

# **Effect of Total Quality Management on the Safety Performance of Construction Firms in Nigeria: Construction Professionals' Perception in Federal Capital Development Authority, Abuja**

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## **Abstract:**

Past studies revealed that the lack of Total Quality Management (TQM) implementation in construction projects in Nigeria leads to poor safety performance on construction sites. This study assessed the effect of TQM on the safety performance of construction firms in Nigeria. A quantitative research approach was employed through the use of a questionnaire survey. One hundred twenty-seven copies of the questionnaire were administered to construction professionals in Federal Capital Development Authority (FCDA), Abuja, with a response rate of 48%. Relative Importance Index (RII), Mean Item Score (MIS) and Spearman Rank correlation analysis were employed for data analyses. It was revealed that: TQM practices have a significant effect on the safety performance of construction firms ( $p < 0.01$ ), and strategies for improving TQM practices of construction firms are effective (Group MIS = 4.19). However, it was concluded that the effect of TQM on the safety performance of construction firms in Abuja is significant. It was recommended that management of construction firms adopt TQM practices right from the conception stage to implement TQM practices throughout the project life cycle. The study's findings are beneficial to construction firms and built environment practice by revealing effective strategies that can bring about 84% improvement in construction firms' safety performance.

## **Keywords:**

Construction Firms, Effect, Safety Performance, Strategies, Total Quality Management.

## **1 Introduction**

Total Quality Management (TQM) has been described as a modern system in the field of quality as defined by quality assurance and quality control. Nowadays, many firms have embraced the application of quality to improve construction practices' safety and improvement (Koutsougiannis,

2020). Lack of strict policies on building construction regulations often leads to TQM practices being neglected in Nigeria (Ede, 2016). This often leads to high rates of accidents, hazards, and unsafe practices, among other issues in Nigeria, which affects construction workers' safety performance. In line with all these, one of the factors affecting safety performance is an organisational factor referred to as factors that could cause accidental conditions in the context of safety performance. Researches have revealed the relationship between organisational factors and worker's safety behaviour (Neal *et al.*, 2000; Zacharatos *et al.*, 2005) and safety outcomes such as injuries, incidents, and accidents (Hunag *et al.*, 2006).

From a theoretical standpoint, quality management and safety management programs have similar characteristics. In construction work, a company's ability to deliver a quality product safely is the key to business success. The similarity between quality management and safety management has been well articulated by researchers (Kwan, 2016). In the light of TQM principles, some safety management theorists have drawn an analogy and put forward different Total Safety Management (TSM) models in the hope of achieving a significant leap forward in safety management. Hence, a positive relationship exists between TQM and safety management (Husin *et al.*, 2008; Kwan, 2016). Therefore, TQM tends to bring about improved safety performance at construction sites.

Unfortunately, the use of TQM has not been adequately researched in the realm of health and safety (H&S) of construction workers on-site (OSTN, 2006; Issa *et al.*, 2020). Although TQM ideas have been around for many years, their concepts and principles have not been generally applied to continuous safety improvement as a management strategy in occupational safety and health (OSTN, 2006). On the other hand, TQM has been practised in developed countries while the concept is still new in developing countries (Issa *et al.*, 2016). This study, therefore, focused on the lack of implementation of TQM in construction projects which leads to injury and illness incidence rates in the construction industry being higher than in all other industries as a result of the frequent occurrence of accidents and injuries to workers at workplaces. This leads to poor H&S performance on construction sites.

Given the problem identified above, it is imperative to note that the safety performance of construction workers is paramount in getting a good return for human resources. Therefore, a quality manager is assigned to each project to be responsible for the implementation and coordination of quality control. However, there is still a failure of the safety performance of construction workers on-site as the number of accidents that occurs in the construction industry is still very high compared with other industries. In order to solve the problem identified, this study assessed the effect of TQM on the safety performance of construction firms in Abuja, Nigeria, to improve the safety performance of construction firms. The following objectives were pursued in order to achieve the study's aim:

- i. To identify the stages of construction projects where TQM practices are most required.
- ii. To examine the TQM practices required for the improvement of the safety performance of construction firms.
- iii. To determine the safety practices of construction firms most likely to be influenced by TQM practices.
- iv. To determine the relationship between TQM and the safety practices of construction firms.
- v. To propose strategies for improving TQM practices for the enhanced safety performance of construction firms.

In view of the fourth objective of the study and the review of literature relating to it (Section 2.4), the following hypothesis was formulated for the study:

**H<sub>1</sub>:** There is a significant relationship between TQM and the safety practices of construction firms.

## **2 Literature Review**

This section gives a detailed discussion of the main theme of the aim and objectives of the study. This provides a reasonable basis for identifying the major variables required for the study's fieldwork.

### **2.1 Stages of Construction Where TQM Practices Are Most Required**

Several procedures must be undergone for a successful project outcome, from the simplest to the most complex stage of a construction project. In construction, projects usually vary based on size, the number of stakeholders involved, budget and date of delivery. Irrespective of the case, however, a construction project is always a long and demanding process. It is therefore interesting to note that management of the distinct phases of a project is easily achievable now with higher precision due to the continuous progress of digital solutions; because of this, six main stages of a construction project where the use of TQM may be required were identified (Koutsougiannis, 2020). These are: Conception of the project; Design Stage; Pre-construction stage; Procurement stage; Construction stage; Post-construction stage.

### **2.2 TQM Practices Required for the Improvement of Safety Practices of Construction Firms**

The management leadership's most important responsibilities for effective implementation of TQM practices led to a significant correlation between leadership management and soft TQM practices. Therefore, it is essential to emphasise that management leadership is a key factor in successfully implementing TQM practices (Mokhtar & Yusof, 2010). Soft TQM practices include education and training, employees' relationship, client's focus, and supplier's management, while hard TQM practices include process management, quality & data reporting, and product & service design (Ahmad *et al.*, 2014). Reporting further on the factors influencing TQM practices, the following were identified: top management, human resources management, education & training, clients' focus, information & analysis, continuous improvement, process management, and supplier management (Faihan *et al.*, 2013). Going by the assertion of past studies (Mokhtar & Yusof, 2010; Faihan *et al.*, 2013; Ahmad *et al.*, 2014), TQM can therefore be viewed as a quality-oriented approach affecting quality performance that has been corroborated by leading studies (OSTN, 2006; Husin *et al.*, 2008; Kwan, 2016; Issa *et al.*, 2020). In view of this, it has been submitted that the characteristic features of TQM practices (management leadership, process management, employees' involvement, and client's focus), as earlier identified, are main parameters that have been generally agreed upon by past studies to be capable of improving the quality performance of organisations (Sadikoglu & Zehir, 2010). Critically viewing the attributes of TQM practices, it can be understood that the attributes can be very influential in the improvement of the safety practices of construction firms

### **2.3 Safety Practices of Construction Firms Most Likely to be influenced by TQM**

The adoption of TQM practices in a firm builds up a culture which seeks to enhance all pursuits consistently, and especially it concentrates on an entire knowledge of the numerous business

procedure by the usual daily participation of all involved (Neal *et al.*, 2000; Zacharatos *et al.*, 2005; Ugboro & Obeng, 2010). The construction industry becomes more popular with a fewer rate of accidents. Keeping workers aware of safety issues, training them on these issues, communicating and discussing ways to improve these safety programs and concerns, and documenting these issues are the leading measures for reducing the rate of accidents. Regardless of this, TQM can influence some of the safety practices undertaken by a construction firm through the following practices: Awareness, Training, Communication, Documentation, Proper Equipment, Supervision and Transparency (ILO, 2005; Adediran & Adediran, 2008; Health and Safety Authority, 2013; Faihan *et al.*, 2013).

## **2.4 Impact of TQM on Safety Performance of Construction Workers**

In TQM, quality is everyone's business; it can be achieved only through mutual trust, coordination, and teamwork (Mohamed, 1997). It needs the Project Manager (PM) to participate in the process instead of inspecting it. As a foremost principle of TQM, top management entails a deep commitment from the PM on-site and leadership on his part. The responsibility of the PM is to ensure that proper equipment is given to workers and an adequate work area for the job at hand. Therefore, a lack of proper equipment leads to an unsafe construction site. This is because there may be an avenue for someone to get injured on-site, and workers are prone to errors without proper equipment. Provision of water always is also important to prevent dehydration. It is also essential to keep to time for rest and break of workers from the PM as lack of rest in time might impact their safety. From the perspective of supplier management at the TQM implementation level, it follows through with what quality and what standard of materials are being brought to the site. This significantly aids in avoiding any slight accident that is likely to occur due to low-quality material standards.

Furthermore, training is also an important principle of TQM. The preparation of employees for the TQM process is enhanced by organising training programmes. Therefore, these imply that TQM impacts workers' safety performance by making them go through rigorous training to help them be better at what they do (Husin *et al.*, 2008; Ali & Omran, 2016). Similarly, it was revealed that the safety performance of the workers might depend impactfully on the construction firm, out of the measures to be improved upon by TQM in the construction industry, as this assures of quality work to be done on-site, the good rhythm of working by the workers on-site and fast work on-site as the workers will be joyful that their safety is kept at the utmost of the construction (Hasse *et al.*, 2015).

In line with the above, it has been established by past studies that there exists a positive relationship between TQM practices and workers'/company's productivity or performance (Loushine *et al.*, 2006; Husin *et al.*, 2008; Kwan, 2016). This, therefore, implies that TQM is an ethical and holistic strategy of a firm in terms of continuous improvement in products/services or processes, including all stakeholders, to bring about clients' satisfaction and improvement of the performance and sustainability of firms. In view of this, all aspects of TQM practices should be effectively managed in a firm (Sadikoglu & Olcay, 2014).

## **2.5 Strategies for Improving TQM Practices for Enhanced Safety Performance**

Studies have identified several Mohamed (1997) suggested the following strategies for improving TQM practices for enhanced safety performance (Mohamed, 1997; Willar, 2012; Kakkad & Ahuja,

2014; Ali & Omran, 2016). These strategies for improving TQM practices for improved project performance are summarised as follows:

- i. Organisations should ensure the availability of quality records that comply with quality procedures and the need to retain quality procedures for a specified period.
- ii. Strategic identification conduct should be employed to discover job competency gaps that will address skills and training.
- iii. Organisations should create standard working systems for the check to occur at all basic phases of procedures identified.
- iv. Evaluation exercises ought to show how the subcontractors' item will be confirmed; the area of review and test focuses, acknowledgement criteria; and witness check focuses.
- v. Persistent quality mindfulness programmes should be developed at all levels of the organisation.
- vi. Organisations should develop a multi-purpose planned prize framework to expand staff motivation.
- vii. Organisations should develop quality goals that can be estimated, with the outcomes being checked and conveyed.

It has been revealed by some of these past studies that these strategies are so effective that they can bring about 82% improvement in safety performance at construction sites (Ali & Omran, 2016). Imperatively, the studies reviewed have emphasised that these strategies are effective strategies for improving TQM practices for enhanced safety performance.

### **3 Research Methodology**

A quantitative research approach was employed for the study. The use of a well-structured questionnaire was adopted for data collection. Descriptive statistical tools were used to analyse the data collected. Research population involves a large collection of individuals or object that is the focus of a scientific query. It refers to the total number of the considerable population for the research (Morenikeji, 2006). The targeted population for this research was made up of selected construction professionals (Architects, Quantity Surveyors, Builders and Engineers) working in Federal Capital Development Authority (FCDA) in Abuja. There are a total of 286 professionals in FCDA, and 194 of them are registered under their respective professional bodies. The population size is, therefore, 194. The sample size for the study is 127 based on Krejcie and Morgan (1970) Table. The representative sample size for a population size of 190 on Krejcie and Morgan (1970) Table is 127. Since the population size of 190 is the nearest number to 194 on Krejcie and Morgan (1970) Table, then the sample size for this population size (127) was adopted for this study. A simple random sampling technique was adopted to select the sample size from the entire population. Therefore, 127 professionals were randomly selected from the total number of professionals in FCDA (194).

The study considered Abuja and FCDA in Abuja because Abuja is the capital city of Nigeria, and as a result, it is the hub of all construction activities due to the rapid development that takes place there (Kadiri *et al.*, 2014). In addition, all the medium and large-sized construction firms in Nigeria usually have construction projects in Abuja. FCDA is a Government organisation in Abuja that is massively and actively involved in construction projects ranging from simple housing projects up to heavy roads and other related engineering construction projects. FCDA is also one of the major

clients and initiator of construction projects in Abuja. FCDA also have competent professionals who oversee project supervision and vested with the responsibilities of ensuring compliance to site safe and quality management. Because of this, construction professionals in FCDA were considered for the study.

The data for the study were collected with the aid of a questionnaire survey during the tail end of the COVID-19 pandemic lockdown up to the last quarter of 2020. A structured questionnaire was employed to collect data on the research objectives based on a five-point Likert's Scale format. The questionnaire contains five sections. The first section addressed issues relating to the profile of respondents, while the other section addresses the study's objectives respectively. Of the 127 copies of a questionnaire distributed, 61 copies were returned and used, giving a response rate of 48%. In order to validate the research instrument used, a reliability test was carried out on the data collected. The reliability test result shows that all the items loaded have a fairly good correlation coefficient ( $r = 0.337 - 0.567$ ). A high Cronbach's Alpha of 0.773 was observed, indicating that the research data are reliable and hence the research instrument is valid.

Analysis of data was carried out using descriptive methods of analysis such as Frequency, Percentage, Relative Importance Index (RII), Mean Item Score (MIS) and Spearman's Rank Correlation analysis. RII was employed to examine stages of construction where TQM are most required. MIS was used to examine the TQM practices required to improve the safety performance of construction firms. MIS was also used to identify the safety practices most likely to be influenced by TQM practices. Spearman's Rank Correlation analysis was used to determine the relationship between TQM and safety practices of construction firms. MIS was also employed to examine the strategies for improving TQM practices for the enhanced safety performance of construction firms in order of effectiveness. The decision rule adopted for the RII and MIS is summarised in Table 1.

Table 1. Decision Rule for Data Analysis

| SCALE | Cut-Off Point |             | Interpretation      |                       |                        | Level Required  |
|-------|---------------|-------------|---------------------|-----------------------|------------------------|-----------------|
|       | RII           | MIS         | Level of Importance | Level of Significance | Level of Effectiveness |                 |
| 5     | 0.81 - 1.00   | 4.51 - 5.00 | Very Important      | Very Significant      | Very Effective         | Very Required   |
| 4     | 0.61 - 0.80   | 3.51 - 4.50 | Important           | Significant           | Effective              | Required        |
| 3     | 0.41 - 0.60   | 2.51 - 3.50 | Fairly Important    | Fairly Significant    | Fairly Effective       | Fairly Required |
| 2     | 0.21 - 0.40   | 1.51 - 2.50 | Less Important      | Less Significant      | Less Effective         | Less Required   |
| 1     | 0.00 - 0.20   | 1.00 - 1.50 | Least Important     | Least Significant     | Least Effective        | Least Required  |

(Source: Adapted and Modified from Shittu *et al.*, 2015)

## 4 Findings and Discussion

### 4.1 Results and Discussions on the Stages of Construction Projects where TQM Practices are most required

Relative Importance Index (RII) was employed to rank the identified stages of construction projects where TQM practices are most required in order of importance. This RII result is presented in Table 2.

Table 2. Stages of Construction Projects where TQM Practices are most required

| CODE NO | STAGES                  | RII         | RANK | DECISION              |
|---------|-------------------------|-------------|------|-----------------------|
| B1      | Conception Stage        | 0.92        | 1st  | Very Important        |
| B4      | Procurement Stage       | 0.87        | 2nd  | Very Important        |
| B5      | Construction Stage      | 0.87        | 2nd  | Very Important        |
| B2      | Design Stage            | 0.84        | 4th  | Very Important        |
| B6      | Post-construction Stage | 0.80        | 5th  | Important             |
| B3      | Pre-construction Stage  | 0.78        | 6th  | Important             |
|         | <b>Group RII</b>        | <b>0.85</b> |      | <b>Very Important</b> |

Table 2 shows the results of five (5) identified stages of construction projects where TQM practices are most required. The result shows that the conception stage is the most important stage, with an RII value of 0.92. This is followed by the procurement stage and construction stage, which are also very important, with RII values of 0.87 each. The design stage is the next ranked stage which is also very important with an RII value of 0.84. The least ranked are the pre-construction and post-construction stages, which are important with RII values of 0.80 and 0.78, respectively. Averagely, all the identified stages of construction projects where TQM practices are most required are very important (Group RII = 0.85). The study of Koutsogiannis (2020) slightly disagrees with this by indicating that the stages where TQM will be mostly required in the stages of construction projects are the pre-construction stage, construction stage and procurement stage. This study shows that all the stages are very important to TQM application, with the conception stage as the most important.

### 4.2 Results and Discussions on the TQM Practices Required for Improvement of Safety Performance of Construction Firms

Mean Item Score (MIS) was employed to rank the level of the requirements of the identified TQM practices required to improve the safety performance of construction firms. This result is presented in Table 3.

Table 3. TQM Practices Required for Improvement of Safety Performance of Construction Firms

| CODE NO | TQM PRACTICES              | MIS         | RANK | DECISION        |
|---------|----------------------------|-------------|------|-----------------|
| C1      | Human Resources Management | 4.52        | 1st  | Very Required   |
| C4      | Suppliers Management       | 4.51        | 2nd  | Required        |
| C3      | Process Management         | 4.31        | 3rd  | Required        |
| C6      | Customer Focus             | 4.25        | 4th  | Required        |
| C5      | Training                   | 4.23        | 5th  | Required        |
| C2      | Top Management             | 4.10        | 6th  | Required        |
| C7      | Workers Relationship       | 4.08        | 7th  | Required        |
|         | <b>Group MIS</b>           | <b>4.29</b> |      | <b>Required</b> |

Table 3 shows that seven major TQM practices are required to improve the safety performance of construction firms in Abuja. It was shown that Human Resource Management and Suppliers' Management are the most required TQM practices with MIS values of 4.52 and 4.51, respectively. The other five (5) TQM practices are also required. These range between Process Management (MIS = 4.31) and Workers Relationship (MIS = 4.08). On average, all the identified TQM practices for improving the safety performance of construction firms in Abuja are required (Group MIS = 4.29). The studies of Sadikoglu & Zehir (2010), Mokhtar & Yusof (2010), Ahmad *et al.* (2014) and Faihan *et al.* (2013) also confirmed, in agreement with the finding of this study, that the dimensions of TQM such as management leadership, process management, employee involvement and customer focus are commonly accepted activities to improve the quality performance of firms. This also shows that these TQM practices can be very influential in improving the safety performance of construction firms.

#### 4.3 Results and Discussions on the Safety Practices of Construction Firms Most Likely to be Influenced by TQM Practices

MIS was also adopted for ranking the identified safety practices of construction firms most likely to be influenced by TQM practices. This MIS result is presented in Table 4.

Table 4. Safety Practices of Construction Firms Most Likely to be influenced by TQM Practices

| CODE NO | SAFETY PRACTICES                            | MIS         | RANK | DECISION      |
|---------|---------------------------------------------|-------------|------|---------------|
| D1      | Proper Equipment Usage                      | 4.67        | 1st  | Very Likely   |
| D6      | Supervision of work carried out.            | 4.25        | 2nd  | Likely        |
| D7      | Transparency of duties and information.     | 4.23        | 3rd  | Likely        |
| D2      | Awareness                                   | 4.20        | 4th  | Likely        |
| D3      | Training of Staffs                          | 4.20        | 4th  | Likely        |
| D5      | Communication within Workers and management | 4.17        | 6th  | Likely        |
| D4      | Documentation of Work progress              | 4.15        | 7th  | Likely        |
|         | <b>Group MIS</b>                            | <b>4.27</b> |      | <b>Likely</b> |

As shown in Table 4, the study identified seven major safety practices of construction firms likely to be influenced by TQM practices. It was revealed that Proper Equipment Usage (MIS = 4.67) is the safety practice of construction firms most likely to be influenced by TQM practices. The remaining six (6) safety practices of construction firms also have high chances of being influenced by TQM practices. These range from Supervision of Work Carried Out (MIS = 4.25) to Documentation of Work Progress (MIS = 4.15). On average, all the safety practices of construction firms identified have a high likelihood chance of being influenced by TQM Practices (Group MIS = 4.27). The study of Adediran & Adediran (2008) slightly differs from the finding of this study by revealing that through training, workers can identify improvement opportunities as it is directed at providing the skills and knowledge required for all workers to be able to contribute to the ongoing quality improvement process of production. In this study, Proper Equipment Usage is the safety practice of construction firms most likely to be influenced by TQM practices instead of training in the study of Adediran & Adediran (2008).

#### 4.4 Results and Discussions on the Relationship between the Level of Implementing TQM and Firms' Safety Performance

Spearman rank correlation was employed to determine the relationship between the level of implementing safety TQM practices and construction firms' safety performance. The correlation result is presented in Table 5.

Table 5: Relationship between the Level of Implementing TQM and Firms' Safety Performance

| VARIABLES                           |                           | OBSERVATIONS |      | INFERENCES         |                          |        |
|-------------------------------------|---------------------------|--------------|------|--------------------|--------------------------|--------|
| X <sub>1</sub>                      | X <sub>2</sub>            | R (%)        | LOS  | P <sub>value</sub> | Strength of Relationship | Remark |
| Level of Implementing TQM Practices | Firms' Safety Performance | 42.0 (0.420) | 0.01 | 0.001              | Slightly Strong          | SS     |

**KEY:**

SS = Statistically Significant  
R = Correlation Coefficient  
LOS = Study's Level of Significance  
P<sub>value</sub> = Calculated Probability Value

It was observed from Table 5 that there exists a slightly strong, positive and significant relationship between the Level of Implementing TQM practices and Firms' Safety Performance. The correlation coefficient (R-value) observed was 42% (0.420), indicating a slightly strong association between the variables. The probability (P<sub>-value</sub>) value of 0.001 observed was less than the level of significance adopted for the study (0.01). This implies a significant relationship between the variables. The study's hypothesis (H<sub>1</sub>) was therefore accepted. The positive correlation observed between the variables indicates a tendency that an increase in the level of implementing TQM practices will increase firms' safety performance and vice versa. In line with the finding of this research, Husin *et al.* (2008) reported that a positive relationship exists between TQM and safety practices. Sadikoglu & Olcay (2014) also reported that TQM practices improve various performance measures in the firms, including safety. Hasse *et al.* (2015) also revealed that training is another principle of TQM that aids the preparation of employees towards the TQM process. Therefore, TQM has a significant impact on workers' safety performance by making them go through rigorous training to help them be better at what they do.

#### 4.6 Results and Discussions on the Strategies for Improving TQM Practices for Enhanced Safety Performance

MIS was also adopted to rank the identified strategies for improving TQM practices for enhanced safety performance in the order of effectiveness. This MIS result is summarised in Table 6. The result of the ten (10) identified strategies for improving TQM practices for the enhanced safety performance of construction firms in Abuja is presented in Table 6. It was shown that the most effective strategy for improving TQM practices for the enhanced safety performance of construction firms is Appointing a Quality Consultant with an MIS value of 4.48. The remaining nine (9) TQM practices for the enhanced safety performance of construction firms are also effective, with high MIS values ranging between 4.36 (Job Competency has to be ensured among workers on site) and 3.97 (Setting up persistent quality mindfulness program). On average, all the identified strategies for improving TQM practices for enhanced safety performance in Abuja are

effective (Group MIS = 4.19). Similarly, the studies of Mohamed (1997), Willar (2012) and Kakkad & Ahuja (2014) emphasised that these strategies are effective strategies for improving TQM practices for enhanced project performance. In addition, Ali & Omran (2016) revealed that these strategies are so effective that they can bring about 82% improvement in safety performance at construction sites.

Table 6. Strategies for Improving TQM Practices for Enhanced Safety Performance

| CODE NO | STRATEGIES FOR IMPROVING TQM PRACTICES                                      | MIS         | RANK | DECISION         |
|---------|-----------------------------------------------------------------------------|-------------|------|------------------|
| E1      | Appointing a Quality Consultant                                             | 4.48        | 1st  | Effective        |
| E10     | Job Competency has to be ensured among workers on site.                     | 4.36        | 2nd  | Effective        |
| E2      | Making a Quality standard                                                   | 4.28        | 3rd  | Effective        |
| E4      | Make available education and training requirements for all levels of staff. | 4.20        | 4th  | Effective        |
| E3      | Create organisational structures and assign responsibilities                | 4.18        | 5th  | Effective        |
| E7      | Planning prize framework to expand staff inspiration and fulfilment         | 4.18        | 6th  | Effective        |
| E5      | Assessment and testing exercises (counting any examination and test plans)  | 4.15        | 7th  | Effective        |
| E9      | The field managers ought to be very responsive to workers.                  | 4.08        | 8th  | Effective        |
| E8      | Successful costing of administration or item is given.                      | 3.98        | 9th  | Effective        |
| E6      | Setting up a persistent quality mindfulness program                         | 3.97        | 10th | Effective        |
|         | <b>Group MIS</b>                                                            | <b>4.19</b> |      | <b>Effective</b> |

## 5 Conclusion and Further Research

The study revealed that the Conception Stage is the most important stage of construction projects where TQM practices are required. Human Resource Management and Suppliers' Management are the most required TQM practices. Proper Equipment Usage is the safety practice of construction firms most likely to be influenced by TQM practices. The relationship between TQM practices and the safety performance of construction firms is significant. The most effective strategy for improving TQM practices for the enhanced safety performance of construction firms is Appointing a Quality Consultant. Therefore, it can be concluded that the effect of TQM on the safety performance of construction firms in Abuja, Nigeria, is significant. Therefore, proper implementation of TQM practices improves the safety performance of construction firms. Based on the findings and conclusions of this study, the following recommendations were made:

- i. The management of construction firms should adopt TQM practices right from the conception stage of a project to ensure that TQM practices are implemented throughout the project life cycle.
- ii. Construction firms should focus more on Human Resource Management and Suppliers' Management when implementing TQM practices to build up a mechanism for improving the safety performance of construction firms.

- iii. Construction firms should prioritise the strategy of Appointing a Quality Consultant when setting up a mechanism for improving the safety practices of workers on site. This will ensure continuous improvement of the relationship between TQM practices and the safety performance of construction firms.

The findings of this study will make a significant contribution by enabling construction firms to cajole their Quality Managers into doing more to improve the safety performance of construction workers on site. This will also improve the safety performance of the built environment practice at large in Nigeria.

In the light of the limitations of this study, the following are suggested for further studies: Impact of TQM practices on the performance of safety supervisors in construction projects; Comparative analysis of the effect of TQM practices on the safety performance of small, medium, and large-sized construction firms in Nigeria; and Comparative analysis of the effect of TQM practices on the safety performance at various stages of construction projects in Nigeria.

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