

Assessment of the impact of total quality management principles on the quality of constructed project in Ebonyi state Nigeria

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Abstract

Construction organisations in developing countries like Nigeria are challenged by many managerial related issues. The collapse of buildings and other infrastructural facilities across the length and breadth of Nigeria has risen to alarming dimension and has raised serious concerns over the quality of constructed projects. The dissatisfaction of the clients/users on the delivered project not meeting the specified requirements has also been a major cause for patronage and unsustainability of constructing organisations and the preference of organisations with improved track record of quality deliverables. Total quality management is a companywide drive led by top management to obtain the involvement of all employees in the continuous improvement of the performance of all activities in the company so as to meet the needs and satisfaction of the customer. The purpose of this study is assess the impact of TQM principles on the quality of constructed facilities. Data were collected from industry professional using a well-structured questionnaire and purposive sampling technique in Ebonyi State, Nigeria. The collected data were analysed using frequency, percentages and relative index methods. Diminishing reworks and reduction in resource wastages (0.831), improving quality of products and services (0.815), providing a disciplined means of producing goods and services (0.782) were found as top the benefits of implementing TQM. The study reveals inadequate top management commitment to TQM (0.802), poor organisational attitude towards TQM (0.787), insufficient cross functional cooperation between stakeholders (0.774), fragmented nature of the construction industry (0.760), amongst barriers/limitations to TQM implementation. Furthermore, top management commitment and leadership (0.887), Continuous improvement (0.846), employee's involvement in TQM (0.831) are top TQM principles that impact on the constructed projects. The study therefore recommends that the organisations top management should take the lead and drive the employees towards high quality project delivery.

Keywords: Quality; Total Quality Management; Constructed projects

1. Introduction

The last decade has witness high rate of infrastructure failures and collapse owing to poor quality of constructed projects. Building Collapse Prevention Guild (BCPG) reported that Nigeria recorded about 61 incident of building collapse in 2022 alone. The delivery of acceptable levels of quality in the construction industry has been a problem in Nigeria (Oke et al., 2013). Quality is one of the major criteria for assessing the success of a project. Great expenditures of time, money and resources both human and materials are wasted each year because of inefficient quality management procedures.

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Quality has been a consistent area of conflicts between the client and the construction organisation. It is the time to build better relationship with customers, provide customer satisfaction, initiate more teamwork at project site and deliver better quality works. Such goals demand the entrenching of a continuous improvement within the constructing organisation to provide quality management, and total quality management has been proven to be the most successful continuous improvement system.

Effective management of quality of construction process and products is an important consideration in modern construction (Iruobe et al., 2012). This is evident from clients increasing use of organisation reputation for good quality work as a basis for the selection of prospective contractors. The world has now become a global market place which is compelling many organisations in different nations including Nigeria to use every possible tool to sustain competition. Ajayi (2024) posited that achieving and retaining a competitive edge is both a necessity and a challenge for the continuous existence of the organisation.

Implementing total quality management requires a major organizational change that would transform culture, process, strategic priorities and belief of an organisation. TQM views an organisation as a collection of process; it maintains that organisations must strive to continuously improve these processes by incorporating the knowledge and experience of their workers. Raja and Paul (2017) submits that TQM is a corporate culture characterized by increased customer satisfaction through continuous improvement in which all employees in the firm actively participate. It has been recognized as a means of gaining and maintaining a competitive edge in the global market place as well as an important factor of growth and survival and success (Elmuti et al., 2006; Sahney et al., 2004). The adoption of TQM by contracting organisation will most likely transform the quality of constructed infrastructures across the nation and reverse the ugly image of failed projects.

Past studies have shown that the indirect cost associated with rework, repair, and replacement in construction projects accounts for an average of 12.4% of the total project cost and requires 11% of the total project working hours (Burati et al., 1992; Barber et al., 2000). It is estimated that lack of quality control costs contractors between 15% and 20% of their annual income (Baiden & Tuuli, 2004). One of the major problems faced by most construction organisation is how to adopt a strategy for high quality buildings that will satisfy the need of the customer at a reduced and effective price and still ensure that they remain in business without incurrence of debts (Sadikoglu and Zehir, 2010; Rotimi, 2022).

TQM plays a significant role in the business goals and objectives achievement of organisation. TQM is imperative for success of organisation focusing on delivery high quality project through the commitment of everyone in the organisation to customer satisfaction by continuously improving the processes (Raiz et al., 2023). Rising from the continuous collapse of constructed infrastructures and the inability to meet customer expectation, it has become pertinent that the quality management practices adopted by construction organisation be reviewed to forestall this ugly trend. This research explored the basic principles of total quality management with a view to establishing how the adoption by the construction industry translates to high quality performance of constructed project in Ebonyi State, Nigeria.

Aim and objectives of the study

The aim of this research is to assessment of the impact of total quality management principles on quality of constructed project in Ebonyi State

Based on the aim of the study, the specific objectives are as follows:

- To explore the concept of total quality management.
- To identify the commonly areas of quality failures on constructed projects.
- To critically evaluate the benefits, limitations and barriers to the adoption of total quality management in Nigerian construction industry.
- To weigh the impact of total quality management principles on quality of constructed projects.

2. Literature review

Quality is a major problem in the Nigerian construction industry, where most constructing organisation promise quality in project delivery but fail to meet the required standards and client expectations set up in the contract documents (Oyedele et al., 2013). Construction projects in Nigerian have continued to be plagued by issues of quality deliverables. Significant amount of time, money and other resources invested are wasted every year due to insufficient quality management procedures. Cases of construction quality failures and constructed facility collapse have been reported in

Nigeria; prominent amongst them are the cases of building collapse. The last decade has witnessed high rate of building collapse across the nation with Lagos and Abuja having the highest numbers. The collapse has also been observed to cut across the different categories of building; private, corporate or public. In Lagos State between 2000 and 2010, private buildings accounted for 76%, corporate buildings 12% and public 12% of collapsed buildings (Folagbade, 2011). Moreso, building collapse is not necessarily influenced by the size of the structure as reports ranges from single story to multi-storey or high rise structures (Harris & McCaffer, 2001; Folagbade, 2011).

The quality of constructed project is defined as the fulfillment of the owners needs per defined scope of work, within budget and specific schedule to satisfy the owner's requirement (Oakland, 2003). Quality has been defined as a products or services positive worth in terms of conformance to specifications, suitability for use and possibilities for ensuring satisfaction (Obunwo and Surash, 2017 cited in Vijayabanu et al., 2022). Furthermore, Abdul-Azeez (2022) defines quality in the construction industry as meeting the requirements of the contractor, regulatory agencies, and the owner. Quality can also be determined from a functional standpoint of how closely the project conforms to standard conditions. The quality of constructed project is determined by the quality of the design, the quality of the materials and equipment and the quality of workmanship (Talib et al., 2010).

Quality assurance (QA) is referred to as a program covering all activities required to provide quality in the work to meet the project requirements. It includes establishing project related policies, procedures, guidelines, standards, training, and system required for producing quality (Ferguson and Clayton, 1998). Whereas, quality control (QC) is a set of specific procedure of implementing the quality assurance process which includes planning, coordinating, developing schedule, checking and reviewing the work. Effective control minimizes the possibility of mistakes, changes and omissions which in turn result in less disagreement and disputes (Raja & Paul, 2017). Total quality management is a holistic approach to quality management.

TQM is harnessing everyone's effort to achieve zero defects at the lowest cost and continually satisfying customer requirement (Turien 1994 cited in Jaafari, 1996). TQM is an integrative firm-wide management philosophy that continuously improves the quality of the process, products, and services by meeting or exceeding customer's expectations to enhance customer satisfaction and organizational performance (Raiz et al., 2023). TQM has 3 key words: *total* refers to consideration of everyone, *quality* refers to meeting their demands, and *management* implies commitment from everyone. Thus TQM is not an isolated process but a team approach to meet quality requirements of a project (Raiz et al., 2023).

The concept of TQM was originated in the 1940s, in the recent years; the level of awareness towards TQM has increased considerably due to intense global competition, increasing consumer consciousness of quality, rapid technology transfer and trends towards achieving world class status. In response to these challenge and to facilitate the organisation in achieving higher quality levels, many companies are implementing TQM approach and quality initiatives for achieving sustainable competitive advantage and enhance company performance (Talib et al., 2010, Kheni and Ackon, 2015). Ajayi (2024) viewed TQM as a strategic approach to improving the competitiveness, effectiveness and flexibility of an organisation.

TQM is a company-wide drive initiated by top management for commitment to quality. TQM process is led by top management to obtain the involvement of all employees in the continuous improvement of the performance of all activities in a company so as to meet the needs and satisfaction of the customer. TQM rest on commitment to quality and quality chains (Harris et al., 2006, Kheni and Ackon, 2015). TQM is increasingly been adopted by construction companies as an initiative to solve quality problems and meet the needs of the final customer (Hoonaker, 2010; Muhammad, 2021).

2.1. Elements of Total Quality Management

The main elements of TQM as found from literatures are: top management commitment and leadership, teamwork, human resource management and training, customer satisfaction, supplier's involvement, continuous improvement, quality culture, etc.

- *Top Management Commitment and Leadership*: management establishes clear mission, vision and plan statement regarding business objectives, their involvement is very crucial to the success of TQM programme of a construction organisation (Ardit and Gunaydin, 1997). Management must provide policies and plans for promoting client/customer satisfaction; actively communicate quality policies and plan to employees to create awareness, interest, desire and action. Management must as well provide necessary resources and problem orientation training to the employees to drive the TQM (Juran and Gryna, 1993).

- *Human Resources Management and Training*: TQM is everyone's responsibility, when employees themselves are committed to delivering quality, they take greater initiatives towards meeting product and process specification, detect and eliminate bottlenecks, improving product and process designs and setting realistic yet challenging performance targets (Khan, 2003). Customized training plans and programmes targeted for every level of the organisation should be organized in line TQM objectives and goals (Ardit and Gunaydin, 1997).
- *Teamwork*: The practice of employees working together in groups provides an atmosphere of mutual relationship, involvement and participation the organisation (Kehni and Ackon, 2015). The ultimate goal of teamwork is to get everyone including contractors, designers, vendors, subcontractors and client involved with the TQM process. It is widely accepted that working in team or group is generally more effective than working individually (Zairi, 2005).
- *Continuous Improvement*: This is the continuous reviewing and improving business processes, ensuring that customers' requirements and statutory and regulatory requirement are met, maintained and exceeded where possible. It is searching for a never-ending improvement and developing processes to find new or improved method sin the process of converting inputs to useful outputs (Sadikoglu and Zehir, 2010).
- *Supplier Involvement and Management*: The quality of the project built by the contractor is directly related to the quality of the plan and specification prepared by the designers, the quality of materials and equipment supplied by the vendors, and the quality of workmanship performed by the constructor and subcontractors (Arditi and Gunaydin, 1997).
- *Quality Culture*: Organisation should create a cooperative and open culture in which all employees have to be made to feel that all of them are responsible for satisfying the organization's customers. This can be achieved if they are involved in the development of the vision, plans and strategies of the organisation. There be active interaction amongst peers and support from supervisors (Kehni and Ackon, 2015).
- *Information Analysis and Evaluation*: This in construction involves the evaluation for various policies and strategies, quality audit, analysis of quality costs, department/function performance evaluation and employee and supplier performance evaluation (Metri, 2004). To maintain a true customer focus, an organisation must ensure prompt feedback of customer survey results to appropriate functional area for effective action.
- *Customer Focus*: This can be seen as the degree to which a firm continually satisfies customer needs. The key to the quality management is maintaining a closer relationship with the customer in order to fully determine the customer's need, so the customer should be involved in the product design and development with valuable inputs (Ashiru et al. 2020).

2.2. Benefits of Implementing TQM

TQM is considered a well-regarded approach to managing project quality. It has proven to minimize non conformity complexity and nonlinearity and achieve distinction. Organisations adopting the principles of TQM gain a strategic and market edge over their competitors. Implementing TQM in construction sector presents various benefits such as (i) enhanced budget efficiency, (ii) increased customer satisfaction, (iii) better workers job commitment, (iv) diminishes reworks and reduction in resource wastages, (v) exquisite schedule and budget performance, (vi) increase the competitive advantage of a company, (vii) reduce cost and saves time, and (viii) Improve quality of the products and services offered, (ix) greater participation in bidding process thereby (x) enhancing the sustainability of the organisation (Ahmed, 2010; Riaz et al., 2023).

2.3. Barriers to Implementing TQM

Despite the benefits of the TQM adoption, its implementation in the construction sector is faced with some challenges. The inability to evaluate clients demand precisely and convert this knowledge into a complete facility and the fragmented nature of the industry were identified as primary barriers to implementing TQM (Raja and Paul, 2017). Other impediments include; (i) poor attitude toward TQM, (ii) poor teamwork and workmanship, (iii) inadequate top management commitment, (iv) insufficient cross functional cooperation among different stakeholders, (v) difficulty in applying TQM principles in an industry with high product diversity and (vi) low cost-benefit ratio of improving quality.

3. Methodology

The population for the study were mainly practicing construction professional (Architects, Builders, Engineers and Quantity Surveyors) working in public sectors/institutions, private consulting and contracting organisations in Ebonyi State, Nigeria. To achieve the objectives of the study, a well-structured questionnaire was used as a primary source of data and were administered to selected constructing organisations, consultants and professional in the construction industry with regard to total quality management practices in the construction industry and physical assessment of the constructed projects. The respondents were selected using purposued judgmental sampling techniques. It was

considered for this research work due to the heterogeneous nature of the professionals that make up the population of the study. A total of 198 questionnaires were distributed, out of which 156 questionnaires indicating 78.80% were retrieved and utilized for the analysis.

Data collected were analyzed using descriptive statistical tools such as frequency distribution, and percentages. The relative index methods were also used on the variables on the scale of 1 – 5 (VL – very low, L – low, M – moderate, H – high and VH – very high). Using the frequency analysis, the relative index ranked the importance and practicability of each performance measure using the given formula below

$$RII = \frac{(5n^5 + 4n^4 + 3n^3 + 2n^2 + n)}{5(n^5 + n^4 + n^3 + n^2 + n)}$$

Where: RII = Relative Importance Index; n^5 , n^4 , n^3 , n^2 & n represents number of indicators of answer.

4. Results analysis and discussions

Table 1 Demographic Profile of Respondents

	Variables	Frequency	Percentage
Professional Affiliation	Architects	36	23.08
	Builders	48	30.77
	Engineers	42	26.92
	Quantity Surveyors	30	19.23
	Total	156	100
Academic Qualifications	B.Sc. /B.Tech./ HND	82	52.56
	PGD	12	7.70
	M.Sc./M. Tech	48	30.77
	Ph.D	14	8.97
	Total	156	100
Working Experience	0 – 5yrs	26	16.67
	6 – 10yrs	52	33.33
	10 – 15yrs	42	26.92
	Above 15yrs	36	23.08
	Total	156	100

From table 1, the professional affiliation of the respondents showed that Architects are (23.08%),

From table 1, the professional affiliation of the respondents showed that Architects are (23.08%), Builders (30.77%), Engineers (26.92%), and Quantity Surveyors (19.23%). The academic qualification of the participants indicates that those with B.Sc./B.Tech./HND are (52.56%), PGD (7.70%), M.Sc./M.Tech. (30.77%) and Ph.D. holders are (8.97%). In terms of years of working experience, it can be seen 16.67% have spent between 0 – 5years in the industry, 33.33% have spent 6 – 10years, 26.92% have spent 10 – 15years, and those who have spent above 15 years at 23.08%.

It is evident that the respondents were proportionally spread among the professionals in the construction industry. They are academically qualified and have the requisite experience to give information that will aid in meeting the objectives of the study.

Table 2 Common Areas of Quality Failures/Defects

SN	Areas	VH	H	M	L	VL	RII	Rank
1	Cracks in structural members (walls, columns, beams, etc.)	6	20	32	40	58	0.441	10
2	Shrinkage cracks on finishings	60	50	24	16	6	0.782	4
3	Dampness on floors and walls	18	24	28	48	38	0.517	9
4	Plumbing pipes leakage in walls and floors	28	40	46	26	16	0.648	8
5	Wall and ceiling joints separations	44	42	36	26	8	0.712	6
6	Unevenness of floor, wall and ceiling finishing	58	56	26	10	6	0.792	3
7	Broken or loose tiles on wall and floors	40	38	44	22	12	0.690	7
8	Paint peeling on surfaces/fading	80	40	20	16	0	0.840	1
9	Roof covering leakages	56	50	28	20	2	0.780	5
10	Sagging of roof structures	4	12	32	42	68	0.400	11
11	Rainwater seepage at window sill	0	14	20	46	76	0.360	12
12	Poor alignments of surface and corners	70	46	30	10	0	0.830	2

VH-Very High, H-High; M-Moderate; L-Low; VL-Very Low

From the observed common areas of quality failures/defects on construction projects in table 2, the fading and peeling of paint on surfaces (0.840), Poor alignment of surfaces and corners (0.830), Unevenness of floor, wall and ceiling finishings (0.792) and roof covering leakages (0.780) were the top ranked quality failures/defects on constructed projects. The quality failures/defects are visible on constructed projects, raising concerns on the need for improvement on the quality of materials and standard of workmanship.

Table 3 Benefits of TQM

SN	Benefits	VH	H	M	L	VL	RII	Rank
1	Enhanced budget efficiency	16	20	26	44	50	0.480	10
2	Increase client's satisfaction	48	54	32	18	4	0.759	4
3	Better workers job commitment	38	40	30	28	20	0.662	7
4	Diminishes reworks and reduction in resource wastages	64	56	32	42	0	0.831	1
5	Saves time and reduce cost	40	44	36	20	16	0.692	6
6	Reduction in conflicts among stakeholders	46	42	38	22	8	0.723	5
7	Provide a disciplined means of producing goods/services for customer	54	58	24	16	4	0.782	3
8	Increase the competitive advantage of a company	24	30	42	48	12	0.608	9
9	Improve quality of the products and services offered	58	60	30	8	0	0.815	2
10	Assist government in maintaining quality standards	32	36	38	26	24	0.633	8

VH-Very High, H-High; M-Moderate; L-Low; VL-Very Low

Analysis from table 3 reveals that diminishing reworks and reduction in resource wastages (0.831) ranked 1st among the benefits of implementing TQM, while Improving quality of products and services (0.815), providing a disciplined means of producing goods and services (0.782), increased client's satisfaction (0.759), and reduction in conflicts among stakeholders (0.723) followed respectively. The benefits arising from the adoption of TQM in construction project delivery are positive and should be encouraged for all projects and organisations.

Table 4 Barriers/Limitations to TQM Implementation

SN	Barriers	VH	H	M	L	VL	RII	Rank
1	Fragmented nature of the construction industry	50	56	30	10	10	0.760	4
2	Poor Organisational attitude towards TQM	56	60	20	14	6	0.787	2
3	Inadequate top management commitment to TQM	62	58	20	10	6	0.802	1
4	Quality objectives are clearly unidentified to employees	2	44	42	46	22	0.460	8
5	Poor workmanship and teamwork	28	54	42	20	14	0.678	6
6	Insufficient cross functional cooperation between stakeholders	54	56	26	11	9	0.774	3
7	High product diversity within the industry	30	56	40	16	14	0.692	5
8	Low cost benefit ratio for adopting TQM	21	35	40	46	20	0.579	7

VH-Very High, H-High; M-Moderate; L-Low; VL-Very Low

Table 4 indicates that amongst barriers/limitations to TQM implementation, inadequate top management commitment to TQM weighs highest with an index of 0.802, followed by poor organisational attitude towards TQM (0.787), insufficient cross functional cooperation between stakeholders (0.774), fragmented nature of the construction industry (0.760), and High product diversity completes the top five barriers with 0.692. Almost all the barriers has above average rating signifying the need for concerted efforts in addressing them for improved implementation of TQM.

Table 5 Impact of TQM Principles on Constructed Projects

SN	Principles	VH	H	M	L	VL	RII	Rank
1	Top management commitment and leadership	86	56	10	4	0	0.887	1
2	Human resource management and training	56	58	24	18	0	0.794	5
3	Continuous improvement	76	56	22	2	0	0.846	2
4	Supplier involvement and management	20	36	40	41	19	0.594	9
5	Organisational quality culture	60	56	24	15	1	0.805	4
6	Teamwork	52	48	30	18	8	0.751	6
7	Information analysis and evaluation	30	28	52	30	16	0.630	8
8	Clients focus	36	40	42	28	10	0.680	7
9	Employees involvement	66	59	21	10	0	0.831	3

VH-Very High, H-High; M-Moderate; L-Low; VL-Very Low

The indices value of > 0.5 in table 5 is an indication that all the principles of TQM impact reasonably on the quality of constructed projects with top management commitment and leadership (0.887) ranking highest. Continuous improvement (0.846), employee's involvement in TQM (0.831), building organisational quality culture (0.801), and human resource management and training (0.794) followed respectively. The complete adoption of the principles of TQM is advocated for efficient construction project delivery.

5. Conclusion and recommendations

This study assessed the impact of total quality management principles on the quality of constructed projects with a view to establishing that it is a useful tool in ensuring that the delivered projects meets the required quality standards and specification. The study highlighted the common arears of quality failures on constructed projects. It also revealed that the implementation of TQM will reduce the quality failure issues in the construction industry, provide a disciplined means of producing quality projects and services, improves client's satisfaction and increase the competitive advantage of a company. This study recommends that the organisation's top management should take the lead and drive the employees towards high quality project delivery. Organisation should strive towards continuous improvements on the

quality of their projects through training and retraining of their workers. The construction experts – consultants, regulators and contractors must ensure the full implementation of TQM principles on projects.

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