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***EVALUATION OF QUALITY ASSURANCE SYSTEMS IN THE AGRI-FOOD  
SECTOR***

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# EVALUATION OF QUALITY ASSURANCE SYSTEMS IN THE AGRI-FOOD SECTOR<sup>1</sup>

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## Abstract

The "quality issue" in the agri-food sector has been gaining importance over the past few years. Firms are continually searching for techniques and tools which permit production of goods that meet as many as possible of the characteristics demanded by the market. Quality assurance methods and techniques can provide a useful tool for approaching evolving markets in the correct way. This paper focuses on a survey conducted in certain sub-sectors (fruit and vegetable, meal and pasta, wine) and is specifically restricted to the Emilia-Romagna region. The survey found that there is extensive awareness of and widespread interest in quality systems. However, the objective of initiating a pattern of renewal which incorporates quality systems has not yet been widely attained. The survey also highlighted a certain absence of the "quality culture" necessary for correctly addressing these issues.

The second part of this paper focuses on the economic analysis of the costs related to quality systems (QS). Its aim is to apply a method for collecting data on activities and resources, and to analyse the results. The importance of QS-related costs is evident if we are to consider it an investment, entailing the deployment of management effort and funds, and yielding a set of benefits in return. Case study analyses were conducted utilising an original classification scheme. From the initial results it is possible to identify the principal cost categories. The method adopted could be useful for firms wishing to monitor their QS.

## 1. Introduction

This study was prompted by the need to analyse the factors which motivate certain firms to adopt a Quality System<sup>2</sup> (QS), and the associated economic aspects. The decision to adopt a QS can be viewed as a "new" tool for enabling firms to operate effectively in a competitive and diversified market context, in that it permits implementation of an "integrated development method" through the re-examination of the entire organisational-management structure. The need for "controlled" management of the production/system is particularly strongly felt in the agri-food sector, where hygiene-sanitary risks and a close interaction with the environment are pressing issues, while at the same time product characteristics are often influenced by factors which are not easily standardised and controlled, as well as by countless mandatory regulations governing the safety of food products. In recent years, Italy has seen the number of firms obtaining Quality System certification rise steadily, to reach the present count of 269 firms (31.12.1997 data, provided by SINCERT).

The first part of the study was of a cognitive character. We considered firms operating in three important sub-sectors of the food industry (processing of fruit and vegetables, cereals for human consumption and wine) located in Emilia-Romagna region. In these, we attempted to gauge the level of awareness and "penetration" of QS in the running of the firm. The characterisation of the firms made it possible to identify elements for distinguishing them as a function of the level of interest manifested in quality issues.

The study then considered the economic aspects related to the Quality System, because the issues connected with adoption of a QS cannot be addressed without a rigorous analysis of the costs and benefits anticipated from introduction of this new model. In fact, it is clear that operating a quality system must not demand changes or cost increases that are unsustainable, and that - for a business - implementing quality should not mean losing profits.

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<sup>1</sup> The contributions of the individual authors within the unified structure of the study can be attributed as follows: D. Regazzi for coordination of the research; R. Spadoni for paragraphs 1 and 3; M. Canavari for paragraphs 2 and 4; the conclusions were drafted jointly.

<sup>2</sup> UNI EN ISO 9000 standards

The study analysed the costs connected with all the activities necessary for implementing/maintaining the QS and rendering the system transparent and “controllable” from the outside. It also attempted to take into consideration the costs deriving from non-conformities, waste, inefficiency, failure to meet the predefined standards etc. which involve the running of the business as a whole.

It is clear that firms will have to approach the economic issues by considering the QS as an investment, which incurs a cost for its implementation and maintenance but at the same time offers potential benefits both in quantitative (monetary) and qualitative (assessments, measures of efficiency and effectiveness) terms.

Analysis of the economic aspects can be useful for verifying some of the objectives set by the firms, which may differ as a function of their characteristics, the market and the problems typical of the sector. These include: introducing a new enterprise management system, reducing the costs connected with quality and non-quality, evaluating the expediency of making an investment and its efficiency and effectiveness, defining economic parameters which provide a measure of the changes and improvements, and the possibility of using a “language” common to all the functions of the enterprise.

The study, starting from precisely these considerations and taking the standpoint of the enterprise, attempted to define a reference framework which would permit systematic measurement of costs and provide elements for their analysis. The positive response of some of the firms participating in the study, notwithstanding the many difficulties encountered, underlined the level of interest in these issues. This openness was found especially in the more highly-motivated sectors, in which the QS is not viewed as an imposition or a useless bureaucratic burden, but rather “experienced” as an effective management model and a real investment of both financial and human resources.

## 2. Adoption of enterprise Quality Systems by agri-food firms in Emilia-Romagna

Firms operating in the market sub-sectors under investigation were mailed a questionnaire designed to elicit:

- elements for defining the type of firm;
- information concerning the firm’s attitude to quality systems (degree of awareness, perceived advantages and disadvantages, etc.);
- only for firms which had undertaken adoption of a QS, the motivations and business context which prompted management to take that decision, the method of realisation and the current stage of system implementation;
- information concerning specific methods of management and analysis;
- information concerning the tools for promoting the enterprise or product QS with consumers and clients (however the responses were not analysed because the information supplied was largely incomplete).

A total of 226 production facilities were involved in the survey. The percentage of responses obtained from all sub-sectors, with mills and pasta factories taken together, was approximately 56%. In detail:

|                             |                 |              |       |
|-----------------------------|-----------------|--------------|-------|
| • meal/pasta                | 85+14 factories | 56 responses | 56.5% |
| • fruit and vegetable       | 68 factories    | 38 responses | 55.8% |
| • wine (coop.) <sup>3</sup> | 59 factories    | 33 responses | 55.9% |

In total, responses were received from 127 production facilities, referable to 111 firms. The survey-sheets of these firms were then used for the calculations reported below.

It should be emphasised that no hypothesis can be made as to the representativeness of this sample, for although it constitutes half the universe in question, its distribution is neither random nor stratified.

### 2.1. Types of enterprises

The firms which participated in the study were characterised, with the exception of wine makers, by a fairly uniform territorial distribution. In terms of legal designation, the prevalent types of business were

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<sup>3</sup> For the wine sub-sector, the regional listing included a large number of small family businesses. The scope of the study was restricted only to cooperatives, which in any case account for a substantial share of the total volume of business for the sub-sector.

partnerships (57.4%) for the meal/pasta sub-sector and companies (66.7%) for the fruit and vegetable sub-sector.

The subdivision into turnover classes reveals a different distribution, in terms of economic size, between the sub-sectors: nearly 70% of the firms engaged in the processing of meal and pasta fall into the under-5 billion lire turnover class, whereas the fruit and vegetable firms were uniformly distributed among the different classes. The wine cooperatives were instead concentrated in the 5 to 15 billion lire class (60%). The different distribution of firm size among the sub-sectors was further confirmed by the data for the number of employees.

With respect to the reference markets, the meal/pasta and wine sub-sectors exhibit a strong orientation towards regional markets, and in any case a low propensity towards export markets. This contrasts with the case of fruit and vegetables, where strongly export-oriented firms account for over 20% of the total, to which we must add another 15% of firms for which export sales are in any case considerable<sup>4</sup>.

The characterisation of firms by sub-sector thus reveals quite a differentiated picture. It suggests that favourable conditions for the introduction of a QS are more likely to be found in the fruit and vegetable sub-sector, which numbers more firms of relatively large economic size and with a greater orientation towards the types of markets and clients most interested in this innovation.

## 2.2. *Attitude to Quality Systems*

A wide majority of the firms which responded to the questionnaire **said they were aware** of the issue. The differences between sub-sectors, though not substantial, denote a higher degree of awareness in the fruit and vegetable sub-sector.

Likewise, the majority of operators **are interested** in this issue.

Customer stimulus is not evenly distributed among the sub-sectors. In the fruit and vegetable sub-sector over 70% of firms **have received requests** in this direction from one or more key clients (Figure 1). On the contrary, in the meal/pasta and wine sub-sectors less than 30% of firms had received requests from clients.

From this picture it emerges that, in the three sub-sectors examined, firms generally have a positive attitude to quality issues, although there are substantial differences in the feedback stimuli along the supply chain.

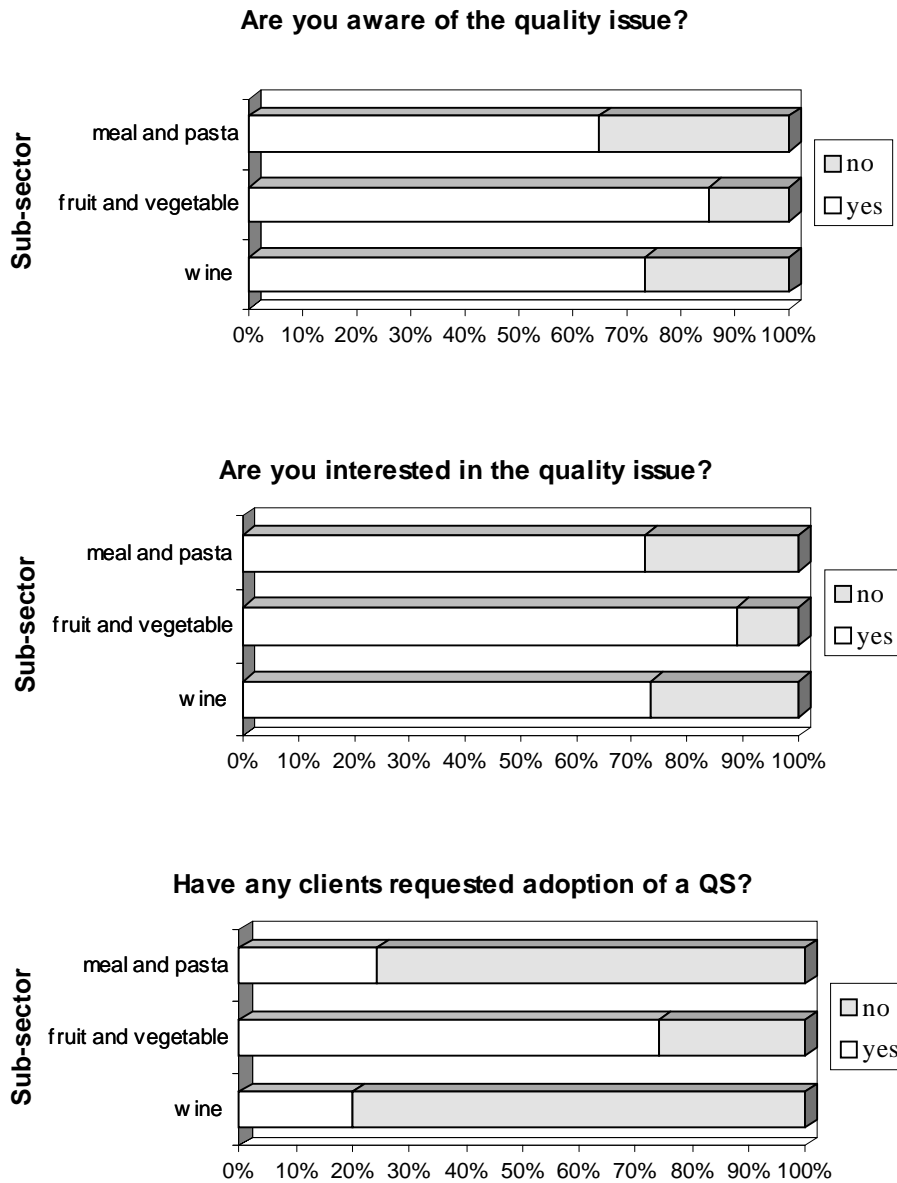
The firms were asked to express a positive or negative opinion concerning the **usefulness of an enterprise QS** (figure 2), stating their reasons. In order to single out the motivations which carried the greatest weight (table 1), each firm was allowed to give only two answers.

Positive responses were generally predominant, totalling 65% overall, and the principal motivation was improving enterprise efficiency, followed by satisfying market requirements and image enhancement. For negative responses, the most frequent motivations were increased costs and low market interest (a reason totally absent in the fruit and vegetable sector, and more frequent in the other two). Another important motivation was the additional bureaucracy imposed by the tool.

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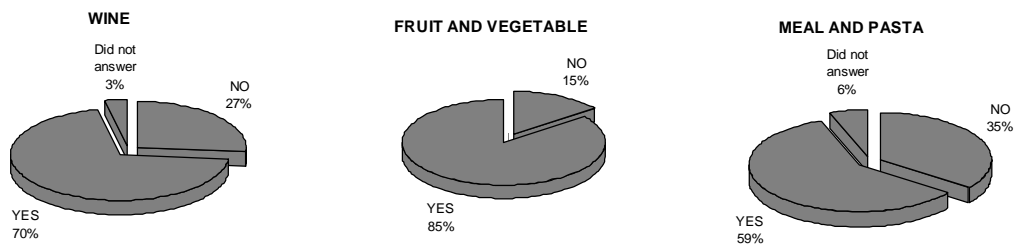
<sup>4</sup> During the study, certain market contexts were identified for classification of the firms: regional, northern Italy, central and southern Italy, overseas. The relevance of the turnover share attributed to any given market is defined by a threshold set at 1/3 of the total; if the threshold of 2/3 is exceeded, it indicates a strong orientation towards that type of market.

**Figure 1 - Attitude to QS**



Source: Our processing of the enterprise data

**Figure 2 - Usefulness of the QS**



Source: Our processing of the enterprise data

**Table 1 - Motivations for the usefulness of adopting an enterprise QS \***

| <b>WINE</b>                          |     |  |     |
|--------------------------------------|-----|--|-----|
| <b>YES</b>                           |     | <b>NO</b>  |     |
| Improving enterprise efficiency      | 47% | Low market interest                              | 20% |
| Image enhancement                    | 43% | Represents a needless increase in costs          | 13% |
| Satisfying market requirements       | 30% | Imposes excessive bureaucracy                    | 10% |
| Expanding the firm's markets         | 7%  | We have already achieved quality                 | 7%  |
| For obtaining DOP                    | 3%  |  |     |
| Reducing costs                       | 3%  |  |     |
| <b>FRUIT AND VEGETABLE</b>           |     |  |     |
| <b>YES</b>                           |     | <b>NO</b>  |     |
| Improving enterprise efficiency      | 63% | Represents a needless increase in costs          | 7%  |
| Satisfying market requirements       | 44% | Imposes excessive bureaucracy                    | 7%  |
| Image enhancement                    | 26% | We have already achieved quality                 | 7%  |
| Reducing customer claims and returns | 15% | Quality is something else                        | 4%  |
| Reducing costs                       | 11% |  |     |
| Expanding the firm's markets         | 7%  |  |     |
| <b>MEAL AND PASTA</b>                |     |  |     |
| <b>YES</b>                           |     | <b>NO</b>  |     |
| Improving enterprise efficiency      | 37% | Represents a needless increase in costs          | 19% |
| Satisfying market requirements       | 26% | Low market interest                              | 19% |
| Image enhancement                    | 24% | Imposes excessive bureaucracy                    | 9%  |
| Expanding the firm's markets         | 11% | Employs excessively rigid tools                  | 6%  |
| Reducing customer claims and returns | 6%  | We have already achieved quality                 | 6%  |
| Gives a meaning to life              | 2%  | It's a small family firm                         | 2%  |
| For all these and other reasons      | 2%  | The firm does not have prospects for development | 2%  |

★ n/N% where: n = number of times the reason was cited  
N = firms which answered the question

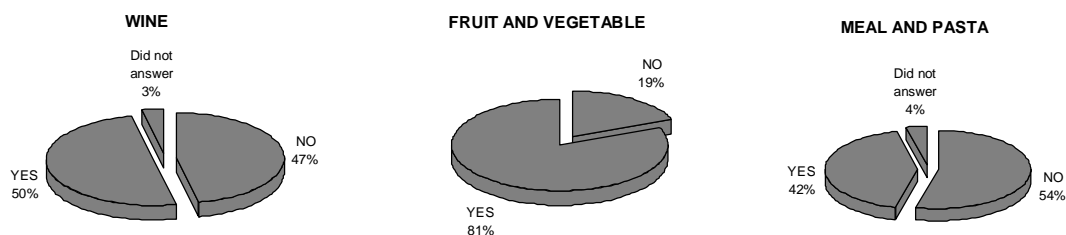
Each enterprise was allowed a maximum of two answers.

Source: Our processing of the sample data.

The question on the **intention of implementing** an enterprise QS elicited the following responses (figure 3 and table 2): 50% of wine cooperatives said they were open to implementing a QS, while this openness exceeded 80% for firms in the fruit and vegetable sub-sector; there was a marked lack of interest in the cereal processing sub-sector, where 54% of firms gave negative responses, denoting a situation of remarkable scepticism toward quality issues.

Some of the reasons cited by all the sub-sectors included, for positive responses, improving enterprise efficiency and satisfying market requirements and, for negative responses, increased costs and lack of market interest.

**Figure 3 - Intention of implementing a QS in the firms surveyed**



Source: Our processing of the sample data.

**Table 2 - Motivations for the intention to adopt an enterprise QS \***

| <b>WINE</b>                                |     |   |     |
|--|-----|---|-----|
| <b>YES</b>                                 |     | <b>NO</b>   |     |
| I consider it useful for the above reasons | 38% | entails costs which are currently unsustainable         | 24% |
| Decision taken by my Group                 | 7%  | I do not consider it useful for the above reasons       | 21% |
| I need to obtain certification             | 7%  | insufficient market interest                            | 10% |
| I already have certification               | 3%  | entails increased internal paperwork                    | 10% |
| We are considering it                      | 3%  | requires greater investments in personnel and materials | 7%  |
| Awaiting the decision of my Group          | 3%  | It has already been adopted by our level II consortium  | 3%  |
| <b>FRUIT AND VEGETABLE</b>                 |     |   |     |
| <b>YES</b>                                 |     | <b>NO</b>   |     |
| I consider it useful for the above reasons | 56% | I do not consider it useful for the above reasons       | 11% |
| I already have certification               | 19% | entails costs which are currently unsustainable         | 7%  |
| I need to obtain certification             | 7%  | entails excessive costs with respect to the benefits    | 7%  |
| other                                      | 4%  | insufficient market interest                            | 4%  |
|  |     | the firm will be closing down                           | 4%  |
|  |     | my personnel is unsuitable                              | 4%  |
| <b>MEAL AND PASTA</b>                      |     |   |     |
| <b>YES</b>                                 |     | <b>NO</b>   |     |
| I consider it useful for the above reasons | 38% | entails costs which are currently unsustainable         | 31% |
| I already have certification               | 4%  | I do not consider it useful for the above reasons       | 21% |
| I need to obtain certification             | 2%  | insufficient market interest                            | 12% |
| other                                      | 2%  | I do not have adequate tools                            | 8%  |
|  |     | the firm will be closing down                           | 6%  |
|  |     | entails excessive costs with respect to the benefits    | 4%  |
|  |     | my personnel is unsuitable                              | 4%  |
|  |     | entails increased internal paperwork                    | 2%  |

★ n/N% where: n = number of times the reason was cited  
N = firms which answered the question

Each firm was allowed a maximum of two responses.

Source: Our processing of the sample data.

### 2.3. Adoption of Quality Systems

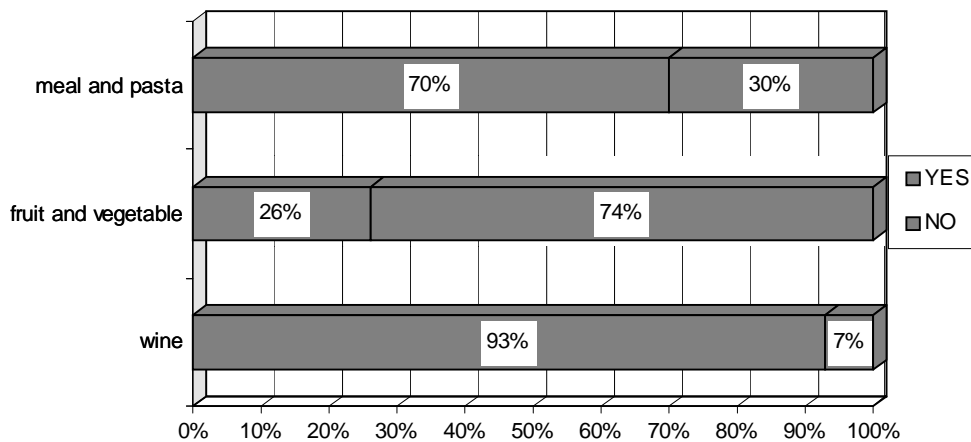
The analysis set out below takes into consideration only those firms which had at least initiated adoption of a Quality System. These firms accounted for less than 7% of the total in the wine sector, 74% in fruit and vegetable processing and almost 30% in mills and pasta factories (Figure 4).

Many firms (50% in cereal processing and winemaking, 25% in fruit and vegetable processing) already have a QS in place but are not interested in certification; whereas in the fruit and vegetable and cereal sectors, approximately 30% of firms are currently implementing the system (table 3).

It is interesting to compare the stated intention of implementing a QS with its actual introduction: among the wine makers, only 13% of those which expressed the intention of implementing a QS had in fact initiated its adoption, while this percentage rises to 70% for cereal processing, and reaches over 90% in the fruit and vegetable sub-sector (figure 5).

The methods for implementing the system were fairly similar for the fruit and vegetable and cereal sectors, where almost half the firms employed internal resources exclusively, about 40% contracted the services of consultancy firm and 10% entrusted the task to an independent consultant. In contrast, the wine-making sub-sector utilised external resources exclusively (table 4).

**Figure 4 - Percentage of firms in the sample which are implementing a QS**



Source: Our processing of the sample data.

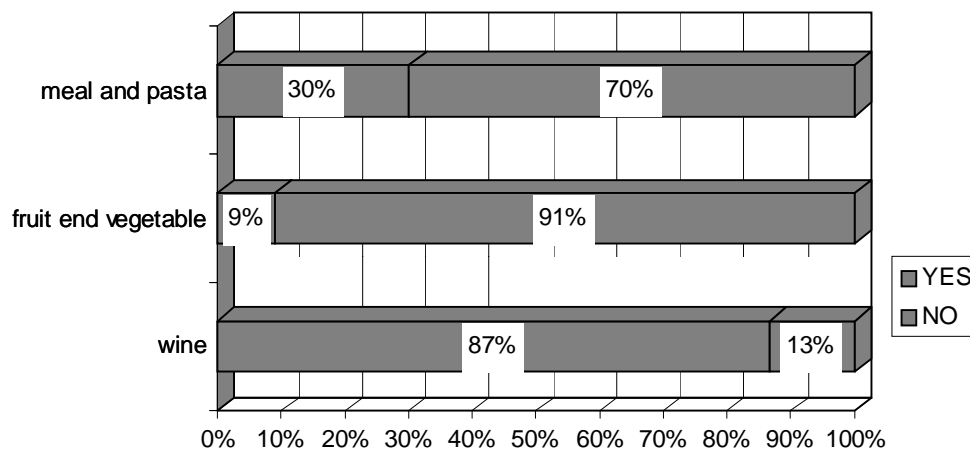
**Table 3 - Current stage of implementation of the enterprise QS \***

|  | wine          | fruit and vegetable | meal and pasta | total         | n. firms  |
|--|---------------|---------------------|----------------|---------------|-----------|
| Quality Manual or enterprise procedures exist, not yet operative | -             | 5.0%                | -              | 2.6%          | 1         |
| A QM or enterprise procedures exist, under testing               | -             | 5.0%                | -              | 2.6%          | 1         |
| Has initiated the certification process                          | -             | 10.0%               | 6.3%           | 7.9%          | 3         |
| Has an operative QS, certified to the ISO 9000 standard          | 50.0%         | 25.0%               | 12.5%          | 21.1%         | 8         |
| Has an operative QS, but is not interested in certification      | 50.0%         | 25.0%               | 50.0%          | 36.8%         | 14        |
| Is implementing an internal QS                                   | -             | 30.0%               | 31.3%          | 28.9%         | 11        |
| <b>Overall total</b>   | <b>100.0%</b> | <b>100.0%</b>       | <b>100.0%</b>  | <b>100.0%</b> | <b>38</b> |

\* percentage of firms which answered the question

Source: Our processing of the sample data

**Figure 5 - Comparison between the intention of implementing a QS and its actual introduction**



Source: Our processing of the sample data.



**Table 4 - Methods for implementing the QS**

|   | <i>wine</i> | <i>fruit and vegetable</i> | <i>meal and pasta</i> | <i>total</i> |
|---|-------------|----------------------------|-----------------------|--------------|
| Did not answer                          | -           | 10.0%                      | 12.5%                 | 10.5%        |
| Employed an independent consultant      | 50.0%       | 10.0%                      | -                     | 7.9%         |
| Engaged a consultancy firm              | 50.0%       | 40.0%                      | 31.3%                 | 36.8%        |
| Utilised internal resources exclusively | -           | 40.0%                      | 56.3%                 | 44.7%        |

*Source: Our processing of sample data*

A large part of the firms self-financed implementation of the quality system: only in three cases, all in the fruit and vegetable processing sector, did firms benefit from public funding for carrying out the project.

Likewise, for personnel training the most widespread solution was courses organised on the firm's premises and taught by internal personnel, followed by internal courses taught by external organisations, while only a few firms made use of external training courses (table 5).

**Table 5 - Methods of training personnel for QS \***

|   | <i>wine</i> | <i>fruit and vegetable</i> | <i>meal and pasta</i> | <i>total</i> |
|---|-------------|----------------------------|-----------------------|--------------|
| Self-learning using documentation in the public domain  | -           | 15.0%                      | 6.3%                  | 10.5%        |
| Self-learning using documentation reserved for the firm | -           | 30.0%                      | 25.0%                 | 26.3%        |
| Internal courses taught by internal personnel           | -           | 40.0%                      | 43.8%                 | 39.5%        |
| Internal courses taught by external organisations       | 50.0%       | 40.0%                      | 18.8%                 | 31.6%        |
| External training courses                               | 50.0%       | 25.0%                      | 12.5%                 | 21.1%        |
| No specific training                                    | -           | -                          | 6.3%                  | 2.6%         |

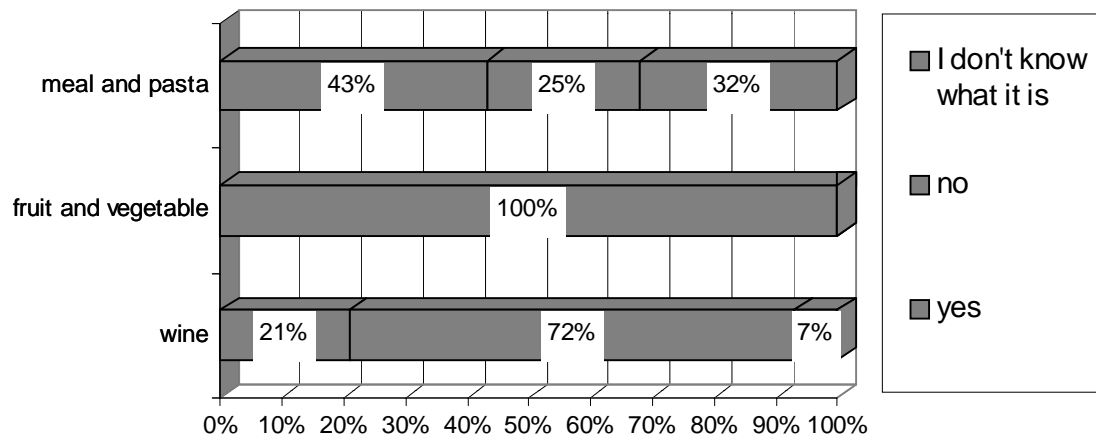
\* Percentage with respect to the number of firms which answered the question. Each firm was allowed to give more than one answer.

*Source: Our processing of the sample data.*

The use of specific methods such as HACCP<sup>5</sup> (Hazard Analysis and Critical Control Point) can be independent of the implementation of a full-fledged QS. From the survey it emerged that 57% of the firms which answered the question (approximately 57% of the sample) said they had developed an HACCP plan, 27% said they had not done so and the remaining 16% did not know what it was. An analysis of the data breakdown by sub-sectors (figure 6) reveals that 100% of the fruit and vegetable processing firms which answered the question utilise an HACCP plan. This contrasts with a striking 72% of wine makers who stated they had not adopted such a plan, and 32% of mills and pasta factories which did not know what it was. In the case of mills and pasta factories, it should be pointed out that over 37% of those who claimed to have adopted a QS did not know what HACCP was.

<sup>5</sup> As of 28/6/1998, following the adoption of directive 43/93/EEC with Law Decree 155/97 of 26/05/1997 which implements the FAO/OMS guidelines on the safety of food products, all firms in the food industry must operate an HACCP plan.

**Figure 6 - Adoption of an HACCP plan**



*Source: Our processing of the sample data.*

### 3. Analysis of the costs of implementing and operating Quality Systems in agri-food firms

The base-data of the study was obtained from observations conducted in specific firms, selected from those which had furnished the information base for the first phase of the study. The five firms in question were selected for their characteristics of market relevance or representativeness.

The study required the preliminary devising of a classification scheme which would permit the identification and description of activities specific to the QS, as well as those related to the Quality System but carried out in the “ordinary” run of business.

With a view to evaluating the investment, it is useful to distinguish:

- 1) an “implementation” phase comprising activities for the design and set-up of the system, some of which will not be repeated once the system is fully operational;
- 2) an "operative" phase in which the system is up and running. It includes activities which are classified as maintenance, even though in quantitative terms they may vary substantially from one year to the next.

This second phase can be further subdivided into three classes of activities consisting of:

- 2.1) ordinary system maintenance activities which represent the **cost of conformity**,
- 2.2) activities deriving from the difference between the quality objectives and the actual quality achieved which represent the **cost of non-conformity**,
- 2.3) activities geared towards adapting the system to evolving requirements or increasing its efficiency and effectiveness, which represent the **cost of continuous improvement**.

The activities, thus classified, constitute the firm’s "Plan of Activities".

In every phase, the QS incurs costs associated with the activities to be carried out, the skills and infrastructures to be acquired, the consumable materials utilised and the services procured externally. These costs can be considered as a deployment of **resources** internal and external to the firm, at the time when the activities are carried out.

The aforesaid resources can be assigned to 5 different categories, and constitute the “Resource Plan”:

- 1) personnel
- 2) infrastructure
- 3) plant
- 4) materials
- 5) services

The definition and adaptation of the classification scheme (partially set out in schedule 1), as well as the incorporation into the scheme of the activities for introducing and maintaining the QS, was done in collaboration with the Quality Assurance Managers (QAM) (and their staff, if any) of the selected firms.

The necessary resources were quantified by formulating estimates wherever it was not possible to accurately reconstruct the cost. The costing of activities performed by personnel internal to the firm was done by quantifying the hourly cost of the title or function, and multiplying it by the number of man-hours required for each activity.

This information-gathering phase was followed by its entry into a computerised database, in which each activity and resource was assigned a link identification code, to facilitate its downstream processing.

The above classification of operations makes it possible to separately group and analyse the items for each operation based on the types of resources and activities, making it possible to distinguish the most significant cost categories. In terms of information quality, this offers an advantage over analysis of accounting data, which does not normally permit attribution of individual cost items to a “horizontal” enterprise function.

The marked diversity of the firms examined has not made it possible, at the present time, for all the information to be available simultaneously. For this reason the following case studies focus on two firms, one engaged in fruit and vegetable processing and the other in the milling of cereals for human consumption. The choice of these firms was motivated by the completeness of the data, and by the desire to show two firms which, at least in the system implementation phase, made very different choices but sustained comparable overall costs.

The first firm initiated implementation of the QS in 1994 and obtained ISO 9002 certification at the end of 1995, about a year and a half later. The firm is primarily a contract operator, and works for many foreign clients which influenced the decision to adopt a QS.

The second firm is currently completing the implementation phase. The idea of adopting a QS dates back to 1994 but the firm is only now approaching certification: this, however, was not the primary objective, partly because in this sub-sector client interest is less strong.

The data obtained from observation of the firms permitted an initial quantification of the QS-related costs incurred during the implementation and operative phases of the system. No hard and fast time limits were set for activities prior to certification (design and implementation phase) because, considering the QS as an investment, its implementation can be effected over several years. The operative phase considered by the study proved to be the period for initial “fine tuning” of the system, lasting slightly over one year from the certification date. The subsequent phases of the system’s operation, to be covered by a future analysis, will be subdivided into one-year periods.

## Schedule 1 - Plan of Activities (first classification level)

### CLASSES Activities

#### 1. System design and implementation

- 1 Preparatory meetings
- 2 Studies and research
- 3 Training of staff who will implement the QS
- 4 Quality training of personnel
- 5 Analysis of the process
- 6 Analysis of suppliers
- 7 Documentation (collection, drafting and printing, checking, approval, revision)
- 8 Instruction of personnel
- 9 Adaptation of structures and plant
- 10 General expenses

#### 2. Cost of conformity (System Management)

- 1 Certification
- 2 Routine Meetings
- 3 Internal inspection checks
- 4 External inspection checks (of sub-suppliers)
- 5 Contract review
- 6 Data analysis
- 7 Relations with suppliers
- 8 Identification of the product
- 9 Performance of process checks
- 10 Performance of product checks
- 11 Performance of plant checks
- 12 Operator training
- 13 Internal communications
- 14 Documentation management
- 15 Management of packing materials
- 16 Maintenance of instruments and plant
- 17 After-sales service
- 18 Customer audits

#### 3. Non-Conformity Management (NCM)

- 1 NCM Discarded product
- 2 NCM Discarded raw materials
- 3 NCM Reprocessing
- 4 NCM Product downgrades
- 5 NCM Returns from clients
- 6 NCM Returns to sub-suppliers
- 7 NCM Production line stoppages
- 8 NCM other process/management aspects
- 9 NCM in administrative procedures

#### 4. System Improvement

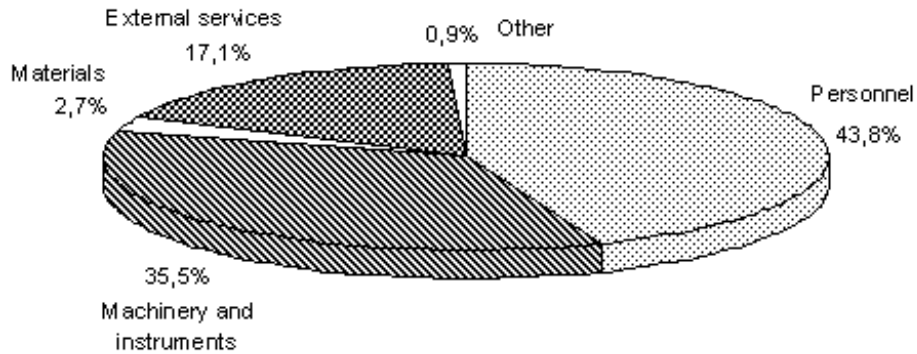
- 1 Corrective and preventive actions
- 2 Adaptation of structures and plant
- 3 Changes to the process/product

### **CASE STUDY 1**

The **implementation phase** employed over Lit. 200 million worth of resources. The largest slice was that for personnel which, as shown in Figure 7, accounts for almost 44% of the total cost. Approximately one third of this share is attributed to the activities of the Quality Assurance Manager (QAM), who also

continued to perform another function within the firm. Other titles involved were the managing director and certain management functions, as well as staff members and supervisors. This denotes substantial management involvement, especially during the initial implementation phases which entailed a greater workload for defining procedures and involving the firm as a whole. The activities which took up the most time were those connected with the drafting, checking and approval of documentation and compilation of the Quality Manual. It should be noted that the firm did not employ the services of a consultant, and used internal resources almost exclusively.

**Figure 7 - Case study 1: attribution of costs during the QS implementation phase**



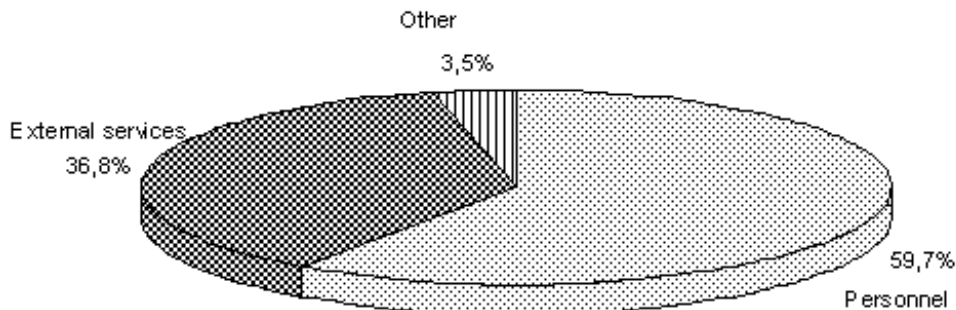
*Source: Our processing of the enterprise data.*

The second largest cost category was that for machinery and instruments (35.5%), because it was necessary to equip a new laboratory.

The costs attributed to external services account for 17% of the total system-implementation cost, and were used in particular for the calibration of instruments. Only one sixth of the cost of external services was attributable to consultancy on quality systems.

Proceeding to the **operative phase** of the system, the variation in the attribution of costs is shown in figure 8. Personnel costs remain the principal item, accounting for almost 60% of the total cost, while there is a substantial increase in the share attributed to external services (just under 37%) and the remaining share is attributed to miscellaneous costs (reimbursement of expenses, etc.).

**Figure 8 - Case study 1: attribution of costs during the operative phase of the QS**



*Source: Our processing of the enterprise data.*

Among the personnel, the greatest involvement was that of the QAM, although there was also an increased contribution on the part of workers and supervisors of the principal functions.

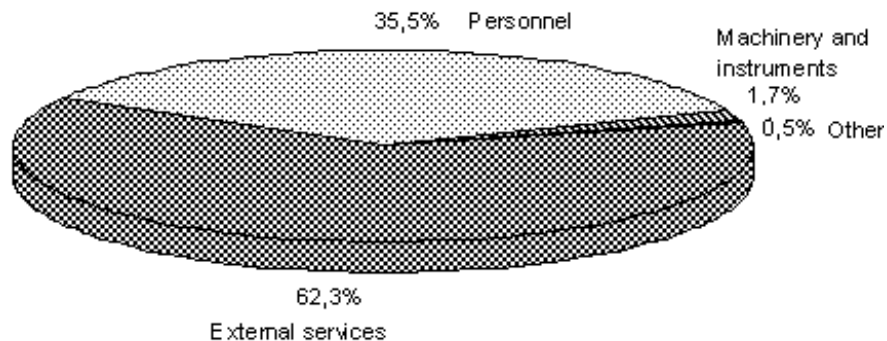
As regards external services, the greatest outlay was for charges due to the certification body for inspection visits and for granting the certification. In this case, this phase was attributed the cost of obtaining certification together with an annual charge. Another important cost item continues to be the calibration of instruments.

## CASE STUDY 2

For case study 2, the data collected concern exclusively the implementation phase in that, as already noted, the firm has only recently applied for certification.

The subdivision of the principal cost categories clearly reflects the strategy adopted by the firm: over 62% of the investment was allocated to acquisition of external services, and 35.5% was attributed to internal personnel costs (Figure 9). In this case there were no major investments in machinery and instruments, and the share for this resource does not reach 2%.

**Figure 9 - Case study 2: attribution of costs during the QS implementation phase**



*Source: Our processing of the enterprise data.*

Three quarters of the “external” costs are accounted for by consultancy services: for running a *pre-audit* to ascertain the expediency of introducing the QS, for the subsequent studies and drafting of documents, for the organisation of training courses and for participating in preparatory meetings. The remaining share is almost entirely attributed to the calibration of instruments.

Obviously, the enterprise function most involved in implementation of the QS was the QAM, which also in this case was not devoted full-time to this task. Other human resources were involved through informational courses and numerous preparatory, procedure validation and training meetings. As in the previous case, there was a clear management commitment to involve the entire firm in the development of the system from the outset.

From the analysis of the two cases illustrated above, it is possible to note the following points:

- the different strategies adopted by the two firms were dependent on the intrinsic characteristics of each situation. In case 1, following a preliminary analysis of the available human resources, it was decided to employ internal personnel almost exclusively for the design and implementation of the QS, whereas the firm of case 2 engaged an external consultant, utilising a substantial share of the budget allocated for implementing the project.
- in both cases, the human factor - the training, involvement and motivation of personnel - were priority issues, so much so that one of the principal personnel cost items was courses for presenting the QS and instructing staff on the new procedures.
- the implementation phase entailed a great deal of attention and a substantial workload for the analysis of enterprise processes, their verification and description, and the subsequent drafting, checking and approval of the various documents.
- during the operative phase, internal inspection checks occupied a substantial part of the allocated human resources, and in particular those of the QAM.
- the process analyses conducted during the implementation phase highlighted any necessary material investments.
- it can be supposed that the most notable differences between firms emerge especially during the implementation phase, when the necessary strategies and investments are decided and the specific characteristics of the enterprise QS are delineated.

It should be noted that the quantification of costs obtained for the above case studies does not have a general applicability in that, as has already been noted, it is dependent on the characteristics of the firm, its pre-existing organisational structure, its reference markets and its chosen objectives.

#### 4. Analysis of the anticipated advantages

The adoption of a QS can be treated as an investment in management innovation which sets a number of benefits - for example in terms of competitiveness, efficiency and effectiveness - against the cost of implementing and operating the system.

To evaluate the benefits derivable by the enterprise from adoption of the quality model, management must conduct a preliminary analysis of the anticipated impacts. This should be done by evaluating, within the limits of forecasting accuracy, the *coeteris paribus* variations in cost and revenue items over a timescale of a few years.

In practice, such evaluations are conducted intuitively, without the support of a precise method of analysis, and on the basis of incomplete and non-verifiable data obtained from sets of forecasts concerning market trends, the orientation of clients and competing firms, the possibility of improving internal management and reducing productive risk, etc.

At each of the firms involved in the study, one of the managers responsible for the decision to adopt an enterprise QS was interviewed. The objective of the analysis was to identify a posteriori the deciding factors in the manager's subjective decision to approve adoption of the QS.

Using elements gleaned from interviews with representatives of the firms involved in the initial part of the study, it was possible to draw up an interview-questionnaire which provided a framework for the discussion.

A first step in the evaluation was that of ascertaining the business context in which the decision was made and what procedure was followed, in order to then define which factors effectively played an important role in the decision. Subsequently we attempted to distinguish the role of any monetary factors. Finally, we formulated questions designed to elicit quantitative evaluations of the costs and benefits directly derived from the enterprise QS, through a *bidding game* in which firms had to explicitly attribute either increase/decrease percentages or a monetary flow to the anticipated costs and benefits, both direct and indirect.

The interviews completed to date provide only a partial picture, which does however delineate certain fundamental lines:

- the representative interviewed had indirect knowledge of the issue, stimulated by the entrepreneurial environment and culture, but over time gained confidence in the QS, and particularly in its ability to provide a tool for rationalising production and management processes.
- the decision to adopt a QS was taken in a relatively short timescale, with low involvement of enterprise functions outside management, and with limited attention to the risk of failure or unforeseen costs.
- to date, the factors which most affected the decision have proved to be, in order of importance, the possibility of:
  - facilitating conformance to regulations
  - reducing customer claims and returns
  - improved control over the process
- secondary factors included the possibility of:
  - fulfilling market requirements
  - improving the enterprise culture
  - improving risk control
  - facilitating attainment of consistent product quality

In every case, the QS was found to require strong personnel motivation and their increased involvement in the projects of the enterprise. Obtaining certification was not so much a deciding factor as a consequence of adopting the QS, providing the advantage of external inspections in addition to the internal

checks. The issue of reduced/increased costs is, on the other hand, controversial, probably due to the different pre-existing approaches to management control prior to adoption of the QS.

During the preliminary economic assessment, management simply defined an expense budget which included only the costs of external resources (consultancy, certification, etc.) whereas the evaluation of the costs of non-quality was not taken into consideration, or was done in a purely qualitative manner.

The willingness to pay which emerged from the bidding game was equivalent to 0.5% of turnover, with the cost being distributed over a three-year time period.

The evaluation of the Quality System's potential effects on the reference market in terms of sales and market share revealed an absence of expectations as regards increased sales, while with respect to market share the prevailing prospect was consolidating loyalty of existing clients through closer and more interactive relationships. Lesser importance was attributed to the possibility of expanding the firm's market: however this aspect is strongly influenced by the type of client, so much so that one specific sales channel (catering) responded very positively to the certification of suppliers.

The conclusive element of the study highlighted the difficulty of effecting a monetary evaluation of the costs and benefits attributable to the innovation in question: the definition of the two reference scenarios for the firm, with or without the QS, was not possible in any of the interviews conducted. The reason lies in part with the difficulty of separating the actual market trend (which in the specific case has undergone a very fast and unexpected evolution) from the opinions which may have prevailed at the time when the decision was taken, and in part with the difficulty of "playing the game" and expressing the firm's evolution in its reference market in simple numerical terms.

The difficulty of evaluating benefits therefore consists first of all in their expression in monetary terms, in that management may not have quantified them explicitly. The monetary assessment of benefits would, however, permit drafting of a preliminary "project" evaluation forecast which should provide a basis for deciding to make such an important investment.

## **5. Conclusions**

The picture which emerges from the initial phase of the study reveals a situation that is relatively favourable to the introduction of QS, and most of the firms recognise its usefulness.

The principal motivations are the improved enterprise efficiency, image enhancement and fulfilment of market needs afforded by this management model. In this connection, a negative aspect is that a certain proportion of firms are interested in certification more for its promotional benefits than as a tool for correct management. The factors which impede the development of QS are essentially its costs, the additional bureaucratic burden and lack of market interest.

Nonetheless, the prospects for the introduction of QS in a larger proportion of firms are favourable. In fact, the intention of implementing a QS was reported in all sub-sectors, even though the practical application of these generic declarations of intent still meets with many obstacles.

It is difficult to understand whether the "pioneering" firms which first decided to adopt a QS were motivated by a real need to improve enterprise efficiency, or instead spurred by a "demand" on the part of the market. It is of fundamental importance to resolve this doubt because the informed and lasting diffusion of QS depends precisely on the motivations. It is certain, however, that firms have self-financed the innovation, because the role of public sector incentives has so far been extremely marginal.

As has already been remarked, the training of personnel, both administrative and technical, is a fundamental factor for the success of the QS-implementation project.

A greater propensity to adopt a QS was found in firms operating in the fruit and vegetable sub-sector. This may depend principally on the fact that this sub-sector has received the highest number of client requests and has the most relations with export markets.

For this sub-sector we can therefore anticipate short-term development of QS and probably of certification,

Awareness of quality issues is in general fairly widespread, but there is not a high degree of conviction as to the feasibility of initiating a restructuring process incorporating the QS. The firms of larger economic size have started or completed its introduction, whereas smaller firms are in part still waiting, or



do not see the need for adopting this tool. There remains, in any case, a marked differentiation among sub-sectors, with the wine industry being least receptive.

The study also highlights, alongside a high level of awareness of quality issues, a certain absence of the “quality culture” necessary for correctly addressing these issues.

With regards to the analysis of economic aspects, we believe that the systematic evaluation of costs should enable firms, especially through comparison of successive financial periods, to verify the economic efficiency of their organisation, interpret the changes and errors made and devise improvement plans for reducing the cost of quality, in order to better focus the efforts for defining their strategies.

This formalisation and identification of cost items, regardless of the possible subsequent analyses, permits certain preliminary considerations concerning the importance of the human factor and the necessary motivation and involvement which underpins the adoption of a quality management model.

The importance of training, collaboration among personnel at all levels (especially the management level), information exchange between different departments, the effort devoted to drawing up appropriate procedures, drafting documents, etc. highlights the personal and financial commitment required from the staff.

These considerations, derived both from the literature and from direct contact with firms, are confirmed by the - as yet limited - case studies reported in this paper.

The analysis of the anticipated benefits is even more complex, and it is widely believed that financial indicators alone are not enough to provide an answer. For some firms, adopting a quality system and obtaining certification can represent the only means for surviving on the market in the medium term, while for others it can mean expanding or changing their client portfolio, and for others still the advantage is implicit in the commitment to operate within a context of quality control and continuous improvement.

It is therefore a simplification to express the advantages of adopting a QS exclusively in terms of increased revenues, without analysing the resulting increases in efficiency, reductions in waste, greater customer satisfaction, enhanced reputation on the market, etc.

This does not preclude management from evaluating the advantages in terms of costs and benefits, in which the aforesaid advantages are quantified also in monetary terms. The values obtained from such an analysis could then be interpreted as expressing a “willingness to pay” to secure enjoyment of those benefits. In the current phase, the study shows that this is not done due to the subjective difficulty of assigning a value to the different factors in play.

The expediency of the investment could, however, be evaluated using a non-monetary method in which monetary factors are qualitatively compared with other factors, but this would not resolve the difficulties inherent in the forecasting and critical analysis of the system.

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