

## ESTABLISHING THE STATUS OF BUILDING MAINTENANCE OPERATIONS OF NIGERIAN UNIVERSITIES BASED ON THE EUROPEAN CONSTRUCTION INSTITUTE TOTAL QUALITY MANAGEMENT MEASUREMENT MATRIX

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### ABSTRACT

The establishment and achievement of acceptable levels of quality in building maintenance projects has long been a problem. Despite significant amount of investigations have already been undertaken to examine quality failures and their causes, maintenance projects are still encountering numerous quality problems. Hence, this research was birthed by the urge to establish the degree by which building maintenance operations are undertaken in Nigerian universities with respect to the total quality management principles. The European Construction Institute (ECI) measurement matrix was adopted for establishing the degree. The sample size was calculated using Kish formula. 75 responses, which accounted for 99% of the total respondents, were received. For reasons of costs and security, three Universities in the north-central region of the country were surveyed. Based on the ECI classification, the selected Universities were graded under the status of "Need Commitment to Overcome Resistance". Hence, it was recommended that Universities should employ competent personnel, and place high premium on quality factors like employee training, team workmanship in order to achieve acceptable quality management in their building maintenance practices.

**Keywords:** Quality Factors, European Construction Institute, Total Quality Management, Building Maintenance

### INTRODUCTION

Total quality management (TQM) consists of organization-wide efforts to install and make permanent a climate in which an organization continuously improve its ability to deliver high - quality products and services to customers (Wikipedia 2011, Kanji 1990, Robert and Robert 1998, Muhammed 2011). It is an effort that involves every organization in the industry towards improving performance (David and Murat 1997). Different authors have given various definitions of TQM. Oakland (2003) defines it as an approach involving whole organization for understanding each activity of individual at each management layer. This argument is supported by Escrig (2004) who considers TQM as a strategic action that focuses on managing the total organization to provide products or services that satisfy their customer needs by utilizing all resources.

TQM is equally considered as "a management approach that tries to achieve and sustain long-term organizational success by encouraging employee feedback and participation, satisfying customer needs and expectations, respecting societal values and beliefs and obeying governmental statutes and regulations" (Harris and McCaffer 2005, Dikko 2013). This definition is broad-based as it encompasses many issues in addition to the traditional customer satisfaction identified in some definitions by other authors. TQM is based on the philosophy of continuously improving goods and services as reflected in one of the requirements of the international standard organization (ISO 9000, 2008). It is generally employable to any type of organization and any organization stands to benefit by its adoption. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices.

Doyle (1994) affirms that the simple objective of TQM is "Do the right things, right the first time, every time". TQM is infinitely variable and adoptable. Although originally applied to manufacturing operations, and for a number of years only used in

that area, TQM is now becoming recognized as a generic management tool, just as applicable in service and public sector organizations. There are a number of evolutionary strands, with different sectors creating their own versions from the common ancestor. Amusan and Bamisile (2005) asserts that certain virtues of TQM could be adopted to solve quality problems in building maintenance problems if implemented accordingly.

According to Sha'ri and Elaine (2000), TQM enjoyed widespread attention during the late 1980's and early 1990s before being overshadowed by ISO 9000, Lean manufacturing and Six Sigma. However, Amusan and Bamisile (2005), Majed (2007), Dikko (2011), Dikko (2013) and Jackline (2013) argue that TQM is still relevant especially in the construction industry, where its adoption is progressively being experienced.

Maintenance is now being largely accepted and recognized as the best approach in ensuring the prolongation of the buildings' lifespans, a strategy for slow renewal and decay prevention, and maintaining utility and economic return. According to Zainal *et al* (2010), the issue of building maintenance is a universal issue and is highly considered in the early process of the construction to assure the quality of the building. To re-affirm the status of maintenance as a component of a conclusive phase of sustainable development, Sunday *et al* (2012) compares maintenance as the last leg of a relay team and the lubricating oil of an engine.

### LITERATURE REVIEW

#### Concept of Quality Management System (QMS)

According to Dikko (2013) and Yasamiset *al* (2002), Quality Management System is the collection of all process, tools, techniques and subsystems that run simultaneously with production system (services or manufacturing), and the control of the production tool, which enables every organization to increase quality of products and service offered through continuous result, in

relation to the quality objectives, to satisfy the needs and requirements of interested parties as appropriate.

The QMS Fundamentals and Vocabulary (2000) echoes that, QMS helps in integrating the various internal processes within the organization. It enables organization to identify, measure, control and improve the various core business processes that will ultimately lead to improved business performance, higher profit, effectiveness and customer satisfaction.

Dikko (2013) asserts that, the requirements of the Quality Management Systems covered by the ISO embrace issues relating to Quality Control (QC), Quality Assurance (QA) and TQM. While much has been covered on TQM in the previous section, this part dwelt on QC, QA, Quality Planning, Quality Improvement, Quality Audits and Quality Circles towards enhancing our understanding of the hallmarks of QMS.

### Basic Governing Principles of TQM

A total quality management principle is a comprehensive and fundamental rule or belief, for leading and operating an organization, aimed at continually improving performance over the long-term by focusing on customers while addressing the needs of all other stakeholders (ISO 9000:2008 and Patrick 2013). These principles represent the basic ingredients or the philosophical pillars of TQM (Majed 2007). The central principle of TQM is that mistakes may be made by people, but most of them are caused, or at least permitted, by faulty systems and processes. This means that the root cause of such mistakes can be identified and eliminated, and repetition can be prevented by changing the process.

According to ISO 9000 (2008), Kanji (1998) and David and Murat (1997), there are eight (8) basic governing principles of TQM. They work not in isolation but interwoven, and once applied correctly they would increase a firm's commitment to quality and support the organizational effectiveness through cost reduction, enhanced productivity, improved product quality and output. The principles include the following:

- Management Commitment and Leadership
- Involvement of People (Team Work)
- Customer Focus and Satisfaction
- Process Approach
- Continual Improvement
- Factual Approach to Decision – Making
- Mutually Beneficial Supplier Relationships
- System Approach to Management

### Concept of Building Maintenance (BM)

By the nature of creation there is virtually nothing man-made that is indestructible, but the usefulness of many such items can be extended by carrying out repair at regular intervals through an activity known as Maintenance (Amusan and Bamisile, 2005). Various definitions have been proposed for the term "Maintenance". Olanrewaju (2010), Tabboub (2011) and Olanrewaju *et al* (2011), define Maintenance as the "required processes and services carried out to preserve, repair, protect and care for a building's fabric and engineering services after completion, repair, refurbishment or replacement to current standards to enable it to serve its intended functions throughout its entire life span without drastically upsetting its basic features and use". This definition perceives maintenance from the comfort of the users of the buildings. However, Iyagba (2005), Adenuga *et al* (2010) and Adenuga (2012) consider maintenance as a "work undertaken in order to keep, restore or improve every facility, to an acceptable standard and to sustain the utility and value of the facility. This definition looks at maintenance as a proactive exercise. Elsewhere, Jalal (2003) and Zainale *et al* (2010) note that, maintenance revolves around the process of reservation and restoration of activity of the structure and components of a building.

According to Iyagba (2005) and Olagunju (2012), one of our greatest economic and social problems as a nation is the general absence of a maintenance culture. There is unpardonable neglect and laxity in all

spheres of our national life. Maintenance is seen by many as an avoidable task which is perceived as adding little to the quality of the working environment, and expending resources which could be better placed. To most of our private and public sectors, maintenance is war. Iyagba (2005) puts forward that the enemies are the triumvirate of breakdown, deterioration and all the types of unplanned events. There is need for immediate change of attitude in connection with our poor maintenance culture if untold national disasters and embarrassment are to be averted.

### Aims of TQM in Building Maintenance

Although construction is a creative, one-time process, for instance, the Japanese construction industry embraced the TQM concepts that some argued could only apply to mass production (David and Murat, 1997). Hence, the following can be considered as aims of adopting TQM concept in building maintenance:

- Improvement in the quality of the maintenance product and process.
- Reduction in cost of maintenance works.
- Improving the prosperity of the organization.
- Accomplishment to defect-free maintenance work.
- Achievement of users/operators satisfaction
- Making work more enjoyable (Sha'ri and Elaine, 2000)
- Improvement in the optimal utilization of financial resource.

Adopting TQM as the guiding philosophy of an organization gives that organization a better chance of surviving and, further, flourishing in the present competitive market place. By considering certain virtues in the TQM concept, effective maintenance management of building can be achieved because the baseline of the concept is enhanced output, efficiently and quality improvement (Amusan and Bamisile 2005 and Jamal 2010). Amusan and Bamisile (2005) concludes that the successful implementation of quality management can contribute to an increase in product quality, improvements in workmanship and efficiency, a decrease in wastage and increase in profit.

### European Construction Institution (ECI)

According to Jalal *et al* (2013), one of the ways of establishing the degree at which organisation adopts TQM is the use of ECI measurement matrix produced by the ECI in 1993. What is the history of this ECI?

#### History of ECI

European Construction Institution (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...> 2010, Dikko 2011, Dikko 2013 and Baldwin 1997). ECI is focused on delivering construction excellence with an aim to improving competitiveness of its members through sharing of knowledge and application of best practice to enable them meet challenges of world-class project delivery in Construction and Engineering Construction (<http://www.eci-online.org/what-is-eci>, 2013).

#### ECI Measurement Matrix

A review was made of the tools and techniques developed for monitoring and control purposes by management both within and outside the construction industries in Europe. This revealed the Total Quality Measurement Matrix, a technique developed by the European Construction Institute (ECI), to provide organisations, projects, sites or sections of a project with a tool for determining their progress towards the achievement of Total Quality (ECI, 1993a). It was produced by the ECI's Total Quality Management Task Force in 1993 as part of their initiative to generate a set of quality milestones appropriate to the construction industry, and covers the significant elements in a programme to achieve a Total Quality culture (ECI, 1993b). It is used in measuring the degree to which a company was operating under total quality management (Harris and McCaffer 2005 and Dikko 2011). The matrix contains 12 quality key objectives inter alia: Commitment and leadership by top management at location, organised process and structure for total

quality, necessary business performance, Supplier relationship (internal and external), Training, awareness, education and skills, Relationship with internal and external customer, Understanding and satisfaction of employees, Communications, Teamwork for improvement, Independent certification of quality management system, objective measurement and feedback and Natural use of total quality tools and techniques.

The twelve objectives, which form the columns of the matrix, are not in any specific order and may be approached individually. Each column has six levels of attainment. The highest levels of each column represent 'Total Quality' (Baldwin et al 1997). Based on the analysis of the measurement matrix, organisations are usually classified according to the following status as developed by the ECI to include:

Scores	Quality Status
55-60	A recognised TQ Organisation
45-54	A world class operation
35-44	Realization of Improvement
25-34	The start of improvement
12-24	Need commitment to overcome resistance
0-11	No appreciation of quality

**RESEARCH METHODOLOGY**

**Study Population**

The target population of the research included the top and middle level staff members of the Works and Services departments of three selected universities in north-central geo-political zone of the country comprising the University of Ilorin (Unilorin), Federal University of Technology, Minna (FUT Minna) and University of Abuja (UniAbuja). To establish the population size, an organisational chart and list of the staff that are directly involved in maintenance work were obtained from the study areas. Hence, it was gathered that there are 97 senior staff in Unilorin, 46 in FUTMinna and 68 in UniAbuja thereby given a total population of 211.

**Sampling Technique and Sampling Size**

The sampling techniques adopted for the study included both simple purposive and cluster. The former was adopted because the respondents included some specified categories of staff within the study areas. This was based on the recommendation by Fellows and Liu (2003) and Keller and Warrack (2003). Each of the selected universities was considered as an independent entity for easy comparison and inferences, hence the need to adopt cluster sampling. The minimum statistically acceptable sample size was determined by employing the Kish formula to justify the responsive sample size of the survey. According to Agbodjah (2008), Kish formula states that:

$$n = \frac{M}{1 + \frac{M}{N}} \quad \text{(eq. 1)}$$

Where n = Sample Size  
N = Total population = 211

$$M = \frac{S^2}{V^2} \quad \text{(eq.2)}$$

Where V is the standard error of the sampling distribution and S is the maximum standard deviation of the population element

$$S^2 = P \times (1 - P) \quad \text{(eq. 3)}$$

P is the proportion of population elements belonging to the defined class.

Using a total error of 0.1 at 95% confidence interval, V is 0.05 and P is 0.5;

$$S^2 = 0.5 \times (1 - 0.5) = 0.25$$

$$M = \frac{0.25}{(0.05)^2}$$

Hence M = 100

$$n = \frac{M}{1 + \frac{M}{N}}$$

$$N = \frac{100}{1 + \frac{100}{211}} = 69$$

Adding 10% of 69 for non-responsiveness  
= 69 X 1.1 = 76

Therefore a value of Seventy-six (76) was adopted as the statistically significant sample size for the survey.

**Administration of Data Collection Instruments**

The questionnaires were administered on top and middle management level staff members of the Works and Services departments of three selected Universities in north-central geo-political zone of the country comprising the University of Ilorin, Federal University of Technology, Minna and University of Abuja. The decision to use those categories of staff was informed by the recommendation made by Fox (1956) as cited by Adenuga (2012) that decisions concerning quality in building maintenance operation rest on the decks of top and middle management levels.

**Methods of Analysis of Result**

Data analyses simply involved calculating the scores of the ECI total quality factors for each responding universities by adding the scores for each university's status corresponding to each quality factors. This was achieved using Microsoft Excel and, Statistical Product and Service Solutions (SPSS).

**FINDINGS AND DISCUSSION**

**Result of Pilot Study**

To verify the usefulness of the questionnaires in solving the research objective, a preliminary study was conducted on the Estate department of Ahmadu Bello University, Zaria. A purposive sampling was adopted on the senior and top management staff of the department. In all, 25 questionnaires were administered: 20 at the Samaru campus and 5 at the Kongo campus. Although, all the questionnaires were returned and useable, it was observed that the administration, responses, retrieval and analysis were very challenging.

**Analysis of Questionnaire Administration**

Based on the observation made during the pilot survey that the administration and retrieval of filled questionnaires was challenging, more effort was geared towards retrieving all the administered. Hence, out of the 76 administered questionnaires 75, which accounted for 99% of the whole were returned and, found useable and significant for further analysis.

**Measurement of the Degree at which Building Maintenance is undertaken in respect to TQM**

To measure the degree at which the studied universities undertake their maintenance activities with respect to the TQM, the ECI measurement matrix was thus adopted. However, it should be noted that, based on the assertion of Dikko (2011) that certification of the quality management activities of construction organisations is yet to be embarked upon, the tenth ECI quality factor i.e Independent Certification of QMS will not be considered for the study.

The following table provided insight in to the degree of TQM application in building maintenance operations of the studied universities:

In view of the responses obtained from the respondents as illustrated in the table above, the following inferences can be made:

**Commitment and Leadership by Management at Location**

The concern of this quality factor is to establish the degree by which maintenance managers provide commitment and leadership for

achieving effectiveness and efficiency in the product and process on site. Therefore, based on the average score obtained by FUT Minna as shown, it can be seen that the University nominates and supports quality representative at senior management level. Even at that, FUT Minna was the only university among the studied Universities that attained that quality status with an average score of 3.17.

Unilorin and UniAbuja obtained average scores of 2.89 and 2.91 respectively in this category. This implied that the two Universities

provide spasmodic support and encouragement to quality initiatives.

**Table 1. Average ECI Quality Factors Scores for the three Universities**

S/No	Quality Factors	FUT Minna Average Scores	UniAbuja Average Scores	Unilorin Average Scores	Average	
1.	Commitment and Leadership by top management at location		3.17	2.91	2.89	2.99
2.	Organised process and structure for Total Quality		2.89	3.18	3.29	3.12
3.	Necessary Business Performance		3.00	3.09	3.37	3.15
4.	Supplier Relationship (internal and External)		3.94	2.50	3.60	3.35
5.	Training awareness, education and Skills		1.17	1.36	1.57	1.37
6.	Relationships with Internal and External Customers		2.67	3.50	2.69	2.95
7.	Understanding Commitment and satisfaction of employees		3.78	3.18	3.31	3.42
8.	Communications		3.33	3.59	3.27	3.40
9.	Team work for improvement		2.89	1.46	2.06	2.14
10.	Independent Certification of Quality Management System (QMS)		-	-	-	-
11.	Objective Measurement and Feed back		2.11	1.23	2.49	1.94
12.	Natural use of Total Quality tools and techniques		1.17	1.41	1.49	1.36
Average		2.74	2.49	2.73	2.65	

Source: Field Survey (2014)

#### **Organised Process and Structure for Total Quality**

From the table, it can be inferred that FUT Minna showcased a fairly rated level for this quality factor. It obtained an average score of 2.83, which implied that the University has a "defined and partially understood" organised process and structure for total quality. Going by the score, it means the Works and Maintenance department of the University operates a total quality structure that is partially defined and understood by the workers.

Unilorin with an average score of 3.29 based on the data obtained on table 4.5.3 is considered better placed with respect to operating an organised process and structure for total quality. The score of 3.29 implied that the studied University operates an understood and partially implemented process and structure for TQ. UniAbuja has an organised process and structure for TQ that is understood but partially implemented. This inference is based on the average score obtained by the institution's Works and Services department.

#### **Necessary Business Performance**

Based on the data in the above table, FUT Minna has shown some level of commitment to business performance by exhibiting re-alignment of business focus and targets. The studied University obtained an average score of 3.00. It is however pertinent to note that, the University must put more effort towards improving her business performance so as not to fall below the baseline of 3.00 it obtained.

Interestingly, Unilorin obtained an average score of 3.37 placing her under the status of "Re-alignment of Business focus and targets".

Although, the average score is relatively better than the one obtained by the former University, it is still necessary that effort is geared towards obtained higher business performance status.

With respect to this TQ factor, UniAbuja scored 3.09, which indicated that there is "Re-alignment of Business focus and targets" in her necessary business performance in maintenance operations.

#### **Supplier Relationship (Internal and External)**

With respect to this TQ factor, FUT Minna recorded an average score of 3.94 which implied that the University ensured joint expectations reviewal and addressing with both her internal and external suppliers. This status, although it needed to be improved, may not be considered relatively bad in view of the fact that it surpassed the lower status of ordinary recognition of both parties concerns. It can be seen that in UniAbuja an average score of 2.50 was obtained for Supplier Relationship quality factor. Unilorin got an average score of 3.60, which implied that the University adopts joint expectations reviewing and addressing in her relationship with both internal and external suppliers.

#### **Training Awareness, Education and Skills**

Based on what can be seen in the table above, it can be deduced generally that the studied Universities scored an average score of less than 2.00. Scores of 1.17, 1.36 and 1.57 were obtained by FUT Minna, UniAbuja and Unilorin respectively under the quality factor of "Training Awareness, Education and Skill". The implication of those scores is that the Universities recognised the importance of the training and education but little is done to fully initiate it.

### Relationship with Internal and External Customers

The word 'customer' will stand for occupants or users in order to suit the quality factor into the framework of maintenance. Regarding this factor, FUT Minna and Unilorin respectively obtained average scores of 2.67 and 2.69, which implied "Recognition of both parties' concerns. However, UniAbuja scored on average 3.50 meaning that the University engages in joint expectations reviewing and addressing with her internal and external users or occupants.

### Understanding Commitment and Satisfaction of Employees

From the provisions in the above table, it can be seen that all the studied Universities obtained scores that placed them on recognizing the existence of benefits and showing understandable commitment with respect to employee's satisfaction and commitment. FUT Minna scored 3.78, Unilorin got 3.31 and UniAbuja scored 3.18 thereby making them at par with respect to the quality factor.

### Communications

With respect to this quality factor, the studied Universities obtained scores that placed them on having communication system that exist but with little use. It should be noted that, in chapter two, it was stressed that effective communication systems a panacea for the application of TQM concept. In view of this notion, the studied Universities may be considered deficient in their efforts towards achieving continuous quality improvement in their maintenance operations. From tables 4.5.2, 4.5.3 and 4.5.4 as summarized in table 4.5.1, it can be seen that FUT Minna scored 3.33, Unilorin scored 3.27 and UniAbuja got 3.59 scores.

### Team Work for Improvement

From the table, it can be seen that UniAbuja scored 1.46, which means there are team improvement programmes established with some budget allocated. This score showed that the teams are at preparatory stages. FUT Minna and Unilorin respectively scored 2.89 and 2.06, which implied that in the two Universities some team improvement projects are being identified. In view of this, more effort must be intensified towards improving the spirit of team work in the two Universities.

### Objective Measurement and Feedback

With respect to this factor, UniAbuja scored 1.23, which implied that the University has identified performance indicators. This is a low rating considering the fact that measurement and feedback are instrumental to restructuring the organisation for a more challenging future by bringing to bear the normal and abnormal of the past. FUT Minna and Unilorin respectively obtained 2.11 and 2.49 scores, which indicated that the Universities used to conduct "regular measurement against targets" in their maintenance operations. However, since the scores fell below 3.00, it means the measurements are not well coordinated.

### Natural Use of TQ Tools and Techniques

Based on the scores available in the table above, this quality factor is the worst among the tested quality factors. All the Universities obtained scores that placed them under having awareness of the quality tools and techniques, but with their little use naturally. FUT Minna scored 1.17; Unilorin scored 1.49 while UniAbuja got 1.41 scores. Hence, this low rating suggests need for improvement.

### Overall ECI Classification of the Studied Universities

In view of the average scores obtained by the studied Universities as shown in figure 1 below, it can be established that FUT Minna recorded 20.09 points, which fall within the category with 12 to 24 points. Considering the ECI classification as discussed earlier, this category operates under the status of "Need Commitment to Overcome Resistance". This implies that with respect to the application of TQM concept in maintenance operations, the Works and Maintenance department of the University has surpassed a little above the baseline. In the same vein, Unilorin and UniAbuja recorded 20.02 and 18.33 points, which made them to fall under the

ECI classification of "Need Commitment to Overcome Resistance" because the points stood between 12- 24 point category. Although, they all appreciate the significance of quality in maintenance operations, much is yet to be done as a result of inherent myriad of problems.

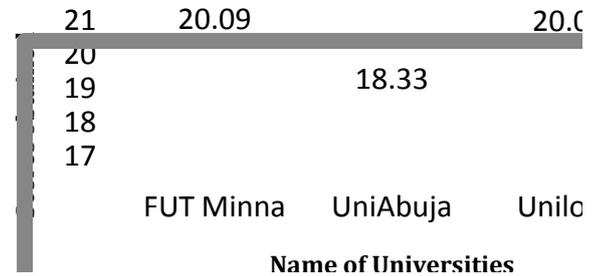


Figure 4.5.12 ECI Classification of Universities

Generally, the research stressed that the low-rated category under which the three Universities fall may be in agreement with the report of the Federal Government of Nigeria Special Committee on Needs Assessment of Nigerian Public Universities (2012), where it was stated that most physical facilities for teaching and learning in Nigerian Universities are inadequate, dilapidated, over-stretched and improvised.

### CONCLUSION

The importance of adopting TQM approach in building maintenance cannot be over-emphasized. However, it is pertinent to note that, based on the research findings much is yet to be achieved in the studied Universities in the area of continuous quality improvement in infrastructural maintenance. Specifically, the research established that based on the provisions of the ECI classifications, all the studied Universities obtained average scores to fall in the class of 'Need Commitment to Overcome Resistance'. They obtained average scores that averaged within 12 to 25 points. FUT Minna obtained 20.09 points; Unilorin got 20.02 points while UniAbuja lagged behind with 18.33 points. On this premise, it can be concluded that the Universities do employ QMS in their maintenance at a low level which requires commitment on the part of the stakeholders to overcome resistance. Hence, the following recommendations are made

Maintenance departments of the Universities should encourage employee training and development in quality-related issues through the provision of staff training schemes and sponsorship for the attendance of professional workshops and conferences. Maintenance departments should be engaged in objective measurement and feed back of their activities. This will effectively improve quality management considering that re-measurement and feedback are instrumental to restructuring the organisation for a more challenging future by bringing to bear the normal and abnormal of the past. The studied Universities scored low in this factor.

The studied departments must strive to incorporate the suppliers, contractors and other stakeholders in order to have a well-facilitated arrangement for quality improvement in their maintenance activities. From the results as discussed earlier, it was revealed that the departments scored low regarding relationship with suppliers and customers (users).

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