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Contribution of management accounting practices to the efficiency of organic farms

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ABSTRACT

This study analyzes the influence of management accounting practices on the efficiency of organic farms. To do this, we collected survey data from 50 Spanish organic farms. Efficiency is measured using Data Envelopment Analysis (DEA). Results show that the use of management accounting practices improves efficiency. Specifically, a greater intensity in their use can lead to an increase in the margin of approximately 4.000 € for the representative farm. We also observe that efficiency is enhanced by the use of newer management accounting techniques (e.g., benchmarking) more than by traditional techniques (e.g., costing). This paper offers guidance to policymakers, farm advisors and entrepreneurs of the organic farm sector about the suitability and the potential economic impact of the management accounting tools.

Keywords:

Organic farms; Efficiency; Management accounting practices; Information and communication technologies

CONTRIBUTION OF MANAGEMENT ACCOUNTING PRACTICES TO THE EFFICIENCY OF ORGANIC FARMS

1. INTRODUCTION

This work examines the link between the use of management accounting practices and efficiency in organic farms. There is an important body of literature on the effectiveness of management accounting on business performance. Most of this research studies large or small-and-medium-sized companies belonging to the industrial, commercial or service sector. However, there is a growing social and political interest in the development of innovative and sustainable food business initiatives (organic label or farm-to-fork strategies) (European Commission, 2020; Ruggerini et al., 2022). Therefore, it is relevant to analyze the effect of management accounting techniques in a sector such as organic farming that contributes to the achievement of sustainable development goals (Lued and Radlach, 2016).

In the current socioeconomic context of high production costs together with environmental concerns and the demand for more healthy food, organic production provides added value. So much so that the organic farmland has increased almost exponentially in recent decades, with Spain being the third country in the world with the largest areas of organic agricultural land (Willer et al., 2021). Therefore, the European Commission presented an Action Plan for the development of organic production. Its overall aim is to boost the production and consumption of organic products, to reach 25% of agricultural land under organic farming by 2030 (European Commission, 2021). In addition, on January 1, 2022, the new Regulation (EU) of the European Parliament and of the Council on organic production and labelling of organic products (Reglamento UE 2018/848) has entered into force.

Most organic farms have a family or micro-enterprise nature and they usually work under budget constraints. Although they do not have a well-defined structure of cost control and management, their daily managerial practice is comparable to current management accounting practices (Ndemewa et al., 2019). Management accounting comprises a set of tools that do not belong exclusively to the accounting domain, and are available to and can be applied by any individual or professional group (Kurunmäki, 2004). We predict that the use of the management accounting practices positively influences the productive efficiency of organic farms.

On the other hand, the suitability of management accounting practices depends on the type of strategy followed by the organization: low cost or product differentiation (Chenhall and Langfield-Smith, 1998a). Traditional practices, such as costing or budgetary planning, focus on operational and internal control and are more appropriate for a low-cost strategy. Newer management accounting techniques, such as balanced scorecard or benchmarking, are tools that permit the measurement and management of both internal factors as well as relationships with the company's environment (e.g., customers, suppliers, public administration, etc.), and are more appropriate for a product-differentiation strategy. Although organic farms do not usually adopt formal strategic planning (De Rosa et al., 2019), it is true that they focus on product differentiation via sustainable innovations (Porter, 1980; Andersén, 2021) such as organic branding (organic labelling). We predict that the newer management practices are more likely to have a positive effect than traditional practices on the efficiency of organic farms.

For the empirical study, we use data collected through surveys gathered from 50 organic farmers in the northern Spanish regions of Asturias and Galicia. We measure management accounting practices with an indicator that comprises several individual control tools, including traditional practices such as costing and newer practices such as benchmarking. We measured farm performance using a frontier methodology to estimate measures of productive efficiency (Chen et al., 2015).

This paper responds to recent calls for in-depth studies on the outcomes of management accounting practices in farms (Ndemewa et al., 2019). Moreover, we contribute to the academic literature on the role of different management accounting tools supporting product differentiation strategies. We add to this literature by quantifying the economic impact of using these tools. Additionally, from a practical point of view we offer empirical evidence about the management accounting techniques that are best suited to the contingencies of organic farming.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1. Management accounting practices in farms

The literature offers ample evidence on the effectiveness of management accounting on business performance. However, most of this research has been focused on large firms. Small and medium-sized enterprises (SMEs) have been studied far less (Lavia-López and Hiebl, 2015) and, particularly little attention has been given to the farm sector (Shadbolt, 2008; Rikkonen et al., 2013; Ndemewa et al., 2019). This is probably due to several reasons, such as their family or micro-enterprise nature, the difficulty in obtaining data, and less interest in the primary sector in accounting research.

A recent review of the literature shows that "it is difficult to develop an overall picture of the practice of management accounting practices in farms and farm enterprises because little research has been published on the topic, and these studies are mostly discrete and unconnected to the others. The findings reveal that the practice of management accounting in farms is subject to information problems and that the empirical research on this topic largely lacks a theoretical explanation" (Ndemewa et al., 2019). Management accounting practices are influenced by factors such as the impact of family ownership on the business processes, government farm policies, market competition, technological changes, the seasons and the weather/climate, the traditions and the cultural and anthropic practices of each specific region. Thus, the limited findings to date on the practice of management accounting in farms indicate that caution should be taken when generalizing the current knowledge on the use of management accounting practices in other organizational forms to farming entities. Moreover, future research should draw on explicit theories to explain empirical results (Wei et al., 2014; Ndemewa et al., 2019).

Farms often work with small budgets, so that accounting-related issues such as budgeting or costing are especially relevant to farmers. Management accounting techniques are also applicable to farms, perhaps in a less formal way. Furthermore, it is probable that farmers have naturally adopted accounting techniques that allow them to prepare budgets and calculate costs as part of their daily routine. In particular, this occurs in the context of subsidized agriculture (e.g. through Common Agricultural Policy, CAP) or with special regulations such as mandatory requirements for organic certification. This acquisition of accounting skills by farmers can be explained by the fact that cost and management accounting comprises a set of tools that do not belong exclusively to the accounting domain but which are available to and can be applied by any individual or professional group (Kurunmäki, 2004). In smaller enterprises, there is usually not a structured use of management accounting techniques, with management accounting often undertaken by the owner-manager/entrepreneur. Furthermore, mechanization, the use of digitalized information systems, monitoring techniques carried out by means of sensors and automated identification in farms have also increased (Ndemewa et al., 2019). Given that these practices can be categorized as being part of management accounting (Horngren et al., 2011), they may have significant impacts on how management accounting is performed in farms. Therefore, we formulate the following hypothesis:

H1: The use of management accounting practices positively influences efficiency of the organic farms.

2.2. Management accounting practices and strategy

Previous literature shows that the suitability of management accounting practices depends on the size and the strategy followed by the company (Chenhall and Langfield-Smith, 1998a). Traditional practices, such as costing or budgetary practices, are focused on operational and internal control and are probably more suitable for low-cost strategies. Newer management accounting practices, such as balanced scorecard or benchmarking, are tools directed at the external environment rather than the internal organization and they combine both financial and non-financial information. Traditional management accounting practices are focused on concerns internal to the organization and are financially-oriented. In contrast, newer management accounting techniques have an explicitly strategic focus. Firms that place a strong emphasis on product differentiation strategies benefit from newer management techniques (Chenhall and Langfield-Smith, 1998b). Financial measures are too aggregated and not timely enough to provide effective feedback on how the organisation is maintaining product quality and timely delivery. Moreover, the financial indicators reflect the financial result of an action whereas the non-financial ones refer to performance drivers (Kaplan and Norton, 1996). For example, balanced performance measures such as the balanced scorecard link measures of customer satisfaction, such as timely and reliable delivery, with other measures of key production activities, such as cycle time and throughput rates, while demonstrating the implications for financial outcomes (Kaplan and Norton, 1996). On the other hand, benchmarking emphasizes an outward focus and seeks to improve performance by learning from the experiences of effective organizations. This involves more than establishing best practice standards, and includes examining the processes used by high-performing organizations. It can help focus managers' attention on broad business principles and assumptions that stimulate the formulation of a variety of policies that may sustain customer service, distribution and delivery strategies (McNair and Leibfried, 1992). Previous work specializing in the farming sector argued for the suitability of the balanced scorecard (designed to fit farms' purposes) or benchmarking (for example using Farm Accountancy Data Network or FADN system and its database) for value creation in farms (Shadbolt 2008; Rikkonen et al., 2013).

Moreover, when it comes to organic production, the current scientific literature is even more scarce or very specific to particular models or types of farms (Ndemewa et al., 2019; Tashakor et al., 2019). Most farms do not usually adopt formal strategic planning (De Rosa et al., 2019) but it is clear that organic farms are focused on product differentiation. They apply this strategy via sustainable innovations (Porter, 1980) reflected in organic branding. In these farms, sustainable innovation does not imply outlays of R & D, but is instead implemented by meeting high levels of quality standards via product qualification (organic label) and by augmenting their portfolio with higher value-added products or by differentiated packaging (Capitanio et al., 2010). In this regard, sustainable innovations allow firms to follow a differentiation strategy. Among other strategic priorities, a differentiation strategy focuses on offering specialized product features that are valuable for costumers. To implement these strategies successfully, organizations need to have an accurate vision of the current competitive situation to persuade costumers about the features of the sustainable products (López-Valeiras et al., 2015). Product certification as organic label is a mechanism for linking local farmers and non-local actors by which farmers can signal to, and attract revenues from, exogenous actors. In this context, the use of organic production labels facilitates bridges to geographical areas other than the region of origin (Müller and Korsgaard, 2018). Previous research shows that in companies that follow a differentiation strategy based on sustainable innovation, performance is enhanced by contemporary rather than traditional management accounting practices (Chenhall and Langfield-Smith, 1998b; López-Valeiras et al., 2015).

Accordingly, we sustain that contemporary practices are more likely to have a positive effect than traditional practices on the efficiency of organic farms. Our second hypothesis, therefore, is:

H2: Newer management accounting practices are more likely to have a positive effect than traditional practices on the efficiency of organic farms.

3. METHODOLOGY

3.1. Sample and data collection

A survey was designed to collect information on success factors of organic farms. With the collaboration of the Regulatory Council for Organic Farming in Asturias (COPAE) and the Campoastur farm cooperative, 80 responses were obtained. After a debugging process, we worked with a final sample of 50 cases that contain all the necessary data to be able to both determine their level of efficiency as well as to analyze the determinants of efficiency. The study centered on the Spanish regions of Asturias and Galicia. Each of the farmers was interviewed with the questionnaire on their own farm, a process lasting an average of one hour. The data, collected in 2020 and 2021, refer to the year 2019.

For the DEA model used to estimate technical efficiency, we selected inputs and outputs based on existing studies that used firm-level financial data, especially those analyzing the case of agri-food firms (Soboh et al., 2012; Sellers-Rubio et al., 2016; Lemonakis et al., 2016). As the output variable, we used the total sales revenue. As inputs, we selected four variables that reflect the resources used in the organic farms: the number of workers; the total amount of investment in buildings and machinery; the total land used expressed in hectares, and the costs of raw materials. The variables used as determinants of efficiency were selected based on both the previous literature on farm efficiency and the opinions of the experts consulted from the collaborating entities. These variables capture different components of managerial strategy and social aspects of sustainability that can influence the efficiency of the organic farms.

Two types of variables were used: (1) two factors extracted from a principal component analysis (PCA) based on Likert-style questions related to the use of management accounting practices and information and communication technologies (ICT) (from 1 to 5); and (2) variables measured directly from interviews or calculated using the information gathered.

Each construct or factor was measured through various items, based on previous studies, and in some cases adapting these to the characteristics of the farms (Chenhall and Langfield-Smith,1998a; Burke, 2010; Vasa and Trendov, 2020). The constructs used in the analysis are presented in Table 1. For their measurement, the farmers were asked to value the degree of implementation/use of the different practices over the previous three years on a scale ranging from 1 (‘very little implementation’) to 5 (‘very high implementation'). Finally, the value of the factors has been normalized to take values between 0 and 1.

Table 1 shows that the Kaiser–Meyer–Olkin (KMO) and Sphericity tests passed for the factors 'use of management accounting practices' and 'use of information and communications technologies' (Hair et al., 2014). The KMO index is a measure of sampling adequacy that ranges from 0 to 1, with a value greater than 0.5 considered to indicate suitability for factor analysis. Bartlett's Test of Sphericity should be significant ($p < 0.05$) for factor analysis to be suitable, which occurred for the two factors. Table 1 shows that, for both factors, the explained variance exceeded 60%. Factor loadings presented values greater than 0.7, except in the case of budgets and variance analysis related to management accounting practices (0.670), and Cronbach's alpha coefficient exceeded 0.8 in the two constructs.

Table 1. Constructs used in the analysis

Factor	Items (from 1 to 5)	Factor loadings	Statistics and tests
Use of management accounting practices	Calculation and analysis of costs of products and/or services	0.830	Cronbach Alpha: 0.886
	Budgets and variance analysis	0.670	Factorial: 1 factor
	Management indicators system	0.892	Explained variance: 63.4%
	Analysis of the profitability of products and/or services	0.856	Sig, Bartlett: 0.000
	Comparative studies are carried out with other companies in order to introduce improvements in the management	0.709	KMO: 0.663
Use of information and communication technologies	To consult information about the farm (databases)	0.836	Cronbach Alpha: 0.893
	To make the farm known to current and potential customers	0.844	Factorial: 1 factor
	For the commercialization of the products	0.937	Explained variance: 76.2%
	For productive agricultural/livestock activities	0.870	Sig, Bartlett: 0.002
			KMO: 0.783

Table 2 shows descriptive statistics of the variables used in the empirical analysis: output, inputs, managerial and social aspects, and certain relevant control variables. The following aspects are highlighted:

- The average value of sales per farm is €55,720. In total, 26% of the farms carry out diversification activities, such as the transformation and commercialization of their production and others such as rural tourism.

- The average number of workers per farm is below 2.
- The industry sales represent 47.8%, the rest being sales through short marketing channels as direct sales, grocery stores and restaurants.
- Beef cattle farms represent 42% of total farms, followed by dairy cattle farms (34%), vegetable production farms (16%) and other livestock production farms (8%).
- Family labor represents 73% of total labor and 22% of the farms are managed by a female. The average age of managers is 47.3 years and 22% of them have certified organic training. 36% of the farmers consider that they have ensured continuity for the next 10 years, rating this issue with 5 points on a scale from 1 to 5.

Table 2. Descriptive statistics of the 50 organic farms included in the study: output, inputs and determinants of efficiency

Variable	Mean	Standard Deviation	Minimun	Maximum
Output and inputs				
Output:				
Sales (€)	55,720	53,159	5,000	212,500
Inputs:				
Number of workers	1.62	0.89	1	5
Investment (€)	237,807	467,294	30	3,000,000
Land (ha)	40.6	29.3	0.8	115.5
Materials costs (€)	19,835	17,464	600	61,000
Determinants of efficiency				
Managerial variables:				
Diversification (dummy)	0.26	0.443	0	1
% Own land	40.1	34.6	0	100
% Industry sales	47.8	47.6	0	100
Use of ICT	0.445	0.312	0	1
Use of management accounting practices	0.540	0.264	0	1
Social variables:				
Female manager (dummy)	0.220	0.418	0	1
Manager age (years)	47.3	8.6	32	70
Manager with certified organic training (dummy)	0.220	0.418	0	1
% Hired labor	27.0	41.3	0	100
Assured continuity (dummy)	0.360	0.485	0	1
Control variables:				
Asturias (dummy)	0.760	0.431	0	1
Galicia (dummy)	0.240	0.431	0	1
Vegetable farms (dummy)	0.160	0.370	0	1
Dairy farms (dummy)	0.340	0.479	0	1
Beef farms (dummy)	0.420	0.499	0	1
Other livestock farms (dummy)	0.080	0.274	0	1

In the Appendix, we present a table with the correlations between the variables used. Correlations between the variables are generally weak, taking values less than 50% in most cases.

3.2. Efficiency analysis

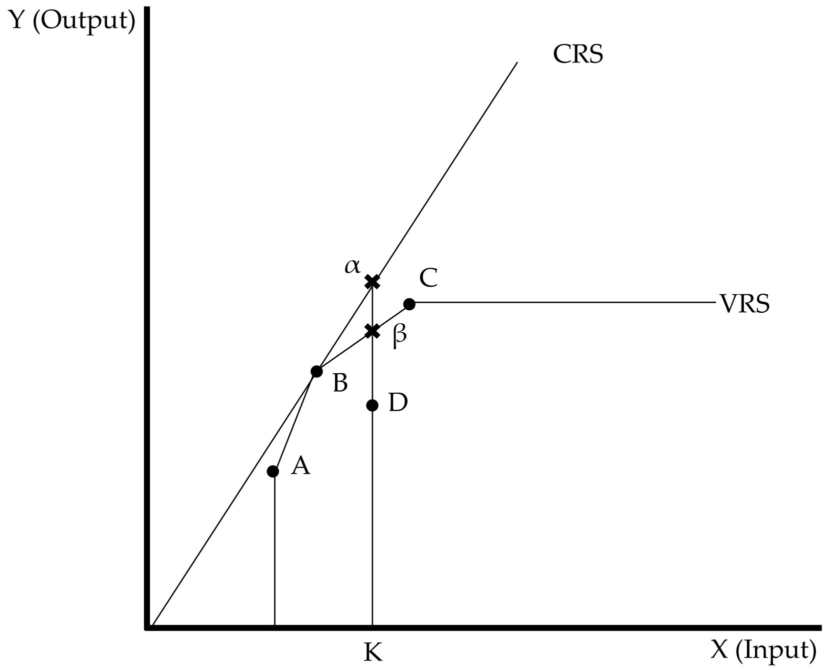
We use efficiency, since it can be considered a meaningful and reliable measure of firm performance (Baik et al., 2013; Chen et al., 2015). Efficiency is a long-run determinant of competitiveness and can be crucial to farm survival in times of market contractions and crises.

Technical efficiency is estimated by the distance to a production frontier. To estimate the production frontier, parametric stochastic frontier analysis (SFA) or non-parametric Data Envelopment Analysis (DEA) can be used. DEA is more appropriate for relatively small samples such as ours, and has the added advantage that it does not impose any structure on the functional form of the frontier (Tovar and Wall, 2019). Following the rule suggested by Banker et al. (1989), we have a sufficient sample size to apply the DEA methodology with four inputs and one output ($50 \geq \max \{4 \times 1, 3 \times (4 + 1)\}$).

We consider that farms seek to generate the maximum possible value from existing inputs. Indeed, in our sample, several farms process part or all of their production in order to capture greater value from it. It therefore seems reasonable for us to choose an output orientation to measure efficiency.

In DEA models, the production frontier, and hence efficiency, can be calculated under the assumptions of constant returns to scale (CRS) (Charnes et al., 1978) or variable returns to scale (VRS) (Banker et al., 1984). Figure 1 illustrates the frontiers and the efficiency calculations under CRS and VRS assumptions for the simplest case of an output (y) being produced with a single input (x):

Figure 1. Data Envelopment Analysis (DEA) frontiers*



* Observations for four firms are represented by input–output combinations A, B, C and D. K represents the input of the inefficient firm D. α and β represent the efficient input-output combinations achievable by firm D under Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) assumptions.

Points on the reference frontier (CRS or VRS) are efficient, while those below the frontier are inefficient. Thus, for the CRS frontier, firm B is efficient, whereas firms A, C and D are inefficient. For the VRS frontier, on the other hand, firms A, B and C are efficient, while firm D is inefficient. Output-oriented efficiency is calculated as the ratio of actual output to maximum output attainable so that efficiency scores range from zero to one, with a value of one representing efficiency in production and values lower than one representing the degree of inefficiency. Focusing on firm D, which is inefficient under both CRS and VRS specifications, efficiency under CRS (EFF_{CRS}) can be calculated as:

$$EFF_{CRS} = \frac{\overline{KD}}{\overline{K\alpha}} < 1 \tag{1}$$

Under VRS, efficiency for firm D is calculated as:

$$EFF_{VRS} = \frac{\overline{KD}}{\overline{K\beta}} < 1 \tag{2}$$

We calculate efficiency scores under both CRS and VRS assumptions. Once this has been done, we relate these scores to a series of explanatory variables in order to analyze the factors that influence efficiency. The following equation is estimated to determine the effect of efficiency determinants on farms' efficiency scores:

$$Eff_i = \beta_0 + \sum_{j=1}^{J} \beta_j z_{ji} + e_i \tag{3}$$

where Eff are the efficiency scores, z_j are the variables considered as efficiency determinants, e is the error term, and the βj are the parameters to be estimated. Subscript i refers to the observed units.

We carried out a two-step procedure with a double bootstrap proposed by Simar and Wilson (2007). In the first stage, the efficiency values corrected by the bias were determined (2000 replications), while in the second stage we studied the factors that could influence the efficiency levels by employing a truncated bootstrap regression (2000 replications) (Badunenko and Tauchmann, 2019).

4. RESULTS

Empirical implementation of the econometric methodology described above has been carried out using the Stata 17.0 package. The results obtained are presented in Table 3, where it can be seen that there is substantial variability in the efficiency scores of the organic farms. According to the CRS model, there are 10 efficient farms, while there are 14 with the VRS model.

Table 3. Standard and bias-corrected DEA efficiency scores (n = 50)

	CRS		VRS	
Variable	**Scores**	**Corrected Scores***	**Scores**	**Corrected Scores***
Mean	0.54	0.46	0.62	0.53
Standard Deviation	0.33	0.27	0.33	0.28
Minimum	0.08	0.07	0.09	0.07
Maximum	1.00	0.85	1.00	0.92
Number of efficient ventures	10		14	

* These are the bias-corrected scores from the first stage of the Simar and Wilson (2007) procedure.

The analysis of the factors that determine efficiency show the effects of variables that reflect management as well as social aspects of the farms, as described in Section 3. The results in Tables 4 and 5 should be interpreted by taking into account the fact that positive coefficients indicate increases in inefficiency, whereas negative coefficients indicate reductions in inefficiency, i.e., efficiency improvements.

Table 4. Determinants of efficiency (n = 50)

	CRS			VRS		
Variable	**Coefficients**	***p*-value**		**Coefficients**	***p*-value**	
Managerial variables:						
Diversification (dummy)	-4.829	0.062	*	-7.947	0.028	**
% Own land	-0.170	0.001	***	-0.247	0.000	***
% Industry sales	0.115	0.000	***	0.148	0.000	***
Use of ICT	-49.226	0.048	**	-61.986	0.039	**
Manager age x Use of ICT	0.939	0.059	*	1.294	0.035	**
Use of management accounting practices	-3.632	0.255		-7.599	0.050	**
Social variables:						
Female manager (dummy)	3.701	0.086	*	4.179	0.118	
Manager age (years)	-0.207	0.276		-0.279	0.196	
Manager with certified organic training (dummy)	-3.864	0.126		-4.744	0.119	
% Hired labor	0.065	0.038	**	0.082	0.033	**
Assured continuity (dummy)	-8.537	0.000	***	-8.524	0.001	***
Control variables:						
Asturias (dummy)	-2.385	0.406		-2.493	0.435	
Dairy farms(dummy)	-4.677	0.447		-9.119	0.228	
Beef farms (dummy)	21.025	0.000	***	24.710	0.002	***
Other livestock farms (dummy)	19.952	0.001	***	25.510	0.002	***
Constant	5.023	0.686		3.994	0.775	

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.

Comparing the results from the CRS- and VRS-based models, in Table 4, it can be seen that they are very similar. The coefficients of the efficiency determinants have the same sign in every case. The coefficients have similar levels of significance across the models except for diversification and the interaction between manager age and use of ICT. The use of management accounting practices is not significant at any conventional level in the CRS model, but is significant at the 5% level in the VRS model, while the dummy female manager is not significant in the VRS model but is significant in the CRS model at the 10% level. In our discussion of the results, we can therefore focus on the VRS model.

Beginning with the managerial variables, the results show that diversification, the percentage of own land, the use of management accounting practices and the use of ICT are positively associated with efficiency, although it is also observed that the effect of the use of ICT is reduced with the age of the manager. The results also show that the sale of products to an industry is negatively associated with efficiency, which seems to indicate that short marketing channels (direct sales, grocery stores, sales to restaurants and hotels, etc.) as reference category, positively affect efficiency.

In terms of social variables, assured continuity is positively associated with efficiency, while female manager in CRS model and the percentage of hired labor have a negative effect.

As for the control variables, it is observed that there are no differences in efficiency between regions, while there are differences between productive orientations. In this sense, in relation to vegetable production farms, the reference category, dairy farms do not have significant differences, showing negative effects in the cases of beef cattle farms and other livestock farms.

In order to quantify the effect of an increase in the use of management accounting practices, a simulation exercise has been carried out based on the results of the VRS model.

Table 5. Effects of Increased Use of Management Accounting Practices (VRS model)

Δ Use of management accounting practices	Δ Efficiency (%)	Δ Sales (€)	Δ Margin (%)
Q1 → Q2	3.38%	1,882	5.25%
Q1 → Q3	6.73%	3,748	10.45%

Table 5 shows that increasing the use of management accounting practices from the first quartile to the third quartile improves efficiency by 6.73% over the initial value. This represents for the average (representative) farm of the sample an increase in sales of 3,748 € that translates into a positive effect on the contribution margin of 10.45% (contribution margin is determined by the difference between sales and raw material costs).

In order to check the robustness of the results obtained in relation to the effect of management accounting practices, five versions of the VRS model have been estimated, substituting the factor ‘use of management accounting practices’ for each of the items that make up this factor. The results obtained show that the first two items (analysis of costs, budgets and analysis of deviations) are not significant in the corresponding estimates, while the remaining three items (system of indicators, analysis of the profitability of products and services, benchmarking) are significant at the 1% level. These results seem to indicate that the more modern practices have a greater effect in improving the efficiency of organic farms.

5. DISCUSSION

This work sheds light on the level of efficiency of organic farms and the effect that management accounting practices have on it. According to the results obtained, a greater use of management accounting practices is associated with a higher level of efficiency. It is also observed that the newer practices (balanced performance measurements, benchmarking) are those that contribute the most to this positive effect. Specifically, management accounting tools with features similar to the newer types of control are able to enhance the impact of innovation developments on efficiency (López Valeiras et al., 2015; Tashakor et al., 2019). Additionally, the methodology used has made it possible to quantify the positive effect of an increase in the level of use of management accounting practices, which reached an improvement in the contribution margin of 10.45% for the average farm in the sample.

On the other hand, our study provides evidence of the variety of managerial strategies that allow organic producers to be efficient. Our results are in line with previous studies that conclude that diversification contributes significantly to more resilient pathways of development (Darnhofer and Strauss, 2015; Roest et al., 2018). The role of diversification initiatives is relevant to guaranteeing the economic viability of small farms, as well as contributing to the generation of additional employment and the maintenance of the population in rural areas.

Previous studies have found contradictory results regarding the effect of the ratio of owned land to the total land used, the interpretation of which depends on the type of agricultural activity, the level of intensification and the geographical and temporal context of the sample under study (del Corral et al., 2011; Pérez-Méndez et al., 2020). In our case, the possession of own land with conditions adequate to meet the requirements demanded by organic certification is important in the decision to convert to this system and to be able to make it profitable.

Regarding the distribution channel of the production, we find that industry sales are related negatively to efficiency. This means that direct marketing strategies (sales to end consumers, traditional markets and fairs, grocery stores, restaurants and hotels), the category of reference, have a positive association with efficiency. This strategy allows farmers to capture a larger share of the consumers' food income budget avoiding intermediaries in the supply chain (Detre et al., 2011; Uematsu and Mishra, 2011).

Use of ICT is a key enabling factor for organic farmers (Morris et al., 2017), who try to differentiate themselves from conventional farmers that are very focused on the production of commodities. In order to be competitive and viable, organic farmers need to apply ICT to improve their operational activities, comply with the requirements of organic certification and connect with customers through a variety of marketing channels. Our results show a positive association between the use of ICT and efficiency, although this effect attenuates with the age of the farmer. Previous studies show how age is a barrier in the effective use of ICT (Michels et al., 2020).

The gender variable is not significant in the VRS model and significant at 10% level in the CRS model. Previous studies have found significant relationships between gender and productivity, but the results are contradictory, probably because the nature of the relationship depends on the type and context of the activity analyzed (Barbieri and Mshenga, 2008; Julie et al., 2017).

We also found that a greater share of hired labour is negatively associated with efficiency. This result agrees with previous studies (Alvarez et al., 2018), which found that family businesses seem to perform better. In those farms with a greater share of family labor there appears to exist a greater commitment on the part of the personnel to give value to the products elaborated, incorporating intangible elements which contribute to consumers perceiving more value. This result could be related to the strategies based on establishing face-to-face links between the producers and consumers, in which authenticity and trust are mediated through personal interaction (Kirwan, 2006).

There is a positive relationship between the perspective of continuity and efficiency. This can be in line with previous studies that show that attitudes and behaviours of farmers, such as business goals and having a growth mindset toward the business are associated with profitability (O'Leary et al., 2018). Empirical work indicates that the farm growth oriented gains better profitability (Rikkonen et al., 2013).

The findings of this study have a number of implications for farm managers and policymakers involved in organic farm sector. It seems that management accounting practices should be taken into consideration to ensure the sustainability of the small farm sector in the long-term.

6. CONCLUSIONS

This study shows that the use of management accounting practices improves the efficiency of organic farms. Specifically, a greater intensity in the use of these techniques led to an increase in the contribution margin of around 4.000 € in the representative farm of our sample. We also observe that efficiency is enhanced by the use of newer management accounting techniques (e.g., benchmarking) more than by the use of traditional techniques (e.g., costing).

Our study makes several contributions. Firstly, this paper responds to recent calls for in-depth studies about on the outcomes of management accounting practices in farm enterprises (Ndemewa et al., 2019). Secondly, we expand current research on the link between performance, management accounting and strategy based on sustainable innovation (Lueg and Radlach, 2016). From a theoretical point of view, our findings are in line with previous research, suggesting that companies that follow differentiation strategies may benefit from the use of newer management accounting practices (Chenhall and Langfield-Smith, 1998a; López-Valeiras, 2015; Andersén, 2021). Specifically, we find a positive relationship between the use of management accounting tools and efficiency, with this effect being higher for those farms that use newer techniques more intensively. Finally, we provide quantitative economic evidence to agents involved in organic farm sector - policy-makers, farm advisory and entrepreneurs - of the effect of management accounting practices to the contingencies of this business.

This paper has several limitations. On the one hand, and as with previous studies in management accounting literature, this paper only considered a limited number of management accounting practices. Moreover, we used a general definition of each practice. This limitation implies that results should be interpreted with care. Future research may use more detailed definitions that allow identify specific tools for improving the efficiency in the organic farm setting. Finally, the sample is small and refers to the year 2019. In future work, it will be important to update our survey and thereby obtain a panel dataset, which would permit the improved the analysis considering the time evolution.

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Appendix

Table A1. Correlation between variables.

	Diversification	% Own land	% Industry sales	Use of ICT	Use Manag. Accounting P.	Female	Manager age	Organic training
Diversification	1							
% Own land	-0.054	1						
% Industry sales	-0.185	0.407	1					
Use of ICT	0.162	0.269	0.261	1				
Use Manag. Accounting P.	-0.007	0.045	0.079	0.255	1			
Female	0.015	-0.139	-0.057	0.122	-0.153	1		
Manager age	-0.098	-0.165	-0.133	-0.213	-0.074	0.052	1	
Organic training	0.015	0.184	-0.022	0.147	-0.163	-0.166	-0.083	1
% Hired labor	0.228	0.403	-0.006	0.263	0.048	0.004	-0.065	0.206
Assured continuity	-0.160	0.005	0.182	-0.168	0.050	-0.097	0.038	0.004
Asturias	0.013	-0.269	-0.199	-0.094	0.108	0.298	0.165	-0.154
Dairy farms	-0.137	0.275	0.519	0.024	-0.012	0.027	0.006	-0.279
Beef farms	-0.227	-0.414	-0.309	-0.318	-0.040	0.135	0.165	0.037
Other livestock farms	0.329	0.104	-0.096	0.090	0.084	-0.157	0.074	0.021

Table A1 (continued). Correlation between variables.

	% Hired labor	Assured continuity	Asturias	Dairy farms	Beef farms	Other livestock farms
Diversification						
% Own land						
% Industry sales						
Use of ICT						
Use Manag. Accounting P.						
Female						
Manager age						
Organic training						
% Hired labor	1					
Assured continuity	-0.036	1				
Asturias	-0.138	-0.164	1			
Dairy farms	-0.166	0.077	-0.190	1		
Beef farms	-0.367	0.122	0.194	-0.611	1	
Other livestock farms	0.346	0.086	-0.352	-0.212	-0.251	1