop management, both navelina and castellana varieties are intended for the processing market, whereas the navelina variety managed under organic management techniques is targeted to the fresh market. Prices of those varieties destined for the organic market, both as fresh and processed products, is higher than the equivalent varieties for the conventional market.

Regarding sales-generated income, the price per kilogram is the same for organic and conventionally farmed oranges due to the fact that all farms grow conventionally for the first 11 years under consideration. After the shift to organic farming, significant differences in sales prices are observed.

In the case of organic farming, we have considered other income from aid and subsidies, which is usually geared towards the improvement of the quality of facilities, investigation, and counseling for producers. Such aid was specifically intended for organic production and usually had a maximum validity of five years, though in some cases this period could be extended. There are two kinds of financial aid. On the one hand, agro-environmental measures regulated by the decree of 24 March 2011, BOJA of the Junta de Andalucía under Regulation (CE) 1698/2005 [37], which grants payments of 510.40 €/ha for the first three years after shifting to organic production and 459.36 €/ha for the following two years. The second is the subsidy covering 80% of the costs of registration and renovation with organic produce Control Organisms, limited to a maximum of 3000 € over the five years of financial aid.

3.1.3. Financial Analysis of Conventional and Organic Farming

After determining the costs and income structure of the farms, their profitability was analyzed. It must be remembered that the aids and subsidies granted to organic farming clearly benefit its financial analysis. Bearing in mind that the subsidy is not a regular source of income, the analysis included current expiration dates of the aid, but it is possible that this institutional support to organic agriculture will continue in the future. However, this analysis includes neither direct aid that certified organic producers receive nor additional aid that all producers receive due to the mismatches in aid to production generated by the new common organization of the market (COM).

Table 7 summarizes the profitability indicators of conventional and organic farming according to variety (navelina or castellana). This analysis reveals better results during the period of organic farming, both for its fresh market variety (navelina) and its fruit juice industry variety (castellana). This result is consistent with other studies of the sector [16,38].

Table 7. Profitability indicators by crop type and variety.

	NPV		IRR		DCBR		DPBT	
	Organic	**Conventional**	**Organic**	**Conventional**	**Organic**	**Conventional**	**Organic**	**Conventional**
Navelina	12,024	−10,590	11%	-	1.32	0.77	16.46	-
Castellana	5222	−555	13%	2%	1.17	1.05	14.98	-

Specifically, we have obtained positive NPV values only in the organic varieties. 12,024 €/ha in case of navelina and 5222 €/ha in case of castellana variety. The analysis of the IRR provided returns of 11% and 13% for navelina and castellana, respectively. Moreover, growers who have opted for organic production have recovered their investment in 16.46 years, in the case of navelina, and 14.98 years for castellana.

Certain guidelines can be recommended to improve the profitability of organic plantations of the fresh market varieties in the Bajo Andarax district. One would be to bring the shift to organic methods forward to the third year of cultivation in new farms, once the seedling has developed, in order to recoup the investment sooner. It is also necessary to improve the quality of the fruit in all plantations, even at the expense of incrementing production costs in order to reduce the quantity of discarded produce, which is decisive to the producers' price settlement. Finally, given these results it is also advisable to valorize the discarded produce for organic fruit juice, thus increasing the added value of the varieties.

Finally, these results confirm that the restructuring to organic farming can be an economically sound alternative that can guarantee the economic sustainability of the holdings for those agricultural areas in which citrus production is still managed under conventional production schemes and the plantations are fully or partially abandoned due to the lack of economic profitability. This is the case, for example, of the Lecrín Valley in Granada, the Guadalquivir Valley in Seville and Cordoba, and the citrus-farming areas of the Almanzora Valley in Almería. The farms in these areas are similar in their varieties and crops to those analyzed in this study, and are also considered to be low-intensity agriculture. However, the shift to organic production would not be easily implemented in high-yield conventional holdings of the Spanish Levante regions (mainly Valencia and Murcia), where conventional farming is a more profitable alternative due to the production structure of the holdings and the use of conventional varieties of higher yield.

3.2. Social Sustainability

Social sustainability was assessed by differentiating between internal (i.e., at farm level) and external (i.e., at municipality level) sustainability. Table 8 summarizes the measures of internal social sustainability employed in the study.

Table 8. Internal social sustainability measures employed in the study.

Measure	**Period**	**SAT Cítricos del Andarax**	**Geographic Reference Areas**	
			Province of Almeria	**Region of Andalusia**
Increase of the percentage of qualified personnel in the SAT	2001–2011	−20.21%	14.04%	12.99%
Increase of the number of workers in the SAT	2001–2011	1168.75%	7.28%	6.99%
Increase of the number of on-the-job training hours per worker	2001–2015	20.23%	Not applicable	
Increase of the percentage of female personnel	2001–2011	6.47%	7.67%	8.62%

Educational attainment was assessed as an indicator of internal social sustainability by calculating the increase of qualified personnel in SAT Cítricos del Andarax during the period from 2001 to 2011. A decrease of 20.21% in the ratio of qualified personnel was observed during this period, thus indicating an average annual decrease of 2.02%. This significant decrease in the qualification profile of the farmers' association can be explained by the fact that most of the new employment took place in the areas of harvesting and processing, where qualified personnel are less prevalent. This decrease in the

qualification profile of the association is in sharp contrast to the evolution of the qualification level in the in the two immediate reference geographic levels, i.e., the province of Almería and the region of Andalusia, where an increase of 14.04% and 12.99%, respectively, was registered for the same indicator in the period from 2001 to 2011.

As a further indicator of internal social sustainability, employment creation by the farmers' association was also evaluated in the study. In the period from 2001 to 2011, the number of workers in the association increased from 16 to 203, thus resulting in a total increase of 1168.75% and an average annual increase of 116.87% during this period. This drastic increase in employment was due to the rapid and consistent rise in the turnover of the association as a result of the conversion from low-yield conventional production to organic production. Indeed, the turnover of SAT Cítricos del Andarax increased by 495.18% during the period from 2001 to 2011. When considered in relation to the increase of employment during the same period in the province of Almería and in the region of Andalusia, it becomes apparent that the increase at the SAT surpassed more than significantly the increase in both territorial domains: the total increase of employment in the province of Almería amounted to 7.28% over the same period (average annual increase of 0.52%), whereas the total increase and the average annual increase of employment in Andalusia during the same period was 6.99% and 0.50%, respectively.

In a similar vein, professional training was also evaluated as a measure of internal social sustainability. To this end, the total number of hours of on-the-job training at SAT Cítricos del Andarax was computed and then the average number of training hours per worker and year were calculated. The results show a total increase of 20.23% in the period from 2001 to 2015 (average annual increase of 1.44%). This rise in the workforce training can be explained by the increasing regulatory qualification requirements in agricultural holdings, especially in the fields of work safety and quality assurance.

As an additional internal social sustainability measure, workforce gender balance in the association was also assessed. To this end, the increase in female personnel was calculated. In this case, an increase of 6.47% was observed in the period from 2001 to 2011. As in the case of educational attainment, this can be explained by the fact that the areas in which most of the new employment was created during this period are those in which traditionally mostly female personnel are hired. This result is in line with the increase in female occupation ratios during the period from 2001 to 2011 in the province of Almeria and in Andalusia, of 7.67% and 8.62%, respectively.

Lastly, two indicators of external social sustainability were considered: employment and education level. Table 9 summarizes the results of the external social sustainability indicators employed in the study.

Table 9. External social sustainability measures employed in the study.

Measure	Period	Municipalities of Study in the Bajo Andarax	Geographic Reference Areas	
			Province of Almería	Region of Andalusia
Increase of unemployment rate	2001–2011	−0.38%	21.14%	10.98%
Increase of the proportion of population with secondary or tertiary education	2001–2011	13.94%	14.04%	12.99%

As measures of external social sustainability, both measures were determined in those territories in which the farmers' association has a high social impact, i.e., in the municipalities of Gádor and Santa Fe de Mondújar. Indeed, the high proportion of employment directly accountable to the SAT in these municipalities results in a high degree of interdependence between the association and the social conditions in the territory.

Firstly, the increase of the unemployment rate in the studied municipalities was assessed. The analysis of the statistical data for these municipalities shows a decrease of 0.38% over the 10-year period from 2001 to 2011, i.e., an average annual decrease of 0.04%. This figure has to be put into the

context by comparing it with the results of the same measure in the two reference territorial domains of Almería and Andalusia. Indeed, the increase of the unemployment rate in the same period amounted to 21.14% and 10.98% in the province of Almería and in the region of Andalusia, respectively. Hence, the municipalities under consideration have been able to counteract to a large extent the more than significant increase in unemployment rate in the immediate reference territories during the most severe years of the last financial crisis. Since the SAT is the largest employer in these municipalities and, as previously discussed, employment creation in the SAT during the same period has increased by 1168.75%, it becomes apparent that this considerable increase of employment in the farmers' association during this period has had a favorable social impact in the municipalities in terms of a reversal of the rise of the unemployment rate that has been experienced in other territories.

Finally, education level was studied as a measure of social sustainability. To this end, the increase of the population with primary or secondary education in the two municipalities under consideration was studied during the period of 2001 to 2011. An increase of 13.94% was registered during this period in the municipalities, i.e., an average annual increase of 1.39%. This result, in turn, has to be considered in relation to the same measure in the reference territorial aggregation levels of the province of Almería and Andalusia. Indeed, the population with primary or secondary education in the province of Almería and Andalusia in the same period increased by 14.04% and 12.99%, respectively, during the same period. We can therefore conclude that a similar variation has taken place in all three territorial domains.

4. Conclusions

The profitability of organic farming in the area is higher than that of conventional farming in both of the orange varieties under consideration. Crop production costs reveal the need for a high sale price for the farms to be profitable, and organic varieties reach higher prices than the conventional varieties: sale prices of organically grown navelina and castellana oranges are 425% and 209% higher, respectively, than those of their conventionally grown counterparts. Cultivation costs are 98% higher in organic navelina farming and 70% higher in organic castellana farming, mostly due to the fact that conventional orange farms are in a state of semi-abandonment, which brings down cultivation costs of the conventional varieties.

From a social sustainability perspective, the restructuring of the citrus sector in the Bajo Andarax district has resulted in a notable improvement of the employment indicators both at the farm level and at the municipality level in comparison to the reference territories of the province of Almería and the region of Andalusia. This improvement, however, has not resulted in an increase of the qualification level of the workforce of the farmers' association in comparison to the reference territories. Moreover, no significant differences have been found in terms of workforce gender equality in the association and of education level in the municipalities in comparison to the reference territories.

Future work will focus on the study of environmental sustainability as a result of the shift from conventional to organic production in the sector, thus complementing the results of this paper.

Acknowledgments: The authors wish to express their gratitude to SAT Cítricos del Andarax and the Research Centre CIAIMBITAL of the University of Almería (Spain), for all the support provided.

Author Contributions: This work is the result of the collaboration between all authors. All authors have equally contributed, reviewed, and improved the manuscript. All authors have revised and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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