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Evaluation of Quality Management Drivers by Key Construction Practitioners

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ABSTRACT

The standards organization of Nigeria (SON) has been active in safeguarding the conformance of quality in Nigeria. This advocates that the pursuit of quality management is at present gaining impetus and momentum. The new environment of construction output is directly linked to the quality of construction projects, and the object of quality management practices is to produce the quality that meets the delivery requirements of construction projects. However, the Nigerian construction industry is bedeviled by incessant collapse of buildings, dilapidated structures, and poor quality of construction projects. Therefore, the objective of this paper is to investigate the major drivers of quality management practices in North-Central Nigerian construction firms involved in the ongoing federal government institution projects. 95 questionnaires were self-administered to construction practitioners in six locations: Plateau; Nasarawa; Benue; Niger; Kogi; and Abuja. The Relative Importance Index (RII) and Cross-Tabulation analysis using the SPSS software were used to analyse the data. The study revealed Top Management Commitment [1st], Customer Satisfaction [2nd], Education and Training [3rd], Quality Management Culture [4th], and Empowerment and Involvement [5th] as the most important drivers of total quality management implementation in Nigerian construction firms. The perception of each practitioner on these drivers was also revealed by the study. Finally, it was recommended that, all implementations should begin with the commitment from the leadership who are in top management, as this factor is unequivocally essential for the success of any Total Quality Management approach. Continuous improvement on quality should also be maintained in order to enhance the value of construction projects. Further studies should be carried out in residential, commercial, and state government projects.

Keywords:
Construction, firms, quality, Total Quality Management (TQM)

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1. Introduction

The question of economic and social progression has remained pivotal to the needs of developed and developing countries [1] and Nigeria is not an exception. Nigeria happens to be the 8th and 6th largest producer of gas oil and exporter of crude oil respectively and has about thirty-three solid minerals in commercial quantity. At the moment, the state of the economy is dependent on the stability in the petroleum sector. According to Chinedu *et al.,* [2], crude petroleum accounts for about 40%, 95%, 70%, and 90% of GDP, foreign exchange earnings, source of federal government revenue, and all investments respectively. Nigeria, with a population of 182 million [3], is also one of the fastest urbanizing countries in Sub-Saharan Africa and purported as the largest and most populated country in Africa. This economic growth is spreading into other vital sectors especially the construction industry.

The construction industry, which is vital to growth and development, is indeed as old as civilization. Tanko *et al.,* [4] advanced that the industry is all-important and indispensable to the economic development of most nations in the world. Also, the industry's housing outlay has been a major contributor to economic growth with numerous social and economic benefits [5]. According to Mansfield *et al.,* [6], the industry is a major stimulant in the economic growth of Nigeria with a strong interrelationship with other industries of the economy. However, Pheng and Ke-Wei [7] observed that the construction industry is typified by a very differentiated, loosely structured and fragmented system. The growing competitiveness of the construction industry influences construction firms to assess performance and implement improvement approaches in order to gain a competitive advantage. The major classifications of firms in Nigeria are the indigenous or local contractor firms, foreign or expatriate contractor firms, and indigenized foreign contractor firms. The indigenized foreign firms are exclusively former foreign firms that later advanced into indigenous firms having between 40% and 60% Nigerian equity ownership as a result of government indigenization policies [8].

In [9] and [6], the Nigerian construction industry was first modeled after the British system with some obvious styles of Italy, Germany and France. This brought about some inherent problems that came with the imported systems [10]. At the moment, the Nigerian construction industry is characterized by lack of adequate planning and control. An individual could build a structure without the knowledge of government and not to the building codes and standards. For that reason, there are limited restrictions in the activities of the industry. Awodele *et al.,* [11] observed that the Nigerian construction industry is poor as it is characterized by frequent setbacks, cost overruns and abandonment of projects. Also, according to Omoregie and Radford [12], one of the critical concerns in the construction industry of most developing countries is the high rate of project delay and cost escalations. Other challenges include poor quality [13], poor communication and management [14, 15], poor contract management [16], and inability to establish the value system of clients [4, 17]. These challenges need to be controlled early or face the certainty of poor quality which will eventually lead to displeasure to construction clients. A study by Tanko *et al.,* [18] advanced that quality and performance of construction projects should not be sacrificed when optimizing the value of construction projects. However, Abdul-Aziz [19] pointed out that, while the construction industry is trying to improve quality, this effort has been slow because the industry is characterized by a "confrontational and adversarial atmosphere" with time and money being the major concerns. This line of reasoning encourages the embrace of the lowest offers, tight project duration, and a short-term attention on cost savings. Therefore, for a project to be successful, effective planning must consider the environmental impact of the project, scheduling, safety, effective budgeting, and quality.

'Quality', which denotes producing a product or service in conformance to standard, is of essence. With respect to the construction process, quality is generally understood to mean a building (product) that meets the user's needs. Kolawole [20] simply defined quality as fitness of purpose. This means that the product or building does what it is expected to do. Thus, every act by an individual or a group of individuals to ensure a product meets a specified standard can be seen as a quality control activity. At present, there are a number of quality control techniques that have been effective. However, the difficult task is the management of these quality control techniques. Hence, this study aims to investigate the drivers of quality management practices in order to enhance the quality of Nigerian construction products. The following research questions will be considered in this study:

1. What are the most significant factors that will influence the successful implementation of quality management in Nigerian construction firms?
2. What is the perception of quality management practices among construction practitioners in Nigeria?

1.1 Quality Management

Quality management (QM) is generally described as a collective and interlinked system of quality management practices that are associated with organizational performance [21]. QM can be introduced in a construction project at the pre-construction stage, and at the construction and completion stages. At the pre-construction stage, this can be done by making sure that the design team work effectively together for the achievement of the project goals. At the construction stage, workers are assigned to their respective area of specialisations; plants and equipment are placed for the right task; materials are in accordance to standards; quality control procedures, testing, inspection and other performance criteria are maintained; and supervision/meetings are properly carried out. At the completion stage, life cycle costing is brought into consideration, pre-commissioning checks are carried out, and defects liability period is monitored and inspected at the expiration of the date. According to ISO [22], QM is basically what organizations carry out to ensure that their products meet the requirements of customers. In addition, Stupak and Leitner [23] advanced that, QM is the process of identifying and managing the activities required to realize the quality objectives of an organization. The QM control techniques are embodied in a set of QM practices known as Total Quality Management (TQM).

1.2 Total Quality Management

Different approaches have been adopted to introduce QM in construction firms such as self-assessment of the firms, accreditation/certification systems, and the TQM. Quality does not only apply to products or services but likewise to the processes, environment and people. Hence, the need for total quality management. According to Lakhe and Mohantry [24], TQM, which was known as total quality cost had its root in Japan, then to Europe and some other developing countries. Like value management, six sigma, and lean management, TQM is a management technique used to enhance the value of construction products with respect to quality.

A TQM approach seeks to manage and improve the quality system continuously [25] and change itself to adapt to the environment of operation [26]. Harrington *et al.,* [27] likened TQM to "an organization's quality-centered management approach, based on the participation of all its members for long-term success through customer satisfaction and benefits to all members of the organization and the society as a whole". Also, TQM is a management-led process that obtains the participation

of all personnel, in the continual improvement of the performance of all activities, as part of the normal business to meet the satisfaction and needs of both the internal and external customers [28]. Pheng and Ke-Wei [7] opined that the general sub-contractors are the last set of people involved in the construction process. According to the authors, the philosophy of TQM enables the general sub-contractors as the customer of the main contractor; and the main contractor, the customer of the quantity surveyor for the bills of quantities. The quantity surveyor is, in turn, the customer of the design team (architect and other engineers), while the design team, the customer of the project manager or the client as the case may be. Thus, the construction practitioners play an important role in realizing an effective TQM implementation.

In Nigeria, a good number of firms are aware of TQM but the level of implementation has been very low [29]. Nosakhare [30] posited that the effective implementation of TQM will help Nigerian firms to compete both locally and internationally. In addition, Akeusola and Ofulue [31] recommended the need to establish an internal quality assurance mechanism and embrace quality in a more holistic way. From a preliminary survey and review of TQM literature, ten (10) major drivers or success factors of TQM implementation were identified. These include top management commitment [13, 32, 33, 34, 7], customer satisfaction [35, 28, 7], quality management culture [36], education and training [37], empowerment and involvement [38, 34], supplier quality management, strategic quality management, design management, information and analysis, and process management. To realize the attainment of TQM intents, Pheng and Ke-Wei [7] revealed eight (8) steps in TQM implementation. These steps include:

1. Obtaining the commitment of clients to quality;
2. Generating TQM awareness, educate, and change of staff attitude;
3. Developing and documenting a TQM approach;
4. Preparing quality plans for all work levels;
5. Installing organization and managing bodies;
6. Instituting continuous improvement;
7. Promoting participation of staff and initiating motivation programs;
8. Reviewing quality plans and measuring performance.

2. Methodology

The study used a purposively-sampled non-parametric statistical approach since it is ideal when the data are measured on nominal or ordinal scales [39]**.** The drivers of TQM were all based on an ordinal scale, while the practitioners' area of speciality were on nominal scale. A questionnaire survey was used for this study, and respondents were requested to indicate on a scale, the importance of each TQM driver. Closed-ended questions were used to realize the intents of this paper, and 95 questionnaires were administered to diverse practitioners which include Architects, Builders, Engineers, Quantity Surveyors, Estate Managers and other practitioners in five locations (Plateau, Nasarawa, Benue, Niger, Kogi, and Abuja). Out of the 95 questionnaires, 68 were returned which represents 72.58% of returned questionnaires. This included 11(16%) Architects, 12 (18%) Builders, 8(12%) Engineers, 25 (35%) Quantity Surveyors, 6 (8%) Estate Managers, and 6 (8%) were others (Land Surveyors, Planners, and construction managers). Also, 9 (13%) of the respondents were from building manufacturing firms, 5 (7%) from building materials supply firms, 17 (25%) from government agencies, 13 (19%) from construction consultancy firms, 18 (27%) from private construction firms, and 6 (9%) constitute others.

The Cross-Tabulation analysis using the SPSS software was used to analyse the data. Cross-tabulation is an analytical tool that records the frequency or number of respondents that have

specific characteristics described in the cells of a table. It provides a wealth of information about the relationship between factors or variables. In addition, the relative importance index (RII) was utilized to determine the rating and importance on a four-point scale. Taiwo *et al.,* [40] and Mohd Rahim *et al.,* [41] likened the RII to a type of relative importance analyses used to determine the ranking of variables, preferences or choices. The RII is calculated using Equation 1.

$$RII = \frac{4n1 + 3n2 + 2n3 + n4}{x\,(n1 + n2 + n3 + n4)} \quad (1)$$

where n1 = number of respondents who answered "Of great importance"
n2 = number of respondents who answered "Of some importance"
n1 = number of respondents who answered "Of no importance"
n1 = number of respondents who answered "Not applicable"
x = highest value in Likert scale.

3. Results

3.1 Perception of Construction Practitioners on TQM Drivers

Ten (10) major drivers of TQM were identified from the literature and preliminary survey. These drivers are the major initiatives that would aid the successful implementation of TQM in Nigerian construction firms. Table 1 depicts the RII and ranking of ten major drivers of TQM among Nigerian construction practitioners. The importance of these drivers was established on a 4-Likert scale (1= not applicable; 2= of no importance; 3= of some importance; 4= of great importance) by using the RII. The practitioners provided numerical scores in order to express their level of assessment with 4 as the highest value. The RII values were derived from the cross-tabulated analysis (Tables 2 - 5), and calculated using Equation 1.

Table 1
RII of TQM drivers among construction practitioners

	Architects		Builders		Engineers		Q/Surveyors		Estate Mgrs		Others		Overall	
Drivers	RII	Rk	RII	Rk	RII	Rk	RII	Rk	RII	Rk	RII	Rk	RII	Rk
TMC	0.955	1	0.917	1	0.906	3	0.940	1	0.958	1	1.000	1	0.941	1
QMC	0.841	5	0.813	8	0.844	5	0.910	3	0.875	4	0.917	3	0.871	4
SQM	0.682	10	0.833	6	0.750	8	0.770	9	0.792	7	0.833	7	0.772	9
DMT	0.818	7	0.750	9	0.563	10	0.690	10	0.833	5	0.792	10	0.728	10
PMT	0.773	8	0.854	5	0.875	4	0.880	5	0.833	5	0.833	7	0.849	6
SQMT	0.773	8	0.833	6	0.844	5	0.830	7	0.792	7	0.917	3	0.827	7
EAT	0.909	2	0.875	2	0.969	1	0.900	4	0.792	7	0.958	2	0.901	3
EAI	0.841	5	0.875	2	0.750	8	0.870	6	0.917	2	0.875	5	0.857	5
IAA	0.864	3	0.729	10	0.781	7	0.780	8	0.750	10	0.833	7	0.787	8
CSN	0.864	3	0.875	2	0.938	2	0.930	2	0.917	2	0.875	5	0.904	2

Note: TMC= Top Management Commitment, QMC= Quality Management Culture, SQM= Strategic Quality Management, DMT= Design Management, PMT= Process Management, SQMT= Supplier Quality Management, EAT= Education and Training, EAI= Empowerment and Involvement, IAA= Information and Analysis, CSN= Customer Satisfaction

The findings indicate that, the Architect, who primarily carries out the design of building construction projects perceived top management commitment [RII = 0.955], education and training [RII = 0.909], customer satisfaction [RII = 0.864], information and analysis [RII = 0.864], empowerment and involvement [RII = 0.841], and quality management culture [RII = 0.841] as the most vital drivers of TQM implementation. Next, the Builders who possess the skills of building construction management observed top management commitment [RII = 0.917], education and training [RII = 0.875], empowerment and involvement [RII = 0.875], customer satisfaction [RII = 0.875], and process management [RII = 0.854] as the most significant drivers for implementing TQM. Afterwards, the engineers who designs and guarantees the structural stability of construction projects, considered education and training [RII = 0.969], customer satisfaction [RII = 0.938], top management commitment [RII = 0.906], process management [RII = 0.875], and quality management culture [RII = 0.844] as the key drivers of TQM implementation. In addition, the cost experts (Quantity surveyors) of construction projects perceived the following drivers as very important for the successful implementation of TQM in Nigerian construction firms. These are top management commitment [RII = 0.940], customer satisfaction [RII = 0.930], quality management culture [RII = 0.910], education and training [RII = 0.900], and process management [RII = 0.880].

The Estate Managers, who manages construction products also perceived top management commitment [RII = 0.958], customer satisfaction [RII = 0.917], empowerment and involvement [RII = 0.917], quality management culture [RII = 0.875], design management [RII = 0.833], and Process Management [RII = 0.833] as the most noteworthy drivers for TQM implementation. And lastly, other practitioners who are either land surveyors, planners, or construction managers perceived top management commitment [RII = 1.000], education and training [RII = 0.958], quality management culture [RII = 0.917], supplier quality management [RII = 0.917], empowerment and involvement [RII = 0.875], and customer satisfaction [RII = 0.875] as the most important drivers for implementing TQM in Nigerian construction firms.

By and large, this study revealed five (5) most important drivers for the successful implementation of TQM as perceived by all the practitioners. These are: Top Management Commitment [1st], Customer Satisfaction [2nd]; Education and Training [3rd]; Quality Management Culture [4th], and Empowerment and Involvement [5th]. These vital drivers are illustrated in Figure 1.

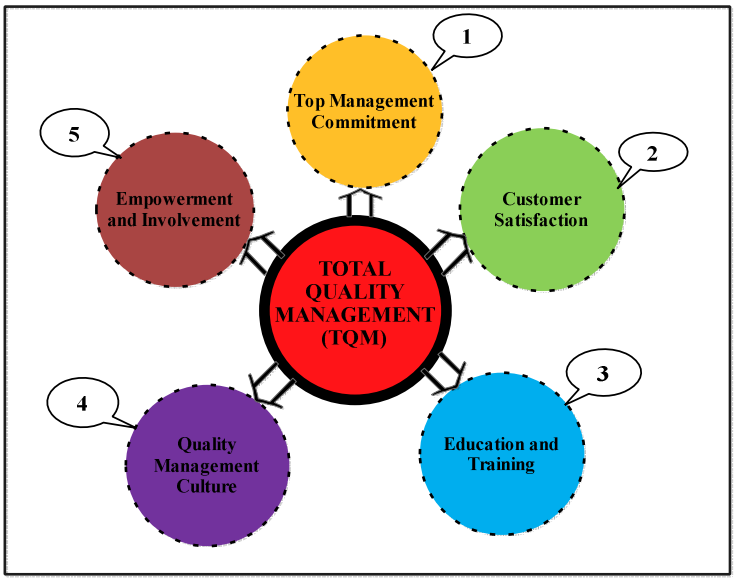

Fig. 1. Five (5) most important drivers for TQM implementation

3.2 Cross-tabulation of Most Important Drivers for TQM Implementation
3.2.1 Top Management Commitment

Table 2 shows that a significantly larger proportion of the practitioners (81%), held top management commitment as "of great importance" for an effective TQM implementation.

Table 2
Cross-tabulation of professional field and top management commitment

			Top Mgt Commitment			
			NI	SI	GI	Total
Professional Field	Architects	Count	1	0	10	11
		% within Professional Field	9.1%	0.0%	90.9%	100.0%
	Builders	Count	0	4	8	12
		% within Professional Field	0.0%	33.3%	66.7%	100.0%
	Engineers	Count	1	1	6	8
		% within Professional Field	12.5%	12.5%	75.0%	100.0%
	Q/surveyors	Count	1	4	20	25
		% within Professional Field	4.0%	16.0%	80.0%	100.0%
	Estate Managers	Count	0	1	5	6
		% within Professional Field	0.0%	16.7%	83.3%	100.0%
	Others	Count	0	0	6	6
		% within Professional Field	0.0%	0.0%	100.0 %	100.0%
Total		Count	3	10	55	68
		% within Professional Field	4.4%	14.7%	80.9%	100.0%

Where NI= Of no importance, SI=Of some importance, GI=Of great importance

While only 15% of the professionals regarded this factor as "of some importance". This finding is held by Buba and Tanko [13] who established a strong case for leadership and quality. The authors described leadership as the fundamental success factor of any activity that involves people. Also, Pheng and Ke-Wei [7] discovered that a persistent and hands-on leadership is a key factor for the successful TQM implementation**.** It is imperative to note that, not a few literature [32-34] on TQM attributed commitment of top management as the most important driver for the success of TQM. Therefore, this study confirmed top management commitment as a critical determinant for TQM implementation.

3.2.2 Customer Satisfaction

Table 3 indicates that 74% and 15% of the construction practitioners regarded customer satisfaction as "of great importance" and "of some importance" respectively. This finding agree with Mahmood *et al*. [34] who argued that, the customers are economic assets, and therefore there is need for continuous improvement for constant customer satisfaction. McAdam and Kelly [42] also submitted that TQM requires greater effort from everyone to continuously satisfy the customer.

Table 3
Cross-tabulation of professional field and customer satisfaction

			Customer Satisfaction			
			NI	SI	GI	Total
Professional Field	Architects	Count	2	2	7	11
		% within Professional Field	18.2%	18.2%	63.6%	100.0%
	Builders	Count	2	2	8	12
		% within Professional Field	16.7%	16.7%	66.7%	100.0%
	Engineers	Count	0	2	6	8
		% within Professional Field	0.0%	25.0%	75.0%	100.0%
	Q/surveyors	Count	3	1	21	25
		% within Professional Field	12.0%	4.0%	84.0%	100.0%
	Estate Managers	Count	0	2	4	6
		% within Professional Field	0.0%	33.3%	66.7%	100.0%
	Others	Count	1	1	4	6
		% within Professional Field	16.7%	16.7%	66.7%	100.0%
Total		Count	8	10	50	68
		% within Professional Field	11.8%	14.7%	73.5%	100.0%

Where NI= Of no importance, SI=Of some importance, GI=Of great importance

3.2.3 Education and Training

Table 4 shows that 88% of the practitioners either regarded education and training as "of some importance" or "of great importance" for an effective TQM implementation in Nigerian construction firms. A systematic formal training on TQM is indispensable. The training of employees will ensure that skills do not become obsolete in a changing environment, while the quality of construction products is enhanced and maintained. Hence Education and Training are important mechanisms of TQM initiatives. This finding is supported by Zhang *et al.,* [37].

Table 4
Cross-tabulation of professional field and education/training

			Education and Training				
			NA	**NI**	**SI**	**GI**	**Total**
Professional Field	Architects	Count	0	1	2	8	11
		% within Professional Field	0.0%	9.1%	18.2%	72.7%	100.0%
	Builders	Count	1	1	1	9	12
		% within Professional Field	8.3%	8.3%	8.3%	75.0%	100.0%
	Engineers	Count	0	0	1	7	8
		% within Professional Field	0.0%	0.0%	12.5%	87.5%	100.0%
	Q/surveyors	Count	0	3	4	18	25
		% within Professional Field	0.0%	12.0%	16.0%	72.0%	100.0%
	Estate Managers	Count	0	2	1	3	6
		% within Professional Field	0.0%	33.3%	16.7%	50.0%	100.0%
	Others	Count	0	0	1	5	6
		% within Professional Field	0.0%	0.0%	16.7%	83.3%	100.0%
Total		Count	1	7	10	50	68
		% within Professional Field	1.5%	10.3%	14.7%	73.5%	100.0%

Where NA= Not applicable, NI= Of no importance, SI=Of some importance, GI=Of great importance

3.2.4 Quality Management Culture

For an effective implementation of TQM in Nigerian construction firms, Table 5 indicates 59% and 29% of construction practitioners who confirmed quality management culture as "of great importance" and "of some importance" respectively. The term "Culture" is the collective indoctrination of the mind, which differentiates the members of one group from another. A person's cultural orientation is existing in every interaction [36]. Therefore, quality management culture is essential as an inducing factor that affects every aspect of the management process.

Table 5
Cross-tabulation of professional field and quality management culture

			Quality Mgt Culture				
			NA	NI	SI	GI	Total
Professional Field	Architects	Count	0	2	3	6	11
		% within Professional Field	0.0%	18.2%	27.3%	54.5%	100.0%
	Builders	Count	1	1	4	6	12
		% within Professional Field	8.3%	8.3%	33.3%	50.0%	100.0%
	Engineers	Count	0	0	5	3	8
		% within Professional Field	0.0%	0.0%	62.5%	37.5%	100.0%
	Q/surveyors	Count	0	1	7	17	25
		% within Professional Field	0.0%	4.0%	28.0%	68.0%	100.0%
	Estate Managers	Count	0	0	3	3	6
		% within Professional Field	0.0%	0.0%	50.0%	50.0%	100.0%
	Others	Count	0	1	0	5	6
		% within Professional Field	0.0%	16.7%	0.0%	83.3%	100.0%
Total		Count	1	5	22	40	68
		% within Professional Field	1.5%	7.4%	32.4%	58.8%	100.0%

Where NA= Not applicable, NI= Of no importance, SI=Of some importance, GI=Of great importance

3.2.5 Empowerment and Involvement

Table 6
Cross-tabulation of professional field and empowerment/involvement

			Empowerment/Involvement				
			NA	NI	SI	GI	Total
Professional Field	Architects	Count	1	1	2	7	11
		% within Professional Field	9.1%	9.1%	18.2%	63.6%	100.0%
	Builders	Count	0	0	6	6	12
		% within Professional Field	0.0%	0.0%	50.0%	50.0%	100.0%
	Engineers	Count	1	2	1	4	8
		% within Professional Field	12.5%	25.0%	12.5%	50.0%	100.0%
	Q/surveyors	Count	1	1	8	15	25
		% within Professional Field	4.0%	4.0%	32.0%	60.0%	100.0%
	Estate Managers	Count	0	0	2	4	6
		% within Professional Field	0.0%	0.0%	33.3%	66.7%	100.0%
	Others	Count	0	1	1	4	6
		% within Professional Field	0.0%	16.7%	16.7%	66.7%	100.0%
Total		Count	3	5	20	40	68
		% within Professional Field	4.4%	7.4%	29.4%	58.8%	100.0%

Table 6 shows that a greater proportion of the practitioners (59%), held empowerment and involvement as "of great importance" for the successful implementation of TQM. People's involvement evolved out of the need to improve performance [34], while the impact of the people (employees) depends on the degree of empowerment given to them. According to Leonard [33], some of the striking advantages of involvement and empowerment are better production efficiency, reduced defects, and improved customer satisfaction. The commitment of top management and formal training of employees would not be complete unless people are involved and empowered. Hence, this factor is critical to the success of TQM implementation in Nigerian construction firms.

4. Conclusions

The preceding sections reveal how the drivers of TQM could influence the successful implementation of quality management in Nigerian construction firms; thus, answering this study's first research question. The first objective of this study was to identify the drivers of quality management practices in order to enhance the quality of construction products. The study outcome indicate that Top Management Commitment, Customer Satisfaction, Education and Training, Quality Management Culture, and Empowerment and Involvement are the most important drivers of total quality management implementation. The second research question was to delineate the perception of quality management practices among construction practitioners. Architects, Builders, Q/Surveyors, Estate Managers, and Others perceived top management commitment as the most significant driver for TQM implementation. Customer satisfaction was perceived to be the second-ranked driver of TQM by Builders, Engineers, Q/Surveyors, and Estate Managers. These findings suggest that management should commit itself on continuous quality improvement to satisfy construction clients and customers. Therefore, getting TQM practices right in Nigeria will place its construction firms in a standpoint for sustainability and longer business survival. Hence, the prerequisite of continuous improvement on quality should be upheld and maintained in order to improve the value of construction products. All implementations should also commence with effective leadership and top management commitment, as this factor is obviously critical for the attainment of any TQM technique. This study considered only the construction phase of ongoing federal government projects in educational institutions. In the future, studies should be carried out in state government, commercial and residential projects to incorporate other stakeholders and phases of construction projects.

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