C i r i e c
i n t e r n a t i o n a l

CIRIEC
I t a l i a

24th International Congress of CIRIEC

Napoli Italia 30 settembre - 2 ottobre 2002

ECONOMIC IMPACT OF THE QUALITY AND ENVIRONMENTAL ACTIONS ON THE VALUE ADDED IN HORTICULTURAL COOPERATIVES OF ANDALUSIA

Emilio Galdeano Gómez

University of Almería

(Spain)

Discussion paper

1 - INTRODUCTION

The production and marketing of high quality foods (understanding 'high quality' in the broadest sense[1]: nutritional value, presentation, healthiness, and, above all, environmentally respectful production) have become crucial factors for the competitiveness of the firms operating within the farming systems of Europe and developed countries (Estruch, 1994).

Within this context we find the European Union (EU) sector of fresh fruits and vegetables. The Common Agrarian Policy (CAP) has been fostering (especially since the 1996 Common Market Organisation –CMO-) investments in activities related to the application of environmentally respectful practices and quality improvement practices (basic elements in the value added of the product)[2]. These activities are considered key factors for the marketing development of the products, and are included in the so-called Operative Programmes (OP's) of the organisations of fruit and vegetable producers (OFVP)[3]. These farming-marketing entities are represented in the Spain and Andalusia by entities of social economy: cooperative societies and agrarian societies of transformation (in general, cooperative sector).

Nevertheless, the voluntary nature of this farming and quality policy and the up-to-date heterogeneity in the implementation of the practices (systems of normalisation, systems of certification...) [4] cause each firm to behave differently when estimating the cost and profit of these activities[5].

We start from two considerations for our analyses: (a) on one hand, the actions

[1] The concept of quality is defined by the International Organization for Standarization (ISO) as "the whole of properties and characteristics of a product or service, on which is conferred the suitability to satisfy implicit and explicit needs" (ISO, 1991).

[2] This is so because the products considered in the present study are fruits and vegetables for fresh consumption, whose transformation for marketing is minimal. In the last years, the utilities added to the product have been focussed on quality-environmental practices (QE) within the cooperatives entities (for the farming and marketing activities). Also, we opt to carry out the related of the quality-environmental practices (which can sometimes have a different effect on profitability) in this analysis because a complementary and a relative balance of the investment in both are required in the incentive programmes.

[3] Though another programmes for this type of practices exist in Spain (basically the agri-environmental programmes of the CAP starting from the 2078/92 EC Regulation) their implementation has been very limited in the fruit and vegetable sector in Andalusia. The generalized development of QE practices in this sector has taken place from 1996 with the Operative Programmes. For this reason, we focus on these incentives.

[4] In countries with traditional protectionist and interventionist farming policies (developed countries), the purpose of integrating farming and environmental policies makes the cluster of economic instruments be reduced to two general types: economic incentives for voluntary actions (*incentive schemes*) and conditioned subsidies (*cross-compliance*). Thus, in the USA, the conservation policy has been developed through the system of conditioned subsidies with compensations calculated in auctions where farmers present the implementation of their conservation programmes while the administration grants the most effective programmes. In the EU, however, the other option has been chosen (Sumpsi *et al.*, 1997).

[5] Thus, the intensification levels of quality-environmental activities depend on the specific demand of the customers of each producing firm.

related to the quality-environmental, represent the main factors of innovation in the fruit and vegetable firms; (b) and, on the other hand, the value added of these actions are used more and more as differentiating elements in the market.

In recent decades, many researches have centred on the analysis of environmental policies[6] yet with exclusive emphasis on the industrial sector, where investments are directed to the fulfilment of compulsory environmental regulation. Accordingly, the analyses draw attention to the impact of such regulation (aimed at the reduction of polluting effects) over business efficiency or growth, using the macro-economic indicators as a basis.

In the context of agri-food policies, Henson and Caswell (1999) transfer some conclusions of the mentioned researches (about the private incentives of the firms) to the food safety regulation. Nevertheless, the flexibility[7] or voluntarism to fulfil the regulation of the analysed sector they guide us to the improvements in industrial performance (profitability or market share) are the main incentives for the firms. Holleran *et. al* (1999) analyse the internal motivations (improve operational efficiency) and the external incentives (market power, transaction costs and customer requirements) in the firms' decision to seek certification to a quality system[8].

In our analysis, we basically focus on private incentives (internal) in terms of contribution to value added (as efficiency and productivity indicator) for horticultural co-operatives and taking into account the current subsidies. Due to the lack of empirical studies on the specific features of the farming firms (especially those working with fresh fruits and vegetables) we opt to carry out here an analysis at micro-economic levels, taken the investments in quality-environmental activities as explanatory components of the production function. References to this type of analysis are found in Garcés and Galve (2001), who focus on the effect of environmental capital on Spanish firms' productivity, though within the framework of restrictive regulation for polluting effects. Likewise, Hitchens *et al.* (2000) or Garcés and Pérez and Pérez (2000) focus on the agri-food industry of Europe and Spain, respectively. The lack of researches on farming products for fresh consumption and the orientations of the investment policy already described have led us to suggest a more specific model of

[6] From the 1990s onwards, some of the most important ones include: Porter (1991), Meyer (1992), Gray and Shadbegian (1993), Van Der Linde (1993), Porter and Van Der Linde (1995), Jaffe *et al.* (1995) and Xepapadeas and Zeeuw (1999). These works draw attention to arguments supporting or rejecting the well-known "Porter hypothesis", which states that the firms operating in sectors affected by environmental debasement problems are compelled to review their producing processes, which helps to detect inefficiencies and to encourage the innovation of better technologies and productive methods.

[7] Thus, for instance, the hazard analysis critical control point (HACCP) has to be applied by the Spanish horticultural firms from 1995. However, the Andalusian Council of Agriculture and Fisheries has been done no control about its application.

[8] We find another researches about costs and profits of quality systems in Bredahl *et. al* (1997), Holleran and Bredahl (1997), Machimada (1994) or Seddon *et. al* (1993). These authors also relate the motivation of the firms with their size (there is a larger incentive when there is a bigger size firm).

analysis. In this case, we take as reference some empirical studies on the evaluation of the effects of innovative processes or determined investments (measured as stock of knowledge capital) on the business value added[9].

The objective of this work is thus to determine the way the value added is affected by those horticultural cooperatives implementing quality-environmental practices, which are resulting in really innovative methods of farming and marketing. To this end, we have taken a sample of Andalusian cooperatives (organisations of producers –OFVP-)[10] for the period 1997-2001 taking into account a series of homogenous characteristics across them.

Also, the basis for this study is given by the lack of analyses accounting for the value of the CAP's incentive-based programmes in Andalusia (Spain), and by the lack of models allowing the quantification of the cited investments in the sector of fresh fruits and vegetables (products of increasing consumption).

The structure of this work is as follows: Section 2 reviews the role of the horticultural cooperatives in the implementation of quality-environmental actions and the description of the data sample used. In Section 3 it is carried out an analysis of the impact on value added of the above mentioned actions. Section 5 shows the conclusions.

2 - THE ROLE OF THE HORTICULTURAL COOPERATIVE IN THE IMPLEMENTATION OF QUALITY-ENVIRONMENTAL ACTIONS. DESCRIPTION OF THE DATA SAMPLE

In the European context, the fruit and vegetable sector is characterised by the multiplicity and the diversity of products and their perishability (necessity of fast commercialisation, limited possibilities of storage). It exists also a limited intervention and market regulation that, in most part, corresponds to the producers' organisations (Commission of the European Communities, 1994).

The process of concentration of the demand, as well as the commercial liberalisation at European and world-wide level, are showing the importance of these cooperative organisations for the commercialisation, specially in the maintenance of the level of profitability and recovery of added value incorporated to the product. The most direct connection with the distribution chains involves a considerable increase of the incorporated utilities in the horticultural product by the marketing firms in their origin (cooperatives), in

[9] We take as reference (for this analysis method) some works by Griliches (1994), Hall and Mairesse (1995) or Bottasso and Sembenelli (2001) among others.

[10] Fruits and vegetables equal 50% of the final farming output in Andalusia, where nearly 24% of Spanish output are produced and commercialised (Spanish output equals 20% in the EU). About 50% of Andalusian output are exported, being European markets its chief destination (more than 90%).

contrast to the traditional trade of these products. At the same time, the greater demand requirement imply a constant renovation of the technology and the structures, as well as changes in the production and commercialisation methods, related, in recent years, with the quality-environmental requirements especially. These factors, are affecting a change of strategy and the business policy of the producers' organisations, those that, have been represented in Spain by Cooperative Societies and Agrarian Societies of Transformation (AST), both framed within the social economy [11].

In general, the social economy is related to entities where the capital is not the basic element, there is a special performance in the attribution of profit which main purpose are rendering a series of services to their associates. Nevertheless, the new agri-food market conditions impose changes of strategic attitude in entities based on agrarian cooperatives, in Spain and in the countries of our surroundings (Chomel, 1993). The incorporation of our country in the European Common Market involved the necessity of adjustment of our cooperatives to the new circumstances and their approach to the economic reality of the European agrarian cooperativism[12], that is to say, a greater part in the business sector[13]. Logically, this approach has been more relevant in those sectors where the agrarian policy attributes to the producers' organisations an outstanding role (directly or indirectly), as it is the fruit and vegetable sector (Commission of the European Communities, 1994).

In the Spanish and Andalusian agriculture, the horticultural production has been one of the basic sectors, representing values near to 50% of the agricultural output. In Andalusian, the expansion of fruit and vegetable production (in provinces as Almeria, Huelva or Granada) has been possible by the development

[11] In the social economy (related to the idea to correct market failure situations) different entities are included:
- Societies nonfinancial: Cooperatives, Agrarian Societies of Transformation and Labour Limited Liability Corporations.
- Credit Institutions: Cooperatives of Credit and Savings banks.
- And in the Insurance sector: Insurance Mutuals, Insurance Cooperatives, Social Forecast Entities and Mutual Patronal of Labour Accidents.

[12] The adaptation of the Spanish producers' organisations to the European regulation, allowed to increase the number of recognised organisations. It is relevant the Law 1101/86, which allows the recognition of the OFVP´s based on Regulation EC 1035/72. This regulation was a decisive element for the increase of the market shares of the agrarian associationism, based exclusively the recognition like producers organisations of this sector on the two existing Spanish agriculture (Cooperatives and AST).

[13] An analysis of the agrarian cooperativism involves the necessity to place these organisations within a larger conceptual frame, fundamentally because we find a more competitive context. The cooperativism, in this context, is improving the situation (profitability) of the farmers without forgetting its social component. The agrarian sector is characterised by little efficient productive models, liberalisation of markets and greater competition of third, and an increase of the part of the subsector of the transformation and distributor in the agro-food chain. These facts make the search of actions necessary to guarantee the improvement of the agrarian rents what will have to be completed by means of the search of mechanisms of transference or value added consideration of processes connected or related to the production (Juliá, 1994). Considering these factors, the role of cooperatives is more and more important.

of the marketing structures. In these, the cooperative for commercialisation is more and more relevant to adapt to the new imposed conditions of the market, specially, by the nourishing distribution on a large scale.

These societies develop all the phases of the process of manipulation of products in their warehouses, from their reception to the packaging and pre- refrigeration for the transport, having for it suitable equipment. At the same time, they serve joint purchase of production factors for their producers. In addition the use of marketing techniques is being intensified through brand policies, product promotion of certain different products, etc.. But, in this work we are going to emphasize the processes of intensification of practices related to the quality-environment.

It is also necessary to bind this process to the European regulation. The actual Common Market Organisation (from EC 2200/96 Regulation and its later modifications, as 2699/00) tries to impel into the development of producers' organisations, through the OFVP´s, as the basic element for the self-regulation of the sector[14], as well as the search of a greater competitiveness at international level. In this regulation special reference to the role becomes of the organisations of producers developing of respectful cultures with the environment and the promotion of the quality in general. This way, organisations as Cooperativas and AST (nowadays OFVP) are playing a fundamental role in the development of this type of practices analysed. With these objectives, along with the one to stimulate the grouping of the producers, the CMO establishes the accomplishment of operation founds (to finance a series of performances in the indicated actions) which take the form of the Founds and Operative Programmes, already mentioned. The financing of these Programs corresponds 50 % to the contributions of the OFVP's associates' contributions and the other 50 % corresponds to the subsidy of European Found for Farming Orientation and Guarantee (EFFOG).

We take as reference these OP in Andalusia (whose horticultural production represents 24 % of the national output)[15] and a sample of Cooperatives and AST (OFVP) of this region. In addition it will allow us to work with a relatively

[14] The actual CMO (continuing with the principles of EC 1035/72 Regulation) establishes as main objectives of the producers' organisation the following ones:
- Assure the programme of production and its adaptation to the quantity and quality demand.
- Promote the supply concentration and the commercialisation of the production members.
- Reduce production costs and regulate production prices.
- Promote crop practices of culture and management and production techniques of the respectful remainders with the environment, special protecting the quality of waters, the ground and the landscape and preserving and/or to harness the bio-diversity.

[15] Fruits and vegetables represent more than 40 % of the agrarian final production in Andalusia and the export involves figures close to 50 % of the total production, being the main destinations the European markets – more than 90 % - (Council of Agriculture and Fishing, 1998).

homogeneus sample of firms[16].

On Table 1 the total investments and expenditures in these Programmes are shown for the considered period[17].

Table 1. Summary of the Operative Programmes (1997-2001) in Andalusia

1997 No. Entities	Value of the Sales (euros)	Operative Programme (OP)	OP over Sales (%)
Total: 56	**535,018,260**	**30,602,081**	**5.72**
1998 No. Entities	Value of the Sales (euros)	Operative Programme (OP)	OP over Sales (%)
Total: 56	**691,268,612**	**38,171,625**	**5.52**
1999 No. Entities	Value of the Sales (euros)	Operative Programme (OP)	OP over Sales (%)
Total: 104	**935,418,843**	**71,570,998**	**7.65**
2000 No. Entities	Value of the Sales (euros)	Operative Programme (OP)	OP over Sales (%)
Total: 101	**1,042,741,155**	**82,933,023**	**7.96**
2001 No of Entities	Value of the Sales (euros)	Operative Programme (OP)	OP over Sales (%)
Total: 110	**1,156,200,116**	**93,767,831**	**8.11**

Source: Andalusian Council of Agriculture and Fisheries

The collected data shows that the actions analysed begin to extend form in 1997, as a result of the first OP[18]. It is also given off that, although the Programmes can include diverse actions (like general investments of the organisation, actions in the quality, retired of products, etc.) the greater participation, in general, has come corresponding to the controls of quality and development of respectful environmental practices. It is appraised as between the 85 % and 95 %t of the investments and expenditures included in the Programmes they are related to the

[16] In general, the data used correspond to firms which have similar production systems (those intensive character) and similar commercialisation, with many common customers, represented mainly at present by distribution chains and great importers of the EU.

[17] We can observe that the investments in the Operative Programmes of the Andalusia OFVP during 1997 and 1998 is not superior 6 % of the sale value, and these investments approach to 8 % of the sale value from 1999 onwards.

[18] This is due to the mentioned coincidence between the establishment of these subsidies and the increasing demand requirements on the part of consumers. Therefore, certification and control systems (adapted to the horticultural sector) have been introduced in the most OFVP's (yet in different degrees over the output). For instance: *ISO 9002, Integrated Production System* (Andalusian Council of Agriculture and Fisheries) or *155001UNE* Regulation (*Controlled Production of Protected Cultivation*, AENOR –National Association of Normalisation and Certification-), among others. The period also coincides with the development of somewhat ecological horticultural methods in Andalusia (Ruesga, 2000).

factors of quality-environment (Table A.1. Appendix)[19].

To make use of the greatest amount of historical information (also because some of these investments will not have immediate effects), we analysed a group of firms that presented their OP in 1997 and in following years (56 OFVP's)[20].

Graph 2 shows the evolution of the economic indicators for value added and profitability determining the differences that may exist between the seasons prior to the generalised investment in the OP activities (the 1994-1996 results accounts were available) and the seasons or years under analysis (1997-2001). The indicators used are the value added (VA), obtained from the countable gross value added, and the sales margin (SM).

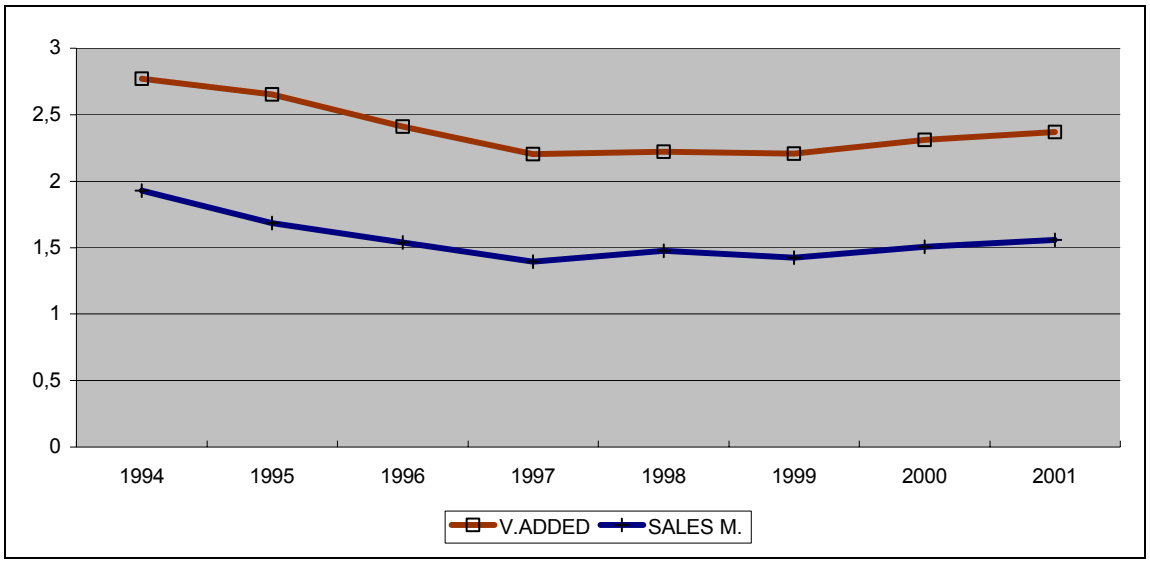
By and large, the evolution of the indicators (in real terms) is quite similar. We observe a decrease of profitability, which characterised the sector in the 1990s (Galdeano, 2000), yet a recovery in the values and a change of tendency in the evolution of the indicators is observed from 1998 onwards. Such a recovery (though not fully relevant) coincides with the period of intensification of the QE practices, which may lead to a priori relationship between the two facts.

Graph 1. Evolution of economic indicators.[21]

[19] Although at first one thought to differentiate in the analysis these four types from actions, finally has considered the percentage of joint investment, due to the complementarity among these actions and the similarities in the percentage of the consulted companies.

[20] This firm sample equal 74 % of the sector (measured in value of sales). The functioning of these entities is quite homogenous (see footnote 16) as it is their size (the number of workers ranges between 65 and 315).

[21] Variable VA was divided by ten and a logarithmic scale was used in order to make it possible the observation of the joint evolution of the indicators.



3 - IMPACT ANALYSIS OF QUALITY-ENVIRONMENTAL ACTIONS ON THE VALUE ADDED

Model and variable specification

The economic analysis of technological innovation or *stock of knowledge capital*, typically represented by research and development (R&D) activities, has been mainly applied to many business sectors[22]. Several studies on the business sector consider the investment in environmental actions part of the knowledge capital because of its innovative effects on technology and productive methods (Porter and Van Der Linde, 1995, Xeppadeas and Zeeuw, 1999, etc). At a microeconomic level, Palmer *et al.*(1995) or Gray and Shadbegian (1993) carry out the same analysis showing a positive correlation with other firm's investments aimed to increase productivity. In our analysis, we consider that investment in quality-environmental practices (QE) is a principal component in the development of new technologies and methods. For the estimate of the QE expenditure over the value added (output)[23], VA, we suggest a multivariate regressive model from the traditional Cobb-Douglas function, expanded here with a measure of knowledge capital (see, for instance, Griliches and Mairesse, 1984) as input of the productive process:

$$VA_{it} = A e^{\lambda t} K^{\alpha}_{it} L^{\beta}_{it} R^{\delta}_{it} e^{eit} \qquad (1)$$

[22] Some of the most important works include Griliches (1984, 1986, 1994), Mansfield (1965), Schmookler (1966), Griliches and Lichtenberg (1984), Hall and Mairesse (1995), Jorgenson and Griliches (1967).

[23] We use the value added as dependant variable (as a better indicator of the quality incorporated to the final product) following analyses such as by Seddon *et al.* (1993). Also, because the study has been done from the annual accounts of the OFVP's marketing activity. These accounts include the product with the value added coming from the farming activity and we have no data available of the inputs used in this activity, only we have the QE expenditure trough the global Operative Programmes.

where VA_{it} is the value added of the firm "i" at period "t", A constant variable, λ measure of the rate of technical change, K_{it} and R_{it} physical and knowledge capital of the firm "i" at "t", L_{it} labour factor, α, β y δ, the elasticities corresponding to the three inputs defined, and e_{it} the error term.

The referenced studies indicate that the effect on the output can be more available to analyse trough the growth rates (especially when a variable of knowledge capital is included). Thus, confining attention to the logarithmic differentiation of the variables, (1) can be rewritten as:

$$\Delta va_{it} = \lambda + \alpha \Delta k_{it} + \beta \Delta l_{it} + \delta \Delta r_{it} + \Delta e_{it} \qquad (2)$$

The knowledge capital is generally calculated from the sum weighted of the (deflated) historical data on R+D investment. However, if data correspond to a short period (as it is the case here, four years), it is impossible to construct a reliable variable reflecting the research capital. Nevertheless, following Llorca (2002), we can use as *proxy* variable a measure based on the firm's expenditure on innovative processes which indicates the knowledge capital intensification[24]. This variable (based here on QE) is going to be the investment and expenditure ratio related to quality-environment on the firm sales value QE/S[25].

Following the procedure and replacing, the expression QE/S by qe, the equation(2) is reformulated of the following form:

$$\Delta va_{it} = \lambda + \alpha \Delta k_{it} + \beta \Delta l_{it} + \rho\, qe_{it} + \Delta e_{it} \qquad (3)$$

In addition we are going to consider on other technological innovation (which we name ord, measured equally as sales ratio) to take into account all the technological capital (since it is a sector based on intensive agriculture). They are not related directly to the previous one and to a great extent, are also included in the PO.

Bearing this in mind the equation(3) will be as it follows:

[24] The mentioned author (analyzing short date series) uses a variable proxy based on the expenses of the firm in innovation processes over the added value (RD/VA). On a simplified way, we start from the elasticity of the knowledge capital in relation to the added value ($\delta = \partial VA/\partial R \cdot R/VA$) and considering that the growth ratio of the productivity depends on the intensity of the mentioned investments (RD/VA) it can be deduced that:
$\delta \Delta r = (\partial VA/\partial R \cdot R/VA)\,(\Delta R/R) = (\partial VA/\partial R \cdot \Delta R/VA) = \rho\, \Delta R/VA \cong \rho\, RD/VA$
where it assumes in that there is not depreciation in the investments of RD ($\Delta R = RD - \eta R$; $\eta = 0$) with a short temporal margin. This situation, that in our analysis, can be more appropriate if we consider that most expenses in QE do not correspond to refund fixed assets and they are current expenses (adoption of new methods and systems in the activity, contracts for specialised personnel, etc) in many cases.

[25] We use sales ratio, to avoid the possible endogeneity of this variable, which can happen when using directly the intensification on VA.

$$\Delta va_{it} = \lambda + \alpha \Delta k_{it} + \beta \Delta l_{it} + \rho\, qe_{it} + \rho' ord_{it} + \Delta e_{it} \quad (4)^{26}$$

Another issue to be considered is the assumption (or not) of constant returns to scale in the Cobb-Douglas function. If we assume their existence we are the implying that the capital and labour elasticities together add one ($\alpha + \beta = 1$)[27]. Introducing this consideration, the equation to be estimated is now expressed in terms of labour productivity as follow

$$(\Delta va_{it} - \Delta l_{it}) = \lambda + \alpha (\Delta k_{it} - \Delta l_{it}) + \gamma \Delta l_{it} + \rho\, qe_{it} + \rho' ord_{it} + \Delta e_{it} \quad (5)$$
(where $\gamma = \alpha + \beta - 1$)

Simplifying the notes on the annual value added-labour ratio ($\Delta va_{it} - \Delta l_{it}$ by Δval_{it}) and the annual growth capital-labour ratio (($\Delta k_{it} - \Delta l_{it}$ por Δkl_{it}) we obtain:

$$\Delta val_{it} = \lambda + \alpha \Delta kl_{it} + \gamma \Delta l_{it} + \rho\, qe_{it} + \rho' ord_{it} + \Delta e_{it} \quad (6)$$

According to this, the dependent variable of the equation (1) is the VA countable previously defined. K is obtained from the firm's fixed gross assets 22 (inflation-corrected using the private investment deflator from the data of Bank of Spain). The labour input, L, is calculated from the total number of employees of a firm and the end of the year [28].

Table 2 shows the descriptive statistics the variable used in increasing data (1997-1998, 1998-1999, 1999-2000 and 2000-2001), except for qe and ord which are measured as two years average.

Table 2. Descriptive statistics of variables.

Variables	Mean	Standard deviation	Observations

[26] This disagregation of R implies that we start from Cobb-Douglas function (1) such as $VA_{it} = A e^{\lambda t} K^{\alpha}_{it} L^{\beta}_{it} R^{\delta}_{QEit} R^{\delta'}_{ORDit} e^{eit}$

[27] When constant scale restrictions are defined, there is a controversy on the introduction in the production function of the parameters related to the knowledge capital. Following Grilliches and Lichtemberg (1984) we have decided not include its to avoid a double accounting with inputs of the labour factor and physical capital.

[28] We have chosen this option (instead of the total number of workers) due to the seasonality of the sector.

Δval	0.092	0.047	224
Δl	0.086	0.051	"
Δkl	0.102	0.035	"
qe	0.068	0.019	"
ord	0.027	0.014	"

Estimation and results

Due to the reduced dimension of the data panel no estimation has been done about λ, which represents a ratio of technological change that normally is unknown (non-observable effect) and it is an indicator of increasing productivity of the sector or the individual firm[29].

Nevertheless, when working with date in first differences the individual effects are transferred to the increases of the explanatory variables. In this form, in spite of not being strictly correct[30], we are going to consider this constant effect along the time and similar to all the cooperatives of the sample (considering also their homogeneity). This hypothesis has also been accepted in works of reference (like Bottasso and Sembenelli, 2001 or Lopez and Sanaú, 1999, among others) when the objective is to obtain average data, as in this case.

Previously to the estimation, the exogeneity of the explanatory variables by Hausman-Wu test[31] has been contrasted. Table A.2 in Appendix shows the results of this test, on which it is observed that no problem of endogeneity for the vector of explanatory variables exist.

In the estimation, we consider the assumption or not of returns to scale, since the results can be different[32]. Therefore, we will consider 2 equations: 6(a) taking returns to scale restriction and 6(b) not taking returns to scale restriction. The

[29] This factor (normally difficult estimation) is made up of specific a component for each firm (λ_i) which is normally considered invariable in the time (fixed effects), a common component for all the sector (λ_{st}) in a given period, and a random component (e_{it}). The specific component of the firm, λ_i, can be reflected by the increases from the other function variables (using data in differences can reduce the possible correlation with the explanatory variables), and the component λ_{st} , is consider in the estimation, but specially when it works with firm data of different industries, not being our case.

[30] Generally, the problem is derived from the correlation which these specific effects have per firm with the explanatory variables (fixed effects, above all, when increases are not considered) and with the error term (random effects). The possibility of random effects would lead us to consider the model through Generalized Least Squares (GLS). Nevertheless, when the time space is reduce the OLS estimation (Ordinary Least Squares) with increasing data and GLS can give rise to very different results, being the first estimation more reliable (Novales, 1996).

[31] To this contrast we have used as instruments all the variables lagged one period and a growth ratio within the sector (measured by volume of sales) as additional variable.

[32] The empirical studies normally show how the coefficient of Δkl can increase in relation to the coefficients of the qe and ord variables.

results of the regression by Ordinary Least Squares (OLS)[33] with correction of heteroscedasticty are on Table 3.

Additionally, considering the evolution of Graph 1 we have introduced three dummy temporal variables $d_{98\text{-}99}$, $d_{99\text{-}00}$ and $d_{00\text{-}01}$ (the period 97-98 has been omitted).

Table 3. Results of estimation.

Variables	6(a)	6(b)
Δl	-0.25**	--
	(-2.17)	
Δkl	0.34***	0.41***
	(3.89)	(2.90)
qe	0.21**	0.13**
	(2.48)	(2.29)
ord	0.12**	0.09*
	(1.93)	(1.84)*
$d_{98\text{-}99}$	0.07*	-0.03
	(1.82)	(-0.86)
$d_{99\text{-}00}$	0.10**	0.06
	(1.97)	(0.92)
$d_{00\text{-}01}$	0.14***	0.07*
	(2.91)	(1.78)
R^2 (adjusted)	0.71	0.39
F	41.34	29.18

Statistic t in parenthesis.
*** 1 % significance level, ** 5 % significance level, * 10 % significance level.

The results obtained show important differences between the two estimations. When the returns to scale restriction is imposed we obtain a worse adjustment on R^2 and statistical F (in addition a slight increase of the Δkl coefficient is obtained, in contrast to the knowledge capital variables).

This result make us to reject the existence of constant returns to scale and to maintain the results of the model without restriction 6(a).

The parameter of Δkl is significant and agreed to results of other empirical analyses[34]. The coefficient of the qe variable (0.21) is also significant respect to

[33] The regression by means of OLS implies that we assume constant coefficients of different factors in time, as were indicated previously, and the treatment is a pull data.
[34] In analyses for industrial sectors of several countries (the USA, France, Japan, etc.), this parameter is about 0.3. In Spain, for example, Raymond (1989), obtains an elasticity for 0.389, for national consolidate data. tc.), dicho parámetro gira entorno al 0,3.

the value added (in this case value added-labour ratio, which may be contrast with another analyses in the Spanish industry, where the result is positive but it does not become significant (for example, Garcés and Galve, 2000); but, which it is possible to be explained by the relevance of this variable in the value added of the agrarian product and, in this case, moreover, dealing with consumption in fresh. In the same way the ord variable is significant so it would be possible to consider certain complementarines of the investments offers in the value added. The annual value added-labour ratio work factor is significant, but it has a negative impact on Δval. The dummy variables are significant, specially 99-00 and 00-01, which can indicate the relation between the increase of this last period of the investments in qe and the increase of the added value, observed in the previous analysis.

On these grounds, we assume that quality-environmental investment affects positively the increase of the value added in the Andalusian horticultural cooperatives, just as other firm's variables or investment inputs do.

To figure out the actual share of these factors in the added utility of the product we miltiply the coefficients of 6(a) by the average values of the sample variables [qe, ord, Δkl] estimating the effect of the corresponding regressor. Dividing this number by the average value of the dependent variable in the sample, we obtain the percentage of each of the above coefficients, which explains the impact of this variable. Table 4 shows the values obtained.

Table 4. Impact of stock and knowledge capital on val.

qe	ord	Δkl
15.52 %	3.53 %	37.69 %

It is observed that the positive incidence of the quality-environmental variable on the value added-labour increase (15.52) is quite superior to those of other technological investments (3.53). The actions related to qe and the physical-labour capital are inputs determining the increase of the val in the analyzed agrarian cooperatives.

However, we are going to use both percentage to compare if the profit derived from the quality-environmental actions (in terms of the value added increase) are superior to the cost. Taking into account the cost we have to bear in mind the incentives derived from the Operative Programmes (subsidies), which they represent the 50 % of expenditure. Thus, we can make a comparison in the following way:

$$(0.1552)\ \Delta val \text{ respect to } (1 - 0.5)\ qe \rightarrow\ 0.0143 < 0.0340$$

In the estimation done in average terms for the referred period, the cost of quality-environmental actions is not compensated (including subsidies) by their contribution the value added. However, this valuation can be partial, since we must consider the correlation of these actions on an other economical variables of the Andalusian horticultural cooperatives. Thus, as it is deduced of previous works (Galdeano and Céspedes, 2001), the incentive for the analyzed practices and innovations derives from the expectations of greater profit in a long term[35] (the studied period can still be very reduced) and specially because of the maintenance of their competitive market position , due to the present demand requirements. These hypothesis could be considered for an extension of the present research.

4 - CONCLUSIONS

In recent years, the relevant of the quality-environmental components have been increasing for products such as fresh fruits and vegetables, which are an important participation in the Andalusian agrarian final production. This sector is lately characterised the role of the cooperative entities (legally under Cooperative Societies and Agrarian Societies of Transformation), fundamentally by the connection of the farming and marketing activity, becoming the factors elements for this agriculture competitiveness (position in the agri-food system and recovery of value added mainly). At the moment, the adaptation of these social economy entities to the communitarian legislation (under of the OFVP´s) reframes the role of these in the sector and the adoption of new methods of performance to the demand requirements All these factors lead the Andalusian horticultural cooperative (more than an other firms) to become as a centre of innovations and new productive inputs which are required by the sector. In this sense and basis on to the increasing importance of the related to the quality-environmental actions in the described context, throughout this work the economic impact of these has been analysed on a representative sample of organisations in the region. The cost increase in these actions has come motivated, on the one hand, by the incentives of the CAP, through the OP mainly and, on the other hand by the greater food demand requirements.

The analysis has been centered on the value added effects of the quality-environmental investments and expenditures, considering these actions as process of innovation in the activity. The participation of these inputs in the production function indicates their positive and relatively high impact in the

[35] Besides, it is observed that consumers can still have undervalued the quality-environmental components incorporated to the product in cost terms. Recent studies on the sector (Galdeano, 2000) show also that sale prices have few increased when compared with previous periods. This fact (like an extension of this study) can also be considered as asymmetry or imperfection in the information of the QE components (Viscusi, 1979, De y Nabar, 1991, Leland, 1979, among others). Also, taking into account the heterogeneity in these practices and the lack of policy control and inspection (Golan *et al.* 2000).

generation of value added to the horticultural product. Nevertheless, although the percentage of participation in the value added can be important, this one cannot still be sufficient to compensate the application costs (also deduced the subsidies). Even so, it is necessary to consider, in these results, that the application of the analyzed actions are undertaking, in a more or less generalized form, for a short period of time and a possibly greater impact is expected next years. In any case, it would indicate that these investments can be considered, at the moment, as a necessity to hold the position of these firms in the market, more than a profit in the sale price. This hypothesis may be considered for further research.

REFERENCES

- BOTTASSO, A. y SEMBENELLI, A. (2001): "Market power, productivity and the EU Single Market Program: Evidence from a panel of Italian firms". *European Economic Review*, 45: 167-186.
- BREDAHL, M., HOLLERAN, E., ZAIBET, L. (1997): "ISO 9000 in the UK food sector". Working Paper 97-3. Center for International Trade Studies. University of Missouri-Columbia, USA.
- CHOMEL, A. (1993): "Observaciones sobre la evolución de la práctica de las normas de las sociedades cooperativas en Francia". *CIRIEC-España*, nº 14.
- COMISIÓN DE LAS COMUNIDADES EUROPEAS (1994): "Evolución y Futuro de la Política Comunitaria en el Sector de Frutas y Hortalizas". *Comunicación de la Comisión al Consejo y al Parlamento Europeo*. 27 de julio, Bruselas.
- CONSEJERÍA DE AGRICULTURA Y PESCA DE LA JUNTA DE ANDALUCÍA: *Memorias 1994 á 2000*.
- DE, S. y NABAR, P. (1991): "Economics implications of imperfect quality certification". *Economics Letters*, 37: 333-337.
- ESTRUCH, V. (1994): "La calidad y las explotaciones agrarias". *Investigaciones Agrarias. Economía*, vol. 9 (3): 345-358.
- GALDEANO, E. (2000): *Estudio de Competitividad de las Entidades Asociativas Andaluzas de Comercialización Hortofrutícola*. Universidad de Almería y Consejería de Empleo y Desarrollo Tecnológico.
- GALDEANO, E. y CÉSPEDES, J. (2001): "Análisis de la incidencia del control de calidad y prácticas respetuosas con el medio ambiente en la rentabilidad de las empresas agroalimentarias" (comunicación). *IV Encuentro de Economía Aplicada* (7-9 de junio).
- GARCÉS, C., GALVE, C. (2000): "Repercusión de las inversiones en protección del medio ambiente en la productividad de las empresas españolas: un análisis empírico". *Cuadernos de Economía y Dirección de la Empresa*, 8: 33-50.
- GARCÉS, C., PÉREZ Y PÉREZ, L. (2000): "La protección medioambiental en la industria alimentaria española" (Comunicación). *III Encuentro de Economía Aplicada* . Valencia, junio de 2000.
- GOLAN, E., KUCHLER, F., MITCHEL, L. (2000): "Economics of food labelling". *Economic Research Service*, U.S. Department of Agriculture, Agricultural Economic Report, nº 793.
- GRAY, W.B., SHADBEGIAN, R. J. (1993): "Environmental Regulation and Manufacturing Productivity at the Plant Level". *Center for Economic Studies Discussion Paper*, n. 96-6, U.S. Departament of Commerce.
- GRILICHES, Z. (1984) (ed.): *R & D, patents and productivity*. National Bureau of Economic Research. Cambridge, Mass.
- GRILICHES, Z. (1986): "Productivity, R&D and basic research at the firm level in the 1970s". *American Economic Review*, 76(5): 141-154.
- GRILICHES, Z. (1994): "Productivity, R&D and the data constraint". *American Economic Review*, 84(1): 1-23.

- GRILICHES, Z., MAIRESSE, J. (1984): "Productivity and R&D at the firm level" in *R&D, Patents and Productivity*, edited by Z. Griliches, University of Chicago Press.
- GRILICHES, Z., LICHTENBERG, F. (1984): "R&D and productivity growth and the industry level: Is there still a relationship" in *R&D, Patents and Productivity*, edited by Z. Griliches, University of Chicago Press.
- HALL, B., MAIRESSE, J. (1995): "Exploring the Relationship between R&D and productivity in French manufacturing firms". *Journal of Econometrics*, 65: 263-293.
- HENSON, S., CASWELL, J. (1999): "Food safety regulation: an overview of contemporary issues". *Food Policy*, 24: 589-603.
- HITCHENS, D., BIRNIE, E., THOMPSON, W., TRIEBSWETTER, U., BERTOSSI, P., MESSORI, L. (2000): *Environmental Regulation and Competitive Advantage: A Study of Packaging Waste in European Supply Chain*. Edward Elgar Publising Limited.
- HOLLERAN, E., BREDAHL, M.E., ZAIBET, L. (1999): "Private incentives for adopting food safety assurance". *Food Policy*, 24: 669-683.
- INTERNATIONAL ORGANIZATION FOR STANDARIZATION (1991): *ISO 9000 International Standars for Quality Management*. Geneve.
- JAFFE, A.B., PETERSON, S.R., PORTNEY, P.R., STAVINS, R. N. (1995): "Environmental Regulation and the Competitiviness of U.S. Manufacturing: What Does the Evidence Tell Us?".*Journal of Economic Literature*, vol.XXXIII(1):132-163.
- JORGENSON, D.W., GRILICHES, Z. (1967): "The explanation of productivity change". *Review of Economic Studies*, 34(3): 249-283.
- JULIÁ, F.J. (1994): "El cooperativismo agrario". *Papeles de Economía Española*, nº 60-61: 243-250.
- LELAND, H.E. (1979): "Quacks, lemons and licensing: a theory of minimun quality standars". *Journal of Political Economy*, 87 (6): 1328-1346.
- LÓPEZ, C., SANAÚ, J. (1999): "Tecnología y crecimiento: análisis en la industria española, 1986-1992". *Papeles de Economía Española*, 781: 11-25.
- LLORCA, R. (2002): "The impact of process innovations on firm's productivity growth: the case of Spain". *Applied Economics*, 34: 1007-1016.
- MACHIMADA, J. (1994): "Multiatribute analysis of ISO 9000 registration: an analutical hierarchy process based approach". Unpublished master's thesis, University of Missouri-Columbia.
- MANSFIELD, E. (1965): "Rates of return from industrial R&D. *American Review (Papers and Proceedings)*, 55(2): 531-542.
- MEYER, S.M. (1992): *Environmentalism and Economic Prosperity: Testing the Environmental Impact Hypothesis*, MIT Press, Cambridge, mimeo.
- NOVALES, A. (1996): *Econometría* (2ª edición). McGraw-Hill.
- PALMER, K., OATES, W.E., PORTNEY, P.R. (1995): "Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?". *Journal of Economic Perspectives*, vol. 9 (4): 119-132.
- PORTER, M.E. (1991):"America's Green Strategy". *Scientific American*, 264

(4): p. 96.
- PORTER, M.E., VAN DER LINDE, C. (1995): "Green and Competitive: Ending the Stalemate". *Harvard Business Review*, 73 (5): 120-134.
- RAYMOND, L. (1989): "Productividad de los factores y expansión del Sector Público en España". *Papeles de Economía Española*, 41: 159-171.
- REVENSCRAFT, D. (1983): "Structure-profit relationships at the line of business and industry level". *Review of Economics and Statistics*, 65: 22-31.
- RUESGA, A. (2000): "La agricultura ecológica, un sistema agraria sostenible". *Informe Anual del Sector Agrario en Andalucía 1999*: pp. 353-405. Analistas Económicos de Andalucía. Unicaja.
- SCHMOOKLER, J. (1966): *Invention and Economic Growth*. Cambridge Ma: Harvard University Press.
- SCOTT, J. y PASCOE, G. (1986): "Beyond firm and industry effects on profiability in imperfect markets". *Review of Economics and Statistics*. 68: pp. 284-292.
- SEDDON, J., DAVIS, R., LOUGHRAN, M.,MURRELL, R. (1993): "BS 5750 Implementation and Value Added: A Survey of Registered Companies". Vanguard Consulting Ltd., Buckingham.
- SHRIVASTAVA, P. (1995): "The role of corporations in achieving ecological sustainability. *Academy of Management Review*, 20: 936-960.
- SUMPSI, J.M., GARRIDO, A., IGLESIAS, E. (1997): "La política agroambiental de la UE: un análisis desde la perspectiva económica". *Revista de Economía Agraria*, 179: 227-265.
- VAN DER LINDE, C. (1993): "The Micro-Economic Implications of Environmental Regulation: A Preliminary Framework". *Environmental Policies and Industrial Competitiveness*, Organization of Economic Cooperation and Development (OECD): 69-77.
- VISCUSI, K.W. (1978): "A note on 'lemons' markets with quality certification". *Bell Journal of Economics*, 9(1): 277-279.
- XEPAPADEAS, A., ZEEUW, A. (1999): "Environmental Policy and Competitiveness: The Porter Hypothesis and the Composition of Capital". *Journal of Environmental Economics and Management*, 37 (2): 165-182.

APPENDIX

Table A.1. Summary of the activities included in the Operative Programmes

Year	Activity	Operative Fund Share (%)

1997	1	48.32
	2	29.12
	3	3.90
	4	15.21
	5	3.45
1998	1	51.18
	2	28.60
	3	4.24
	4	13.18
	5	2.80
1999	1	62.47
	2	25.81
	3	4.11
	4	5.68
	5	1.93
2000	1	63.92
	2	25.94
	3	5.86
	4	2.71
	5	1.57
2001	1	62.78
	2	26.04
	3	6.72
	4	2.85
	5	1.61

1.- Agricultural production methods compatible with environmental standards.
2.- Quality improvement in the productive system.
3.- Commercialisation under quality systems.
4.- Methods for the control of phytosanitary standards and provisions.
5.- General expenditures.
Source: Andalusian Council of Agriculture and Fisheries.

Table A.2. Results of Hausman-Wu test (equation 6)

H_0	Statistic	Degrees of freedom	$\chi^2_{0,05}$
Exogeneity of explanatory variables	5.33	4	9.49