LEVEL OF IMPLEMENTATION OF QUALITY SYSTEMS AND TECHNIQUES IN THE SPANISH CERAMIC INDUSTRY.

Quality Promotion Group . Association of Ceramic Technicians (A.T.C.)
Spain

SUMMARY

The boom experienced by the Spanish ceramic industry over recent years is not unrelated, among other aspects, to the fomentation of factors considered to be of strategic importance, such as Price, Design, Service,... and Quality.

Spanish ceramic products, and consequently the industry itself, were traditionally considered on international markets as products of average quality, limited design, irregular service and a competitive price. The price factor, however, was not sufficient to produce a substantial increase in foreign sales.

The firm commitment on the part of manufacturers of Ceramic Floor and Wall Tile, Third Fire Trims and Decorations, Frits, Glazes and Colours, as well as Ceramic Machinery to generating a technology of their own, with increased investments in Design, a spectacular improvement in Service and the introduction of Quality Systems and Quality Tools, has placed Spanish products at the forefront of the world ceramic industry in terms of expansion on the most solid markets.

For some years now, at the initiative of certain companies, the culture of Quality and Total Quality has been introduced, at an increasing rate and this culture now extends throughout the totality of the industry. We believe that this process has been a determining factor in the present dynamism of the industry, while the determined undertakings of ceramic professionals who have introduced new Quality techniques into their training has also been a basic factor in this growth.

This paper presents the results and conclusions of a survey on the level of implementation of these techniques in the Spanish Ceramic Industry. The survey is intended to stand as a first contact with the present situation of such techniques in sectoral companies that produce Ceramic Floor and Wall Tile, Third Fire Trims and Decorations, Frits, Glazes and Colours, as well as Auxiliary Machinery.

The study represents the first part of a collection of field data. For this purpose, sampling has been conducted across differently sized companies in the industry. A series of criteria were used, such as: size, number of workers, technology utilized, product manufactured, organizational structure, etc. This sampling has a data representativeness factor of over 90%.

The second part involves the preparation and structuring of the information obtained according to the objective of the work, i.e. to determine the level of implementation of quality systems and quality tools.

Finally, we present our conclusions which, apart from their qualitative and quantitative value, represent the first data bank available on the subject, and which should allow for comparison with further studies or contrast with other industries.

INTRODUCTION

Quality has become one of the most prominent topics in management, and in just a few years there has been a move away from a consideration of «product quality» to one of «total quality».

From a simple definition of «Conformity of products to customer requirements», there has been a move to a new definition of «Conformity of products and services to customer requirements» and «Conformity of products and services to customer requirements, both internal and external». This development thus includes something more than just the product (Service, image, delivery period, etc.) and something more than just the customer (the concept of the internal customer is beginning to be heard), in such a way as to open the way towards TOTAL QUALITY.

Consideration of the internal customer and its generalization allows for a broad consideration of the concept of quality, since each section of the company is viewed as the customer of that which precedes it and as a supplier to the following one, to such an extent that each work station may be considered as a customer or a supplier. This means that all the component parts of the company participate in compliance with the requirements of the stations following them. This helps to remove the bad habit of thinking that the work stations at the end of the process (Selection) can solve problems by «removing» the errors and thus preventing these being delivered to the customer.

Likewise, the concept has started becoming assimilated, whereby within the company, the process of transformation is applied not only to physical matter, but rather that the treatment of «information» also requires extensive human and material resources to provide an added value to the system. The administrative, sales, etc. departments involve a high proportion of human and material resources, and form a link at an equal level between external customers and external suppliers. From a point of view of quality, the company is

beginning to be considered as a whole and not merely as a compartmentalized organism in which quality is the responsibility of Production, or, at best, of an isolated department bringing together the responsibilities of Quality Control and Management.

At the same time, however, Quality and Total Quality are beginning to become mythicized, to be considered as bearers of assured success, yielding updated management and bestowing prestige, which will act as vehicles for future profits. The impression may be held that Quality is a passing train and that not to catch it implies delay and marginalization. The truth lies somewhere between the two extremes: all myths include a dose of irrationality and an aid to dispelling certain misnomers may be found in open discussion, comparison of experiences and consideration of Quality as a means and not an end in itself, as may sometimes be believed as a result of the aforementioned mythicizing process.

Both companies and individuals tend to seek a linear formula for achieving quality, basing themselves on successful cases, theoretical models or simple imitation. Effort is invested in a search for logical steps to achieve quality in a short space of time, in executing a list of actions which, supposedly inter-linked, should result in rapid success, Quality and Total Quality. This approach results in a purely rational exercise, guided exclusively by cold reason, and forgetting the enormous importance of the emotional aspect in a concept, which on the other hand makes the participation of all one of its cornerstones. Thus if we ask «Who benefits from Quality», the following will be the answers:

- Employees, who find greater work and job satisfaction.
- Customers, who get greater value for their money.
- Company Owners, who have greater chances of success.
- Society, which avoids losses through problems arising in the above links.

Not all of the benefits in the above list are pecuniary, although in the end they may all be measured in monetary terms. If, on the other hand, we ask ourselves «**How may such benefits be achieved?**», «**How may success in Quality be attained?**», we begin to enter into the heart of the matter and this requires a series of conditioning factors.

- A strategic analysis centred on the identification of the sectors (products, markets) in which the company can respond better to the requirements of its customers.
- A common language between the functional part and the operational part of the company, which allows clarification of the operation requirements so that the functional part may satisfy these without creating misunderstandings.
- Decision-making processes that guarantee the precision of the decision flow and consistency between the various decisions, particularly from one service to another.
- Mastering of the manufacturing processes, which for the end customer is the concrete result of all the efforts of the company directed towards a single end: Respecting the requirements of the customers.

With all this we are presenting what we might call and which has generally been called a «**Quality System**» understood as a means of introducing Total Quality, although in most cases the tendency is towards a structured or bureaucratic limitation instead of the wider concept of Quality. We may say that TOTAL QUALITY is the whole of which the Quality System forms a necessary, but not by itself sufficient, part.

An exercise such as that proposed by this study - an investigation of the particular situation of the level of implementation of quality tools and systems - has the advantage that it deals with reality, distancing itself from assumed states of opinion, from speculations on advantages or disadvantages, exaggeration or wishful thinking, etc. at the same time as

being a point of comparison in the study of evolutions. Furthermore, with an industry such as Ceramics, in the case of Spain, which is so geographically concentrated and with all its own peculiarities, it has the added advantage that, as well as having a high level of representativeness, it involves a test of differences according to a series of variables which it is intended to introduce (size, structure, markets, products, etc.), yielding a study of enormous importance for an understanding of the actual situation of TOTAL QUALITY within the sectoral companies.

RESULTS AND DISCUSSION

OVERALL AVERAGE FIGURES:

Figure 1 shows the proportional distribution of the companies surveyed by activity. Figures 2 and 3 show the proportion of companies surveyed compared to the total number of companies in each of the branches studied, both in number and turnover. Figure 4 shows the level of segmentation found in the branches of Ceramic Floor and Wall Tile, Glazes and Third Fire and Trims, Workshops, Auxiliary Machinery and Spray Dryers. Figure 5 shows the percentage of questionnaires returned compared to those sent out. The selection of companies within each segment was carried out using random sampling. All the above-mentioned graphs show the level of representativeness of the study and the high level of cooperation displayed. We may thus conclude that this study is entirely representative of the current situation of the ceramic industry with regard to the introduction of quality systems and tools, not only because of the overall number of companies included in the study, but also because of the methodology utilized in selecting them.

The definition of the Level of Importance attached to Quality is shown in Figures 6 and 7. Figure 8 shows the scale and priority rating given to Quality, compared to other appreciated factors. There can be no doubt that for the Ceramic Industry, quality is now the most appreciated factor, though followed at some distance by Service, then Design and Price, and finally Safety. The basic reasons for this evaluation are (Figure 9) Market Competition, followed at an almost equal distance by the Need to Reduce Costs, Consumer Demand and Compliance with International Standards. It is clear that this evaluation is of a **competitive** nature, especially if one takes into account that complaints unrelated to quality are insignificant (less than 3%) as shown in Figure 10.

However, one thing is the level of importance given to Quality and another, not necessarily parallel, the level of implementation thereof. Specifically, it may be stated that certain quality tools are being used (Fig. 11) especially in Training. With regard to other Tools, it must be said that the possible answers were presented on the questionnaire sheet, with an indication of where these should be ticked, 75% of the companies surveyed carry out Finished Product Inspections. This is by far the most widespread inspection performed (Fig. 12). On this point it should be mentioned that, because of the nature of the questionnaire, with cross-referenced questions, we have detected a certain (at times high) level of misunderstanding or confusion with regard to some of the tools indicated. For example there is a tendency to confuse Statistical Process Control (SPC) with normal process control, Experiment Design with tasks more properly related to the Product Development Department (Graphic Design). Nonetheless, the level of implementation of certain quality techniques is significant. In this regard it is necessary to make a distinction between the different branches, with especial emphasis on Glazes. Within Floor and Wall Tile manufacture, it is also necessary to distinguish between two groups of companies since there exists a group with a high level of introduction of quality techniques (It should not be forgotten that the Industry includes such companies as Gres de Valls S.A. and Gres de Nules S.A. which have respectively been

awarded the National Quality Award and the Prince of Asturias Award for Business Excellence, the highest acknowledgement of business quality in Spain. The industry also includes Taugres and Saloni who have attained recognition for their efforts in the area of Quality, together with the aforementioned Gres de Valls and Gres de Nules, with the Valencia Award for Quality Innovation.)

Examining in greater detail other elements related to Quality Systems, we can see that the surveys of Level of Customer Satisfaction were carried out in 38% of cases (Fig. 13). This to some extent contradicts the answers which were given with regard to the frequency thereof, as 70% stated «none» (Fig. 14). With regard to the Suggestions System, 66% reported that they had introduced this system (Fig. 15) with a frequency in most cases of less than 20 per year (Fig. 16). Quality Indicators (Fig. 17) are widely used (74%) although the most predominant are those corresponding to the Production Area and especially, indeed almost exclusively, those connected with Quantities and Qualities obtained, in most cases not even target-orientated. Costs are also used as an indicator of Quality. It is interesting to note the level of Organization information (77% of the responses indicated Communication and Information) (Figure 18).

With regard to the model used for the implementation of Quality Systems, the response was practically unanimous in referring to the ISO 9000 Standards, although only among those which observe a model (55%) (Fig. 19).

In terms of the level of participation of the Operators, Participation Schemes were found to exist in 60% of cases (Fig. 20) with follow-up meetings in Production being the most common system (Fig. 21). In this regard it is necessary once again to distinguish between branches and companies since, if the leading Quality companies are not taken into account, the indicator is much lower. The Level of Implementation of Improvement Groups (or similar schemes) should be emphasised. This is a technique currently being introduced which still has a low level of participation (Fig. 22). Training, the true leader among the present concerns, is primarily targeted at medium and, above all, higher management levels (Figure 23). The level of investment in this regard is quite variable and even unknown in many cases (Fig. 24). It is interesting to note that this training basically responds to specialization requirements since the Level of Work Station Rotation is very low (Fig. 25). As regards the culture of the internal Customer/Supplier there is a medium level of implementation in this field (Fig. 26), which is greater in the case of the Glaze producers, and basically in the Floor and Wall Tile branch, where the trend is practically reversed, to stand at a level of 70-30. Despite the apparent participation by operators in Training, etc., the number of surveys carried out regarding Staff Satisfaction Levels is minimal.

All the results would seem to indicate a certain «delegation» of Quality matters to a single Department, although this only occurs in 50% of cases (Fig. 28), and there are even cases where a department exists without a department head (Fig. 29) which would seem to suggest an assimilation of this by other departments, especially Production which uses Quality for Control tasks. With regard to training of the head as well as the members of the department, the most common is a University Degree in Chemistry (Fig. 30 B) taking into account the majors at the Jaume I University and the specialities at the Professional Training School. The number of staff members is variable (Fig. 31), with a clear upward trend (Fig. 32) although in some cases such as Glazes, it stands at over 5% of the total staff, and in Floor and Wall Tile manufacture two groups may be established of 2-3% and 3-4% respectively. This also gives us an idea of the low level in the remaining branches and the difference between the different company dimensions. Nonetheless, it is important to emphasise the level of interest shown in matters of quality and the level of membership of

Associations, subscriptions to journals, etc (Fig. 33 and 34).

COMPARATIVE SECTORAL DATA:

A study such as this, as well as covering general or overall aspects of the Spanish Ceramic Industry, as a point of confluence of different branches, should also consider the peculiarities of each of these, since there may exist appreciable differences between them, which may be hidden by an overall examination.

- *Level of Quality Evaluation*: The scale of values used by each branch is as follows:

  - Floor and Wall Tile: Quality - Service - Price/Design.
  - Glazes: Service - Quality - Price.
  - Spray-Dried Powder: Quality - Service - Price
  - Auxiliary Machinery: Quality - Price - Service
  - Third Fire: Quality - Design - Service

- *Motivating factors in the promotion of Quality:* In all cases *Competition* is given as the decisive factor, except in the case of the Auxiliary Machinery Sector, where Fashion is given as one of the factors of influence, and in the case of Third Fire, where International Standards play a role.

- *Quality Complaints:* The low rate of complaints is noteworthy, both in overall and in particular cases. This is an Industry where the Costs of Non-Quality are especially concentrated within the companies themselves, thence the enormous possibilities for influencing costs.

- *Tools Used*: It may be fairly stated that the implementation of Quality Systems (Adaptation to ISO 9000 Standards) is a path which generally speaking, has barely been embarked upon, although there are many companies (most) in the Glaze branch which are currently implementing Quality Systems. In the other branches, it is important to stress the division within the Floor and Wall Tile branch, where there exists one group of companies with a fully implemented System or one that is at an introduction stage and another, very numerous group, which still stands at the concept clarification stage. In the Spray Dryer, Auxiliary Machinery and Third Fire branches, the process has not yet been initiated.

- *Control*: This is an industry where control of the finished product is the basis of all control, although to a greater or lesser extent according to the characteristics of the product. Thus, it is in the Spray Dryer branch that there is a greater incidence of End Control.

- *Customer Satisfaction Surveys*: In this case too, the specific product in question is a deciding factor in the extent to which Customer Satisfaction Surveys are undertaken. Those with the highest occurrence of such surveys are the Spray-Dried Powder producers and Floor and Wall Tile manufacturers. Those with the most reduced incidence are Glazes, which is paradoxical given the high level of implementation of Quality Systems in this sector.

- *Participation Systems:* This is an industry where participation, in an organized and structured form, is underdeveloped and basically centred on direct contact and on meetings of the production group. This implies a certain level of integration of the middle-management, but hardly goes any further than this. On an individual level, it is the branches of Auxiliary Machinery and Third Fire which have the least level of participation.

- *Quality Indicators*: In general, Quality Indicators are used, although fundamentally, or almost exclusively, in the area of Production. Within Production these are based on Quantity and Quality. At the same time, the information on and publication of the Indicators is quite reduced and at most refers to the Middle-Management meetings mentioned above.

- *Quality Models:* The ISO Series 9000 Standards are the most widely known, indeed practically the only, models for implementing a Quality System. The level of awareness of these standards is high, but the level of comprehension is much smaller, particularly in the Auxiliary Machinery branch.

- *Training:* As mentioned above, this is the most widely used resource, with investment figures of less than 0.1% in most cases. Under this heading, it is also important to note the differences between the groups of companies within the Floor and Wall Tile branch, as there exist companies with a figure of over 0.3%, or even as high as 0.5%. The Spray-Dried Powder, Auxiliary Machinery and Third Fire branches are those which invest least in training.

- *Quality Department:* Under this heading it is important to highlight the Glaze sector which has the greatest level of implementation of Quality Departments, and the highest staff qualification and number of staff members. On the contrary, the Auxiliary Machinery sector scarcely contains any introduction of this sort. Neither is there a differentiated treatment (of production) in the case of Spray-Dried Powder and Third Fire. In the case of the Floor and Wall Tile manufacturers, there exists once again a separation between the companies in the two groups mentioned above, in terms both of the existence of Quality Departments and in the level of qualification and number of staff involved.

CONCLUSIONS:

1.- Quality is considered a factor of prime importance.
2.- The level of introduction of Total Quality and Quality Systems is low and stands at an initial stage. There are two distinguishable groups, one of which is on the road towards introduction, whereas the other has not yet undertaken this step.
3.- Quality is fundamentally assimilated into Control. See Point 2.
4.- The instruments placed at the disposal of Quality are on the increase.
5.- Training is the starting point for all the initiated programmes.
6.- The Level of Participation is low and centred on monitoring Production results.
7.- The use of techniques or tools is quite diverse. Point 2 also applies here.
8.- The mechanisms of Training and Information are well structured and the offer is wide, as is the existence of Quality professionals.
9.- Quality is understood to be a competitive factor of the first order.
10.- A generalized decision to introduce Quality Systems is lacking.

Focusing on these conclusions, it may be stated that:

A.- Two differentiated groups may be observed in the Ceramic Industry with regard to quality: Those companies which have set out upon the road, or which have been covering it with proven success for the last five years and those which have not yet taken this path. Nonetheless, the latter, in most cases, are aware of the implications. There is a possible lack of a greater understanding of the mechanisms, necessary structure, elimination of additional costs, etc.

B.- The Ceramic Industry (the group of companies which have set out upon the road to Quality) has benefited with respect to other industries, both within Spain and abroad, as also shown by studies carried out in the UK, France and Germany. This is true both for the level of Implementation of Quality Systems and the specific techniques used.

C.- It is clear that the Industry is not a homogenous whole, but it is equally true that it is precisely the industry itself which competes, together with other producers, and on this point it is necessary to indicate that the present level in Spain is highly competitive in matters of Quality when compared to its immediate competitors. This is true of the Industry taken as a whole, especially for the leading companies.

D.- An increasing concern may be observed on the part of the companies to set out on the path towards Total Quality.

REFERENCES:

-D. Peña: "Los métodos estadísticos en la Gestión de la Calidad de las empresas españolas". Trabajos de estadística 5(1990)53

-E.J.Schwarz, J.J. Kanet and H.D. Leigh III: "Quality Control Practices in the American Ceramic Industry". Am. Cer. Soc. Bull. 68-3(1989)530

-P. Corma: "Grado de utilización del Control Estadístico de Procesos en la Industria Cerámica". Cerámica Información 184-March (1993)

-Castellón Chamber of Commerce, Industry and Navigation: "Resultados de la encuesta provincial sobre las necesidades de formación en la empresa"

CONCLUSIONS OF ANOTHER STUDY

1.- Principal driving forces in quality policies:
- increase in customer requirements
- increase in competition
- need to reduce costs

2.- Level of importance of quality:
- decisive for a percentage of:
  - -80-85% Spain
  - -85-90% France
  - -90-95% Germany

3.- Main benefit expected from introduction of quality systems:
- customer satisfaction
- however:
  - customer satisfaction surveys are not widely used.
  - the techniques which introduce customer needs and requirements into the company (qfd and others) are virtually unknown.

4.- One of the consequences of quality programmes is the involvement of human resources.
- introduction of improvement groups:
  - high in France
  - medium in Germany
  - low in Spain

5.- Internal staff opinion surveys carried out:

- in 55-60% of cases (France)
- in 40-45% of cases (Spain)
- in 20-25% of cases (Germany)

6.- Level of usage of the most elaborate techniques (spc, doe, qfd, etc.):
- very low or unknown

7.- Concept of «internal customer-supplier»:
- intellectually under-assimilated or very under-assimilated in Spain and Germany
- accepted and integrated to a great degree in France
- however the mechanisms of integration are under-developed and there is a tendency to use jointly-developed specific programmes or improvement proposals.

8.- The concept of «ongoing improvement» is:
- more developed in Germany than in France and Spain
- the same is true of suggestion systems.
- the same is true of the use and monitoring of quality indicators.
- the same is true of comparisons with other companies (benchmarking)

In conclusion, it can be stated that in terms of the level of implementation of total quality, French companies, in general, are more highly evolved than their German counterparts and that both are more evolved than Spanish companies. There exists a differentiating factor which is that of possessing total quality plans under way or scheduled, which is also higher in France and Germany. Spain may be considered to be currently undergoing a period of «awakening» in this regard, although in certain cases there is a high level of development which on occasions (albeit only in individual cases) is greater than that of French or German companies.

FIGURE 1

NUMBER OF COMPANIES SURVEYED BY ACTIVITY	
THIRD FIRE AND TRIMS	8
WORKSHOPS AND AUXILIARY MACHINERY	18
GLAZES, FRITS AND COLOURS	13
FLOOR AND WALL TILE	45
SPRAY DRYERS	4

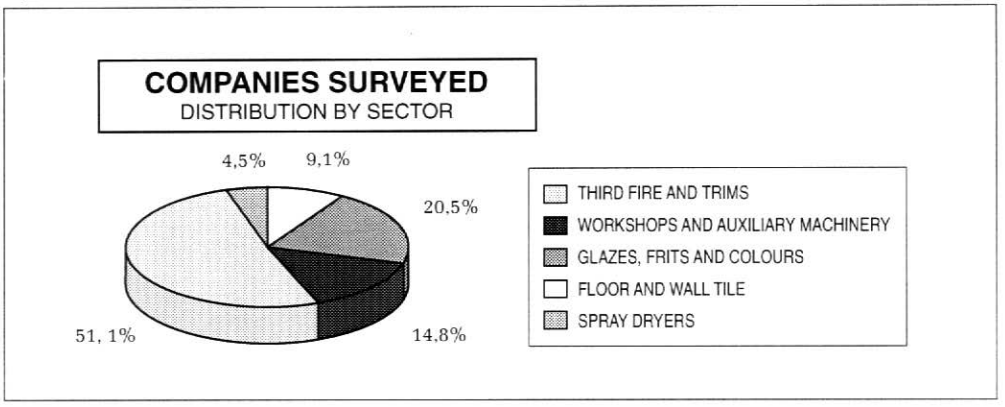


FIGURE 2

% OF COMPANIES SURVEYED IN EACH SECTOR	
> 40%	THIRD FIRE AND TRIMS
> 50%	WORKSHOPS AND AUXILIARY MACHINERY
> 60%	FRITS, GLAZES AND COLOURS
> 40%	FLOOR AND WALL TILE
> 60%	SPRAY DRYERS

FIGURE 3

% OF SECTOR TURNOVER REPRESENTED BY COMPANIES SURVEYED	
THIRD FIRE AND TRIMS	>75%
WORKSHOPS AND AUXILIARY MACHINERY	>50%
FRITS, GLAZES AND COLOURS	>75%
FLOOR AND WALL TILE	>75%
SPRAY DRYERS	>75%

FIGURA 4

COMPANIES GROUPED BY SIZE				
	NUMBER OF OPERATORS			
SECTOR	UP TO 50	50-100	100-200	MORE THAN 200
THIRD FIRE AND TRIMS	5	3		
WORKSHOPS AND AUXILIARY MACHINERY	8	7	3	
FRITS, GLAZES AND COLOURS	3	5	5	
FLOOR AND WALL TILE	6	15	12	12
SPRAY DRYERS		4		

FIGURA 5

RETURNED	87
UNRETURNED	15
SENT OUT	102

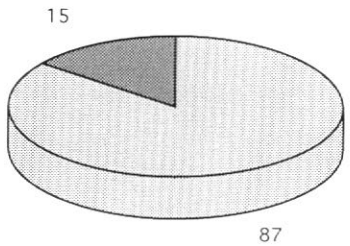


FIGURE 6

LEVEL OF IMPORTANCE OF QUALITY IN THE COMPANY	
VERY IMPORTANT	77%
IMPORTANT	33%
QUITE IMPORTANT	0%
NOT VERY IMPORTANT	0%
NIL	0%

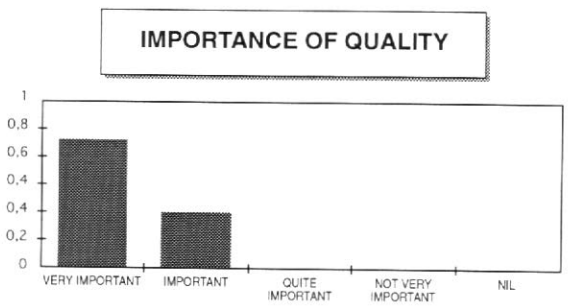


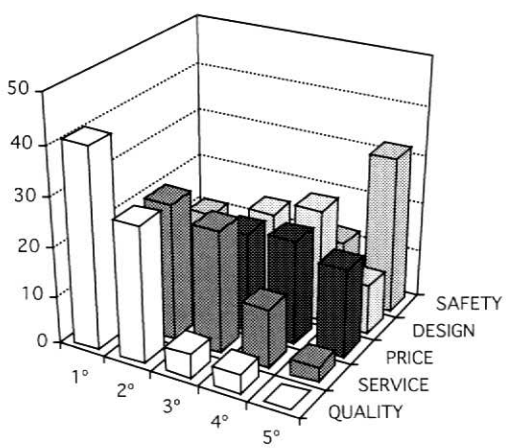
FIGURE 7

FACTORS DETERMINING IMPORTANCE OF QUALITY	
MARKET COMPETITION	33%
NEED TO REDUCE COSTS	19%
GREATER DEMAND FROM CONSUMERS	18%
COMPLIANCE WITH INTERNATIONAL STANDARDS	18%
DOMINANT CULTURE. FASHION	8%
LEGISLATION	4%

FIGURE 8

PLACE IN ORDER OF IMPORTANCE PRICE, DESIGN, QUALITY, SERVICE, SAFETY	
QUALITY	41 FIRST 28 SECOND 5 THIRD 4 FOURTH 0 FIFTH
SERVICE	10 FIRST 28 SECOND 25 THIRD 12 FOURTH 3 FIFTH
PRICE	9 FIRST 10 SECOND 20 THIRD 21 FOURTH 18 FIFTH
DESIGN	7 FIRST 10 SECOND 20 THIRD 23 FOURTH 10 FIFTH
SAFETY	11 FIRST 2 SECOND 9 THIRD 12 FOURTH 32 FIFTH

SCALE OF VALUES	
FIRST	QUALITY
SECOND	SERVICE
THIRD	PRICE AND DESIGN
FOURTH	SAFETY



Scale of Values

FIGURE 9

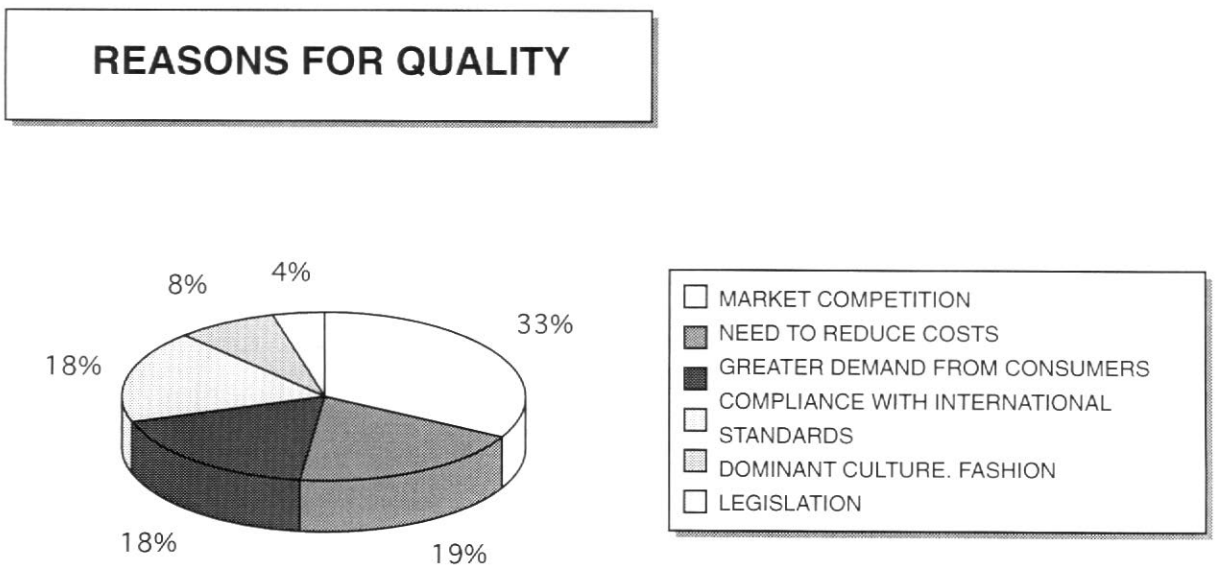


FIGURE 10

PERCENTAGE OF COMPLAINTS AS A PERCENTAGE OF SALES	
< 5%	97%
5-10%	2%
10-20%	1%

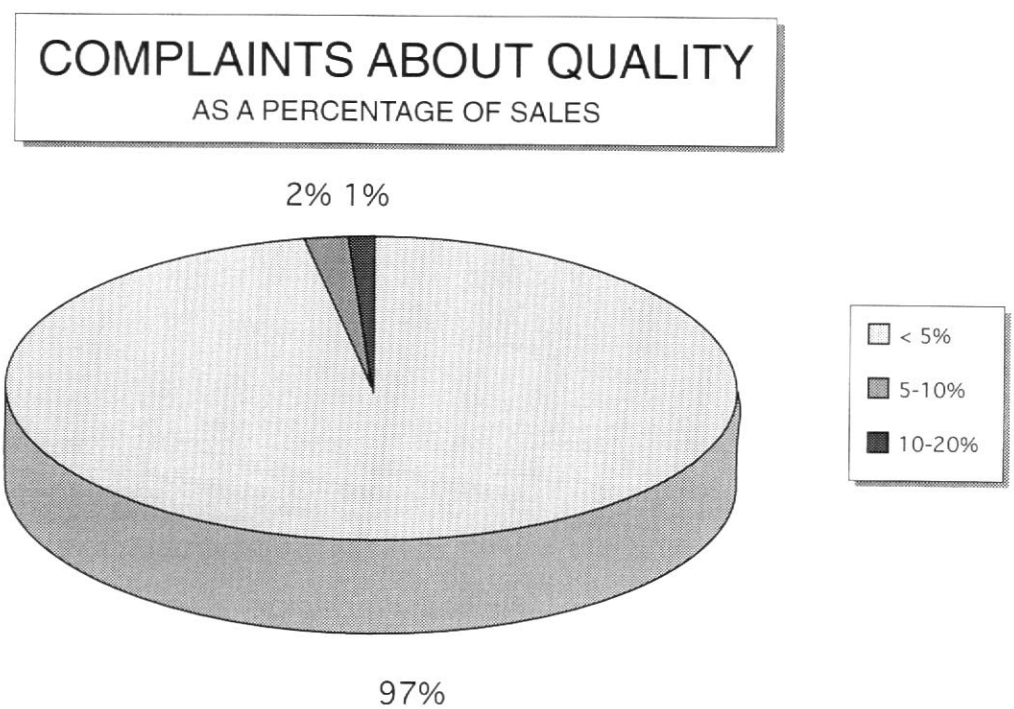


FIGURE 11

QUALITY TOOLS APPLIED	
INTERNAL TRAINING	63
SPC. STATISTICAL PROCESS CONTROL	48
IMPROVEMENT GROUPS	45
ISO-9000 QUALITY SYSTEM	37
CUSTOMER SATISFACTION ANALYSES	37
NON-QUALITY COST ANALYSES	37
AMFE	24
DESIGN OF EXPERIMENTS	23
OTHERS	14
VALUE ANALYSES	8
QFD	2

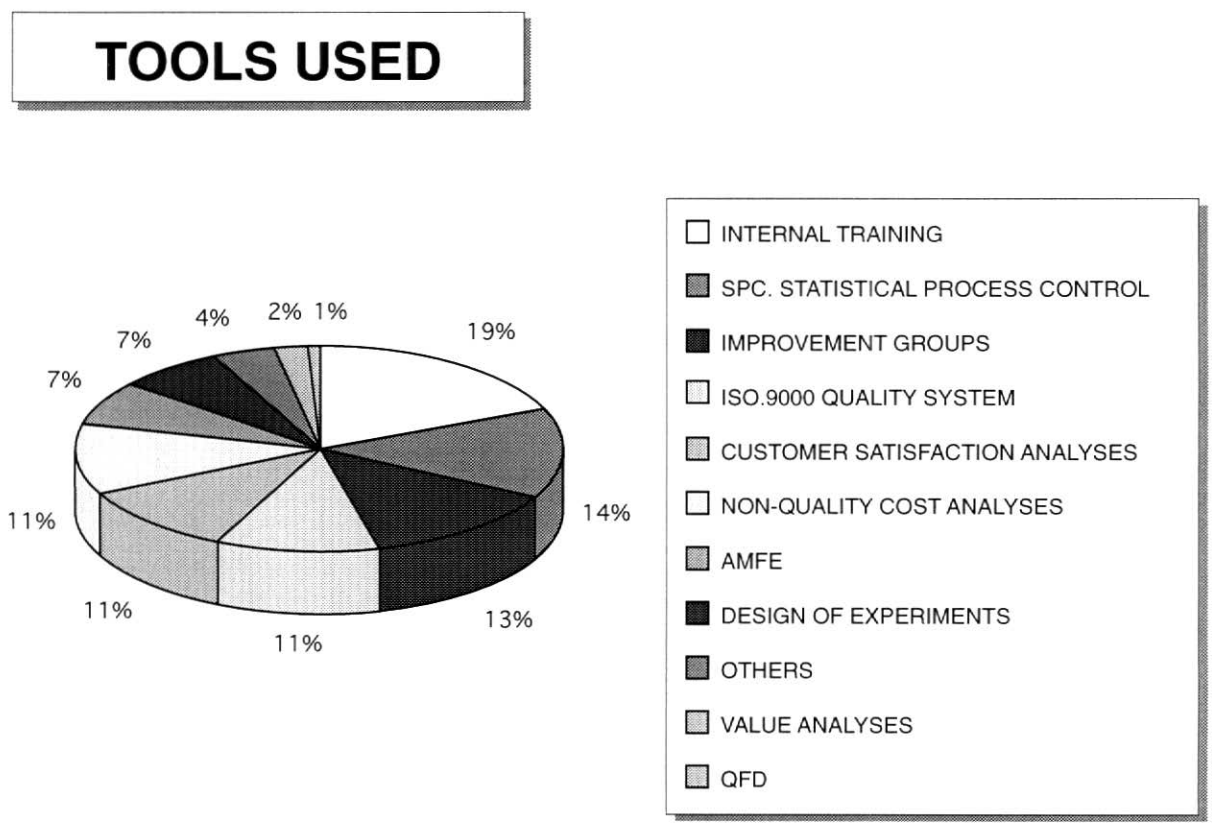


FIGURE 12

CONTROL OF FINISHED PRODUCT	
YES	75%
NO	25%

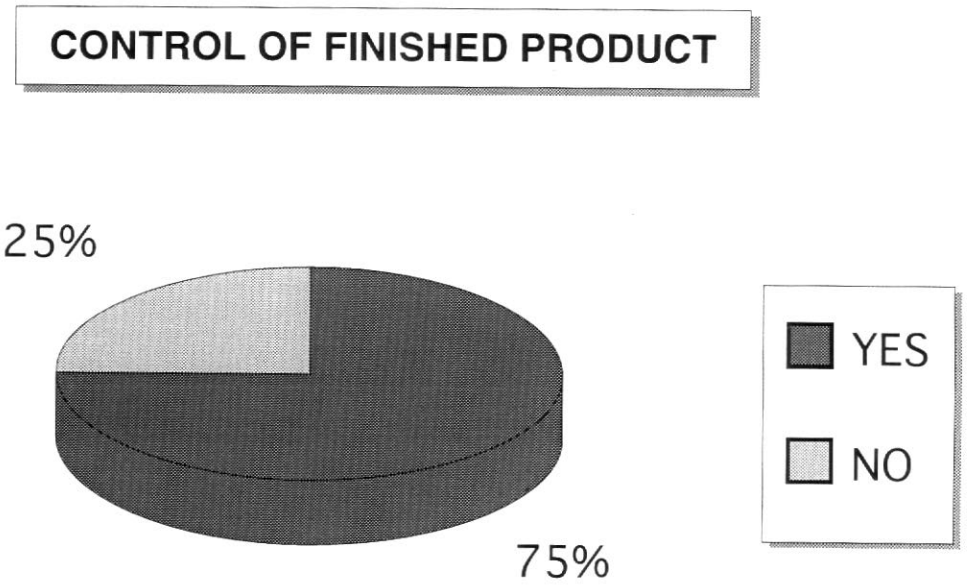


FIGURE 13

CUSTOMER SATISFACTION SURVEYS	
YES	60%
NO	40%

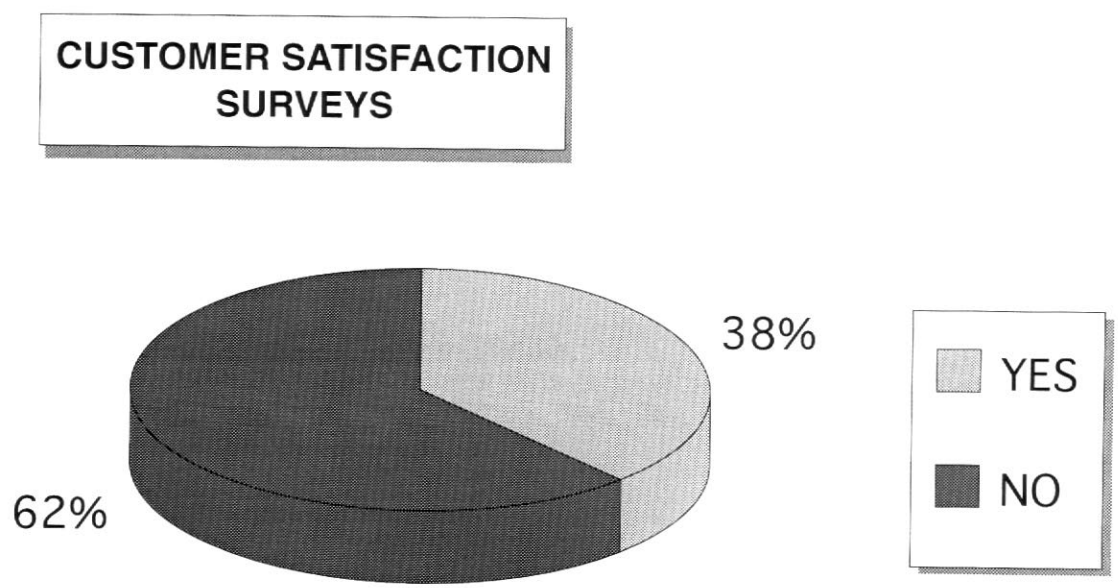


FIGURE 14

FREQUENCY OF CUSTOMER SATISFACTION SURVEYS	
NONE	70%
YEARLY	10%
EVERY SIX MONTHS	7%
EVERY THREE MONTHS	7%
OCCASIONALLY	6%

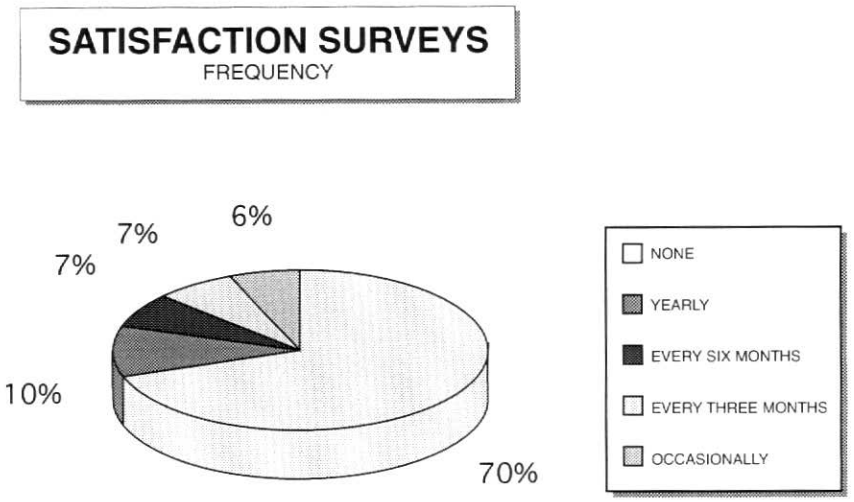


FIGURE 15

INTERNAL SUGGESTIONS SCHEME	
YES	48%
NO	52%

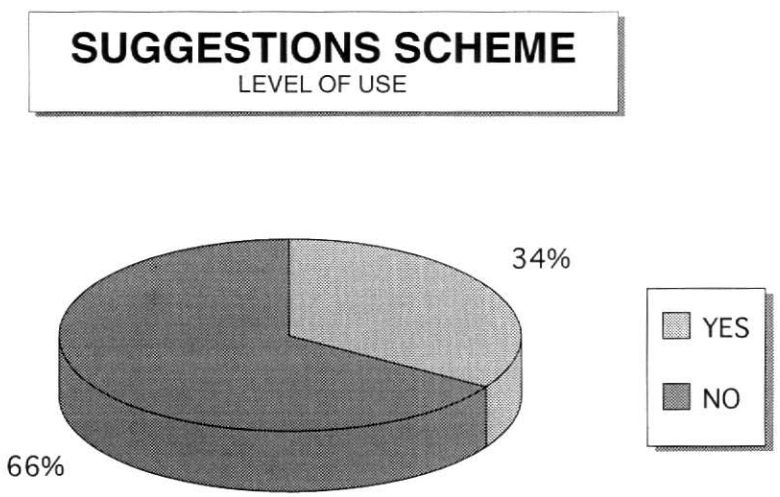


FIGURE 16

NUMBER OF SUGGESTIONS PER YEAR	
FEWER THAN 20	47%
20 - 50	16%
50 - 100	21%
MORE THAN 100	16%

SUGGESTIONS
NUMBER PER YEAR

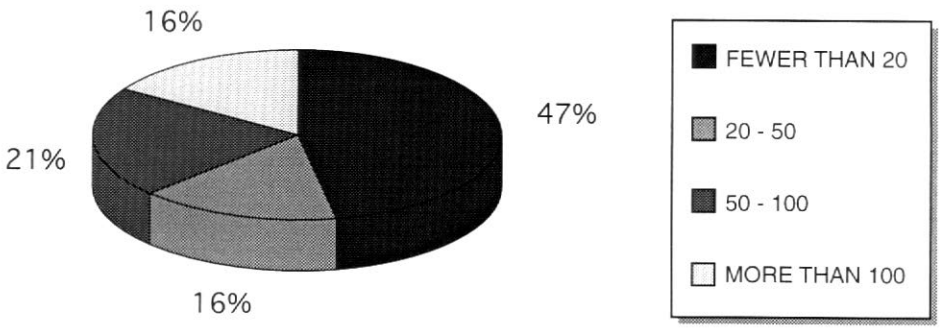


FIGURE 17

QUALITY INDICATORS	
YES	74%
NO	26%

QUALITY INDICATORS

TYPE OF QUALITY INDICATOR
QUALITY PRODUCED
QUANTITY PRODUCED
COSTS

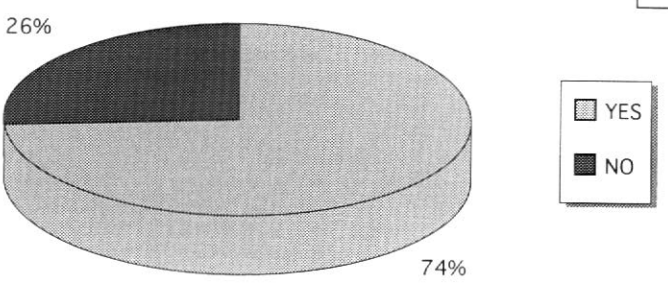


FIGURE 18

QUALITY INDICATORS FOLLOW-UP AND INFORMATION	
YES	77%
NO	23%

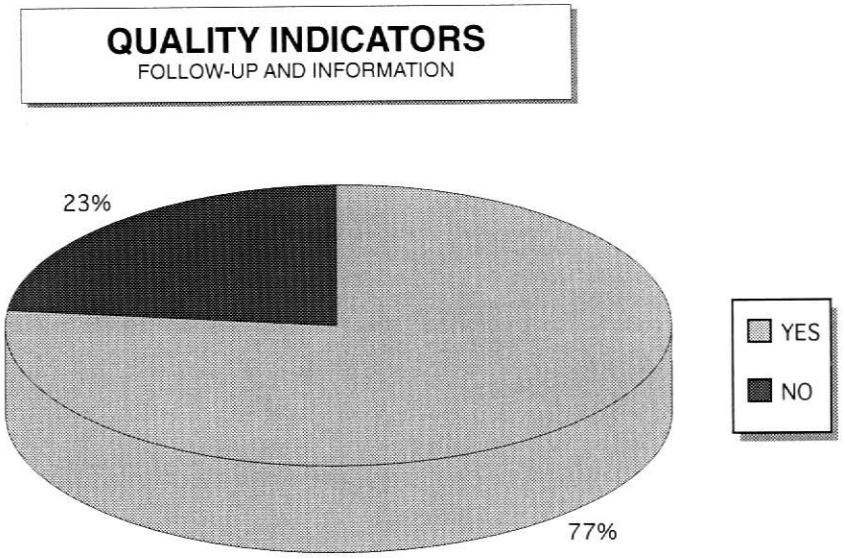


FIGURE 19

MODEL FOR QUALITY IMPLEMENTATION	
ISO-9000 STANDARDS	55%
NONE	35%
EFQM	3%
MALCOLM BALDRIGE	0%
OTHERS	7%

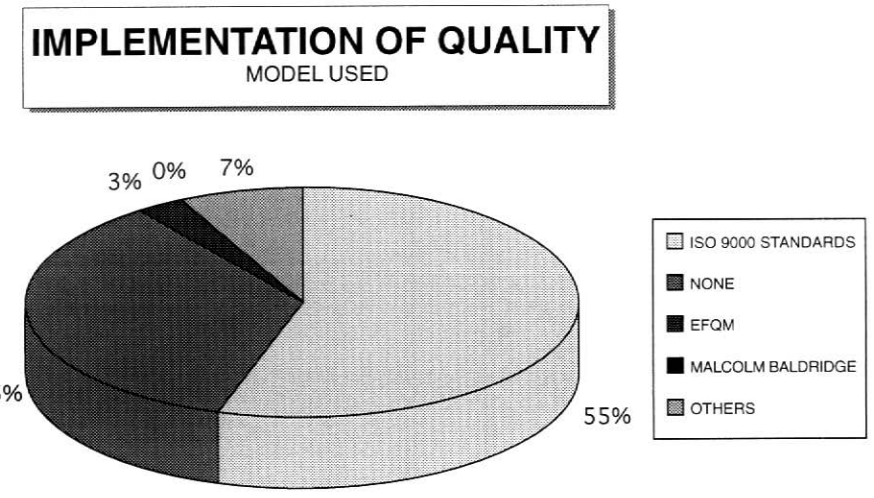


FIGURE 20

OPERATOR PARTICIPATION SCHEME	
YES	59%
NO	41%

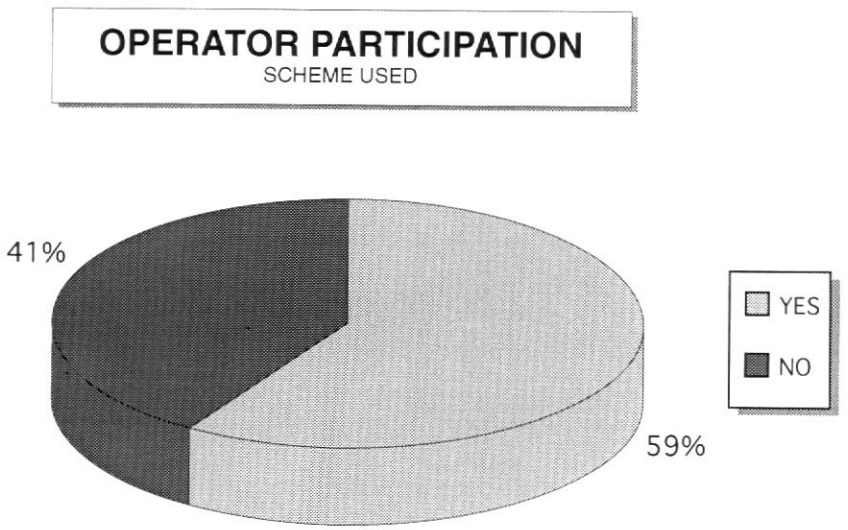


FIGURE 21

OPERATOR PARTICIPATION SCHEME	
MEETINGS	32%
IMPROVEMENT GROUPS	21%
SUGGESTIONS BOX	21%
CONSULTATIONS	11%
QUALITY PROGRAMME	5%
OTHERS	10%

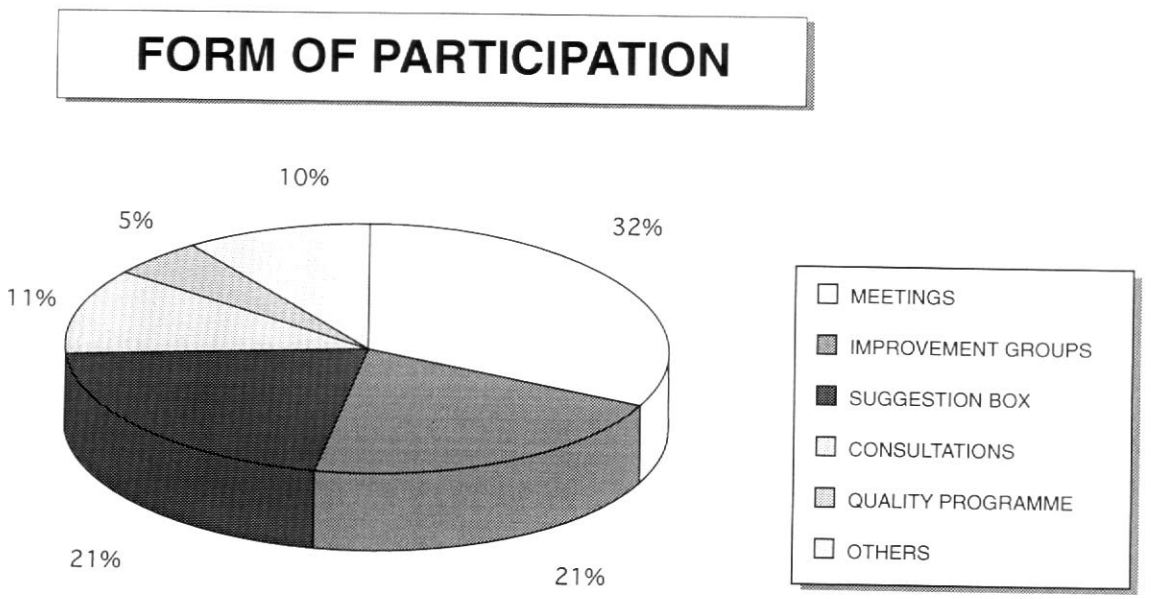


FIGURE 22

OPERATORS PARTICIPATING IN QUALITY GROUPS	
LESS THAN 5	38%
NONE	28%
5 - 10	15%
10 - 20	13%
MORE THAN 30	6%

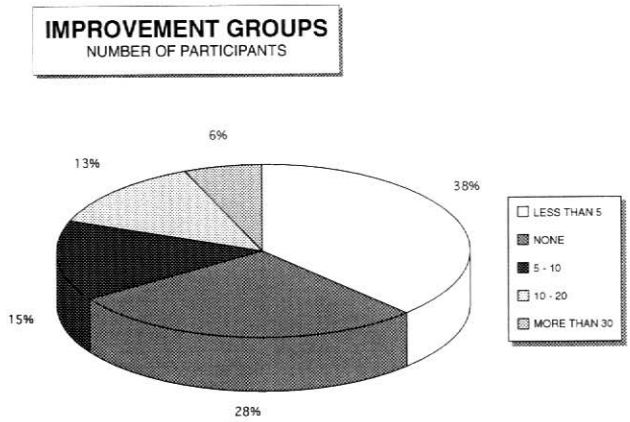


FIGURE 23

WHO IS TRAINING TARGETED AT?	
TECHNICIANS AND MANAGEMENT	47%
OPERATORS	32%
MIDDLE-MANAGEMENT	9%
SALES PERSONNEL	4%
OTHER	S8%

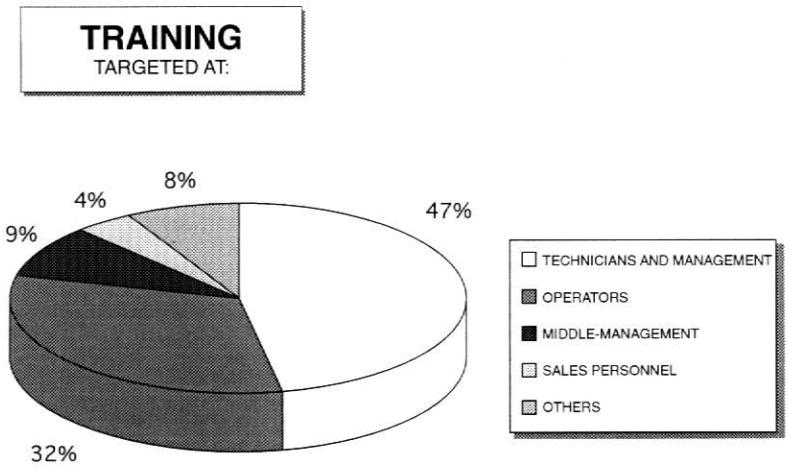


FIGURE 24

PERCENTAGE OF TURNOVER DEVOTED TO TRAINING	
LESS THAN 0,1%	54%
0,1 - 0,3%	10%
0,3% - 1%	21%
OVER 1%	15%

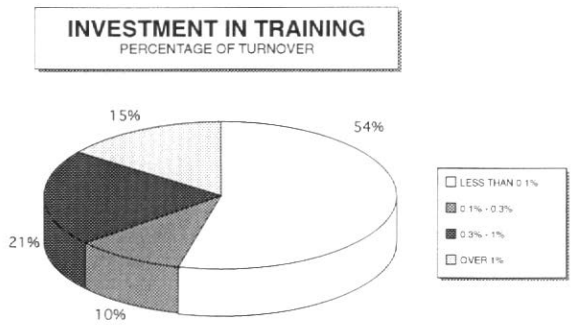


FIGURE 25

ROTATION IN WORK STATIONS	
YES	28%
NO	72%

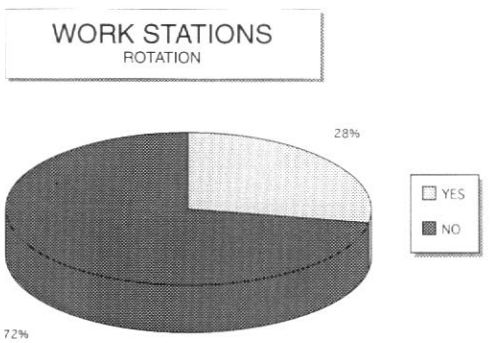


FIGURE 26

INTERNAL CUSTOMER-SUPPLIER CULTURE	
YES	70%
NO	30%

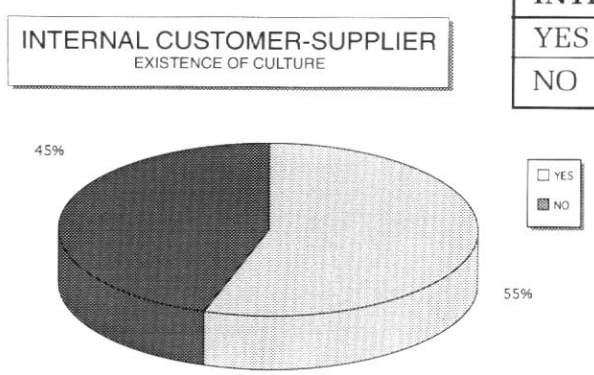


FIGURE 27

STAFF SATISFACTION SURVEYS	
YES	16%
NO	84%

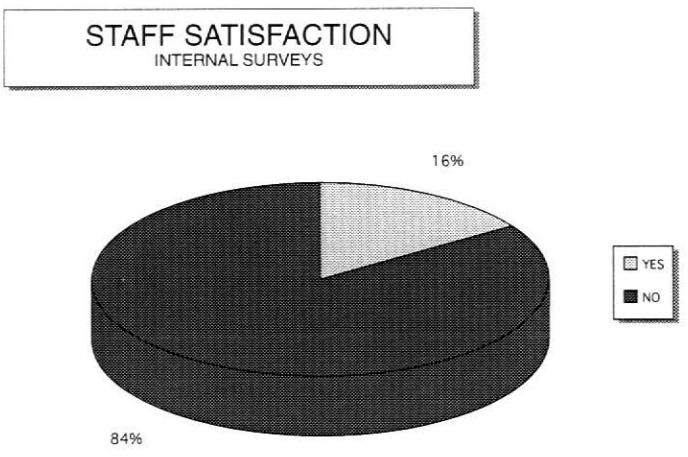
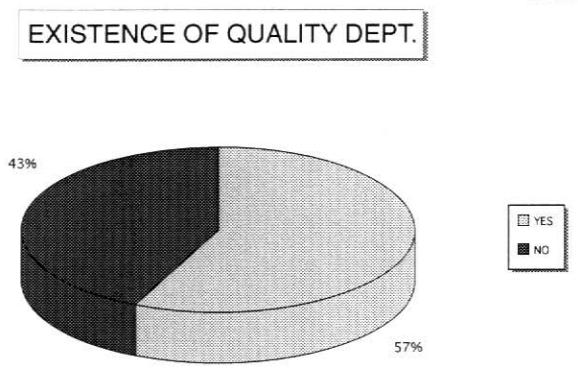


FIGURE 28



EXISTENCE OF QUALITY DEPARTMENT	
YES	57%
NO	43%

FIGURE 29

EXISTENCE OF QUALITY HEAD OR MANAGER	
YES	80%
NO	20%

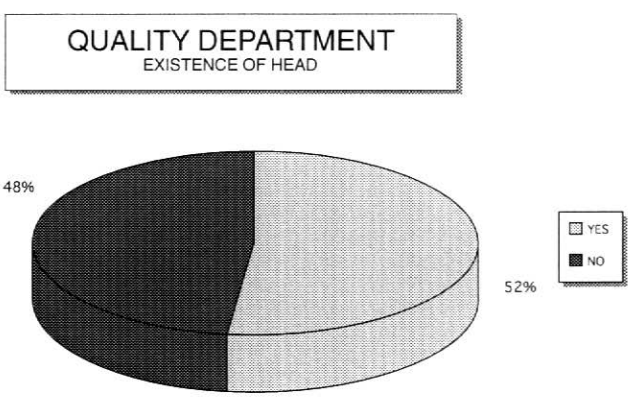


FIGURE 30

QUALIFICATIONS OF HEAD OF QUALITY	
CHEMISTRY DEGREE	48%
TECHNICAL ENGINEER	20%
SECONDARY EDUCATION	13%
PROFESSIONAL TRAINING	8%
INDUSTRIAL ENGINEER	5%
OTHERS	6%

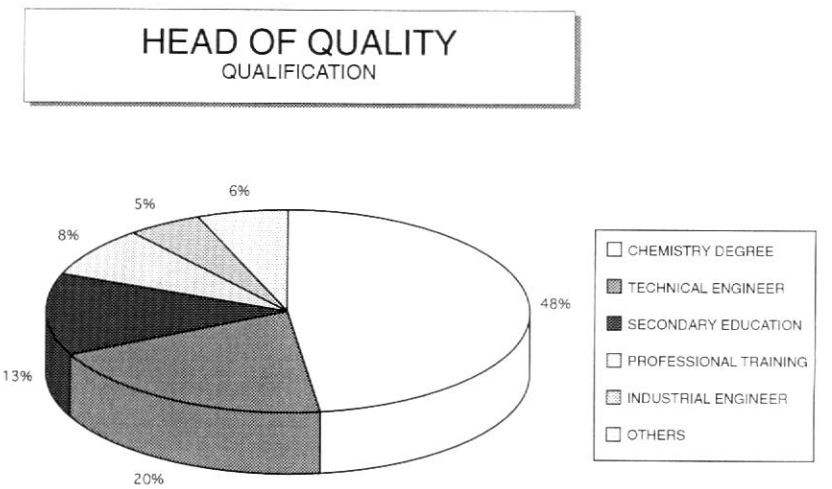


FIGURE 30 B

QUALIFICATIONS OF QUALITY STAFF	
UNIVERSITY OR ENGINEERING DEGREE	35%
MEDIUM-LEVEL TECHNICAL QUALIFICATIONS	23%
PROFESSIONAL TRAINING DIPLOMAS	17%
SECONDARY EDUCATION	14%
PRIMARY EDUCATION	11%

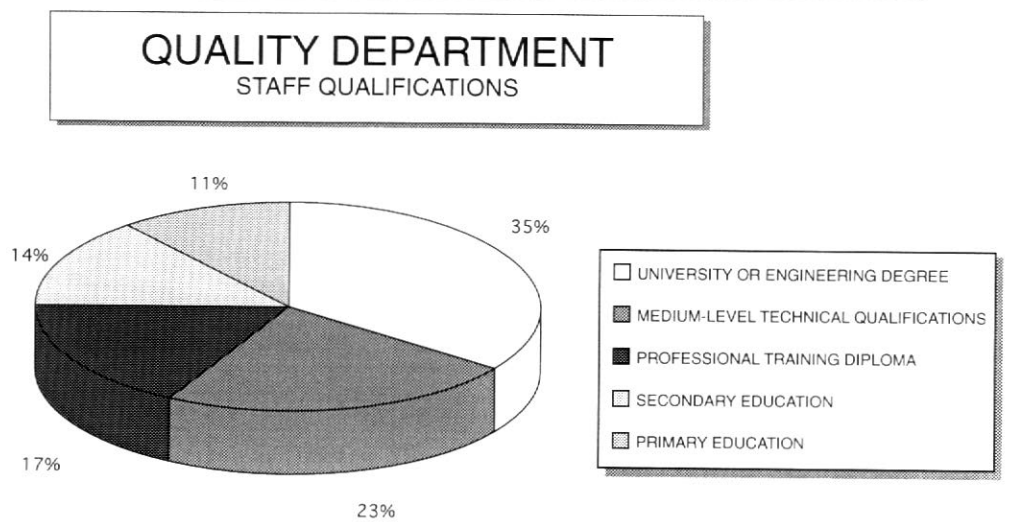


FIGURE 31

MEMBERS OF QUALITY STAFF	
TWO OR LESS	36%
TWO TO FOUR	36%
FOUR TO SIX	17%
SIX TO TEN	7%
TEN OR MORE	4%

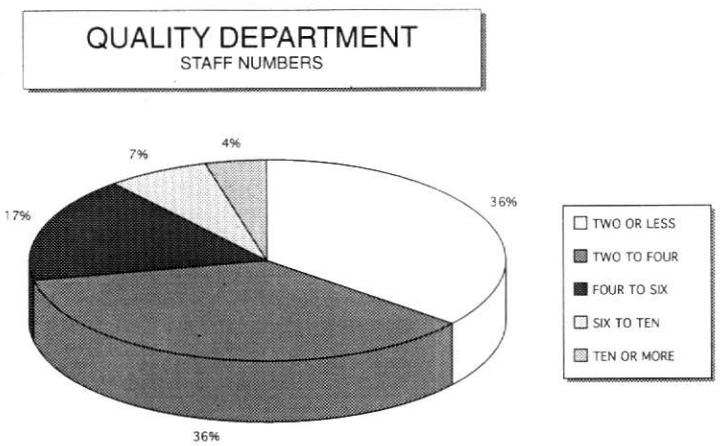


FIGURE 32

EVOLUTION OF NUMBER OF PERSONS IN QUALITY	
INCREASE	51%
DECREASE	4%
SAME	45%

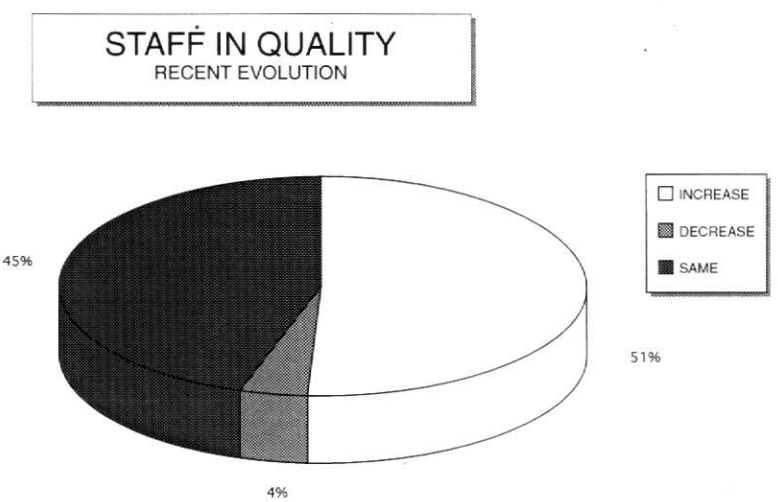


FIGURE 33

MEMBERSHIP OF QUALITY ASSOCIATIONS	
NONE	62%
AECC	14%
OTHERS	34%

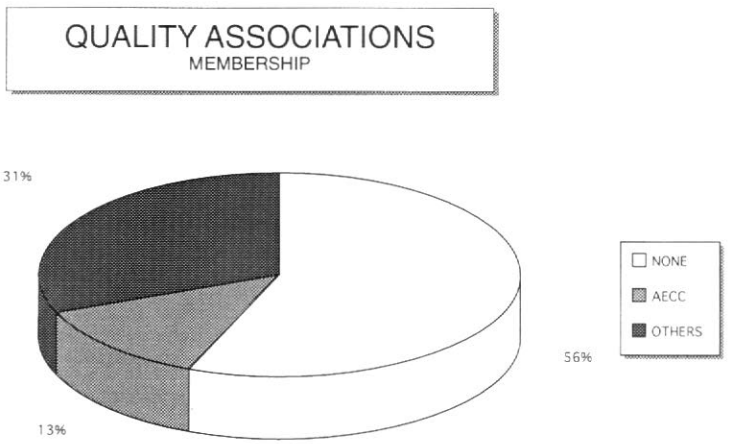


FIGURE 34

JOURNALS RECEIVED	
TÉCNICA CERÁMICA	71%
CERÁMICA INFORMACIÓN	61%
AZULEJO	35%
ATC-INFORMA	6%
TILE & BRICK	6%
ARTE Y CERÁMICA	5%
BOL. SOC. ESP. CER. VIDRIO	3%
OTHERS (UP TO 33)	2%