

Competitiveness of the local production of apple in the Douro region (North of Portugal)

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Abstract: *The production of apple is an ancient traditional activity in the Douro region (integrated in the Northern region of Portugal) and the fruit produced benefits from a very positive image of quality in the internal Portuguese market. Based on a model of small family businesses and state inspired cooperatives, the regional apple sector suffered a deep restructuring during the last couple of decades, visible in the modernization of orchards and the rise of new conservation and marketing structures. The strategy of the economic agents that produced these investments was directed towards the regional markets and the needs of the large national food distribution companies. This article seeks to contribute to the evaluation whether the competitive advantages that the apple sector has been acquiring and the option for the supply of regional and national markets has been, or not, sufficient so that it may continue to compete in a sustainable way locally in face of an increasingly more internationalized market. For that purpose the apple production systems in existence on the Douro region were identified and their competitiveness was evaluated. It became clear that the different systems, the majority of which typical of part time and small agriculture are able to be competitive in financial terms with systems of other regions of Europe and the New World. But the growing competition will force the sector to continue to correct their main competitive weaknesses: the insufficient development of the more specialized resources and the lack of formal networks between institutions and companies.*

Keywords: *Competitiveness, Apple Production, Douro, Regional Production*

Introduction

Globalization, resulting from the growing interdependence and interconnection between the national economies is characterized by a growing movement of goods, services, capital, ideas and people between the several countries. The international integration process has, as one of the most visible dimensions, the reduction of barriers to the international trade of goods and services and the transference of capital and technologies. Many believe that the increasing compatibility of commercial politics at an international level and the resulting greater equality in competitive conditions will accelerate commercial trading and sustained world economic growth, allowing for the creation of employment and the broadening of quality levels to new layers of the population and new countries.

Due to the integration in the European Community and the process of globalization and internationalization, deep changes in the economical environment in which the companies, the institutions, the farmers and the Portuguese rural populations are active, continue to occur. The environment of growing global competition seems to favour the more conventional agricultural model, "...with a constant concern for technical betterment, intensification and competitiveness, characterized by high performance and productivity ..." (Tibério, 2003). However, along with the reduction of production costs, the differentiation strategies have a fundamental role in the process of the distribution of food products (Covino and Mariani, 1999), with effects reflected in the agricultural production. The activities that, based primarily in the use of natural, human and cultural resources, produce goods and services with specific characteristics, set apart by their specificity and organoleptical and environmental quality, can compete in specific market segments. "The improvement of the quality of regional agricultural products is one of the strategies for development in vogue for disadvantaged regions" (Tibério, 2003). The importance of the location and the proximity to the production sites in relation to the consumption locations has also been reinforced

by the growing concern with environmental costs associated with the transportation of food for long distances.

The Douro region is a territorial unit NUTIII (Nomenclature of Territorial Unit Level 3) that has in common a set of characteristics typical of the periphery spaces of the EU, which contributed to a noticeable demographical degradation to which, thus far, only a few urban centres have escaped. The strategic options for development in the region continue to depend on the use of all endogenous resources, material and human, being the agricultural and agro-food activity (associated to services like tourism) one of the main means for that purpose. The region, in general, presents unfavourable conditions (climate, soil, land structure, etc.) for agriculture of a more intensive kind, dedicated to the production of undifferentiated goods, in which the prices and costs are decisive for competitive success.

The apple is, to begin with, one of the local assets that, in the physical and cultural environment of the Douro, has intrinsic conditions to be used in oriented strategies for the differentiation and quality of products (not forgetting that the effective use of resources and productivity does not stop being especially important in any of them) and, for that reason, with the potential of constituting a very competitive sector able to supply the closest markets. The apple sector in the Douro experienced, throughout the last 20 years, a very significant evolution resulting in the expansion and modernization of orchards, the improvement of the cultural practices used, the development of conservation structures and the creation of more effective marketing networks. Other than that, the production of apple is the activity in which the local economic agents are more interested in being involved, besides the primary production, in the phases of the apple supply chain, conservation, preparation for consumption and even wholesale marketing. Individually or in groups, many producers have built small and medium installations for conservation. Some have taken upon themselves even the functions performed by intermediary agents in transportation and sale on the closest distribution markets or at national purchase centres.

According to Mateus et al. (1995), competitiveness is a relative, comparative and dynamic notion, much more structural than conjunctural and with multiple dimensional characteristics, resulting from complex economical, social and political processes and cannot, for that reason, be portrayed by simplified indicators. One of the possible definitions applied to companies and sectors, consists in considering them for their capacity to supply goods and services in the period, location and way desired by buyers, at prices as good, or better than those provided by competitors, generating equivalent levels of profitability, at least, at the cost of the opportunity of the resources used. It's the capacity to remain in the market thanks to a performance that is not lower than that of the competitors in terms of quality and cost for goods and services supplied (Esposito, 1999).

The main objective of this article is to analyse the competitive capacity of the agro-food sector of the apple in the Douro region to supply the national and regional Portuguese markets, in a context of globalization and internationalization of the economies. In order to attain that goal:

- we evaluated the sector in terms of some competitive factors: material and human production factors, technological knowledge, investigation and experimentation, support activities, productive and organizational structure and the performance of public and private entities connected to the sector;
- we identified and characterized the main apple production systems in the Douro region, using the statistical procedure known as cluster statistical analysis;
- we analysed the financial profitability of the more specialized apple production systems in the Douro region, taking into consideration the conditions of the local market and the different productive options and cultural operations adopted in their holdings and apple orchards.

Methodology

The competitiveness of the apple sector in the Douro region was evaluated following two complementary points of view: one more qualitative, centred in the perception of the functioning of the sector and its surroundings and the competitive factors which it presents and another more quantitative, at a microeconomic level, centred in the production systems of the apple and their financial results.

Competitiveness is determined by a series of very diverse factors like availability of raw materials, trained labour and capital, the climate or the existence of certain infrastructures. Competitiveness is also conditioned by the strategy of companies integrating the sector, their structure, the level of concentration and vertical coordination, the cooperation, the corporate rivalry and the competitive intensity, the power of buyers and suppliers, the substitute goods and services or the threat of new competitors (Esposito, 1999). The support activities and institutions, their presence or absence, their capacity for innovation and stimulation of interactive processes of creation and adoption of technology and knowledge, along with the sector, are also important factors to consider (Drejer et al., 1999). The performance of governmental organizations can also condition competitiveness, in trade politics, in the creation and development of infrastructures and institutions, in regulating the sectors, through indirect support of economical activities or the creation of environments more or less competitive.

The evaluation of apple sector in the Douro region, in terms of the competitive factors, was based in interviews (38) to local elements that are actors in the apple value chain, from production to marketing. Individual businessmen were questioned, in general with orchard sections from medium to large in size, often with their own conservation structures, leaders of local producers associations and cooperatives and extension technicians connected either to the producers' organizations or the State and other entities. The interviews were performed according to a script of open questions and the sampling used is non-probabilistic and non-random.

This evaluation was followed by a deeper analysis in terms of the holdings (of the main local production systems) which produce apple in the Douro region. Therefore, the evaluation of the competitiveness of the sector also went through the analysis of the profitability of the more specialized apple production systems in the Douro, for the year of 2008.

For that purpose, we started by identifying and characterizing the existing apple production systems in the Douro region in terms of orientation and productive structure of the holdings. Cary (1994) defines production system as the combination of the productions (vegetable or animal) to which the farmer dedicated himself or intends to dedicate himself and the human resources (labour) and materials (capital) which application is considered necessary in order to extract the economical result intended. Although each holding corresponds to a unique combination, there are holdings with similar characteristics which can be represented by the same production system.

The statistical procedure chosen to group holdings with similar characteristics in production systems (statistical clusters) is known as statistical analysis of groups or clusters. "It's an exploratory multivariate analysis technique that allows the grouping of subjects or variables in homogeneous or compact groups in relation to one or more common characteristics" (Maroco, 2003). It "...seeks to classify a set of initial data into groups or categories, using the variable values observed that refer to the phenomena in study, not knowing, however, the number or members of the groups" (Pestana and Gageiro, 2000).

The database used in the statistical analysis of clusters groups a set of data on the holdings that is more significant for the local apple sector. It was built from the database of the General Agricultural Census of 1999, relative to all agricultural holdings of the Douro. The holdings included in the apple tree database were selected according to the area cultivated with apple trees and the economic importance of the activity in each holding.

Given the high number of holdings existent, we resorted to the k means method of cluster analysis in which it is necessary to define, from the start, the parameter number of groups (k) in which the

holdings are to be included. The solutions with higher k tend to form a greater number of holdings with more similar characteristics in terms of productive orientation. However, the purpose of the performance of the cluster analysis is that of finding groups with homogeneous characteristics which help to simplify reality, that is, which reduce the universe of 2432 holdings under consideration to a few dozen groups of holdings. Considering the results obtained for the different values of the parameter, the groups presented in this article result from a value of k equal to 400.

For each one of the holdings of the apple tree database there is a detailed characterization at the level of the size of the agricultural surface, of the productive orientation (areas occupied by the different cultures), the animal assets and the equipment and human resources employed - degree of use of family and non-family workers and other characteristics like age, education or professional training. The 18 variables chosen for the classification and identification process of production systems reflect their productive orientation and size, corresponding to the areas occupied and the number of animals of the main vegetable and animal activities identified.

The information present in the apple tree database is not, however, enough for the fulfilment of the next step, the evaluation of profitability of the specialized apple production systems in the Douro region. The determination of profits and costs depends of the description of the means through which a culture is explored, its productivity, the different technical options in the implantation of orchards, the cultural operations performed and the resources used in their fulfilment. It is also a consequence of the prices of goods and production factors that are related to the conditions of the markets. At the time of performance of the field work, some of the interviewees (28 technicians and producers) were asked for data related to the aspects mentioned, to compensate the lack of information existent on the subject in published studies.

It was considered that the orchards come into full production on the 5th year and their useful life cycle from the time of planting up to the moment of removal of the trees is of 20 years. On the 3rd and 4th year of installation, the production considered is a fraction of 10% and 50%, respectively, from the production of the cruise years¹. This refers to marketable apple and "refuge" apple², normally destined to the industry (Fonseca, 2006). The analysis performed was based in the productivities of 30 and 40 tonnes per ha.

The costs of investment included the tasks of land mobilization, the acquisition of 1250 plants, props and wire, the organic and mineral fertilizers, hours of traction and labour that, in many holdings, are insured, partly, by the holding's own resources, drip irrigation system and a small construction.

The consumption of fertilizers (cover fertilization, fertigation and foliar fertilization, manure and organic and calcareous fertilizers) assumed were of 430 €/ha and per year and of pesticides was estimated in 920 €/ha and per year. The payment of unqualified temporary labour considered was of 25 € per day, including meal subsidy and transportation and that of qualified temporary labour was of 35 € per day³. To these amounts is added the single social tax by the employing party and work insurance.

The yearly liquid result chosen for the determining of the financial profitability of the more specialized apple production systems in the Douro region was the profitability of the land and the family labour (PLL_F), which reflects, implicitly, the earnings of the factors land and family labour. It is the difference between the production value and the cost of production with salaries, fertilizers, pesticides, fuel, renting of machines and transportation, maintenance and repair of machines,

¹ The data used in determining the costs of investment and exploration were based in the field work performed for the work of Fonseca (2006) "Contributo para a análise da competitividade da fileira da maçã no Douro".

² 12,5% of the apple produced sold at prices of 4 cents per kg.

³ Other costs included: repair and maintenance of machines (calculated based on the number of work hours), the yearly repair and maintenance of constructions (2% of their initial value), general expenses (3% of the responsibilities with intermediary factors and salaries), the interests of circulating capital ((responsibilities with intermediary factors + salaries) / 2 x interest rate) and the insurance of machines and constructions.

equipment and construction, capital interest⁴, etc. (Fonseca, 2006). The internal factors, normally used by the local apple producers (their work, that of members of their families and the land) are not accounted for in the calculation of the PLL_F. It is, therefore, necessary to compare the value of this result with reference profits like minimum and medium wage levels practiced in the labour market. Profitable farms will be those that can generate a PLL_F for each family work unit (WU_F)⁵, higher than the minimum national wage (5964 €/year in 2008)⁶ or to the yearly average wage (12500.3 € in 2008)⁷, according to whether the companies have characteristics more noticeably familiar or corporate.

Results

Qualitative evaluation of the competitive factors

At this point we perform an evaluation of the apple sector in the Douro region in terms of some competitive factors and we identify, characterize and evaluate, in terms of financial results, some of the different local apple production systems.

The producers and the members of their families, the businessmen and employed workers have, in general, low educational levels and training which derives only from practical experience. It is, for example, symptomatic that, even in the larger and more specialized production systems, a considerable percentage of producers (between 45% and 60%) did not attend any training course, either short or long term. About 55% of individual producers had only primary education, that is, the first cycle of instruction. Besides that, 85% of individual producers that devote themselves to the production of apple state that they have exclusively practical training. The effort that was made to train people is criticized almost by the whole of the different economical agents contacted. Some inadequacy is mentioned between what is taught in the professional training courses and the real needs of employers or producers. Some of the entities that provide them are eyed with some suspicion, and it is considered that these see them only as a source of financing.

The regional apple production sector faces the problem of lack of human technical resources trained and experienced. The introduction of the Integrated Protection contributed to the increase of the number of associations and of technicians attached to them. However, part of the associations created possess very weak logistic and financial conditions and can't provide stable positions to the majority of the technicians. As a result, many end up leaving the region, a wealth of knowledge and technical experience being lost. At the same time, the Ministry of Agriculture's services started a process of reduction of its own resources and transference of functions into other entities.

There is a lack of skills and technical knowledge, which limits the spread of adequate productive methods in terms of the local conditions and the evolving tendencies of the markets. Quotes from some of the interviewees like "correct technical options for the West region (another important apple-producing region in Portugal) are not so for the Douro region" or "the adequate varieties there are not adequate here", reflect the reserve which is felt towards the local application of scientific and technical knowledge that was developed and tried in other regions and in other countries.

Therefore, several technical limitations prevail that condition the productivity of orchards, the costs of production and the quality of the fruit. The average size of many of the orchard sections tends to be small, making the effective use of the production factors difficult. The installation in poor soils, or in locations prone to frost, affected the average productivity and quality. Several inadequate choices of rootstocks and varieties in relation to the types of soil and demand were registered (Gerry et al.,

⁴ Annual cost of a fixed capital:
$$\left[Vi - Vf \frac{1}{(1+i)^n} \right] \left[\frac{(1+i)^n i}{(1+i)^n - 1} \right]$$

⁵ 1 WU_F = 240 days or 1920 hours of work per year.

⁶ DL n^o 397/2007.

⁷ Gross amount (before deduction of any discounts) in money and/or kind paid in a regular frequency and insured to works in the reference period and corresponding to the normal work period. The amount is part of the Survey on Gains and Duration of Work (GEP, MTSS, 2009).

2001). Additionally the cultural practices adopted by many producers are, also, not the best. In many orchards, the process of introduction of integrated production is relatively recent and is not fully spread across the farms, especially in those of smaller size. The most common tractors, with 34 to 55 horse power, and sprayers are only present in 23.5% and 25% of the farms, respectively. Producers continue not to protect their orchards from common meteorological occurrences like frosts which can reduce the production drastically in terms of quantity and quality.

The modernization process implied a remarkable increase in freezer capacity, especially in the southern part of the Douro region, based in the creation of conservation structures of different levels, from dozens of refrigerator chambers of small size belonging to small and medium sized producers and/or merchants, to fruit centres, promoted by associations of producers. The appearance of conservation and normalization units of a reasonable size, the modernization of the existing units and, furthermore, the creation of the conditions so that some producers have managed to establish themselves as suppliers of the main national purchase centres, reinforced this advantaged.

There are, however, important challenges to overcome by the sector, the main such challenge is the quality and differentiation of the apple produced in the region. The modernization process of the orchards and fruit centres, even though contributing to the improvement of the average marketing quality of the apple, did not prevent that a part of the production would be unfit to be used for human consumption and that another part must be classified on category II. Other than the climate factors, hard to control, less accurate technical options in the performance of chemical weeding, plant health treatments and fertilization affect not only the productivity of orchards as the quality of the apple (Guerry et al., 2001).

The differentiation of the apple produced in the Douro region needs to be expressed to buyers and consumers. The sole regional variety with some presence is the Bravo de Esmolfe. The geographical indication of Apple from Beira Alta, shared by several regions of the northern interior and centre of Portugal, was unable to get a true footing in the market. Therefore, the local agents with greater capacity chose to market their production with their own brands and references to high altitude apple or mountain apple. However the most significant and visible distinction that the consumers can detect is between the apple produced in integrated protection and the apple produced conventionally.

The company structure of the apple sector in the Douro region includes a large number of holdings that individually produce a very small amount of apple. In their majority, these holdings are not specialized in apple trees and the producers have other professional activities. Many have a very small economical size, which renders the investment, productive conversion and efficient performance of the different cultural operations in orchards difficult. Therefore, these producers would have to organize themselves in order to access factor and product markets in a more favourable way, which only happens for those that are integrated in cooperatives or associations of producers. Obviously, the productive structure is also made up of holdings and companies of larger size, more specialized and with greater financial capacity, which form the core of the sector. As we have seen, some of them, in an isolated way, or joined in associations of producers, invested, in larger or smaller scale, in the verticalization of the business, in order to reinforce their bargaining power, which had positive effects throughout the sector.

Despite some examples of the contrary, the corporate culture continues to be dominated by a certain individualism and distrust. Therefore, businessmen tend to compete with one another much more than cooperate. Rivalry is necessary. It creates the conditions that allow companies to improve and change their actions, due to the fact that they must face a competitive environment. Cooperation, however, allows the sharing and common usage of technological knowledge and the creation of specialized support services in professional training, research or management, for example.

One of the main deficiencies that can be detected and which limits the development of the sector derives from the lack of solidity of a network of institutions and companies, able to supply innovative

goods and services and the almost total absence of networking and meaningful cooperation relationships among them. The formal and informal channels of circulation of information and knowledge are practically non-existent.

We can observe that the institutional framework is fragile, which makes it harder for the organization of the sector, research and experimenting and the supply of technical support to the producers. The existing organizations, and new ones as well, have started to provision themselves with human and material resources and to supply services to the producers as technical support (integrated protection) and consultancy in areas like accounting, insurance and project analysis (Guerry et al., 2001). The integrated protection and insurance, in particular, have contributed for the growth and for a greater visibility of producer's associations directed towards the rendering of services. However the lack of critical mass and material conditions, financial and human, which most of them face, condition their work and reduce the effects that their actions might have. In the Douro region, the state contributions for the apple sector by way of the regional services of the Ministry of Agriculture, traditionally concentrated in technical support and with research and experimentation, have been getting more reduced. In a sector (agricultural) so used to depending of the support of those services, the agricultural county teams are being emptied of human resources.

Financial results

The statistic analysis of clusters showed, for the k solution chosen (400), a set of production systems that can be considered as specialized in the production of apple. It includes from systems with average areas of orchard higher than 10 ha, through systems with 9, 7, 5 and 4 ha of apple trees, up to farms in which the orchards occupy 1 to 2 ha. These nine systems correspond to 35.6% of the apple production area and to 17.5% of the number of farms belonging to the apple tree database (Table I).

Table 1. Relative representativeness of the production systems.

Types of Systems	Systems		Cases		Apple Area	
	(no.)	(%)	(no.)	(%)	(ha)	(%)
Specialized in apple trees	9	2.3	426	17.5	1555.96	35.6
Permanent cultures (> 1,6 ha apple trees)	17	4.3	175	7.2	556.64	12.7
Small/medium to medium/large size (<1ha apple trees)	13	3.3	187	7.7	124.71	2.8
Of small size (< 1 ha apple trees)	8	2.0	531	21.8	274.56	6.3
Very small size (< 1 ha apple trees)	1	0.3	560	23.0	173.97	4.0
With animal activities (< 1 ha apple trees)	7	1.8	99	4.1	63.27	1.4
Systems with 5, 4 and 3 cases	27	6.8	101	4.2	129.35	3.0
Systems with 2 cases	35	8.8	70	2.9	280.78	6.4
Systems with 1 case	283	70.8	283	11.6	1216.61	27.8

Source: Estimated from the apple tree database

Another set of production systems combines the apple tree (with an area larger than 1.6 ha) with vineyards for designation of origin wine, the olive orchard for olive oil, the chestnut, the vineyards for other wines and even the cherry tree. The farms that integrate them occupy 12.7% of the area of apple trees (7.2% of the farms) of the database mentioned. In some of the systems, the apple trees, occupying areas between 3 and 6 ha, are dominant in comparison to the remaining activities. In others the area was distributed among apple orchards and vineyards for designation of origin wines. There are also some systems in which, on the contrary, the activity of apple production (with 2 to 3 ha) is not predominant.

The majority of the farms with apple trees has, however, orchards with a size smaller than 1 ha. They are grouped in systems of very small to large size, dominated by the most common permanent crops in the region and by activities like corn/potato, permanent pasture, fallow and animal production (bovine or ovine). The production systems with these characteristics represent 56.6% of the farms and 14.5% of the apple tree orchard area of the apple tree database.

The remaining farms (18.7% of the total) are grouped in systems with less than 6 cases or are isolated, holding dissimilar apple orchard areas that correspond to 37.2% of the surface of this fruit production in the database.

Having identified the main groups of production systems, knowing their productive orientations, the size of their apple tree areas, as well as information relative to the device and production technologies adopted and human resources, the financial profitability was determined for those that were classified as specialized in apple trees for the year of 2008. Of these six groups were studied (Table II). In those systems the economic results reflect exactly and only the apple activity, its productive process and its transnational and institutional environment. On the contrary, in the remaining identified systems, the economic and financial performance depends of various agricultural activities, for which the related results cannot be associated only to the production of apple.

The analysis of the financial profitability performed on the more specialized production systems, and of larger size, revealed that, for a production of 40 ton/ha, 0.25 € per kg of apple and real opportunity capital costs of 4%, E1 and E2 are profitable, since the PLL_F/WU_F is much higher than the minimum national wage and also higher than the average yearly wage (Table II).

Table 2. Financial results of apple production systems.

Types of specialized systems	Apple Tree Area (ha)	40 ton/ha		30 ton/ha	
		PLL_F (€)	PLL_F/WU_F (€)	PLL_F (€)	PLL_F/WU_F (€)
Very large size (E1)	15.58	48348.9	27907.8	18807.2	11010.4
Of large size (E2)	10.12	31717.6	23011.6	11841.8	9264.6
Large/medium size (E3)	6.35	21045.2	19137.4	9043.9	8375.2
Small/medium size (E4)	3.87	10642.4	15879.2	3328.2	5057.1
Of small size (E5)	2.35	4266.5	10483.3	-174.9	-437.6
Very small size (E6)	1.20	2818.8	15033.6	612.6	3311.4

However, more reduced productivity levels added to higher opportunity capital costs and/or lower sale prices can affect the profitability of these groups. The PLL_F/WU_F is higher than the minimum national wage (5964 €), but lower than the yearly average wage (12500.3 €), for production levels of 30 ton/ha.

The E3, E4 and E5 systems, with average apple tree areas of 6.35 ha, 3.87 ha and 2.35 ha, are less profitable for the same production conditions (40 ton/ha) and prices than the previous systems (Table II). For productions of 30 ton/ha, the PLL_F/WU_F of E3, although higher than the minimum national wage, is lower than the yearly average wage. In systems with smaller apple tree areas, as is the case of E4 and E5, a production of 30 t/ha is insufficient in order to generate incomes that allow the PLL_F/WU_F to be higher than the minimum national wage.

The system with the smallest apple tree area (represented by E6 with 1.20 ha of orchard) is profitable as long as there is no degradation of the apple quotations, that the productivity does not drop to reduced levels or, also, that the opportunity costs are not high. For productions of 30 ton/ha and capital opportunity costs of 4%, the PLL_F/WU_F is lower than the minimum national wage (Table II). The greater profitability of E6 in comparison to E5 derives from the fact that E6 resorts to the rental of machines and equipment in replacement of maintaining its own and has lower fixed costs.

Conclusions

The recent expansion of the apple productive structure, with the planting of new areas of apple tree, introduced significant changes in the technical characteristics of orchards and production technologies. It allowed for the renovation and density increase of orchards, the increase in quality and quantity of production, the growth of productivity, an increase in varieties and a greater technological progress. The attempt by the producers to incorporate in their economical activity new stages of the supply chain that takes the apple from the orchard to the consumer is a very valuable

competitive force, in facilitating access to the producers and local associations to the supply markets and large distribution purchase centres.

Thanks to these developments, the sector has managed to resist the opening of the markets, continuing to supply the national and regional food distribution and constituting itself as an important source of income for producers and businessmen and the counties of the Douro region, where the orchard and fruit centres are localized.

This is confirmed by the financial analysis that was performed on the specialized apple production systems groups (E1 to E6), which revealed that they are profitable if the prices and productivities hold to values around the 25 cents per kilo of apple (at the exit point of the holding) and 40 tonnes per ha. If apple quotations or productivity per ha drop below the values indicated, the profitability of the systems can be greatly affected. The economical pressure on these groups of systems can also derive from higher opportunity capital costs (close to the barrier of 6%) or the increase of the costs of pesticides, fertilizers and labour.

The comparison of the results of the different groups of production systems allows us to conclude that the profitability of the holdings has a tendency to decrease with the reduction of the area of apple trees. This is due mainly to the existence of scale economies, resulting from the greater usage of certain components of fixed capital, like machines and equipment, as the size of the systems increases. There is, therefore, the possibility of the groups of average to large size systems to improve their profitability by increasing the area explored with apple trees without, in order to do that, needing to resize their machine park since there is an available margin for the use of these assets.

Another conclusion that can be underlined is that even the small size systems, with orchard areas of about 1 ha, under favourable price, productivity and costs of opportunity conditions, can be profitable, representing, therefore, to the small part-time producer, an interesting possibility for application of the land asset and an additional source of income. For that purpose, however, they need to minimize the usage of fixed capital, resorting preferably to the rental of machines and equipment in detriment of their purchase and concentrating the investment in the plantation.

As we have seen, different combinations of productivity levels and more reduced quotations for apple with higher interest rates can dramatically affect the profitability of all the groups under analysis, which means that the growing competition will force the sector to continue to correct and minimize some of their main competitive weaknesses.

Among them we must underline the insufficient development of the more specialized resources, with consequences to the technical and technological evolution of the productive systems and which condition the productivity of the orchards, the costs of production and the quality of the fruit.

A first level to be underlined when we look at the development of specialized resources is that related to human resources. The producers and their families as well as the employees have very weak qualifications, based only on know-how, as was mentioned and noticeable. In the scope of technological and technical support there is a lack of qualified and experienced personnel. The technical support provided to producers has limitations that derive, largely, of the weaknesses of the institutions that could provide that support.

Despite the investments performed by local producers and merchants in terms of business verticalization, which allowed many of them to start insuring the placement of the apple directly on the most important wholesale and retail markets, there are steps that must be taken towards organizing and joining these efforts which up to this time derived mainly from isolated initiatives.

It is necessary to insure quality and diversify the supply of apple, through more appealing regional differentiation, considering that the distinction of the Douro region apple, by certification and current common brands is not very clear. There is no clear bet in the development of regional varieties when the market is seeking diversity and difference.

The reorganization and concentration of the food distribution sector is as much a threat as an opportunity. A threat in the sense that it facilitated the importing and growth of the competition; an opportunity because it constituted a challenge for producers and fruit centres, in order to satisfy demands in terms of prices, delivery schedules, quantity and quality.

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