

Quality management practices among construction firms in Lagos State, Nigeria

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Abstract

Quality management is an important management system to be considered by construction firms in order to improve the level of their performance. It is required for a construction firm that seeks to sustain itself in the current construction market which is highly challenging and competitive. The construction industries in the developing countries have been struggling with quality issues for many years; while the construction firms have been wasting resources as a result of faulty construction. Therefore, this study examined quality management practices by construction firms in Nigeria, assess the impact of quality management practices on the construction firms and determine factors affecting quality management practices in construction firms. Fifty construction firms with registration category of A, B, C and D were surveyed for the study and the data elicited were analyzed using Frequency distribution and percentage, relative importance index (RII) and analytical hierarchy process (AHP). The study found that quality management systems are being practised among construction firms but not in a standardized manner as the firms indicated different quantity management systems. The opportunity to get continued work from clients was found as the most significant impact of quality management practices on construction firms. The study concluded that no standard quality management system existed among the construction firms and that construction firms lack the resources and training to manage quality and are being affected by the corruption climate in Nigeria.

Keywords: quality management, quality management systems, quality management practices.

1.0 Introduction

Construction industry has been widely criticized for its low quality of delivery of construction projects (Marasini and Quinnell, 2010; Hoonakker et al., 2010). Ashokkumar (2014) and Al-Ani and Al-Adhmani (2011) concluded that construction firms need to adopt quality management in order to solve quality problems and meet the demands of the clients. ISO 8402 (1994) describes quality as the degree of excellence in a competitive sense. Ashokkumar (2014) noted that the quality of construction projects is determined by quality management. According to Hoonakker et al. (2010), quality management is important for the delivery of a project with zero defects. Also, Tan and Abdul-Rahman (2011) opined that quality management is required for a construction firm that seeks to sustain itself in the current construction market which is highly challenging and competitive. Quality management practice can help minimize material wastage, cost overrun and delay (Ashokkumar, 2014) and can be used to address client's requirements (Hoonakker et al., 2010). Al-Ani and Al-Adhmani (2011) argued that quality management is an important management system to be considered by construction firms in order to improve the level of their performance; yet construction firms are not practicing quality management.

Delgado-Hernandez and Aspinwall (2008) noted that quality management practices has helped the construction firms in UK to enjoy more business from clients, increase their market shares and improve their customer satisfaction levels. As compared to construction firms in the developed countries, the level of quality construction in the developing countries is low and the construction firms in the developing countries are slow in adopting quality management practices (Adusa-Poku, 2014). Ashokkumar (2014) stated that the construction industry in India has been struggling with quality issues for many years and the construction firms have been wasting resources as a result of faulty construction. In Nigeria, little is known about quality management practices among the construction firms. Hence, this study intends to examine quality management practices by construction firms in Nigeria, assess the impact of quality management practices on the construction firms and determine factors affecting quality management practices in construction firms.

2.0 Background

ISO 8402 (1994) describes quality management system as the organizational structure, process, resources and procedure needed to implement quality management and that it involves the activities of the overall management function that determines the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement. Mane and Patil (2015) referred to quality management system as quality planning, quality assurance and quality control. Hoonakker et al. (2010) noted that quality management system includes investing in people, ISO 9000, custom designed systems and third party certifications.

The practice of quality management, according to Liu (2003), Hoonakker et al. (2010), Pheng and Wee (2001), McIntyre and Kirschenman (2000), Kiuus and Williams (2001), Turk (2006), Watson and Howarth (2011) and Ofori et al. (2002) can speed up projects and increase profitability, help to satisfy clients, reduce the number of defects in projects, reduce rework, bring competitive edge for firm and help to complete project within budget, improve construction firm's reputation, help firm get continued business or work from clients, improve schedule performance, improve relationships with the consulting architects and engineering firms, increase buildability factors of projects, increase efficiency in using materials, promote control of suppliers and subcontractors, reduce inspection costs, contribute to an increase in product quality, improve workmanship and efficiency, decrease wastage, and improve organizational communication.

Quality management system could be implemented at the organizational level or at the project level (Mane and Patil, 2015). Hoonakker et al. (2010) opined that company size as a factor affects the implementation of quality management. Chin and Choi (2003) identified top management commitment as the most critical factor affecting quality management practices. Other factors affecting quality management practices at the organizational or project level include; inconclusive interpretation of standard requirements, training policies, lack of internal quality audit and training for staffs at all levels, lack of understanding of quality management, lack of awareness, lack of available quality management system, high cost of implementing

quality management system and time constraints (Chew and Chai, 1996; Goh and Chong, 2000; Said et al., 2006).

3.0 Method

The target population for this study was composed of construction firms in Lagos State and were surveyed through a structured questionnaire survey approach. Stratified random sampling was employed to select the firms, where each of the construction firms was assigned to a group, then firms to be sampled were selected from each group using simple random sampling technique. The construction firms were grouped into four groups namely; building and civil engineering firms, general building contractors, general civil engineering contractors, and Lagos State ministry of work. In total, 50 construction firms with registration category of A, B, C and D were selected for the study; however, 44 completed questionnaire were returned. The rate of response in this study was 88%.

Data collected were analyzed using Frequency distribution and percentage, Relative Importance Index (RII) and Analytical Hierarchy Process (AHP). RII was used to examine the predominant quality management systems among the construction firms and to show the degree of impact of quality management practices on the construction firms. To determine the relativity index for the quality management system, respondents were asked to rate the usage of quality management system on a five-point Likert scale. The relativity index was then determined using the ratio of the summation of all the weighted value (SWV) and the total number of the respondents from all ratings and respective number of respondents. RII for the quality management systems and their impacts were calculated based on the formula below;

$$RII = \sum rfu/n$$

$$rfu = \text{ratings of the frequency of use} = SWV/\sum xi$$

$$n = \text{number of use}$$

$$SWV = \sum xiyi$$

$$xi = \text{number of responses to rating } i$$

$$yi = \text{the value to rating } i$$

AHP is useful for reducing complex decisions to a series of pairwise comparisons, and then synthesizing the results. In order to compute the weights and check the consistency of the evaluation of the factors affecting quality management system among the construction firms, a pairwise comparison matrix was created. A total of 12 factors were identified and grouped into three groups, namely; manpower-related factors (factor 1- factor 4), management practices-related factors (factor 5 – factor 8), and procurement-related factors (factor 9 – factor 12). The factors are as described below;

Factor 1: Lack of top management commitment

Factor 2: Lack of expertise and resources required for quality management

Factor 3: Lack of employee commitment to quality management

- Factor 4: Lack of human resources development (HRD) strategies
- Factor 5: Willingness to sacrifice quality for profits
- Factor 6: Readiness to sacrifice quality for low bid
- Factor 7: Perception that quality management is all about workmanship supervision
- Factor 8: Perception that quality management is for manufacturing industry only
- Factor 9: Current tendering and bidding climate
- Factor 10: Perception that too much paper work is required for quality management
- Factor 11: Time and cost of implementing quality management
- Factor 12: Changing trends in procurement system

Each entry a_{jk} of the pairwise comparison matrix represents the importance of the j_{th} criterion relative to the k_{th} criterion. The pairwise comparison judgement matrix and inconsistency matrix for the three groups were shown in Table 1.0, Table 2.0, Table 3.0, Table 4.0, Table 5.0 and Table 6.0. Where $a_{jk} > 1$, then the j_{th} criterion is more important than the k_{th} criterion, and when $a_{jk} < 1$, then the j_{th} criterion is less important than the k_{th} criterion. When two criterion have the same importance, then the entry a_{jk} is 1. The entries a_{jk} and a_{kj} satisfy the following constraint:

$$a_{jk} \cdot a_{kj} = 1$$

Table 1.0: Pairwise comparison judgement matrix on manpower-related factors

| Factors | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|-----------------|----------|----------|----------|----------|
| Factor 1 | 1 | 1.97 | 1.69 | 0.82 |
| Factor 2 | 0.51 | 1 | 3.79 | 2.54 |
| Factor 3 | 0.59 | 1.22 | 1 | 3.65 |
| Factor 4 | 0.50 | 0.26 | 0.39 | 1 |
| | 2.60 | 4.45 | 6.87 | 8.01 |

Table 2.0: Inconsistency matrix on manpower-related factors

| Factors | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|-----------------|----------|----------|----------|----------|
| Factor 1 | 0.39 | 0.44 | 0.26 | 0.10 |
| Factor 2 | 0.20 | 0.23 | 0.55 | 0.32 |
| Factor 3 | 0.23 | 0.27 | 0.15 | 0.45 |
| Factor 4 | 0.19 | 0.06 | 0.06 | 0.13 |

Table 3.0: Pairwise comparison judgement matrix on management practices-related factors

| Factors | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|-----------------|----------|----------|----------|----------|
| Factor 5 | 1 | 1.08 | 2.59 | 1.51 |
| Factor 6 | 0.93 | 1 | 1.73 | 1.73 |
| Factor 7 | 0.39 | 0.66 | 1 | 1.79 |
| Factor 8 | 0.49 | 0.58 | 0.58 | 1 |
| | 2.81 | 3.32 | 5.90 | 6.03 |

Table 4.0: inconsistency matrix on management practices-related factors

| Factors | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|----------|----------|----------|----------|----------|
| Factor 5 | 0.36 | 0.33 | 0.44 | 0.25 |
| Factor 6 | 0.32 | 0.30 | 0.30 | 0.29 |
| Factor 7 | 0.14 | 0.20 | 0.17 | 0.30 |
| Factor 8 | 0.17 | 0.18 | 0.10 | 0.17 |

Table 5.0: Pairwise comparison judgement matrix on procurement-related factors

| Factors | Factor 9 | Factor 10 | Factor 11 | Factor 12 |
|-----------|----------|-----------|-----------|-----------|
| Factor 9 | 1 | 2.28 | 2.05 | 2.12 |
| Factor 10 | 0.49 | 1 | 3.07 | 1.87 |
| Factor 11 | 0.49 | 0.51 | 1 | 1.96 |
| Factor 12 | 0.46 | 0.53 | 0.51 | 1 |
| | 2.44 | 4.32 | 7.63 | 6.95 |

Table 6.0: inconsistency matrix on procurement-related factors

| Factors | Factor 9 | Factor 10 | Factor 11 | Factor 12 |
|-----------|----------|-----------|-----------|-----------|
| Factor 9 | 0.40 | 0.53 | 0.27 | 0.31 |
| Factor 10 | 0.20 | 0.23 | 0.40 | 0.27 |
| Factor 11 | 0.20 | 0.12 | 0.13 | 0.28 |
| Factor 12 | 0.19 | 0.12 | 0.07 | 0.14 |

4.0 Findings and discussions

Table 7.0: Quality management systems in use among construction firms

| Quality management systems | SWV | RFU | ROI |
|---------------------------------|-----|------|-------|
| Jobsite quality plan | 118 | 2.95 | 0.44 |
| Skill enhancement and training | 96 | 2.53 | 0.02 |
| ISO 9000 standards | 80 | 2.11 | -0.40 |
| Client's checklist | 112 | 2.80 | 0.29 |
| Proper material storage | 97 | 2.43 | -0.08 |
| Specialist subcontractor system | 81 | 2.03 | -0.48 |
| Third party certification | 100 | 2.50 | -0.01 |
| Custom designed system | 80 | 2.00 | -0.51 |
| Workmanship supervision | 130 | 3.25 | 0.74 |
| Proper procurement system | 78 | 2.01 | -0.48 |
| Aggregated Index = 2.46 | | | |

Table 8.0: Department handling quality management in construction firms

| Department handling quality management | Frequency | Percent | Valid Percent | Cumulative Percent |
|--|-----------|---------|---------------|--------------------|
| Head office administration | 5 | 11.4 | 20.8 | 95.8 |
| Project manager's office | 7 | 15.9 | 29.2 | 29.2 |
| Site engineer's office/Site agents | 11 | 25.0 | 45.8 | 75.0 |
| Architect | 1 | 2.3 | 4.2 | 100.0 |
| Total | 24 | 54.5 | 100.0 | |
| No response | 20 | 45.5 | | |
| | 44 | 100.0 | | |

Table 9.0: Impact of quality management practices on construction firms

| Impact of quality management practices | SWV | RFU | ROI |
|--|-----|------|-------|
| Improvement in firm's reputation | 124 | 3.10 | 0.32 |
| Improving relationship with consultants and subcontractors | 119 | 2.98 | 0.20 |
| Completion of projects within budgets | 85 | 2.30 | -0.48 |
| Completion of projects on time | 99 | 2.54 | -0.24 |
| Competitive edge | 109 | 2.80 | 0.02 |
| Better efficiency | 100 | 2.56 | -0.22 |
| Improve organizational communication | 109 | 2.73 | -0.05 |
| Reduction in rework | 104 | 2.60 | -0.18 |
| Getting continued work from clients | 135 | 3.38 | 0.60 |
| Profitability | 80 | 2.10 | -0.21 |
| Aggregated Index = 2.71 | | | |

Table 10.0: Priority vector (normalized Eigen vector) on manpower-related factor

| Factors | Priority vector (normalized Eigen vector) | Grade |
|----------|---|-------|
| Factor 1 | 0.30 | 2 |
| Factor 2 | 0.33 | 1 |
| Factor 3 | 0.28 | 3 |
| Factor 4 | 0.11 | 4 |

Table 11.0: Priority vector (normalized Eigen vector) on management practices-related factor

| | Priority vector (normalized Eigen vector) | Grade |
|----------|---|-------|
| Factor 5 | 0.35 | 1 |
| Factor 6 | 0.30 | 2 |
| Factor 7 | 0.20 | 3 |
| Factor 8 | 0.16 | 4 |

Table 12.0: Priority vector (normalized Eigen vector) on procurement-related factor

| | Priority vector (normalized Eigen vector) | Grade |
|------------------|---|-------|
| Factor 9 | 0.37 | 1 |
| Factor 10 | 0.28 | 2 |
| Factor 11 | 0.18 | 3 |
| Factor 12 | 0.13 | 4 |

4.1 Quality management practices by construction firms

Quality management systems are being used among construction firms but not in a standardized manner as the firms indicated different quantity management systems. Table 7.0 shows that supervision of workmanship was the most used quality management system among construction firms, its index was 3.25 with a positive deviation of +0.74. Also it is higher than the aggregated index of 2.46. This suggests that supervision of workers is a common occurrence on construction sites in Lagos state and that supervisors are relied upon to determine the quality of work done. The level of quality of projects can be said to depend on the level of expertise of supervisors. In projects, where inexperienced supervisors or supervisors that are not knowledgeable in quality control are in charge of workmanship supervision, the project might not be of good quality. The other most used quality management system among construction firms is jobsite quality plan with an index of 2.95 and positive deviation of 0.44. Other systems mostly used for quality management were client’s checklists and skill enhancement and training. This suggests that construction firms usually develop plans to control quality of work and materials on site and adhere to client’s specifications. Also, workers are being trained to enhance their skills in order to ensure good workmanship and educate them on quality management. The management of quality is not the sole responsibility of construction managers and should cut across the levels of management from top to bottom.

Among the quality management systems with negative deviation, proper procurement system has the highest negative deviation of 0.48 with index of 2.01. This suggests that construction firms do not use to follow proper procurement system. Depending on the contractual agreement, construction firms may be procuring materials or even contracts through improper channels. Suppliers and subcontractors nominated by architects or clients who contractors have little or no control over may be responsible for defective works in projects. Also, construction firms were not too frequently using ISO 9000 standards. This can only mean that the majority of projects executed in Lagos State were not in conformity with international standards. Few of the construction firms using ISO 9000 standards as quality management system are likely to have expatriates among their workers. Other quality management systems that had lesser frequency of use were specialist subcontractor system, proper material storage, custom designed system and third party certification. High rate of defective works could be as a result of improper storage of materials, low usage of specialist subcontractor, low-usage of custom designed and third party certification system.

As shown in Table 8.0, majority of the construction firms (25%) were only handling quality management on construction sites, with top management (11.4%) not committed to quality management. Less than 16% and 3% of the construction firms relied on project managers and architects respectively to handle quality management. Over 45% of the respondents did not indicate the department handling quality management in their firms, this could suggest that these firms were not practising quality management or did not have a specific department handling quality management. These findings are consistent with studies by Hoonakker et al. (2010), Tan and Abdul-Rahman (2011) and Adusa-Poku (2014) which indicated that construction firms lacked the use of a uniform quality management system and that while countries like UK and Hong Kong have adopted ISO 9000 for quality management, countries like Ghana and Malaysia have not done so.

4.2 Impact of quality management practices on the construction firms

Table 9.0 shows the impact of quality management practices on construction firms. Ranked first among the impact of quality management practices on construction firms is the opportunity to get continued work from clients with an index of 0.60, followed by improvement in firm's reputation with an index of 0.32; while improvement in relationship with consultants, suppliers and subcontractors ranked third with an index of 0.20. Impacts with negative deviation include improvement in organizational communication, reduction in rework, profitability, and better efficiency, completion of projects on time and completion of projects within budgets. This findings shows that quality management practice is helping construction firms to meet client's requirements, thereby ensuring increased patronage from the clients. Majority of construction customers know exactly what they want and appreciate it when they get what they want from construction firms. The continued patronage of the construction firms is a way of showing their appreciation and repaying the firm for a job well-done. Quality management practices have great impact on the reputation of construction firms as satisfied clients and users will give the firm a good recommendation. Also, consultants and suppliers who worked with quality management practicing construction firms will be more than willing to work with them on future projects. When bidding for contracts, quality management practices could give construction firms a competitive edge over rivals. However, quality management practices have little impact on construction firms when it comes to organizational communication, reduction in rework, profitability, efficiency, time savings and cost savings. This could be as a result of over-dependence of construction firms on workmanship supervision as the only system of quality management.

4.3 factors affecting quality management practices in construction firms

Table 10 shows how manpower-related factors affecting quality management practices among construction firms. Lack of expertise and resources required for quality management ranked first with a priority eigenvector of 0.33, followed by lack of top management commitment with a priority eigenvector of 0.30, while lack of employee commitment to quality management and lack of human resources development strategies ranked third and fourth with priority eigenvector of 0.28 and 0.11 respectively. This finding shows that construction firms in Lagos

State lack the manpower to implement quality management. The lack of expertise and resources required for quality management among construction firms suggests that construction professionals lack knowledge of quality management or are not provided with the resources needed to implement quality management. Therefore, there's need for the management of construction firms in Lagos State to look into criteria for employing workers and areas in which they develop their human resources. With lack of top management commitment as one of manpower-related factors affecting quality management practices. This shows that construction professionals in the top management of the construction firms are not prioritizing quality management in their respective firms and that quality of projects are being taken for granted. Top management in organization are saddled with the responsibility of driving growth for their organizations. The impact of quality management on the reputation of construction firms is very great and this could affect the growth and visions of an organization. This finding is consistent with an earlier study by Mane and Patil (2015) which indicated that top management full support and commitment to quality management is very important to its implementation. Without the commitment of top management to quality management, employees won't be committed to quality management as well. The middle and bottom level of management in an organization are occupied by employees whose responsibilities are to implement the visions of top management. However, in some cases, where top management is committed to quality management, the lack of commitment on the part of employee may also affect quality management practices. This is due to the fact that most of the quality management practices are to be carried out by the employee. The finding also shows that the construction firms lack the human resources development strategies that could be used to implement or enhance quality management practices. This factor affects both the top management and employee, since human resources development strategy focusing on quality management practices can be adopted in the training and development of human resources in the construction firms and this could bring the required commitment from them.

Table 11 shows the ranking of management practices-related factors affecting quality management practices among construction firms. The willingness to sacrifice quality for profits by management ranked first priority eigenvector of 0.35, closely followed by the readiness of the management to sacrifice quality for low bid with priority eigenvector of 0.30. ranked third and fourth with priority eigenvector of 0.20 and 0.16 are perception of management that quality management is all about workmanship supervision and perception that quality management is only required in manufacturing industry. The willingness of management of construction firms to sacrifice quality for profits is a major contributing factor to defective projects in Lagos State. Substandard materials are used in place of standard ones, concrete mix ratios are increased, and inexperience and cheap labour are employed for projects with the aim of maximizing profits on projects. This is a common management practices and it affects quality management practices. It is impossible to practice quality management where the management practices is all about maximising profits at the expense of quality. The willingness of management of construction firms to sacrifice quality for profits is similar to what have been reported in previous studies. Oke and Abiola-Falemu (2009) reported that the climate of corruption in Nigeria favoured poor-

quality construction, and Hoonakker et al. (2010) reported that quality is affected by the pressure to reduce the initial cost of construction and supervision. Another important management practices-related factor is the readiness of management to sacrifice quality in order to secure contracts. This seems to be the bidding strategy commonly employed by management of construction firms to outbid their rivals. Desperation for contracts and lack of integrity could be explained as reasons why this management practices is rampant among construction firms. Although quality management was borrowed from the manufacturing industry but so also were other innovative ideas which have benefited the manufacturing industry. The construction industry is trailing the manufacturing industry in terms of productivity, profitability and customer satisfaction. The influence of the manufacturing industry on the construction industry cannot be overlooked, so also are the innovative ideas in the manufacturing industry which have contributed to its development. It is about time that management of construction firms change their perception that quality management is only meant for the manufacturing industry. Also, the perception that workmanship supervision is all there is to quality management is erroneous. Workmanship supervision is a mere technique to control quality on construction sites. Management are required to do more in quality management than relying on workmanship supervision alone to deliver quality projects.

Table 12 shows the procurement-related factors influencing quality management practices in construction firms. Current tendering and bidding climate ranked first with priority eigenvector of 0.37. Ranked second is the perception that too much paperwork is required for quality management with priority eigenvector of 0.28, followed by time and cost of implementing quality management with priority eigenvector of 0.18. Changing trends in procurement system ranked least with priority eigenvector of 0.13. This shows that the current bidding climate which allows the quality of projects to be sacrificed for low-bid is affecting the practice of quality management among construction firms. Construction firms in order to survive in the current bidding climate will attach little or no importance to quality management. Practicing quality management will lead to delivery of quality projects but will also affect profits and overheads of the firms. The bureaucracy attached to management has also deterred construction firms from managing quality. Fear of too much paperwork and bottlenecks which might indirectly waste time and other resources may be responsible for this. Also, time and cost of implementing quality management and the ever-changing trends in procurement systems could affect the way construction firms practice quality management.

5.0 Conclusions

The study concluded that no standard quality management system existed among the construction firms in the study area. The firms have not adopted ISO 9000 for quality management as it was adopted by construction firms in the developed countries. Also, quality management is site-based and is mostly undertaken by supervising workers. Moreover, construction firms do not use to follow proper procurement system and are willing to sacrifice quality for profits and contracts. Firms who are practicing quality management are getting continued work from clients, witnessing improvement in their reputation, and enjoying a

competitive edge over their rivals. Top management of construction firms are not committed to quality management and the systems of quality management being employed by construction firms have negligible impact on their profitability, time savings and organizational communication. It was also concluded that construction firms in the study area lack the resources and training to manage quality and are being affected by the corruption climate in Nigeria.

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