Pareto Analysis on the Total Quality Management (TQM) Status of the Nigerian Design Firms

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Abstract

This research sought to establish the status of the Nigerian Design Firms using European Construction Institute (ECI) Total Quality Management Matrix; and identified major factors responsible for the poor performance of the Nigerian design firms. Data for the study was obtained from a sample of 237 design firms across the country using ECI measurement matrix. Results were computed as outlined by ECI which was used to establish the status of the firms. Pareto Analysis was conducted to identify the vital factors. Result of ECI measurement matrix revealed that the Nigerian Building Design Firms scored an overall average of 27.4 points which placed them in the 4th ECI category – 'the Start of Improvement.' This indicated poor performance. Three quality factors identified using the Pareto Analysis were 'Training, awareness, education and skill' (3.3 ECI score), 'Objective measurement and feedback' (3.4) and 'Natural use of TQ tools and techniques' (3.4). Therefore, firms' programme relating to TQM should be improved beyond partial implementation. In particular, staff training should be provided, firms should create environment for natural use of TQM tools and techniques, while objective measurement and feedback be established.

Keywords: Design Firms, Measurement Matrix, Pareto Analysis, Quality Factors, Total Quality Management.

Introduction

The issue of quality and standard has been the subject of concern in the Nigerian construction industry, especially due to incessant collapse of building structures around the nation (Abiodun & Afangadem, 2007). 'Cheapest cost first' attitude in design and construction were identified by Kolawole (1998) as categories of factors militating against the achievement of quality in construction. Thus, design organisations play a major role in the construction industry. Bubshait *et al.* (1999) stated that design organisations "are the media that transfer the requirements of the client to the contractor and ensure that they are met". Furthermore, "they need to provide a high quality of service to ensure that their client's project achieves the best possible standards of cost, time and quality".

Although there are various standards, professional associations, laws and regulatory bodies to enable best practices in Nigerian construction industry, yet shortcomings still persist. Bamisile (2004) observed that in certain instances, unqualified persons prepared both architectural and structural designs. In some cases, working drawings were prepared without drawing number, name of the designer and name of the person that checked the drawings before they are issued for construction. In addition, some of the drawings are uncoordinated, grossly inadequate for construction, specifications are often not issued by the design team – in majority of cases they are left to discretion of quantity surveyors. References are often improperly made to certain standards and codes of practice which are not complied to. Their current status and relevance to a specific project are also hardly checked. In conclusion, Bamisile (2004) remarked that "the design team has not yet adopted any quality culture in their contribution to production of buildings in Nigeria". Therefore the need to adopt an established Quality Management System (QMS) becomes imperative by the Nigerian design organisations.

According to Yasamis *et al.* (2002), QMS is the collection of all processes, tools, techniques and subsystems that run simultaneously with production system (service or manufacturing), and the control of the production system's effectiveness and efficiency. QMS is therefore responsible in ensuring that production conforms to customer requirements, minimization of cost and production of products to standards. The system basically consists of a framework guiding quality related actions and employees requirements and a means of assessing how well these actions are carried out.

Total Quality Management (TQM) otherwise known as Strategic Quality Management (SQM) was identified as an aspect and apex of QMS and it evolved from Quality Assurance (QA) as a result of the change in the concept of QMS (Chan & Tam, 2000; Harris & McCaffer, 2005). Stebbing (1990) opined that 'do it right the first time' is the underlying focus of QA. However, TQM intends to improve both process and its product.

Mack and Joshnsten (2004) revealed that the concept of TQM came from the work and leadership of late Dr. Edwards Deming. Deming's formula for company's business success was based on the relationship between improved quality and improved productivity. Thus its primary focus was to improve production quality of goods and services (Gupta & Arora, 2014). ISO 9001 (2008) required that quality organisation “shall continually improve effectiveness of the quality of management system through the use of the quality policy, quality objectives, and audits results, analysis of data, corrective actions and management review”. Similarly, Kume (1988) outlined the following bases in order to improve quality generally:

1) Understanding or being aware of the points to be improved.
2) Understanding or being aware of the technical possibilities for improvement.
3) Establishing cooperative or organisational structures for improvement.
4) Implementation education and training for improvement.

In the same premise, ISO 9000 (2005) highlighted that the aim of continual improvement of QMS is to increase the probability of enhancing the satisfaction of customers and other interested parties. Aggarwal and Rezaee (1996) asserted that many of the most successful organisations that have become global, more cost effective and efficient, and, more focused on customer satisfaction have implemented the TQM concept. In general, Kolawole (1998), stated that “total quality can be achieved only if every individual including the client and every organisation is working towards the achievement of consistent project oriented objectives”, and that “quality in construction requires appropriate systems..., sound procedures, clear communication and documentation that is accurate and easily understood”. These requirements place responsibilities not only upon the client but also on the main parties involved in construction; designers, manufacturers, builders/contractors and users.

There are various standards, tools and techniques that are used in the implementation of TQM. One of such is Total Quality Management Matrix produced by European Construction Institute (ECI) in 1993. The matrix uses 12 quality factors to measure the degree to which a company was operating under TQM. The research was aimed at establishing the status of the Nigerian Design Firms using the ECI Total Quality Management Matrix; and identifying major factors affecting the poor performance of the Nigerian design firms which, if properly addressed will improve the status of the firms. Pareto Principle which separates 'vital factors' from 'trivial ones' was adopted for the purpose of identifying the vital factors.

Total Quality Management Tools and Techniques

Watson and Howarth (2011) revealed that “a key feature of the Western quality revolution of later part of the twentieth century was the development of a strategic approach to quality management.” The approach was labelled 'Total Quality Management'. Its philosophy revolves around continues improvement. Kume (1988) noted that the cornerstone of continuous improvement programme is the ability of management and employees to control their work processes, to recognise problems, trace their root causes and implement effective remedies. He added that, "attempts to achieve better quality without improving design and process will result in increased cost". Awour and Kinutia (2013) re-echoed that 'Total Quality Management (TQM) is management philosophy which is used by organisations who strive to improve their efficiency and competiveness in the business market place.

In addition, use of right tools and techniques for system implementation is necessary. According to Aggarwal and Rezaee (1996), TQM uses effective management techniques and therefore delivers product on time and within budgetary constraints. Some of the tools and techniques of TQM as outlined by Harris and McCaffer (2005) include:

1) Brainstorming: it encourages creative thinking and helps in generating ideas from small groups of people using their collective thoughts. Its main uses are in generating list of problems; identify their causes, solutions and development of action plans.
2) Matrix analysis: a procedure for short listing or ranking using two-dimensional matrix. Its main use is in obtaining a group consensus against an agreed set of criteria.
3) Paired group comparison: a method of prioritising or ranking of alternatives to achieve a specific goal. It is mainly useful in obtaining group consensus when prioritising possible causes of problems.
4) Ranking and rating: Ranking is a structured process of placing an order of preference on a list of options and rating is scoring each option on the likelihood of achieving change. Both assist in getting best choice, making the choice less emotional and increasing commitment to the chosen option. Ranking and rating are mainly used in deciding which problem to tackle, or which solution to implement.
5) Pareto analysis: A technique that helps separates the major causes of problems from the minor ones.
6) Causes and effect diagrams: Known as Ishikawa or fishbone diagrams. They display potential causes of a problem. They are mainly used in identifying the root causes of a problem and in identifying the nature of the problem.
7) Failure prevention analysis: A technique intended to aid anticipation of problems before they happen and is designed to promote a move-away from reacting to failure to being pro-active in preventing failure. Mainly used in new activities or whenever significant changes to a process are planned.
8) Force field analysis: A technique intended to aid identification of

forces that will either help or obstruct a planned change. It is used in gaining understanding of what is working for or against any proposal and hence very useful in planning to overcome barriers for change.

9) Process flow chart: Diagram of a process using symbols to represent each element and displaying the sequence of events, stages and decisions in a form that is easily communicated and understood by all. It is useful in understanding work process and in improving the work process and eliminating waste.

Besides, another relevant tool for TQM is the matrix produced by ECI in 1993 to measure the degree to which a company was operating under TQM. The 12 quality factors with their corresponding requirements according to Harris and McCaffer (2005) are:

1) Commitment and leadership by top management at location. The ultimate aspiration is for an organisation to be fully committed and actively leading the process of total quality.
2) Organised process and structure for total quality. An organisation should be fully integrated with normal management system.
3) Necessary business performance. A company should be of a high performance; one meeting or exceeding targets.
4) Supplier relationship (internal and external). Active partnering should be taking place with jointly improved team work.
5) Training, awareness, education and skills. All that are involved are provided with essential training,
6) Relationship with internal and external customer. Active partnering is taking place with jointly improved team work.
7) Understanding and satisfaction of employees. The organisational culture should show total commitment and enthusiasm for total quality through employees' commitment as a result of job satisfaction and motivation.
8) Communications. There should be an established communication system fully implemented with feedback.
9) Teamwork for improvement. Action should noticeably be taken on the teams' recommendations and results monitored.
10) Independent certification of quality management system. Quality management system should be fully documented, implemented and certified.
11) Objective measurement and feedback. There should be performance indicators that will serve as standard measurement tool.
12) Natural use of total quality tools and techniques. The use of the total quality management should come naturally to all within the organisation.

Kume (1991) opined that development of quality management in a company should be based on a recognised quality culture and its development process. To aid development of total quality, certain models exist and a company should select the right model which captures the essence of what it is trying to achieve. One of the prominent ones is the 'Deming's 14 points.' In 1988 Deming developed a list of fourteen points that can be used to aid in the development of quality. However, some of the points do not pertain to methods used by the construction industry in its businesses (Macks and Joshnsten, 2004; Watson and Howarth, 2011). But the majority of them can be applied to the context of an overall quality strategy. These quality points are:

1) Create constancy of purpose for improvement of product and service.
2) Adopt the new philosophy of refusing to allow defects.
3) Cease dependence on mass inspection and rely only on statistical control.
4) Require suppliers to provide statistical evidence of quality.
5) Constantly and forever improve production and service.
6) Train all employees.
7) Give all employees the proper tools to do the job.
8) Encourage communication and productivity.
9) Encourage different departments to work together on problem solving.
10) Eliminate posters and slogans that teach specific improvement method.
11) Use statistical methods to continuously improve quality and productivity.
12) Eliminate all barriers to pride in workmanship.
13) Provide ongoing retraining to keep pace with changing products, methods, etc.
14) Clearly define top management's permanent commitment to quality.

Aggarwal and Rezaee (1996) highlighted some of the features and benefits of TQM as follows:

1) TQM concepts strive to meet and exceed the expectation of users.
2) It requires active involvement of senior managers in improving users' satisfaction.
3) Its goal is user satisfaction by developing a system toward 'zero' defect and it advocates that the best approach to minimize defects is to understand user needs.
4) To minimise defects, TQM focuses on the design process.
5) It emphasises the deployment of technology and hence it demands streamlining development process with automation.
6) It emphasises extensive communication between users and developers to create quality product that meets users' requirements.
7) The goal of TQM is to establish feeling of ownership among users and this increases the acceptability of the project and thereby the probability of its success.
8) It requires that needs of personnel

should be examined to improve the quality of their performance.

9) It minimises the problem of staff turnover by improving job satisfaction and shortening project duration.
10) It provides a fundamental shift in the organisational processes of generating and disseminating information.

To successfully promote business efficiency and effectiveness and also to realise the benefits of TQM; it must be companywide. Its principle is based on the state of mind of every individual in an organisation based on his pride in the job (Harris and McCaffer, 2005). For TQM to succeed, certain level of commitment is required from each class of members of an organisation as outlined by Kume (1991) below:

1) TQM must be initiated by top management and must demonstrate that they are serious about quality.
2) Middle management must grasp the principles of TQM and explain them to the people for whom they are responsible, and in addition must communicate their commitment to quality.
3) The middle management should also ensure that the efforts and achievements of their subordinates obtain the recognition and reward they deserve.

Research Methods

Population of the study, Sampling frame and Sample Sizing

Nigerian building design firms were the target population for the study. A list of registered design firms was obtained from Corporate Affairs Commission (CAC, 2010), Abuja in order to calculate sample size of the research. Records showed that 6,990 Architectural and Engineering Consultancy firms registered with the body.

Sample size was calculated using the approaches outlined by Krejcie and Morgan, (1970), Cochran (1977), Bartlett *et al.* (2001), United Nation Development Programme (UNDP) (2004) and Olanruwaju (2010). According to Olanruwaju (2010), sample size of a population can be calculated using the relation in equation 1.

n = ----------------------- (1)

Where,

n = the sample size.

p = the proportion in the sampled population possessing the major attributes. The value of p is normally set between 0.1 and 0.5.

$q = 1.0 - p$ ----------------------- (2)

SE = the standard error of the proportion. This is the confidence interval divided by the value corresponding to a chosen confidence level for 95% confidence level, 1.96 is used in calculating SE value.

Krejcie and Morgan (1970) recommended that researchers should use p = 0.5 as an estimate of the population proportion. This proportion will result in the maximization of variance, which will also produce the maximum sample size. Similarly, Bartlett *et al* (2001) outlined that maximum possible proportion (p = 0.5) and 1 minus maximum possible proportion (q) produces maximum possible sample size. However, in the TNA Report of the United Nation Development Programme (UNDP) (2004) an indication was given that for a large population, p can be taken as 0.1. Based on these facts and for economic reasons, the research work decided to use 0.125 as the value of p. Therefore, from equation 2, q is calculated to be 0.875.

For a confidence level of 95%, SE = 5%/1.96 = 0.026

Therefore, n = = 162.

Cochran (1977) advocates that actual sample size should be adjusted to reflect the size of population. Equation 3 is used for that purpose.

n = ----------------------- (3)

Where n = Adjusted sample size,

no = n = the initial sample size (adjusted sample size in this case),

n =

Therefore, n = 158 samples of design firms.

However, Bartlett *et al* (2001) noted that the value obtained using such procedures results in the minimum returned sample size and that in many educational and social research studies the response rates are typically well below 100%. For this reason, 50% (79 samples) of the adjusted sample size was added according to the recommendation of Salkind (1997) that "If you are mailing out surveys or questionnaires . . . count on increasing your sample size by 40%-50% to account for lost mail and uncooperative subjects". Therefore 237 questionnaires were administered to take care of 'uncooperative subjects'.

Direct administration and use of field assistants were the approaches used in questionnaire administration. Management of firms involved with building design were targeted as respondents.

Data Collection

Data for the research was obtained by adopting and administering the ECI measurement matrix. The matrix is used to measure the degree to which a company is operating under TQM (Harris and McCaffer, 2005). The matrix is accompanied by guide for improvement. ECI was founded in 1990 to build and champion a culture motivated to raising the performance standards of the construction industry across Europe, (http://www.loughboroughengineering.com/prospectus/pg/courses/dept/cv/research/rc)

The matrix contains 12 total quality factors and it uses a measurement scale of zero (0) to five (5) based on which response was made by organisations assessed.

Data Analysis

Establishing ECI Status of Design Firms

ECI status of design firms will be established based on the scores obtained by individual firms in relation to the 12 quality factors. If an organisation scores a maximum of 5 points on all the 12 factors it would achieve a maximum of 60 points. Based on the scores obtained, an organisation can be classified under the following categories of status (Harris and McCaffer, 2005):

Score	Quality Status
55-60	A recognised TQ Company
45-54	A world class operation
33-44	Realisation of improvement needed
25-32	The start of improvement
12-24	Need commitment to overcome resistance
0-11	No appreciation of quality.

For the purpose of this research, overall average scores will be used to establish the status of the Nigerian design firms. Moreover, average scores recorded against each factor will be used to identify the level of performance of the firms in relation to the factors. This will be used for the Pareto Analysis, which will reveal those factors that need to be more focused on by the firms.

Pareto Analysis

According to Harris and McCaffer (2005) Pareto Analysis is a simple technique that helps separates the major causes of problems from the minor ones. It is identified as an effective means of visually representing major causes of a problem. It is useful in helping focusing attention on the really important issues. The history of Pareto Analysis was traced back to early 1990s. Reh (2014) mentioned that “in 1906, Italian economist Vilfredo Pareto created a mathematical formula to describe the unequal distribution of wealth in his country.” This was as a result of his observation that 20% of his people owned 80% of country's wealth. In 1940s Dr. Joseph M. Juran named the 80/20 Rule as Pareto's Principle.

Wikipedia (2014) stated that 'the Pareto principle states that, for many events, roughly 80% of the effects come from 20% of the causes. The principle is also known as Pareto's Law – the law of vital few, and the principle of factor sparsity. It was generally recognised as a very effective management tool. In particular, its principle is identified to have many applications in quality control.

Haughey (2014) outlined eight steps in identifying principal causes (20%) that should be focused in such events that can be governed by Pareto Principle: The steps are as follow:

1) Create a vertical bar chart with causes on the x-axis and count (number of occurrence) on the y-axis.
2) Arrange the bars in descending order of cause importance, that is, the cause with highest count first.
3) Calculate the cumulative count for each cause in descending order.
4) Calculate the cumulative count percentage for each cause in descending order
5) Create a second y-axis with percentages descending in increments of 10 from 100% to 0%.
6) Plot the cumulative count percentage of each cause on the x-axis.
7) Join the points to form a curve.
8) Draw a line at 80% on the y-axis running parallel to the x-axis. Then drop the line at the point of intersection with the curve on the x-axis. This point on the x-axis separates the important causes on the left (vital few) from the less

important causes on the right (trivial many).

Results and Discussion

Response Rate

A response rate of 44.7% was obtained. 106 administered questionnaires were returned out of the 237 out of which 40.5% were identified to be usable for analysis. Based on the assertion of Moser and Kalton (1971), result of a survey could be considered as unbiased and significant if return rate falls between 30 to 40%. In that premise, the percentage of usable questionnaires was regarded adequate for analysis.

ECI Status of Design Firms

Table 1 presents the average scores of the ECI quality factors scored by the Nigerian design firms. Note that quality factor coded ECIF10 (Independent certification of quality management system) bears zero (0) score. This was as a result of the fact that Standard Organisation of Nigeria (SON) is yet to embark on certification of quality management system of the Nigerian design firms (Bamisile, 2004).

Table 1: Average ECI Quality Factors Scores for Groups of Design Firms

Firms/ Code	Architectural Average Scores	Structural Average Scores	M & E Average Scores	Multi-disciplinary Average Scores	Average
ECI F1	4.3	4.6	2.0	4.1	3.8
ECI F2	3.4	3.8	3.1	3.6	3.5
ECI F3	3.7	3.8	3.1	3.8	3.6
ECI F4	3.9	4.1	3.5	3.9	3.9
ECI F5	3.4	2.8	3.6	3.5	3.3
ECI F6	3.6	3.4	3.1	4.0	3.5
ECI F7	4.1	4.0	3.5	3.7	3.8
ECI F8	3.7	4.0	3.7	4.1	3.9
ECI F9	3.7	3.9	3.7	3.8	3.8
ECI F10	0.0	0.0	0.0	0.0	0.0
ECI F11	3.2	3.3	3.5	3.4	3.4
ECI F12	3.1	3.8	3.2	3.6	3.4

The overall average score of the firms is calculated to be 27.4. Therefore, the overall efforts of the Nigerian design firms generally and according to the ECI classification belong to the class recognized as 'the start of improvement'. This suggests that improvement is needed in fulfilling the requirements of the individual quality factors. However, as can be depicted from Table 1, certain factors bear lower score F5 (3.3), F11 (3.3), F12(3.4) and F(6) and for that reason could be adjudged as having greater effect on the general performance of the firms . Thus if vital factors among them can be addressed effectively, the performance of the firms can be improved. Pareto Analysis provides such avenue.

Identifying Vital Factors using Pareto Analysis

For the purpose of the analysis, the overall average scores of the firms in the last column of Table 1 will be used. As earlier described, each factor has a maximum of 5 points, but none of the overall average attained the maximum score. Thus, it implied that factors with lowest average score were the major causes of such result. In order to carry out the Pareto Analysis it is necessary to identify the shortfall from the overall score of each factor. The factors with higher shortfall will therefore be regarded as the 'vital few' (causes). Table 2 presents the required adjustment and some of the steps outlined in the procedure.

Table 2: Average ECI Quality factors score and shortfall

Factors/ scores	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
Overall Average	3.8	3.5	3.6	3.9	3.3	3.5	3.8	3.9	3.8	-	3.4	3.4
Shortfall (5 - Overall Average)	1.2	1.5	1.4	1.1	1.7	1.5	1.2	1.1	1.2	-	1.6	1.4

To address the requirements of steps 3-5 of the procedure, Table 3 is constructed with factors rearranged in descending order (step 3). Note that F5 appeared first since it was having the highest shortfall.

Table 3: Calculation of Cumulative Count Percentages

Factors	Short fall scores (descending order)	Cumulative count (descending order)	Percentage count (descending order) %	Cumulative percentage count (descending order) %
F5	1.7	15.1	11.1	100.0
F12	1.6	13.4	10.6	88.9
F11	1.6	11.8	10.6	78.3
F6	1.5	10.2	9.9	67.7
F2	1.5	8.7	9.9	57.8
F3	1.4	7.2	9.3	45.9
F9	1.2	5.8	8.0	38.6
F7	1.2	4.6	8.0	30.6
F1	1.2	3.4	8.0	22.6
F8	1.1	2.2	7.3	14.6
F4	1.1	1.1	7.3	7.3

The result of the analysis, stages 1, 2 and 5-8 was completed based on the information on Tables 2 and 3. Figure 1 shows the bar chart with factors (causes) in descending order of importance. It can easily be depicted that factor F5 has the highest cause among others. The factors were followed by F12 and F11 with similar shortfalls. F8 and F4 have the lowest shortfall (thus placed to the far right).

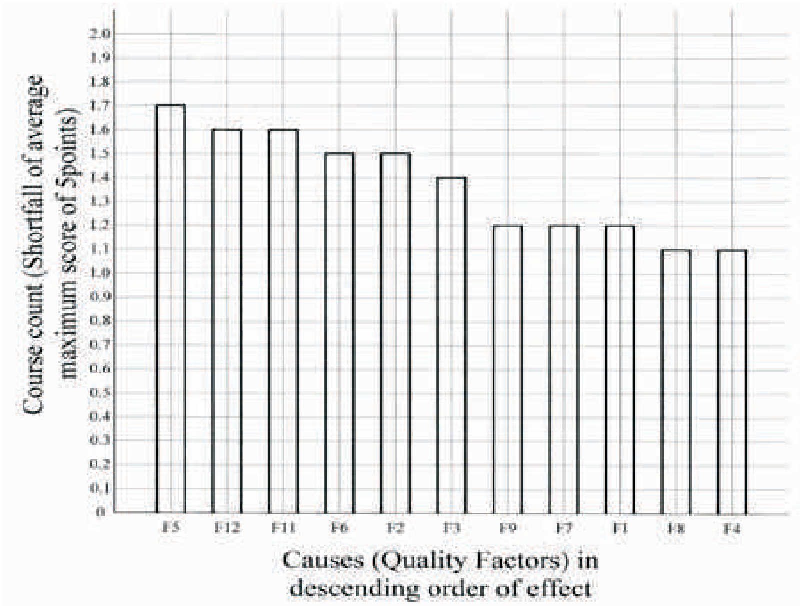

Figure 1, Bar chart of quality factors in relation to shortfall (Source: Field Survey, 2015)

Step 5 is illustrated in figure 2. The figure shows a curve plotted using the cumulative count percentages. The broken line separates the vital causes (factors) – top 20% from the trivial many – lower 80%.

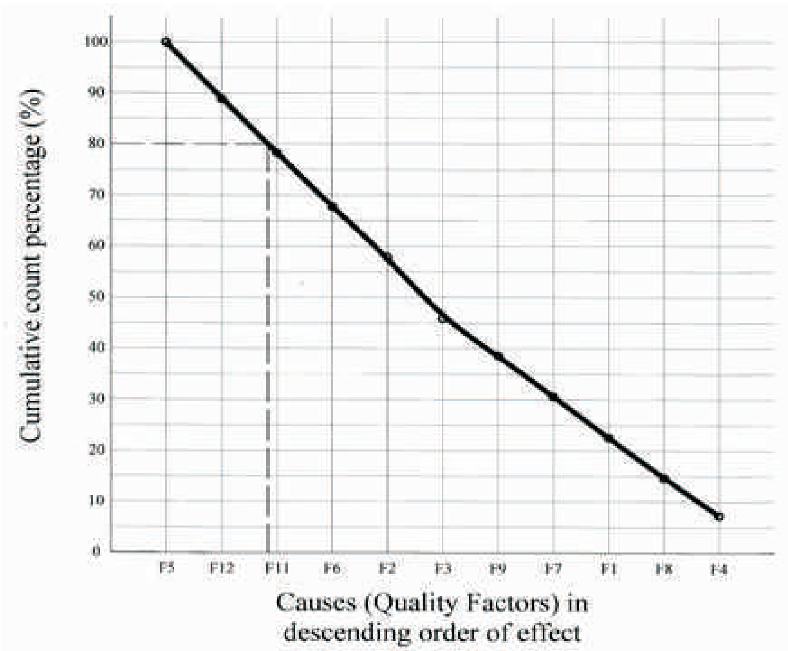

Figure 2, Curve for cumulative count percentages of factors (causes) (Source: Field Survey, 2015).

To clearly identify the factors, figures 2 and 3 were superimposed into figure 4 as suggested in steps 5-8. From the figure, it can be understood that three factors were affected by the broken line draw at 80% cumulative count percentage. These factors are F5, F12 and F11.

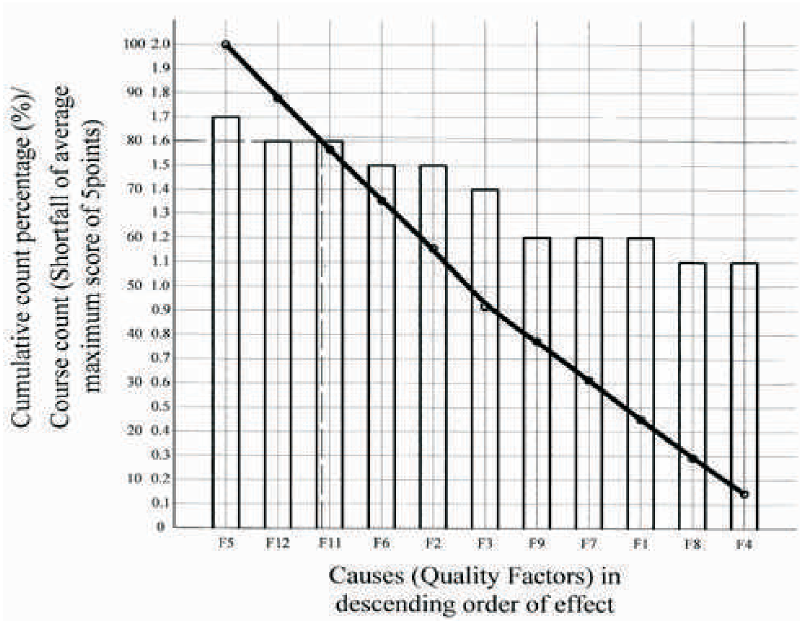

Figure 3, Separation of vital from trivial factors (causes) (Source: Field Survey, 2015)

By earning overall average score of 3.3 by the firms in 'Training, awareness, Education and Skill' (F5), it implied that there in only partial implementation of staff training programme among the firms. Staff training is a fundamental requirement of QMS (ISO 9001, 2008) and this is established to be lacking among the firms. It should be noted that, compared with other the overall averages, the overall average score recorded under this factor is the least and it indicates least overall performance.

With regards to F11 (Objective Measurement and Feedback), overall average score earned by the firms of 3.4 pointed out that this is one of the areas of weak performance exhibited by the design firms. This indicated that with respect to measurement of TQ objectives and feedback, the groups attained the status of only having coordinated measurement and analysis of results without clear indication of application and continuous measurement (Harris and McCaffer, 2005).

Similar to F11, F12 ('Natural Use of TQ Tools and Techniques) is also observed to be having poor performance by the firm as reflected by overall average score of 3.4. For success to be realised in any QMS, management of organisations must ensure that not only right tools and techniques are provided but right culture and atmosphere are created for implementation (Kume, 1991).

Conclusion

An average score of ECI 2.74 placed the Nigerian Design Firm at a status of 'The start of improvement' – the 4th status among the ECI classification. This suggests need for improvement especially in the areas (factors) where major weaknesses were eminent. These factors were revealed using Pareto Analysis. According to the analysis 'Training, awareness, Education and Skill' (F5; overall ECI average score = 3.3), 'Natural Use of TQ Tools and Techniques' (F12; overall ECI average score = 3.4) and 'Objective Measurement and Feedback' (F11; overall ECI average score = 3.3) were the most relevant quality factors that contributed largely in the poor performance of the Nigerian design firms based on the ECI matrix. According to the ECI matrix it implied that 'Training, awareness, Education and Skill' programme (F5) is only partially being implemented by the design firms. With regards to 'Natural Use of TQ Tools and Techniques' (F12), the status indicated that the firms use TQM tools and techniques only when reminded or necessary, while result regarding 'Objective Measurement and Feedback' (F11) indicated that the firms stop only at having coordinated measurement and analysis of results but not regularly.

Recommendations

In order to effectively improve the status of the Nigerian design firms, the following measures need to be taken by the firms. The measures were based on the provisions of the ECI matrix directed at raising organisation to the highest level of TQM attainment reflecting the identified vital factors and the need for certification of the design firms.

Firms' programme relating to total quality should be improved beyond partial implementation. Firms should aspire to progressively achieve full development and rise to the position of providing external training to others.

In order to achieve requirements relating to use of tools and techniques, firms should create environment such that the use of tools and techniques in their undertaking becomes natural (not when reminded or necessary).

Firms should aspire to improve the aspect of objective measurement and feedback beyond having coordinated measurement and analysis of results, but to the level of establishing performance indicators as standards measurement tools.

SON should as a matter of urgency embark on the certification of construction activities among the Nigerian Construction Firms (design inclusive). This is imperative as it one of the fundamental requirements of QMS.

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