Artisanal and industrial models of the PDQ cheese Queijo de Nisa (North of Alentejo, Portugal)

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Abstract

Among the processors of PDO "Queijo de Nisa" two different types of cheese dairies were identified : one type including micro and artisanal units and the other type including small firms with industrial equipment. This contribution tries to answer the question "For what reasons is cheese without typicity produced by the units with industrial equipment ?". The action associates the local managers of PDO and researchers, including the authors of this paper, and the conclusion presented results from a joint reflection on the scope of an action - research model. It is adopted the point of view of plurality of rationality in management actions in the field of Protected Designation of Origin.

Keywords : PDO cheese *Queijo de Nisa*, models of processors, typicity, tecnological management

INTRODUCTION

The *Queijo de Nisa* is a semi-hard cheese made from raw sheep milk ; it has been produced with a Protected Designation of Origin (PDO) in a less favoured area (North of Alentejo) of Portugal since 1995. The total marketing value of this PDO cheese represents 11% of the total value of 10 cheeses protected on the Portuguese mainland (DGDR, 1998, pp. 6-8).

Among the nine processors of PDO *Queijo de Nisa* two different types of cheese dairies were identified : one type including six micro and artisanal units and the other type including three small firms with industrial equipment (Fragata *et al.*, 1998, p. 2). This cheese is particularly fragile in respect of its specific qualities when substantial increases in volume occur. The production of PDO *Queijo de Nisa* has grown three times in the small period of time 1995/97 and that growth was supported by the three small firms with industrial equipment which did guaranty a constant and sufficient supply to the hypermarkets chains.

The demands were so high that there has not been enough time for these small cheese dairies to adapt the traditional techniques of artisanal units to a larger scale. As a result the sensorial panel began to refuse the label *Queijo de Nisa PDO* to the huge quantities of cheese produced by these firms without its typical characteristics. The production of cheese lacking the specific characteristics began to constitute a central problem to the managing directors of the PDO. These in turn placed the question to researchers (authors of this paper), who have therefore, in 1997/98, decided to follow the production of cheese industrially manufactured in order to try to understand this problematic. These results may be seen in two ways.

At first, the *Nisa* cheese as a PDO is defined locally by its manufacturers which, by a process of negotiation, form a criteria concerning the specificity of the protected products. This agreement regulates its existence and should permanently be renewed by the management and control of the local producers group, closely supported by a strong economy uniting the milk producers and several types of cheese processors. These characteristics form the basis of the "local auto-organisation process" for the defence of a common product (Letablier, 1994, pp. 3-4).

Secondly, the plurality of rationality is accepted in management actions in the field of PDO. Besides the artisanal model, we accept the developments and management of ancient and traditional technical know-how in a so-called "open rational model" as a model of Specific Quality Products (SQP) by the preservation of usual know-how to improve the product specificity under costs constraints and by the acceptation of a natural degree of variability in the final characteristics of the product (Lassaut and Sylvander, 1998, pp. 6-8).

This empirical contribution emphasises that in the small no craft dairies with industrial equipment, the factors of typicity will only have a positive effect if the more evident difficulties are eliminated : that is to say if the quality of the raw material is improved and better adapted technological processes will be used.

1. THE REGULATION OF THE SPECIFICATION OF PDO *QUEIJO DE NISA* IS BASED ON AN ARTISANAL MODEL OF PRODUCT MANAGEMENT

The name *Nisa* has its origin in the municipality of Nisa, which has been the most important and traditional central point of cheese production in North Alentejo. The geographical production area for the *Queijo de Nisa* is the less favoured one out of eight municipalities in North Alentejo. The agriculture in these municipalities includes high natural value farming systems such as breeding sheep and beef cattle on wooded agro-pastoral land and Mediterranean scrub.

The PDO *Queijo de Nisa* is produced by nine firms. This PDO cheese can have two different sizes : *merendeiro*, of about 400g weight ; "normal", of about 1kg weight. Beside the PDO cheese, almost all of these firms, as well as other 23 processors in the area of *Nisa*, produce a semi-hard non-PDO cheese made from a mixture of raw sheep and goat milks coagulated with animal rennet.

The regional dairy herd has 33718 sheep of two different Portuguese breeds, *merino* (89,6%) and *saloia* (10,4%) breeds. Traditionally, the production of sheep cheese, such as the *Nisa* one, is concentrated in the period from November to May/June. The reason for such a period lies in : i) the non-existence of natural conditions for preserving the milk, which forces the farmers to produce the cheese after milking so that maturation occurs in a cold weather season ; ii) the Mediterranean climate provides a great volume of forage, based in pastures in spring and in the beginning

of summer. For these reasons, the births are scheduled from the end of October onwards, and so weaning and milking takes place about two months later.

Unlike to what happens with other traditional Portuguese PDO cheeses - *Serra da Estrela, Serpa, Azeitão* and *Castelo Branco* - information about the *Queijo de Nisa* was rather scarce and the regulation regarding its production is not very complete and was based on the : "ripened semi-hard cheese, of a whitish-yellow paste colour, closed texture, with some small eyes, obtained by slow draining of the clot, after coagulation of the raw sheep milk with a thistle infusion (*Cynara cardunculus L.),* and produced in the defined region". The characteristics include a humidity content in non-fat cheese of 54 to 65% and a fat content in dry matter between 45-60%, after a ripening time of at least 45 days" (Decree nº 6/93*).* This cheese characterisation was based on the cheese from some cheese makers with milk from the traditional sheep breed called *merino.* The facilities are considered typical examples of "*Nisa"* cheese producers by both artisanal processors and manufacturers with industrial equipment.

The feeding conditions of the sheep and the relationship between natural pastures and the quality of the cheese, as well as the breed and the maturation conditions for cheeses of different sizes, are not specified in the amendment of the specification. However, as we will see they can become crucial elements in the milk quality through the valorisation of the food resources and the organisation by the farmers of the flock feeding. In the future, the professionals will be forced to raise arguments in order to preserve the milk production in the *Nisa* cheese region.

2. TWO TYPES OF PROCESSORS OF PDO *QUEIJO DE NISA* : ARTISANAL AND "WITH INDUSTRIAL EQUIPMENT"

Among the nine processors of *Queijo de Nisa,* it is possible to identify two different types of cheese dairies, "artisanal" and "with industrial equipment", which present the following differences (Fragata *et al.,* 1998, pp. 2-4) :

- The ownership and control of artisanal enterprises are within the family members. In the industrial enterprises, the control is provided by the owners as the patrons of the business ; these are local associations in which people hold direct membership and are able to participate in the affairs of the firm ; these associations were created in the 90´s from milk producers or independent processors ;
- Artisanal enterprises use family labour and hired labour, in average 4 workers per unit ; the hired labour dominates in the other enterprises, in average there are 19 workers per unit ;
- Artisanal units operate from December to June, while the partner firms work all year round ;
- The know-how of craft firms is based on knowledge and experience handed down from generation to generation ; industrial enterprises have developed some formal and vocational training for their workers ;
- The majority of artisanal micro-enterprises undergo maturation in ripening rooms with a natural atmosphere ; the small enterprises ripen the cheese in rooms with temperature and humidity control equipment.

With regard to the cheese making, manufacturing daily 50 litres in a vat using artisanal methods is entirely different from manufacturing 500 litres in an industrial vat. In a traditional cheese dairy, the manual and slow draining with serum extraction in a 50-litre milk vat is carried out by a cheese maker in roughly an hour. In an industrial cheese dairy, the draining in the 500-litre vat should take place with equal speed and should produce the same results in terms of fresh cheese.

This requires technological modifications at the draining, with the use of industrial equipment and without modifying the typical characteristics of the final product.

3. THE PRODUCTION AND COMMERCIALISATION OF PDO *QUEIJO DE NISA* IS CONCENTRATED IN THE CHEESE DAIRIES WITH INDUSTRIAL EQUIPMENT

Encouraged by an increased demand for traditional cheese in the large urban centres, the production of PDO *Queijo de Nisa* has grown substantially in a small period of time : reaching 23 426 kg in 1997, three times the amount produced in 1995.

The total marketing value of the PDO cheese produced by the nine dairies (gate value) was evaluated about 59 million PTE- Portuguese *escudos* (prices 1997). This value represented 9% of the total PDO and non-PDO cheese produced in 1997, in the eight municipalities of North Alentejo (Fragata *et al.,* 1998, p. 4).

The production is very concentrated in the three enterprises, which associate several partners. They form 33% of the total number and are responsible for the commercialisation of 91% of the PDO *Queijo de Nisa*. In average, the marketing value of the PDO cheese is 858 x 10^3 PTE and 18 080 x 10^3 PTE (prices 1997) for the artisanal and "industrial" firms, respectively.

The varied commercialisation processes of PDO manufacturers are shown in table 1.

Table 1 : Dominant selling ways of PDO *Queijo* de *Nisa* by type of processors (% of processors)

Dominant selling ways	Artisanal %	With industrial equipment (%)
Only direct selling to consumers at gate cheese dairy	50	
Regional distributors	17	17
Municipal fairs	50	17
Local small shops	17	
Distributors of cities → Superstores		100

Source : Fragata *et al.* (1998 : 7).

Half of the artisanal cheese producers sell directly all the PDO *Queijo de Nisa* at the gate of their dairies. Their cheeses are the most expensive and are often demanded by local and urban consumers. These consumers tend to belong to a higher social stratum and particularly enjoy traditional cheese, having been friendly customers for many years. These dairies are largely involved in local marketing, as well as small shops and municipal fairs.

The industrial enterprises are the only producers who sell PDO *Queijo de Nisa* to city distributors who in turn channel the cheese to superstores.

In view of the commercial links established with the large distributors, the units of larger dimensions turned the PDO into a visible product outside the local markets, in the larger Portuguese cities and even into an export product to France. The growth in the PDO industry had some impact on the local and disadvantaged economics providing these with employment such as office workers, distributors and naturally cheese makers.

4. CHEESE DAIRIES WITH INDUSTRIAL EQUIPMENT : SOME REASONS FOR CHEESE WITHOUT TYPICITY

Pressed by the increased demand and the large distributors the *Nisa* PDO cheese was supported by the units with industrial equipment which, taking advantage of the PDO appearance and the market opportunity, did guaranty constant and sufficient supplies.

These characteristic demands of the large distribution did not allow enough time for the larger cheese dairies to adapt the traditional techniques to the industrial principles of little hand labour and non-stop production. Production continued throughout the summer period as a means to guarantee the viability of the high capital invested.

As a result, the sensory panel began to refuse the label PDO *Queijo de Nisa* for certain cheeses. The production of cheese lacking certain specific characteristics began to constitute a central problem to the managing

directors of the PDO, which in turn questioned the researchers (authors of this paper), that have since 1997/98 followed the production of one of these units.

Before presenting the results of this follow-up, let us first analyse the main factors affecting the quality of these traditional cheeses and the particularities common to technology.

4.1. The fragility of typical cheeses

According to Bertozzi and Panari (1993 : pp. 305-307) and Bertozzi (1995, p. 145) the factors that characterise the type of cheese with PDO are based on the animal breed, on the feeding conditions, on animal growth, in the milk treatment, on the methods of production and in the ripening period. These are general factors which also influence the characteristics of Portuguese PDO cheese (Graça, 1988, pp. 50-51 ; Martins and Vasconcelos, 1993, pp. 74-75).

However, cheese is also a product in which these effects can be overlaid by other factors or even by the intense changes in milk components along the cheese making process. Therefore, it is necessary to consider the specific aspects of each traditional cheese technology.

Almost all Portuguese traditional cheeses are particularly fragile in regard to their specific qualities when substantial increases in production occur, as technological transformations are required at the dairies. If the cheese producers fail to make small technological alterations, such as to reproduce simply the artisanal practices, there could be a large negative impact in the cheese quality.

In Portugal, the production of sheep cheese is based on the use of raw milk curdled at low temperatures (28-32ºc) with thistle extracts (*Cynara cardunculus L.)*. With the slow draining of the curd also under the same low temperatures, there is no acidification or lowering of the pH throughout the cheese making process. It is not possible to raise the dehydration rate of the curd by an increase in temperature during the release of serum or decrease the lactose content of the paste by washing the curd. These procedures would increase the stability of the product during maturation, however they would modify the characteristics of the final product.

The result is a product with a high water and lactose content, not at all stable and susceptible to undesirable microbiological developments. On the one hand, the species present in the microflora only show a natural equilibrium when milk is quickly transformed into cheese. On the other hand, it is not possible to condition the microbiological and enzymaticaly activity and the enzyme complex (thistle) has an intense proteolytic activity which is not specified.

The subsequent evolution of the cheese also depends on the ripening conditions. During the first ripening step, a peak of acidification is reached and the pH drops, this favours the proteolytic action of the thistle enzyme complex. In this step, the cheese should be turned over so as to maintain a regular shape and develop a uniform flora on the surface ; the excess flora should be removed through washing in order to reduce defects in appearance and flavour. Frequently lower temperatures help to control undesirable microflora.

The final phase of ripening should occur in a dryer environment and under slightly higher temperatures in order to promote the formation of the rind and limit the development of surface flora and the growth of mould through dehydration of the surface. The duration of this last ripening phase should correspond to an adequate rind formation and an appropriate internal evolution to obtain the characteristic texture and flavour.

This process of ripening is much more complex and demanding in hand labour than other cheeses in which the surface flora does not play such a decisive role. Small variations in the production and ripening might explain the different characteristics found in cheeses among the same group although the production technology is quite similar. It is necessary to manage a group of factors and agents in a fragile equilibrium which demand good raw material and correct technology traditionally based on time and labour consuming procedures.

4.2. Two decisive factors : the quality of milk and the modification of traditional technology

The unwise "industrialisation" of cheese production is the base of the problems related to its lack of specific characteristics. Two decisive factors contribute to such an unwise production : the quality of raw milk and the modification of traditional technology.

In the cheese dairies with industrial equipment, due to the need of purchasing milk from different producers, the collection and conservation of milk becomes a criti-

cal operation in the production of cheese from raw milk. In such conditions, modifications in the microflora equilibrium might occur through contamination or the differential growth of undesirable micro-organisms which tend to be less present in small volumes of milk found in the traditional dairies.

The new units have been unable to reproduce the essence of traditional technology with regard to good conditions in the production of fresh cheese, conditions which largely determine the later cheese evolution throughout the ripening. In these dairies the human element - the staff and the cheese makers - have failed to provide the correct interpretation to this problem, which has led companies to adopt less efficient solutions. To manufacture large quantities of milk, industrial equipment must be used, which implies the use of correct techniques in order not to modify the specific qualities of cheeses.

The results shown in table 2 for milk characterisation support this thesis. Furthermore, during the period in study, about 40% of the analysed cheeses demonstrated defects in their physiochemical characteristics (fat in dry matter and water in non-fat cheese) and more than 95% of the cheeses revealed very low maturation levels (<30% WSN/TN). In relation to sensorial evaluation, most of the cheeses did not reach the minimum requirements, revealing deficiencies in flavour, the most specific quality. Even for the external characteristics, the samples often showed rind deficiency and persistent lack of ripening in the larger cheeses.

Table 2 : Characterisation of ewe's milk for cheese making PDO *Queijo de Nisa* in an enterprise with industrial equipment

Characteristics	Average	S. D.	Max.	Min.
Density (20°C)	1,0345	0,0014	1,0370	1,0318
Fat (g/100g)	7,5	1,0	10,2	6,4
Protein (g/100g)	5,83	0,49	6,57	5,19
TS (g/100g)	19,32	1,97	24,09	17,16
SNF (g/100g)	12,07	1,77	17,32	10,80
Acidity (mL NaOH N/l)	26,5	3,3	36,0	15,0
pH	6,59	0,10	6,72	6,35
Total mic. count (ufc/mL)	$2,12 \times 10^7$	$3,21 \times 10^7$	$1,38 \times 10^8$	$1,60 \times 10^5$
Coliforms (NMP/mL)	$1,83 \times 10^6$	$5,53 \times 10^6$	$2,50 \times 10^7$	$2,50 \times 10^3$

In the same period, the physiochemical characteristics of the milk did not seem to be a limitation (Table 2). The milk showed an average fat content of 7,5%, 5,8% protein, 12,1% SNF, indicating a good yield potential. The main problems refer to the microbiological parameters : the acidity and pH indicate problems in 80% and 50% of the samples, respectively ; about 90% and 70% reveal, respectively, bacteria count superior to 10^6 cfu/mL and coliforms superior to 10^4 cfu/mL.

The dairy studied was unable to adapt from a technological point of view because it failed to understand the essence of traditional technology. This led to the hiring of more hand labour and the use of hasty practices to overcome the difficulties. The consuming procedure of labour time was reached. Nevertheless, the essential question regarding the good characteristics of the cheese was not overcome. In general, the fresh cheese showed to be less drained creating difficulties in the ripening. Under these conditions, the milk quality constituted only an additional limitation to the technological success.

With other Portuguese PDO cheese *Queijo de Azeitão* the problem was overcome by slight modifications and adaptations in technology, beginning with the curdled milk in the vat, cutting of the curd with appropriate knives, mechanical stirring and draining and finally mechanical pressing in small moulds (Vasconcelos,

1990, pp. 171-174). The process and the size of the mould varied from cheese to cheese and it was necessary to find an appropriate solution for each case.

CONCLUSION

As a result of the experience gained since 1995 in the control and certification of this PDO cheese, and from the knowledge obtained through this action - research, the local organisations most involved with the PDO intended that the most common defects of this cheese, and its causes, are reasonably well known, which allows the major part of the problems to be solved. The existing regulation does possess a sufficient number of characteristics to reject or accept *Nisa* cheese as PDO. Nevertheless, we would like to emphasise that the actions of these factors only have a positive effect if the more evident difficulties are eliminated. Therefore, it is necessary to improve the quality of the raw material and use correct technological processes by units with industrial equipment.

The results of the cheese dairy followed up by the research team showed that the principles of modern industry, "advanced equipment and reduced hand-labour", could not be transferred to the production of a traditional cheese by a simplistic way. As a basis of a compromise in the negotiation process for a new agreement about the regulation of dossier *Queijo de Nisa*, the larger units must intend the research of a flexible model besides the artisanal and industrial models, an "open rational model" for the technological management of the product.

It is worth noting that the equipment did not prove to be an obstacle in the quality of the cheese, but wrong utilisation by man did. Therefore, we can clearly state that the quality of traditional cheeses continues to depend on the human element, especially in the understanding of the essential elements of traditional technology. Additional problems with raw material quality lead to a lack of specific qualities in large quantities of cheese.

Following the steps taken in the initial four years of the PDO, by agreement of its producers the *Nisa* cheese characteristics and its adaptation to industrial dairies shall be thoroughly studied.

The technological alterations in these dairies should be adjusted in order not to modify the specific product characteristics. If there are skills which cannot be mechanised, they must not be modified or avoided, and enterprises should be forced to provide the adequate hand-labour.

Unlike other Portuguese PDO cheese *Queijo de Azeitão*, the problem in *Nisa* is still not solved and our research project aims to contribute for finding appropriate solutions for the *Nisa* case.

It is crucial for the *Nisa* cheese that the transition from traditional technology to modern technology, associated with the larger dairies, which, as we have seen, produce a large percentage of the market cheese, should take place. Nevertheless, since these cheese dairies are highly dependent on the purchase of milk from suppliers, which have remained isolated from the agreements, the strengthening of ties with cheese manufacturers is fundamental to the future of this PDO, namely through the payment of milk according to its quality.

In search of a compromise between different forms of co-ordination, those responsible for the management of the PDO *Queijo de Nisa* should share a vision of a collected production process / transformation in order to obtain a clear understanding of the desired quality of milk and cheese to be achieved.

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