ASSESSMENT OF NON-QUALITY COSTS IN THE SPANISH TILE INDUSTRY

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SUMMARY:

Over the last few years a great deal has been heard about the concept of Non-Quality Costs, but very little about this in respect of the Ceramic Industry.

What is more, over recent years there has also been a veritable «boom» in the production and marketing of Spanish floor and wall tiles, which we could well extend to the whole Spanish ceramic industry. Amongst other factors, this boom has a lot to do with the implementation of the concept of Quality in tile manufacturing firms, with the training in Quality tools that has been given and the raised general awareness of Quality that has spread amongst the professionals working in these enterprises.

In spite of all this, the concept of Non-Quality Costs has still not been fully introduced in company management and this could be a consequence of the relative difficulty involved in the accounting process needed for this, of the confusing nature of certain standard terms used in the traditional classification of Non-Quality Costs and also of the lack of training in a tool that could be a decisive mainstay for definitively launching Spanish ceramic companies as world leaders.

The assessment of Non-Quality Costs is doubtlessly a hard task and something that can be particularly troublesome if one goes by the canons laid down in certain manuals attempting to standardize methods and modes of conduct, which in some cases do not tie in with the dynamics of Spain's floor and wall tile firms. One has to be constantly aware of the characteristics of these firms, their culture, form of management, size, structure, dynamism, and so on. Calculations like the ones we are now concerned with can only be undertaken from a particular, individual standpoint.

In this work, the first of its kind on a world-wide level in a ceramic sector, the data for Non-Quality costs are given for a fully representative group of companies from the Spanish floor and wall tile industry. An analysis was made of the Non-Quality Costs of a group of companies representing around 20% of the production of the floor and/or wall tile manufacturing firms in the Castellón region; all these were of different sizes as regards their production and staff capacity and had different organization structures in their Quality Departments.

The study reports Non-Quality Costs in terms of their different manifestations (Internal Complaints, External Complaints, Assessment and Prevention) their influence on Total Costs, their relative weight and their comparison with standard companies in the industrial sector mentioned in the references.

There is a detailed analysis of each of the categories of Non-Quality Costs (Internal Complaints, External Complaints, Assessment and Prevention) with a breakdown of the costs involved into over seven subcategories in each case, in order to be able to evaluate the main items which affect these sections.

The study gives a number of results which enable the present situation of floor and wall tile companies with regard to Non-Quality Costs to be clearly pinpointed, as well as entailing a diagnosis of the items subject to improvement within the growing dynamics of Total Quality Management.

The results also show that Non-Quality Costs in the tile industry make up around 20% of the sales, with the consequent possibility for improving cost-effective management and increasing competitiveness. They also reveal the great variability of results from one company to the next, showing the industry to be rather inconsistent as a whole in this field.

The work also presents a specific proposal for this industrial branch, for an accounting classification of Non-Quality Costs, after making a detailed analysis of the degree of particularity involved in the points suggested in ASQC standards.

The work includes figures and tables and can be seen as an open file, in a constant state of expansion, for following up the development over time of this parameter, as well as being an essential element for comparatively appraising each company's situation.

INTRODUCTION:

On many, perhaps too many occasions, Quality and Costs have been set against each other, when not considered to be downright antagonistic. As time has gone by, with the gradual introduction of the concepts of Quality, especially Total Quality, a change has come about in this former state of affairs. To efficiently implement improvements nowadays, company managers here will have to make sure that their whole organizations have introduced an awareness of the fact that *Quality and Costs are complementary and not opposing aims* amongst their operating principles.

Good Quality leads to greater Productivity and to lower Quality Costs, thus increasing Competitiveness and possible market penetration and bringing about higher sales. This circle may well have been one of the most widely quoted elements of Quality literature in the last ten years.

The assessment of Quality Costs (also known as Bad Quality Costs) does not only mean reflecting these items in "accounts", producing new entries in old accounting systems - the challenge to "managing" Quality Costs goes beyond this:

1.- *First of all, it provides a tool to follow up the quality programmes under way and improvements that are being achieved.*
2.- *The assessment of Quality Costs is an indicator of "where" the strong and weak points lie and of what progress is being made.*
3.- *These are a "monetary" indicator, and for this reason extremely sensitive and spectacular evidence of the profits or losses meant by any activity.*
4.- *They can be considered a criterion when looking into problems, classifying activities, etc.*

The concept of Quality Costs is neither as new as it might seem, nor so old it can be ignored. The classic work by A.V. Feighenbaum "Control of Total Quality (McGraw Hill)" 1961, is amongst the first texts to use the concept, and by the late sixties the American Society for Quality Control had already published works on Cost Principles, How to appraise these, Classification, etc.. But it was not until the eighties that literature on Quality Costs became widespread, as well as popular, with classifications, differentiations, appraisal criteria, specific and diverse applications and so on. Both the literature and articles in specialized journals as well as its presence at Congresses made Quality Costs another of the concepts deeply involved in the eighties' Quality boom which, dragging in the wake of the Japan phenomenon, gradually spread all over the world.

In Spain it was in the late eighties and early nineties that publications with domestic applications started to appear, though it can be said that nowadays this is still a concept lacking application or implementation in most companies. Except for a few praiseworthy exceptions, the Management of Bad Quality Costs has still not gained a firm foothold in Spanish businesses, and even less so if we are talking about small- and medium-sized firms.

With the great boom found in certain industrial branches such as that of floor and wall tile manufacture, with growing penetration in international markets, there seem to be ideal circumstances for introducing "Bad Quality Cost Management" as an important element for increasing competitiveness by means of improving quality and cutting costs. This is precisely what it is all about - not a passing craze springing up in the exhilaration of the Japanese boom, but a highly valuable instrument to be used in heading towards greater competitiveness by improving quality and lowering costs. This is a means and not an end,

a technique to be used, knowledge which when applied in the right direction contributes to improving Quality Management, lowering costs and improving company yield.

As in any other discipline, for business is only another of these, there are innovations or developments of new techniques of proven efficiency that are not assimilated or used by the users or protagonists of this discipline, producing an effect seen time and time again: those in favour on one side and on the other those who disdain, play down or openly contest these innovations. Time, the definitive judge, will show who is right and who is wrong. The case we are now concerned with, through the way Spain and our branch in particular is lagging behind as compared with other companies and sectors, can already make use of the judgement made by time. There are too many, too effective experiences to jump on the wrong bandwagon with those who disdain, play down or openly fight "Bad Quality Cost Management".

2.-EXPERIMENTAL PROCEDURE:

2.1.-Population: An assessment was made of the Non-Quality Costs of a group of firms from the floor and wall tile industry representing roughly 15% of the tile producers in the Castellón region and 20% of their production as a whole.

A study like this one can only be valid if the number of firms, their size, the technology involved, organizational culture etc., is really representative of the Sector. To put this in other words, the results will only be heading in the right direction if any company (the majority) "feels" that its own data have been included in the study and considers the results to be a mirror in which it can see itself.

The Non-Quality Costs of companies producing floor tiles, firms making wall tiles and companies making both of these items were evaluated. The companies have different production lines and kilns (one, two, three, four and six) different production capacities (from 4000 to 25000 square metres daily production), different Quality Department structures (with no structure, with a structure, with a structure and Quality system).

2.2.-Calculation bases: One of the main problems involved when assessing Non-Quality Costs is that of the calculation base, and even more so if a study intends to make a consistent treatment of data from a diverse population in making its own indicators.

The *"100-total"* calculation base can be taken (seen for example in the possibility of working 24 hours a day in spite of work really being done in eight, sixteen or twenty-four hours) or one can take the *"100-partial"*, which means taking the theoretical or objective reality as being 100 (real time present in one, two or three shifts). The most accurate calculations would be the ones taking the first calculation base, but given the habit of talking about the data "really" used, the *"100-partial"* will be taken as the commonly accepted calculation base.

Nevertheless, for other factors, the *"0 time"* calculation base will be used as a target to be achieved (for example the time for changing a die or model, etc.). In this case too we could use a "standard time" as calculation base, based on average data, experience, machinery suppliers' instructions etc, but the scatter of such values would mean a problem. This form of calculating, based on "standard times" would only be advisable for calculations restricted to one sole factory for making a study of evolution over time.

The *"0 quantity"* calculation base is also used for the materials (for example glaze or spray-dried powder waste, production losses, etc.) for the same reason given above.

For the case of "quality" the *"100"* calculation base is used, since the top quality target is 100% and the differential is a very real and specific Non-Quality cost.

As stated above, internal objectives could be used for a "calculation base", but this is effective basically in the study of one sole company. In this study, such a possibility is considered for the future but for the time being we can only introduce the first and more general value in order to obtain a general and consistent point of view of the advantages of analysing Non-Quality Costs, as well as that of the situation of the Spanish floor and wall tile industry.

2.3.-Scatter in values: A study like this must consider the scattering of values, given the diverse nature of the companies, as regards their production volume, internal structure, implemented quality system, culture etc..

The study found that there were differences which were important in some cases and of little or no importance in others. Taking into account the relatively short statistical series (23 cases), a complete statistical study was not made but the ranges of some values are given, as well as the average data, in order to provide an idea of the scatter in values. Given that the study is of the "open" type, the possibility of reaching 40 values is being considered, proceeding with this information to a representative statistical study.

It is also important to bear in mind the **aim** of the study in order to understand certain licences. From a general standpoint we feel that an initial position must be obtained first of all, to be able to compare data, make comparative studies between companies, enter value assignation etc., in order to *go deeper* into the particular details of each company later on. In this case, due to the relatively short series, (23 data units) - even though this is fully representative of the sector as can easily be calculated - general conclusions will be drawn.

2.4.-The Data: For compiling the data, one of the assessment lists published for evaluating and classifying Non-Quality Costs could have been used. In this work the one put forward by the ASQC (American Society for Quality Control) was used, though this was adapted to the production and organization of Spanish floor and wall tile manufacturing companies.

The adaptation was needed for several reasons:

-The terminology used for certain concepts
-The lack of identification of other concepts
-The lack of documentation in other cases
-Similarity (confusion) of certain terms
-Particular culture in the use of words, data, registers, etc..

3.-RESULTS:

Figures 1,2,3,4 and 5 give the data for the companies included in the study (Type of Products, Sizing and Structure of the Quality Department). The structure of the Quality Department is of great importance as this is the main driving force for getting systems under way for the assessment of Non-Quality Costs. In other cases the department involved is Accounts, but using its own systems. Only when both Departments work together can there

be proper accounting of Non-Quality Costs. As all companies have accounts departments, it is the Quality Department that will make the biggest contribution to getting assessment under way.

Tables 1,2,3 and 4 give the data evaluated, as well as the level of detail of the entries at the companies studied (Average data). It will be seen that some of the data required by the ASQC's check list do not tend to be used in the traditional form of analytical cost accounting. In other cases the difference is basically to do with terminology and for this reason the aforementioned adaptation was used in said tables in order to obtain consistent and comparable data. This list is thus a *Specific Proposal for the Assessment of Non-Quality Costs in the Ceramic Industry.*

Figures 6 and 7 show the results for the distribution of the Total Non-Quality costs and the same distribution for an ideal industrial firm (References). It can be seen that the highest values are those of *Internal Complaints.* Figures 8 and 9 give the influence of Non-Quality Costs and their distribution within Total Costs. This provides the most accurate view possible of the influence of Non-Quality Costs: their internal distribution and the total influence of each section on the total for Non-Quality costs and on the Total for Costs. *Internal complaints make up 72% of Non-Quality Costs and 16% of Total Costs. Non-Quality Costs are around 22% of Total Costs.*

Figures 10,11,12 and 13 give greater details of the distribution of Non-Quality Costs for each of the sections or categories. The concept or value of "any others" is used to cover all other values not identified, though it can be seen that their influence is relatively low (15%). The degree of detail in the data contributed for Cost distribution can therefore be said to be relatively high, with consequently high suitability of the assessment list. It is also possible to identify the total influence of each of the four large divisions and of the factors of each of these, and thus to proceed to draw up plans for their improvement and continuous reduction, which is the real purpose of the study of Non-Quality Costs, as the assessment of these items is a prior step and means for achieving continuous improvement.

Table 5 shows the average and boundary values found for some of the most commonly appraised values in tile production, for the case of stoneware and porous single-fired tile manufacture. These values are presented in greater detail, unlike others, keeping in mind the greater importance of the concept of *Internal Complaints* and in order to give an idea of the descending study methodology used for analysing the factors of influence in the presence of Non-Quality Costs and to be able to assign specific plans. The structure of Quality Departments is also shown.

Tables 6 and 7 give the % data of Non-Quality Costs (with their distribution) for the group of companies studied as well as a *best/worst* classification. The economic effects of each item and the total are also given (by means of a standard company with a turnover of 3000.000.000 pesetas, lying within the range of results obtained in the study), to appreciate the volume of money we are working with, and the vast room for improvement, which is even greater if we observe that the savings go directly to the profits item in the operating account. There can be no doubt that talking in terms of pesetas is the most direct way of understanding the repercussions of Non-Quality Costs and the need to get plans under way to assess and reduce these *immediately*, as a means for cutting Costs and increasing Competitiveness.

4.-CONCLUSIONS:

The data obtained allow several conclusions to be drawn. The first of all these, after observing the values, is about how representative the sample taken for study was. Bearing in mind the number of companies in the area, their size and the type of products made, we can state with no doubt whatsoever that there was a more than appreciable degree of representativeness of the population. The scatter found in certain values merely indicates the firms' different level of development as regards analytical accounting, the structure of the Quality Department and the level of implementation of Quality Systems. We can conclude that the floor and wall tile industry is at present in an initiation stage as regards Quality Systems and raising the awareness of Non-Quality Costs.

As for absolute values, we have found that Non-Quality Costs make up 22% of Total Costs, higher than the example taken from the literature for standard industrial companies (15%), but in harmony with the Non-Quality Costs that are being published. The most significant category in the distribution of these costs is Internal Complaints (Internal Bad Quality) which reaches 15.8%, that is, 70% of the Non-Quality Costs, whilst External Complaints only represent a partial 1.2%, that is 5% of the Total. This aspect is the one where the greatest difference is seen in respect of other industrial sectors.

Prevention Costs are very low (0.9%) as well as those for intermediary assessment (4.1%). On this point we could say that the Sector is in a situation where Costs (Investments) in Prevention are required in order to reduce Internal Complaints.

Within these Internal Complaints, the determining factors are Returns and Scrap, along with impaired Quality and Down time, (60% between the three of these), which make up 40% of the total for Non-Quality Costs and are thus the ones to which most attention should be given, without forgetting other factors that traditionally go unnoticed: down time, reworking, repairs, etc.

It can also be concluded that investments in Quality are relatively low, though in this item one must stress the differences between the various firms, which also match the ones with best results in Non-Quality Costs. The firms that invest most in Assessment and Prevention and have a Quality structure (differentiated from Quality Control) are the ones with the best balance between the different Non-Quality Cost categories.

Lastly, we should underline that the possibilities for improvement in the Ceramic Floor and Wall Tile Industry are vast, as a result of a number of factors: a certain technical-technological stability, expertise in processes and behaviour of the raw materials, a good degree of cohesion between customers and suppliers, an appreciable level of training, an expansive stage in the introduction of quality culture, (Quality Systems, Total Quality etc.). All this should lead to greater in-depth study, analysis and action on Non-Quality Costs, which require ridiculously small investments, and which can entail spectacular progress in our companies' competitiveness, keeping in mind their direct impact on Costs and enhanced Quality.

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We consider it important to express our gratefulness to all the people and companies that have cooperated in this study in the past and are still assisting us now, without whose contributions this would have been totally impossible. It is satisfying to say that in return, at least, there is a body of data available which may enable determination of the starting point for finding out the present situation, as well as for future comparisons, and perhaps be an incentive to start along the road of assessment and correction of Non-Quality Costs.

FIGURE 1

PRODUCT DISTRIBUTION	
FLOOR TILE	15%
WALL TILE	5%
FLOOR+WALL TILE	80%

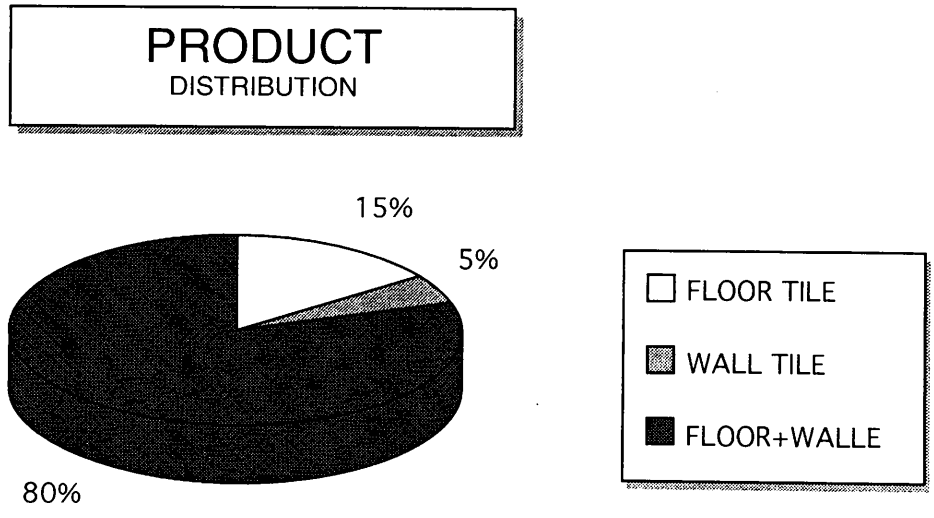


FIGURE 2

PRODUCTION RANGE	
A < 6000 M2	5%
´6000 < B < 15000	70%
´15000 < C < 20000	15%
D > 20000	10%

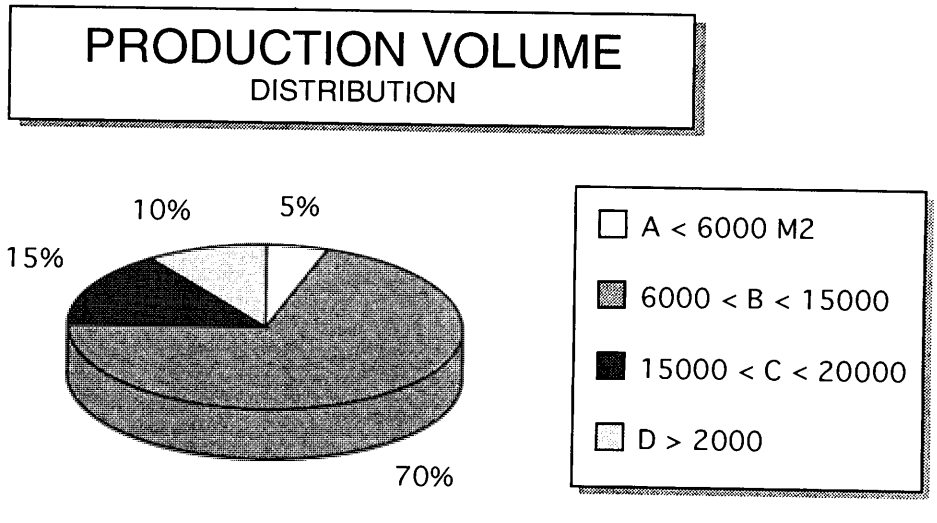


FIGURE 3

QUALITY DEPT. STRUCTURE	
A (NO Q. DEPT.)	10%
B (WITH Q. DEPT.)	80%
C (WITH SYSTEM)	10%

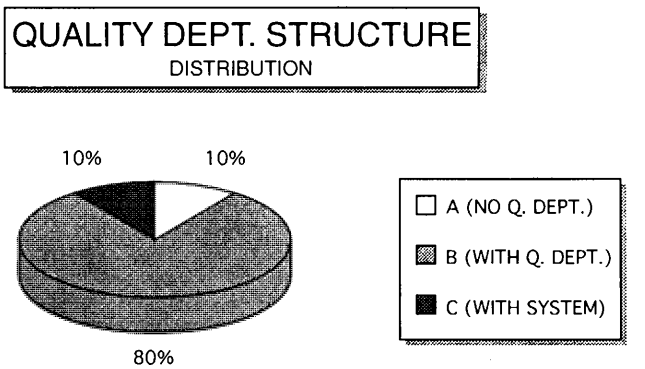
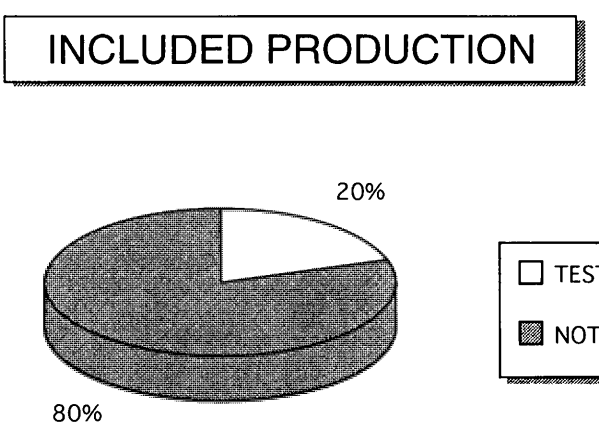


FIGURE 4



PERCENTAGE OF PRODUCTION SECTOR TESTED	
TESTED	20%
NOT TESTED	80%

FIGURE 5

PERCENTAGE OF FIRMS	
TESTED	15%
NOT TESTED	85%

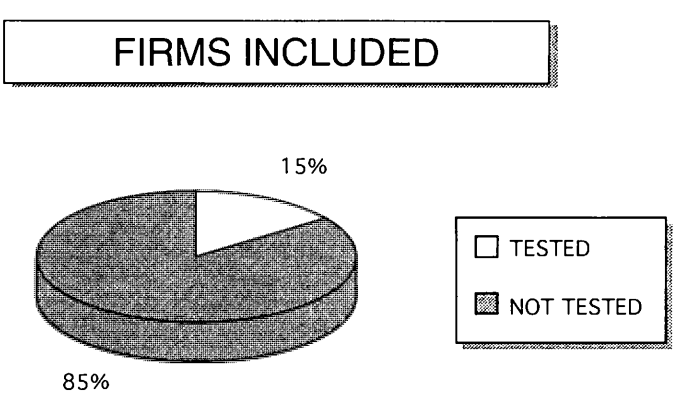


TABLE 1

EXTERNAL NON-QUALITY COSTS LEVEL OF DETAIL OF ENTRIES	
STUDY OF COMPLAINTS	1*
RETURNS	4
DEPRECIATION/COMPLAINTS	2
OTHER RETURNS COSTS	1
REPAIRS	2
INDEMNITIES	3
SANCTIONS	-
COMPENSATION	1
SALES LOSSES	-
SUNDRY	-

*1 AND 2 : ESTIMATED AND ADJUSTED
3 AND 4 : DIRECT ASSIGNATION

TABLE 2

INTERNAL NON-QUALITY COSTS		
DESIGN		2
	REDESIGN	1
	REWORKING THROUGH DESIGN	3
	RETURNS THROUGH DESIGN	1
PURCHASES		2
	ADMIN. OF NON-CONFORMITIES	1
	COST OF REPLACEMENTS «	2
	ADMIN. OF SUPPLIERS	1
	MATERIALS LOSSES	2
PROCESSES		2
	ADMIN. OF NON-CONFORMITIES	1
	STUDIES OF CORRECTIONS	2
	BACK-UP (LAB., QUALITY, ...)	2
	CORRECTIVE ACTION	2
	REWORKING	1
	REPAIRS	2
	TESTS ON REPETITIONS	1
	ADJUSTMENTS & EXTRA WORK	1
	RETURNS AND SCRAP	4
	IMPAIRED FINAL QUALITY	4
	MANPOWER	3

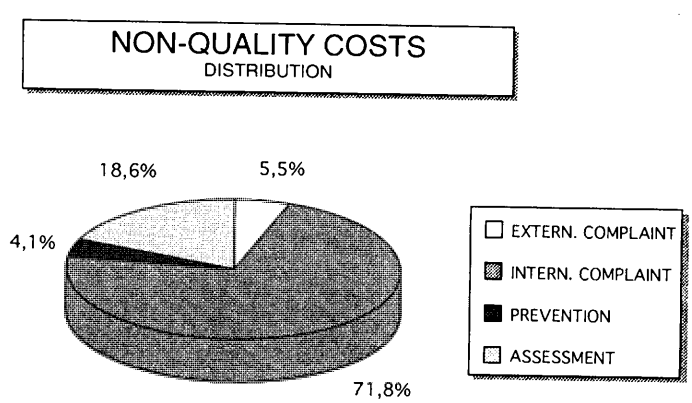
TABLE 3

PREVENTION COSTS		
MARKETING/CUSTOMERS		2
	MARKETING STUDIES	2
	SURVEYS AND CONSULTING	1
	CONTRACTS & DOCUM. REVIEW	1
PRODUCT DEVELOPMENT		3
	REVIEWS OF DESIGN	1
	DESIGN SUPPORTING WORK	2
	PRODUCT TESTING	3
	SEMI-INDUSTRIAL TRIALS	3
	TESTS OF PRODUCT IN USE	3
PURCHASES		1
	REVIEW OF SUPPLIERS	1
	SUPPLIER CLASSIFIC. & CONTROL	1
	REVIEW OF TECHNICAL DATA	1
PROCESS QUALITY PLANNING		2
	CAPACITY STUDIES	1
	Q. SYSTEM OPERATIONS	2
	CALIBRATION	1
	Q. PLANNING OPERATIONS	3
	TRAINING & EDUCATION	3
QUALITY MANAGEMENT		2
	DEPARTMENT SALARIES	3
	ADMINISTRATIVE COSTS	2
	SYSTEM MAINTENANCE	3
	COST OF REPORTS	2
	QUALITY TRAINING	3
	COSTS OF QUAL. PLANS	1
	COST OF INTERNAL AUDITS	1

TABLE 4

ASSESSMENT COSTS	
PURCHASES	2
PRODUCT TESTING	3
EQUIPMENT CONTROL	1
SUPPLIER ENDORSEMENT	1
CONTROL AT SOURCE	1
PROCESS	2
DAILY INSP., TEST, AUDIT.	3
AUTO-CONTROL INSPECTIONS	1
PRODUCT AUDITS	3
MATERIALS CONTROL	1
LOSSES AND SCRAP CONTROL	1
SPECIAL TESTS	1
USE OF LABORATORY	3
INSPECTIONS ON EQUIPMENT	1
REPAYMENTS OF LAB. EQUIP.	4
MATERIALS LOSSES	2
CALIBRATION LABOUR	1
EXTERNAL CERTIFICATES	4
EXTERNAL ASSESSMENTS	2
ON-LINE ASSESSMENT	1
PRODUCT TESTING	3
DOCUMENTS, FILING AND REVIEWS	1
OTHER SECTIONS CONNECTED W. ASSESS.	1

FIGURE 6



NON-QUALITY COSTS DISTRIBUTION	
EXTERN. COMPLAINT	5.5%
INTERN. COMPLAINT	71.8%
PREVENTION	4.1%
ASSESSMENT	18.6%

FIGURE 7

NON-QUALITY COSTS DISTRIBUTION	
EXTERN. COMPLAINT	5.5%
INTERN. COMPLAINT	71.8%
PREVENTION	4.1%
ASSESSMENT	18.6%

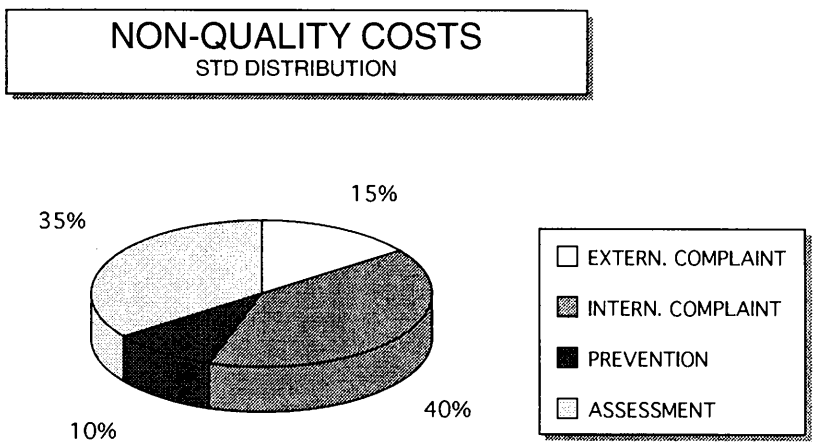
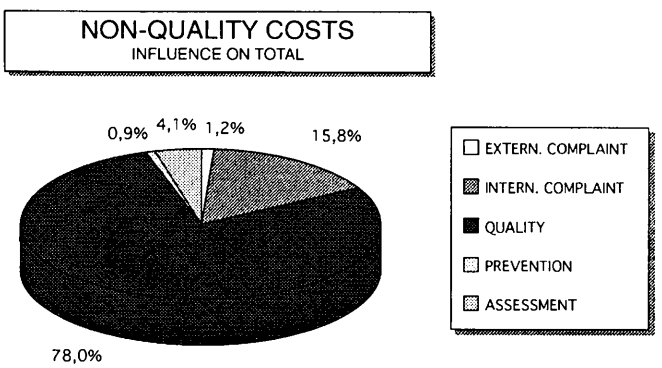


FIGURE 8



NON-QUALITY COSTS INFLUENCE ON TOTAL	
EXTERN. COMPLAINT	1.2%
INTERN. COMPLAINT	15.8%
QUALITY	78.0%
PREVENTION	0.9%
ASSESSMENT	4.1%

FIGURE 9

STD. INDUSTRIAL FIRM NON-QUALITY COSTS TOTAL INFLUENCE	
EXTERN. COMPLAINT	2%
INTERN. COMPLAINT	7%
QUALITY	85%
PREVENTION	1.5%
ASSESSMENT	4%

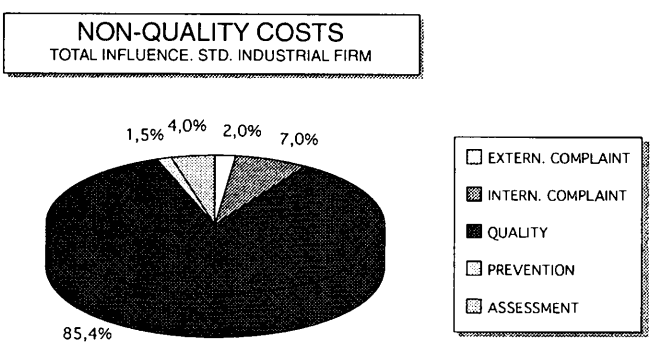


FIGURE 10

INTERNAL COMPLAINTS DISTRIBUTION	
RETURNS & SCRAP	23%
IMPAIRED QUALITY	20%
DOWN TIME	16%
REWORKING	10%
CONTROL & STUDY	5%
REPAIRS	7%
ADMIN.	5%
SUNDRY	14%

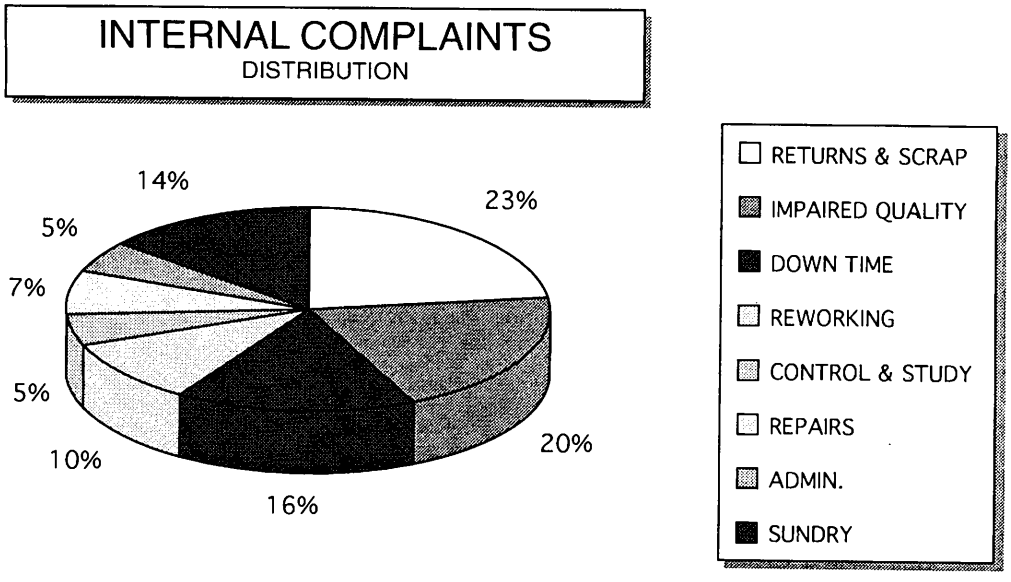
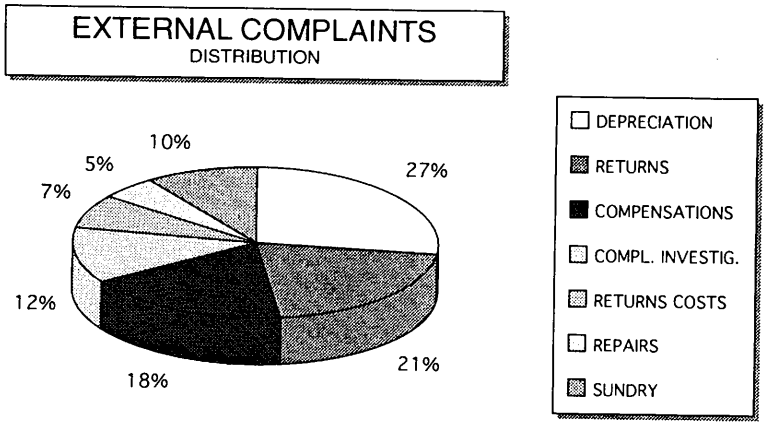
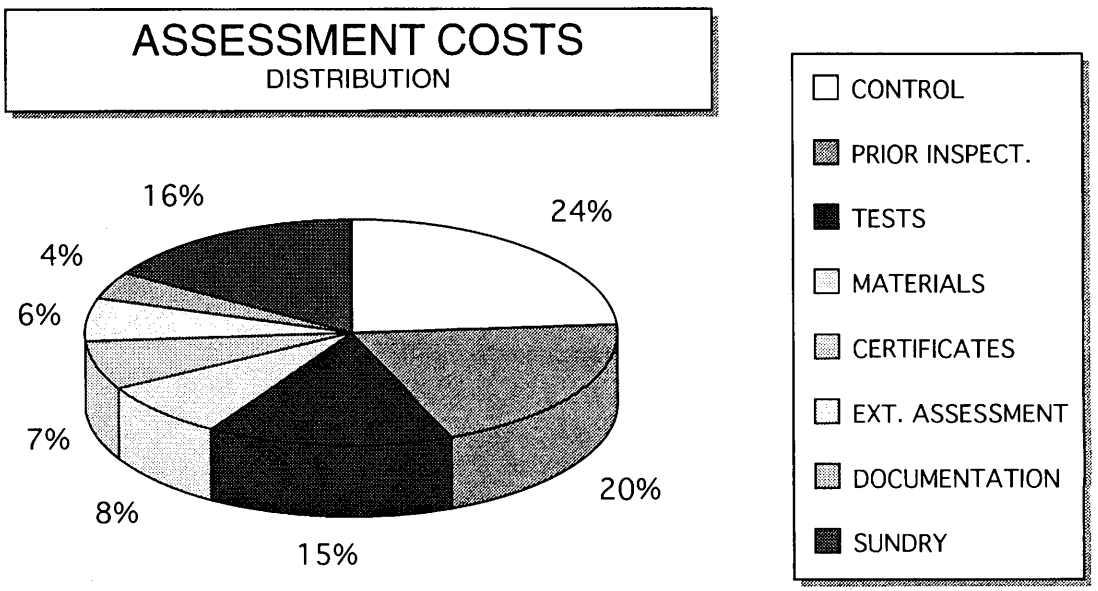


FIGURE 11



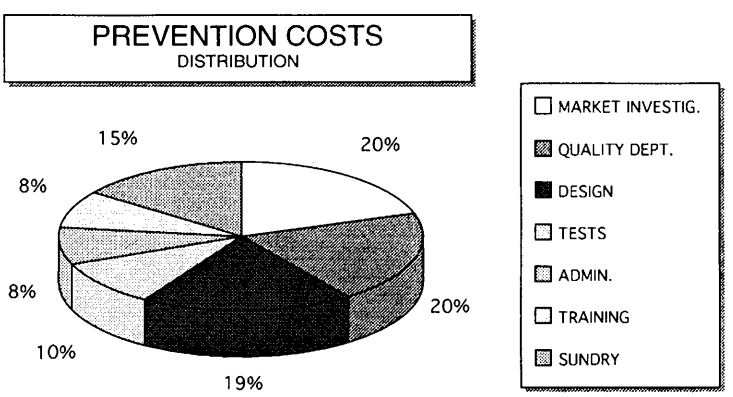
EXTERNAL COMPLAINTS DISTRIBUTION	
DEPRECIATION	27%
RETURNS	21%
COMPENSATIONS	18%
COMPL. INVESTIG.	12%
RETURNS COSTS	7%
REPAIRS	5%
SUNDRY	10%

FIGURE 12



ASSESSMENT COSTS DISTRIBUTION	
CONTROL	24%
PRIOR INSPECT.	20%
TESTS	15%
MATERIALS	8%
CERTIFICATES	7%
EXT. ASSESSMENT	6%
DOCUMENTATION	4%
SUNDRY	16%

FIGURE 13



PREVENTION COSTS DISTRIBUTION	
MARKET INVESTIG.	20%
QUALITY DEPT.	20%
DESIGN	19%
TESTS	10%
ADMIN.	8%
TRAINING	8%
SUNDRY	15%

TABLE 5

ITEMS	STONEWARE TILE			WALL TILE		
	MAX.	AVGE.	MIN	MAX.	AVGE.	MIN
RETURNS & SCRAP	10.1	7.2	4.8	11.3	8.5	7.6
QUALITY						
FIRST	92	89	84	91	86	82
SECOND	3	4	4	3	5	6
THIRD	3	6	12	6	9	12
% TIME EFF. LINE	85	78	71	83	74	70
STOP DIE	12	7	5	12	9	7
STOP LINE	43	34	30	38	33	30
STOP MODEL	48	40	34	49	45	47
MISC. STOP	7	19	31	1	11	18
% TIME EFF. LINE	85	78	71	83	74	70
PLANNED STOP	41	35	30	39	42	46
UNPLANNED STOP	59	65	70	61	58	54
% TIME EFF. LINE	85	78	71	83	74	70
STOPS>10 MIN	56	42	32	57	39	30
STOPS<5 MIN	44	58	68	43	61	70
% TIME EFF. KILN	98	96	93	98	94	91
PLANNED STOP	80	76	72	83	79	75
UNPLANNED STOP	20	24	28	17	21	25
% TIME EFF. KILN	98	96	93	98	94	91
STOPS>10 MIN	17	12	10	20	17	12
STOPS <5 MIN	83	88	90	80	83	88
% TIME EFF. SORT.	91	83	80	90	78	65
PLANNED STOP	51	37	31	43	29	25
UNPLANNED STOP	49	63	69	57	71	75
% TIME EFF. SORT.	91	83	80	90	78	65
STOPS>10 MIN	32	19	15	31	27	24
STOPS<5 MIN	68	81	85	69	63	76
% DEVIATION CONSUMPTION						
CLAY	11	8	5	9	6	4
GLAZE	15	13	8	9	8	5
SCREEN PRINT MAT	19	18	15	13	12	9
GAS	4	3	2	4	3	2
ELEC. & LIGHTING	10	7	5	10	6	5
BOXES	4	4	4	5	5	5
PALLETS	3	3	3	3	3	3
PACKAGING	3	3	3	2	2	2
MANP.(REAL/THEO)	18	16	15	18	16	15

TABLE 6

% NON-QUALITY COSTS ON INDUSTRIAL COST	CLASSIFICATION FIRMS		
	3 BEST	3 WORST	AVGE.
FAILURE	11%	20%	17%
PREVENTION	3.1%	0.7%	0.9%
ASSESSMENT	3.9%	4.3%	4.1%
TOTAL	18%	25%	22%

TABLE 7

MILLION PTA. (AVGE. DATA) TURNOVER 3000 MILL. PTA.	NON-QUALITY COST			
	FAILURE	PREVENT.	ASSESS.	TOTAL
3 BEST FIRMS	330	93	117	540
3 WORST FIRMS	600	21	129	750
AVERAGE	510	27	123	660