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Factors Affecting Quality Management Practices in the Delivery of Public Housing Projects in Nigeria

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ABSTRACT

Quality management aims at satisfying clients' craving in order to bring long haul aggressiveness and business survival for the organization. However, over the years, the construction industry has been widely criticized for the low quality of delivery of construction projects (both the finished product quality and the processes used during the project design as well as the construction stages). Significant time and cost are currently spent in correcting problems during the snagging process and the majority of projects either suffer from time overrun or cost overrun or both. However, this discounts the importance of process-based approach to deliver final product with desired quality. The aim of this study was to examine the factors that affect quality management in the delivery of public housing in Nigeria. The specific objectives were to identify the factors and their indicators, and to establish the relationships between them and quality management. The study employed a survey method using questionnaires. The data obtained from the questionnaires were analysed using path coefficients, *t* statistics and p-values. The study revealed that there were significant relationships between manpower, management practice, procurement, professional regulation, moral turpitude, and quality management in the study area and recommended that they should be considered to achieve effective quality management in the delivery of public housing projects in Nigeria.

1. Introduction

Quality can be defined according to American Society of Civil Engineers [1] as meeting the legal, aesthetic, and functional requirements of a project. These requirements may be simple or complex, or they may be stated in terms of the result required or as a detailed description of what is to be done. For construction of public housing projects, quality management is paramount and means making sure things are done according to the plans, specifications, and permit requirements. This is necessary, given the fact that public housing is a form of housing tenure in which the property is usually owned by a government authority, either central or local, established to provide decent and safe rental housing for eligible low-income families, the elderly, and persons with disabilities. The days of embarking on projects which usually involve huge funds without due diligence and proper regulation seem to be over, making it imperative that communities get the most out of their infrastructure projects [2].

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According to Dada, Obiegbu and Kunya [3], quality management covers all activities of integrating all processes, procedures, structures, and products to achieve quality in the finished project. Council of Registered Builders of Nigeria [4] captured quality as the critical factor in evaluating the success or otherwise of construction project delivery, which provides the measurable parameter for appreciating the extent to which the expectations of project participants are acceptably fulfilled. In a nutshell, quality by Agbenyega [5] aims at standardization, while Bala, Keftin and Adamu [6] perceived quality management as a wide-scale failure prevention program. Quality can also be defined from the viewpoint of function, by how closely the project conforms to its requirements.

Using this definition, a high-quality project can be described by such terms as ease in understanding drawings, level of conflict in drawings and specifications, economics of construction, ease of operation, ease of maintenance, and energy efficiency. In the construction industry, quality can be defined as meeting the requirements of the designer, constructor, and regulatory agencies as well as the owner. According to American Society of Civil Engineers [1], quality can be characterized as follows;

a. Meeting the requirements of the owner as to functional adequacy; completion on time and within budget; lifecycle costs; and operation and maintenance.

b. Meeting the requirements of the design professional as to provision of well-defined scope of work; budget to assemble and use qualified, Trained, and experienced staff; budget to obtain adequate field information prior to design; provisions for timely decisions by owner and design professional; and contract to perform necessary work at a fair fee with adequate time allowance.

c. Meeting the requirements of the construction as to provision of contract plans, specifications, and other documents prepared in sufficient detail to permit the constructor to prepare priced proposal or competitive bid; timely decisions by the owner and design professional on authorization and processing of change orders; fair and timely interpretation of contract requirements from field design and inspection staff; and contract for performance of work on a reasonable schedule with reasonable profit.

d. Meeting the requirements of regulatory agencies (the public) as to public safety and health; environmental considerations; protection of public property including utilities; and conformance with applicable laws, regulations, Codes, and policies. Quality management procedures need to be implemented throughout the project lifecycle of any project to attain the desire level of quality as planned. Project procurement lifecycle as cited in Sirbadhoo, Hoyana and Othman [7] summarizes the consequences of not adhering to and not ensuring that quality management procedures are implemented throughout the project lifecycle as: Design fault; Misunderstanding the clients brief to develop the design; Using the information which is incorrect or out of date; Misunderstanding clients expectation of quality standard; Construction faults; Not building to drawing or specifications and poor supervision leading to bad workmanship.

According to the Nigeria National Quality Policy (2020), quality means the degree to which a set of inherent characteristics or distinguishing feature fulfils requirements that are stated, generally implied or obligatory while quality management is the coordinated activities to direct and control an organization with regard to quality. The Standards Organisation of Nigeria (SON) and the National Quality Infrastructure Project for Nigeria (NQIP) were established, in order to increase the awareness on quality and standards, contribute to the consumers' confidence in Nigerian products and promote healthy competition among manufacturers and services providers. They are involved

in the preparation of Standards relating products, measurements, materials, processes and services amongst others and their promotion at National, Regional and International levels; certification of products, assistance in the production of quality goods and services; improvement of measurement accuracies and circulation of information relating to standards.

When quality is fully and properly addressed through a quality management plan, it leads to greater efficiencies as the plans are designed to: Standardize processes; Minimize waste; Eliminate rework; Increase profit; Reduce inefficiencies; Improve work practices; Increase workers morale and increase opportunity for a greater market share [8]. The aim of this study is to examine the factors that affect quality management in the delivery of public housing in Nigeria. The specific objectives were to identify the factors and their indicators; to establish the relationships between them and quality management using path coefficients.

In the process of managing Standard quality in construction projects, different techniques are used to help construction parties complete the projects on time. Quality management systems indicate the direction of the project at each time and reveal progress. They are utilized in the construction industry for the planning and control of materials, labour, and machinery/equipment for project delivery & sustainability. Some of these include Quality Planning; Quality Assurance; Quality Control; ISO 9001 Quality Management Practices; Jobsite Quality Management; Checklist for Clients; Materials Storage System; Third Party Certification System; Workmanship Supervision [9].

Factors that affect quality in each phase of the construction process

a. Management and leadership

The prominent method of management practiced in the United States today, including the construction industry, is management by control, not by participation. Forced by international competitive pressures and increasing demands for quality products and services, industries are re-evaluating the effectiveness of management by control. In this style of management, the emphasis is on the organizational chart and the key control points within the structure.

All managers, beginning at the top, are given certain goals for the next year. They in turn, set goals and impose controls on each of their subordinates. In construction terms, cost, schedule, and possibly quality goals are established for each project. Project managers are rewarded based on meeting these goals. This method has been somewhat successful. It is simple, logical, and consistent. But there are problems when the work gets displaced by the controls themselves.

Also, competition to meet short-term goals can lead to internal conflict, adversarial relationships, reduced communication, and accusations. Management by control encourages an organization to look inward rather than outward to the customer and the customer's needs. Once it is acknowledged that there is a problem, the second step for the management is to develop a clear understanding of the underlying principles and elements of Total Quality Management [TQM] [9].

Management then demonstrates its commitment to quality through action. Without this understanding, management's action will most likely contradict TQM, confirming the doubts of the labour force and stemming the effort to failure. Construction managers, designers, contractors and facility managers investigated TQM in the design, construction, and operation phases of projects undertaken in the USA and stated that the level of management commitment to continuous quality improvement is rated as one of the most important factors that affect the quality of the constructed facility [10].

b. Skill enhancement and training (manpower development) on quality

Employee training on quality is one of the factors that affect quality management. The importance is recognized by every quality expert. Under TQM, quality becomes the responsibility of everyone and the training must be targeted for every level of the company. There should be customized training plans for management, engineers, technicians, home and field office staff, support personnel and field labour [9].

However, there are many aspects, such as training and awareness that are similar between the safety consciousness of construction firms and the implementation of TQM concepts. Many US construction companies that had safety forced upon them with the formation of the Occupational Safety and Health Administration have proven the cost effectiveness of their safety programs and now use their safety records as a marketing tool. Some of the same techniques used to instil safety awareness in craft labour may be adaptable to instil similar quality awareness [11]. It is easy to envision using a good quality performance record as a strong marketing tool. If TQM concepts become widely accepted throughout the construction, industry, workers switching from one company to another should require less TQM training since all workers would have received basic quality awareness in their previous employment.

The training effort may include instruction in the basics of TQM, cause-and-effect analysis, team problem solving, interpersonal communication and interaction, rudimentary statistical methods, and cost of quality measurement. A study of TQM in more than 200 companies found that skills in human interaction, leadership, and initiative are instrumental to the success of any quality improvement effort [11].

The demands on these interpersonal skills increase as the complexity and sophistication of the technical systems increase. The training effort follows a specific plan, and its implementation and effectiveness are carefully tracked. It is initiated in a limited number of pilot teams. The success stories of the pilot teams are then used to fuel the training effort. Follow-up training is essential and is part of the overall training plan and a job requirement for everyone [9].

It follows that operation and maintenance crews working in constructed facilities should be the main recipient of training efforts, Findings are parallel to ISO 9001 which emphasizes the importance of training and underlines that activities demanding acquired skills should be identified and the necessary training provided [12].

c. Teamwork among professionals

Quality teams provide companies with the structured environment necessary for successfully implementing and continuously applying the TQM process. Quality training is conducted, and the continuous improvement process executed through a well-planned team structure [13]. The goal of the team approach is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with the TQM process. At the industry level, extending the TQM concept to the parties mentioned above in the form of joint teams achieves higher customer satisfaction [14]. These joint teams are responsible for establishing joint goals, plans, and controls. The teams provide a mechanism for listening to and communicating with the owner and for measuring the level of customer satisfaction. At the company level, teams composed of department representatives are necessary to implement TQM throughout the organization. The same team approach can be used at the project level. "Extent of teamwork of parties participating in the design phase" was found to be the most important factor that affects quality [15].

d. Proper procurement system

A proper procurement system is essential for effective quality management on building construction sites. In the planning of procurement strategies, the following stakeholders are involved: The client; The main contractor; Project sponsors; Financial bodies; Insurers; Designers; Sub-contractors; Suppliers; Purchasing department employees. The major responsibilities include buying products and services; managing procurement processes; maintaining supplier relationships (supply chain engagements) and ethics; sustaining business/client's goals and objectives; policy on budget management; breaking down projects into packages; determining types of engagement model-risk allocation and management responsibility; selecting appropriate commercial models (BIM); determination of timelines and milestones; establishing probity requirements; other operations and logistics [16].

e. Specialist sub-contractor system

In specialist sub-contracting, supplier involvement in procurement is very crucial. Specialist sub-contractor system enhances contractors' performance in proper procurement systems. The ability to produce a quality product largely depends on the relationship among the parties involved in the process, the supplier, the processor, and the customer. The quality of any stage in a process is contingent upon the quality of the previous stages [14]. In Nigeria, significant time and cost are currently spent in correcting problems during the snagging process and the majority of projects either suffer from time overrun or cost overrun or both. However, this discounts the importance of process-based approach to deliver final product with desired quality. The aim of this study therefore was to examine the factors that affect quality management in the delivery of public housing in Nigeria. The specific objectives were to identify the factors and their indicators, and to establish the relationships between them and quality management.

2. Methods and Materials

2.1 Model of Relationships between Dependent and Independent Variables

The model of the relationship between manpower, management practice, procurement, professional regulation, moral turpitude, and quality management in the study area was established using the following hypotheses:

H1: Manpower has a significant effect on quality;

H2: Management practice has a significant effect on quality;

H3: Procurement practice has a significant effect on quality;

H4: Professional regulation has a significant effect on quality, and

H5: Moral Turpitude has a significant effect on quality.

The research variables and indicators can be seen in Table 1 below:

2.2. Data Collection and Analysis Method

Data collection was carried out in the form of surveys using structured questionnaire as the primary tool. The questionnaire was tested for validity and reliability with SPSS 16.0 software. The validity test refers to the total correlation value of the corrected item, while the reliability test

refers to the Cronbach's alpha value. All the questions had an average Cronbach's alpha of 0.805 and indicated a high level of internal consistency. This implied a high level of validity and reliability. The PLS analysis was performed with SmartPLS 3.0 software.

Table 1:
Research Variables and Indicators

Variable	Indicators
Manpower (X1)	- Top management commitment (X11) - Expertise/Technical Knowledge (X12) - Employee Commitment (X13) Human Resource Development (X14)
Management Practice (X2)	- Sacrifice of quality for profit (X21) - Understanding of quality management (X22) - Buildability Analysis (X23)
Procurement System (X3)	- Tendering and bidding climate (X31) - Project time (X32) - Project cost (X33) - Poor specifications (X34)
Professional Regulations (X4)	- Adequate sanctions (X41) - Standard assurance agencies (X42) - Implementation of the National Building Code (X43)
Moral Turpitude (X5)	- Pilfering (X51) - Bribery and Corruption (X52)

The operational procedure of smartPLS is as follows: data input of questionnaire distribution, arrangement of path diagram (measurement model and structural model), outer model analysis, inner model analysis, and hypothesis testing. The questionnaire distribution period was 3 months (September-November, 2023). The criteria of the respondents in this study were that respondents must have positions at the management level or be part of the ISO 9001 representative management within the organization. One thousand (1000) respondents from different companies in Nigeria were considered. Company size and how long ISO 9001 had been implemented were not considered. The researcher used data from companies that were ISO 9001 certified since they had undergone ISO 9001 accreditation.

3. Results and Discussion

The results of the path coefficient calculation are shown on Table 2. The acceptance criteria for the hypotheses were *t* statistics greater than 1.96 and the *p* value of less than 0.05 using the *t*-statistics decision rule.

Hypothesis 1

The path coefficient of X1 → Y was calculated to be 0.005 with *t* statistics value of 3.14 and p-value of 0.042. This implies that there is a significant relationship between manpower and quality management. Productivity generally increases with manpower and measures the quantity of output or work accomplished by individuals, teams, or the entire workforce for a given input within a specific timeframe or using a set of resources. Manpower productivity quantifies how effectively employees or teams convert their input (time, effort, skills) into valuable quality output. Thus, quality management is enhanced. This agrees with the findings of Agbenyega [5], Omajuwa *et al.* [9] that when quality becomes a component of productivity, and manpower increases, there would be more employees to ensure its sustainability.

Table 2:
The Path Coefficient of Variables

Path	Original sample	Sample mean	Standard deviation	*t* Statistics	*p* Values
X1 → Y	0.005	0.011	0.050	3.140	0.042
X2 → Y	0.268	0.266	0.075	2.681	0.046
X3 → Y	0.554	0.266	0.089	3.587	0.035
X4 →Y	0.141	0.145	0.060	4.342	0.008
X5 →Y	0.196	0.200	0.085	6.441	0.002

Hypothesis 2

The path coefficient of X2 → Y was calculated to be 0.268 with *t* statistics value of 2.681 and p-value of 0.046. This implies that there is a significant relationship between management practice and quality management. Management practice improves manpower productivity and overall efficiency of the operations in terms of regular monitoring, reviewing, analyzing performance metrics, and customer feedback. When the culture of quality is part of the management practice, then quality is ensured at every stage of procurement, production and maintenance. This is also in line with the findings of Bravi, Murmura and Santos [10] and Obi *et al.* [20] that the culture of quality should be inculcated in the management practices on building construction sites.

Hypothesis 3

The path coefficient of X3 → Y was calculated to be 0.554 with *t* statistics value of 3.587 and p-value of 0.035. This implies that there is a significant relationship between procurement practice and quality management. Procurement ensures that the right raw materials are sourced from reliable suppliers and products are made at competitive prices and quality. When a company has an effective procurement plan (which involves standard quality criteria) quality management is enhanced. Mane and Patil [15], Barner [19] and, Adem and Virdi [8] are of the same opinion that when any step in the procurement process is truncated, quality management is compromised and the quality of any stage in a process is contingent upon the quality of the previous stages.

Hypothesis 4

The path coefficient of X4 → Y was calculated to be 0.141 with *t* statistics value of 4.342 and p-value of 0.008. This implies that there is a significant relationship between professional regulation and quality management. Professional regulation requires that companies engage, improve and sustain the right workforce; procure the right equipment, plant and materials; adopt standard procedures and are responsible for the quality of their outputs or products. This implies that when a company collaborates closely with the relevant professional regulatory bodies, it will enhance quality management in the system due to the possibility of adequate sanctions to offenders. Esgarrancho and Carlos [12], Aghimien [17] and Ahaotu [18] also state that constant adherence to quality standards as stipulated by both local and international professional regulatory bodies will help to eliminate quackery and sub-standard operations while enhancing quality management.

Hypothesis 5

The path coefficient of X5 → Y was calculated to be 0.196 with *t* statistics value of 6.441 and p-value of 0.002. This implies that there is a significant relationship between moral turpitude and quality management. Crimes of moral turpitude negatively impact the reputation of a company and its products. Where issues of bribery, corruption, theft and fraud arise in an organization, quality is usually compromised and the reputation of products is in jeopardy. Organizations that have a strict check on moral turpitude using laws and regulations tend to have a higher level of quality management. This agrees with the finding of Cavallone and Palumbo [14] which states that it is very crucial to avoid crimes of moral turpitude in any organization because of their devastating effects on both the product and the overall image of the organization.

4. Conclusions

From the findings of this study, the following conclusions were made:

i. An increase in manpower leads to an increase in productivity or quality outputs; thus, enhancing quality management;
ii. Management practice affects the overall operations of a company and consequently determines the level of quality assurance adopted by the management;
iii. Effective procurement processes from the design to execution stages of any project yield high quality outputs and therefore enhance quality management;
iv. Professional regulations enhance quality management since they are effective in the elimination of quackery and sub-standard works in the construction industry;
v. Bribery, corruption, theft, pilfering and fraud lead to losses in lives and properties including money in companies and compromise quality.

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