# QUALITY IN AQUACULTURE : A MAJOR ISSUE IN INTERNATIONAL COMPETITION.

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**Summary**

Despite its youth, aquaculture is an activity which is definitely subjected to the rules of international trade. The dependence on natural conditions is the first cause for the existence of national or regional comparative advantages. But both economic and institutional environment have to be taken into account when listing the assets or constraints of a location for implementing aquaculture. Because of little possibilities of economies of scale and because of fast technological spread in aquaculture, it is very difficult to obtain a price competitiveness based on industrial size of the activity or on technological advance. That is the reason why aquaculture has to look for other sources of competitiveness like the quality or the control of the market chain. As for the quality which includes not only freshness and good taste but also adequation to the increasing diversity of the demand, a lot is still to be done to get free from the natural constraints, especially upstream in genetics and nutrition. The example of the salmonid industry shows the importance of the control of the marketing in order to diversify the products. It has been a major issue in its recent development and a big help to get over several production crisis, but other sectors are far behind from this viewpoint.

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## Introduction

As in every industrial activity, the development of aquaculture entails a deep transformation in the nature of the relationship between producers and consumers. The close relations based on mutual acquaintance between the small-scale producer and the local consumer soon become relations marked by a competition between many firms on international markets and by a lack of information on the origine and the characteristics of the products.

In this economic context of free market and uncertain demand, the notion of quality turns out to be a means to develop competitive advantages and create a trustful relationship between supply and demand. This notion of quality has nothing but absolute and covers diverse realities which, when taken into account, involve changes not only in the internal organization of the firms but also in the commitments between the actors of all the activity channel.

## 1. Quality as a means to develop competitiveness

In every production sector, it turns out that different types of investments succeed each other in the search of competitive advantages. At first, these are investments to increase the production capacities and get economies of scale when possible. Later, investments aim at labour productiveness through mechanization and automatization. Eventually, the diversity and the constant evolution not only of the consumer demand but also of the social demand lead to other kinds of investments in order to attain quality control, products differentiation and environment preservation.

As for the quality control, some management methods until now devoted to activities with high potential risk like nuclear activity or aircraft industries are in the process of being implemented to mass consumption goods and particularly to food industry[1]. In order to face up the constraints of differentiation imposed by the consumer demand, these investments must conciliate flexible automatization and adaptability. In a framework of trade globalization, comparative advantages in terms of natural production factors endowments can no longer be regarded as definitive. That is the reason why the firms are obliged to explore new ways to maintain their competitive advantages.

The arwareness of the importance of quality in raw farm products as well as in the food industry dates back to the sixties in Europe, but has recently become a major issue with the failure of productivist agriculture to resolve the farm surpluses and to guarantee a decent

income to farmers. From this standpoint, the peculiarity of aquaculture is to be a recent activity, very often still in the development stage, but confronted with international competition and fast transformation of the distribution networks. Among the top five major success stories in modern aquaculture, three concern species which are involved in worldwide international trade (shrimp, salmon, scallop) and two which are are limited to national market (catfish in the U.S., amberjack in Japan). Within Europe, mussel (traditional activity) and seabass (developing activity) are submitted to international competition. Moreover, marine farm products take part in a larger competition including fisheries products and meat products. So they enter a market where they will be judged not only on their price, but also on their characteristics in comparison with reference products (meat or wild fish) and on the quality of the information the buyers can receive.

Differences in production factors endowments like natural environmental characteristics (temperature, protection from meteo impediments, carrying capacity, salubrity), institutional context (acces to land and sea, research and development effort, subsidies) and economic conditions (labour productivity, cost of inputs, interest rates of bank loans, efficiency of services to industry) make it possible to support the initial development of aquaculture with price competiveness. But this factors are subject to change and can not guarantee any productiveness advantage forever.

Some features of aquaculture show the limits of seeking competitiveness only in terms of quantity or price. First, even when site availibility is not a limiting factor to increase the production capacities (like in Norway for salmon or in South East Asia for shrimp), environmental constraints may limit the increase of local production on each site. Indeed, in most of the cases (except in recycling systems or offshore installations), there is a fierce competition for the use of a fundamental renewable resource, i.e. clean water, and consequently a natural limitation of the activity. Second, as in agriculture, economies of scale seem difficult to reach beyond a certain size, because of the high proportion of variable costs in most forms of aquaculture, the increasing costs of survey and transportation on larger production units and the importance of investments for large offshore installations[2].

Because few advanced bio-technologies or genetic engineering is used in aquaculture, technical progress can easily spread from one country to another, especially for the ongrowing techniques. The quick developments of salmon in Chile, sea-bass in Greece and shrimp in Vietnam show that pioneer countries can not hold back for long a technical advance nor base their competitiveness on this item.

## 2. Quality from the demand viewpoint

Quality is a subjective and polysemic notion which involves numerous economic and social actors whose aims are different and even divergent. Quality concerns diverse measuring instruments, management methods and scientific fields[1]. On the demand side, we can distinguish the final consumers (at home and outside), the different actors of the outlet channel, the processing industries and also the authorities.

As for other food products, six main quality criteria may be taken into account by the consumer :

- the **nutritional quality**, the appreciation of which is characterized by cycles and contradictory trends. In a general context of sought for food without cholesterol, without saturated fatty acids free and rich in vitamins, an new orientation still exists for traditional more tasteful products[3].

- the **health quality**, which has to be considered as a compulsory factor by the consumer. Since it is impossible to measure this parameter only on the appearance before the transaction, the buyer leaves it to the public rules and to the discipline of the actors along the outlet channel.

- the **organoleptic quality** which is essentially dependant on cultural factors. The absence of odor and of "fish" taste is one of the keys of the success of catfish on the American market, but this characteristic is not likely transferable to the European market[4].

- the **"user friendly" quality**, also influenced by cultural differences, especially by quick changes in life-style. The demand for sea products is more and more focused on easy-to-cook products (fillets, slices, boneless preparations), easy-to-store (frozen, vacuum-packed, boxes with plastic film) and available in any retail outlet.

- the **symbolic quality**, which associates seafood consumption to the return to nature, to the free use of a natural resource, to refinement and to purification. The reactions of consumers toward aquaculture are somehow ambiguous with a mix of trust concerning the sanitary aspects and of rejection concerning captivity and artificial feed concepts[5]
. The name of the the fish may play or not, according to the markets, an important role in the confident relation and the purchase decision. For instance, German consumers are looking for

Fish with a capital F and do not mind the species, while Spanish or Italians consumers know what they are ready to pay for.

- the **societal quality**, which takes into account the risks of externalities due to aquaculture, i.e., degradation of the aquatic environment as well on biological aspects as on aesthetic aspects.

Highly diverse, this demand is also poorly qualified. The "connoisseur market" is very narrow and contrary to other sectors (mechanics, electronics), the assessment of the quality of aquaculture products can not be done through an analysis of the hidden characteristics of the product, nor on the basis of brand loyalty. It is done either through the inspection of the appearance (and after the purchase through tasting), or through the relation of trust between buyer and seller. The development of the catering market for fish also enhances this diversity and the lack of information on the consumer side.

The expectations of the outlet channel concern :

-the **availability** of the product in quantity and in regularity (along the year or according to the picks of demand). As for this issue, the role of French hypermarkets is quite ambiguous for it pushes to spread the sale period all over the year for some products like smoked salmon but has the opposite effect for some other products like oysters.

- the **origin** of the product, for at this level there is still a relation of acquaintance between the producer and the wholesaler. This actor may associate some characteristics he is looking for with the location of the production.

- the **potential shelf life** is a very important issue for the wholesaler and the retailer, and depends on the slaughtering and handling conditions after harvest and on the care during transportation.

- the **homogeneity** of the product, in order not to have to take in charge the sorting operations required by the diversity of the demand.

- the supply of **assorted products** for the wholesailers and retailers who wish to have a wide range of products and prefer to deal with producers proposing several products.

- the **price**, an especially important criteria for supermarkets which prefer to buy and sell at lower prices but on a larger scale.

The processing industry is not yet predominant in aquaculture outlets (smoked salmon, cooked shrimps, frozen turbot fillets) but its specific requirements have to be taken into account in order to anticipate the evolution of the demand :

- big size and high ratio of flesh weight in total weight,
- easiness of carving,
- low price in order to get an affordable product at the end of the process channel.

The authorities take part in the implementation of standards of quality in order to reach their aim of public health protection. These norms and regulations make it possible to reduce the risks of the products. But one of the other roles of the standard of quality may be to contribute to reduce market failures, as for example when the price of a product does not faithfully reflect its real social production or social consumption costs[6]. In aquaculture, this concerns the problem of production externalities through the breach of the coastal environment, which is not yet the object of regulation[7]. But it is possible that the authorities may incite firms to internalize the cost of the preservation of the environment by issuing an "environmently friendly" label to those playing the game.

The rules the authorities have enforced entail compulsory results, and therefore may not be avoided. But the disparities in national regulations are source of competition distorsion (lower production costs if no regulation) and restrictive practices (non-tariff barriers).

## 3. Quality on the supply side

As a certain number of quality criteria like freshness, the absence of bad smell, the salubrity are now indisputable, it is time to take into account the question of products differentiation and market segmentation[8]. To answer the increasing diversity of the demand for sea-food (different cultures, income levels and consumption symbolics) and the main trends in terms of consumption modes (need of easy-to-cook products, more and more meals outside the home), it is possible to distinguish two approaches which both aim at developing an off-price competitiveness :

- the **horizontal differentiation**, or products diversification, which makes it possible to respond to the variety of tastes and lifestyles in sea-food consumption. The target for the firms is to increase their market-share not only in the aquacultural products but in the meat products

as a whole. Like the poultry industry, the huge development of which has been related to the creation of a large range of products (raw, guts-free, breast, legs)[9], the salmon industry has succeeded in its adaptation to the demand. France is the first European market for salmon and the development of this market has taken place in the context of a reduction in the house-hold fish consumption to the benefit of catering consumption[10]. Within household consumption, the trend is a decrease in the demand for whole fish, a stagnation in the demand for slices, and the development of a demand for fillets and frozen products (Figure 1).

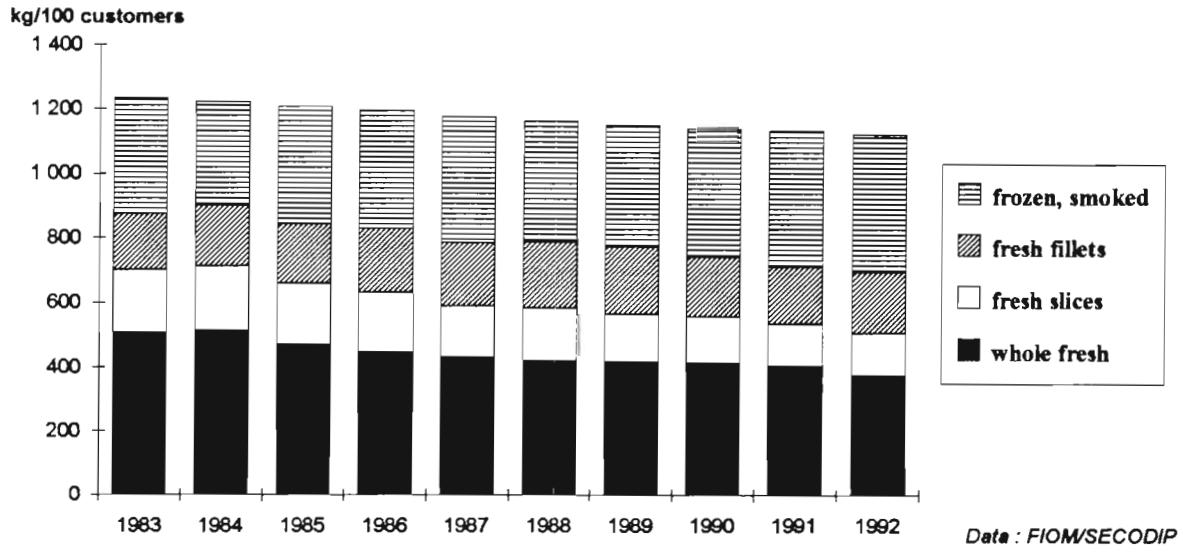


Figure 1 : Breakdown of the household fish consumption in France by type of presentation

From 1982 to 1992, if the decreasing price of imported salmon (from 68 F/kg to 31 F/kg in constant 1992 French Francs) has made it possible for the market develop so much (from 3,378 m.t. in 1982 to 49,803 m.t. in 1992), it is unquestionably because this production increase was coupled with a diversification of the products : small salmon (1 to 3 kg) for fresh consumption, slices, fillets, big salmon (over 3 kg) for smoking. Big fish are particularly desired as shown by the prices on the Rungis market (French National Wholesale Market which accounts for 25% of the salmon market in France) : the average price for big salmon is much higher than for small salmon (Figure 2). In the case of salmon, product differentiation has affected the presentation of the fish but does not concern the species nor the farming techniques. The goal was not to reach a connoisseur market but a mass market. Another factor which has worked in favour of the development of the farmed salmon market is that the fishing season of wild salmon (June, July) did not fit the seasonnal nature of the French demand which is heaviest in December and also in April. On the contrary, the diversifcation by species only, as it is the object now for the Mediterranean aquaculture with farming attempts on different species of the seabream family does not make it possible to reach anything but a bigger marketshare for the farm proposing different species inside the small segment of "expensive

small whole fresh fish". It means that there should be only substitution between seabass and the other species and little hope for a global increase of the demand. The aim can not be so ambitious as for salmon because it is a market segment for which the expectations in price and volume are the less interesting.

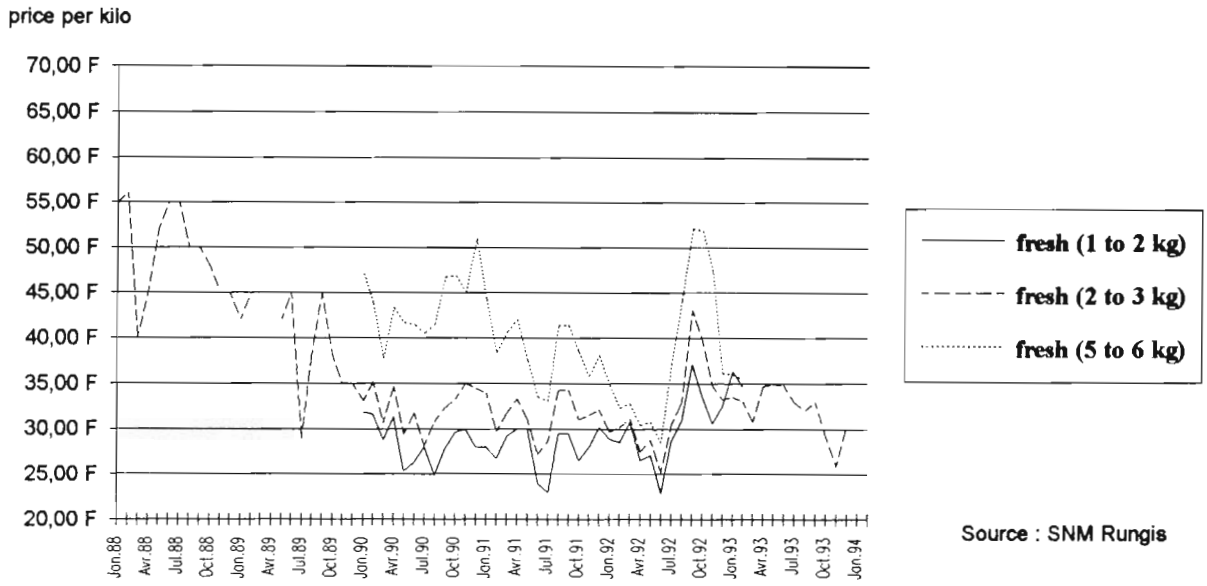


Figure 2 : Norwegian salmon price at Rungis French National Market

- the **vertical differentiation** which allows to propose different levels of quality for the same product. In that case, the appraisal of the quality may be related to the country of origin of the production (label of origin) or to the process of fabrication (certification, quality label). In the French food industry, these quality specifications do not have the same importance in all production sectors : 15% of the cheese have a label of origin, 0,5% have an organic certification and 1,5% a dietetic certification while 20% of the chickens are sold with a quality label ("Label Rouge") and most of the wines have a label of origin. In mollusc culture, the country of origin plays an important role in the relation of confidence between supply and demand, because of the role of natural environment in the mollusc farming process. In finfish farming, this notion is more vague but it is undeniable that Scottish salmon has been enjoying higher prices at Rungis since 1988 than Norwegian salmon (Figure 3). Though irregular, the price differential from 1988 to 1992 has a median of 8% in the case of the middle-sized salmon (2 to 3 kg). The recent attribution of "Label Rouge" to Scottish salmon should confirm this competitive advantage. In this kind of differentiation, the aim is an increase in the ratio of profitability (net result / turn-over) by selling at a higher price a product which has not been much more expensive to produce . It would be interesting to do a study comparing production costs between Norwegian and Scottish salmon. In the same way, in the variety "smoked salmon", which is one of the forms of diversification for salmon, one can see a vertical

differentiation through the quality concerning either the country of origin (Pacific salmon, Norwegian salmon, Scottish salmon) or through the industrial process (frozen smoked, fresh smoked, woodfire smoked) in order to reach all categories of consumers and to occupy all grades from bottom to top.

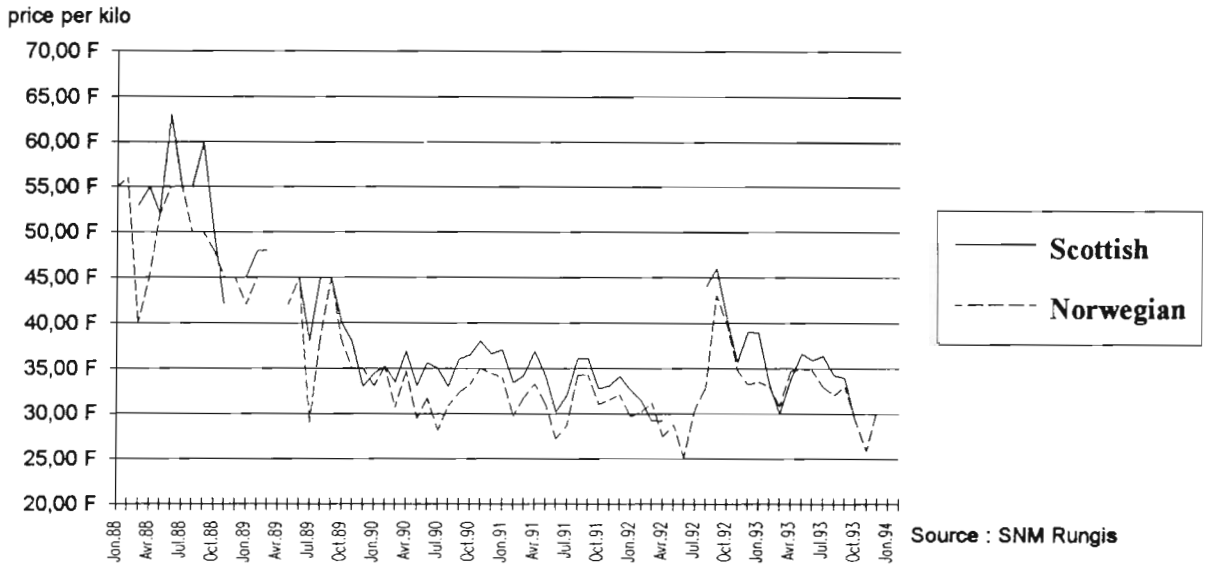


Figure 3 : Price of Salmon (2 to 3 kg) at Rungis French National Market

**4. Economic involvments and limitations of a quality approach**

While for industrial products direct costs for purchases and labour represent only 22% of the total production costs[11], they are over 50% in aquaculture. For industrial products, that means that almost 80% of the product value concerns only immaterial activities : R&D, marketing, distribution, communication. So the main sources of differentiation belong to these fields..

In aquaculture, objective factors of physical differentiation seem more numerous and concern :
- quantity and quality of food,
- water quality (level of O2, ratio of renewal, strength of the stream, salubrity, nature of the substrat),
- survey of the livestock, regularity and homogeneity of the batches,
- good command of techniques for slaughtering and packaging,
- different species.

But the firms have to take into account the counterpart in terms of extra production costs :

- cost of inputs,
- cost of monitoring systems,
- staff formation,
- cost of investments to get free from natural constraints (recycling systems or offshore installations),
- cost due to sorting and eliminating animals which are below the target level of quality,
- cost of promotion to establish a brand mark and give a fame to certain production sites or industrial process.

In the case of a species diversification, the increase of the risk due to the higher requirement in technical skills has to be appraised too. So, if involved in a quality approach, the firm has to conciliate these four poles - quantity, quality, cost and risk - by doing its own arbitration on an uncertain market, under the dependance of natural conditions and in a context of quick technical progress.

That is the reason why some limitations occur in this kind of approach :

- From a technical viewpoint, the poor choice of fingerling strains and of genetic differentiation among farmed aquatic species in comparison with other agricultural activities is definitely a major handicap.

- The lack of visibility along the distribution channels for sea-products is also a constraint that must be remedied. Little information exists on the origin of the products. The different appellations and local names are very confusing and prices are highly variable from place to place.

- The present economic downturn in Europe diverts consumers from expensive up-market products and gives advantage to cheap products. For instance, Danone, one of the major European food companies has decided to lower the price of its brand name products in order to compete with generic products and to recapture lost marketshares.

Overall, the increasing power of the supermarkets indicates that quality control is foremost a question of coordination between different actors and agents who dispose only part of the skills or of the means which are necessary to complete an approach for quality. Such an approach involves not only actions of internal coordination inside the production units but also actions of external coordination among the competing firms on the one hand, and among the different elements of the production and distribution channel on the other hand[12].

Within the firms, the implementation of quality control methods entails rationalized labour and production organization. So, the survey of the costs due to insufficient quality (elimination of a part of the production), the organization of the human resources, and the flexibility of the management are fundamental conditions for competitiveness in a situation of international competition and of modification of the demand. This modification of the organization has to be extended to all firms from the same economic zone which compete on a domestic or an international market. The traditional behavior of basic competition should be replaced by cooperative actions for the implementation of standards of quality and for the respect of the industrial processes[13]. This coordination would make it possible to create aknowledged standards clearly identified by consumers and to allocate the costs of collective expenses among the firms, and particularly those for quality control and marketing. In that case, a quality approach may be supported by economies of scope for the purchase of equipments or services (bulk buying, common marketing operations). For instance, the collective effort to promote farmed catfish on the American market has made it possible to enhance the individual profit of the firms and to take advantage of their investment in advertisment[4].

At the level of the global activity, these actions of external coordination make take the form of synergies between production units and intermediate goods suppliers. Unlike what happens in the industrial field (car industry, aircraft industry), there is no problem of reliability of the end-products which depends directly on the quality of intermediate products. But the risk inherent in a rearing phase is highly related to the quality of the initial product and in particular to the rearing conditions during the precedent phase. This quality requirement may give birth to a relation of partnership between the firms and not only to a basic relation between customer and subcontractor. In order to impose its referential of quality, the downstream industry may implement instruments to measure the quality in the framework of the partnership. So, it is no longer an ordinary evaluation of the product but an evaluation of the production itself[12].

The following relations have also to be taken into account :

- the firms and the organizations of research and development
- the firms and the formation network
- the firms and the authorities
- the firms and the services (transporters, veterinarians, and so on); the importance of services has to be taken into account for value adding concerns more and more the services offered to the customers.

## Conclusion

For the conception and the specifications of the products as well as for their production and the control of the quality, principles, methods and tools are in deep evolution. A strong consensus has to be found on the representation of the quality between producer, distribution channel and consumer in order to reduce uncertainty and transaction costs and develop customer loyalty. This consensus which has also to include an equitable allocation of the costs of the quality approach (in order to eliminate the problem of free-riding) may generate an adaptative process to the requirements of the customers who are ultimately the real judges of the competitiveness of an industrial activity.

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