Original Research Article

Using Exploratory Factor Analysis Technique for Establishing Barriers to Total Quality Management Implementation in the Construction Industry

Abstract

This study aims to establish the barriers to Total Quality Management (TQM) implementation in the construction industry. The study adopted a quantitative research approach. Questionnaire survey was administered to 536 participants who were drawn from a list of registered construction companies in good standing in Ghana. Data collected were analyzed using Exploratory Factor Analysis technique. The reliability of the study's instrument was measured using Cronbach's alpha. Whiles the Kaiser–Meyer–Olkin and Bartlett's test of sphericity were used to measure the sampling adequacy and significance respectively. The study discovered sixteen barriers to TQM implementation in the construction industry. The top five ranking barriers established were: Lack or limited knowledge of TQM, Lack of enforcement from the legislative bodies overseeing TQM implementation, Lack of efficient TQM management system, Lack of interest in the application of TQM, and Absent of TQM policy. Other barrier established were: Lack of commitment from management, Reluctance to change old management technique, Lack of coordination of TQM implementation policy, Lack and inability to train and educate employees on TQM, Complex nature of TQM technique, Lack of TQM expert, Lack of finance in the management of TQM experts, Lack of understanding among construction professionals in applying TQM, Perception that TQM may not yield any better results, TQM technique is costly, and TQM technique is time consuming. All the sixteen items established were found suitable and good measures for the analytical test to be carried out. The factor loadings for all items were greater than 0.586 which were greater than the recommended value of 0.40. Cronbach's alpha value achieved was 0.944, while the Kaiser–Meyer–Olkin measure of sampling adequacy recorded was 0.927. The result of Bartlett's test of sphericity also revealed a significance level of 0.000 (p<0.05). The study, thus, seeks to guide and help top managers to appreciate and better understand the factors that impede the effective implementation of TQM in the construction industry. The study contributes to the body of knowledge by using exploratory factor analysis technique for establishing barriers towards total quality management implementation in the construction industry.

Keywords: Barriers, Construction industry, Performance, Total quality management

1. Introduction

Lack of strict compliance to the principles of total quality management (TQM) by construction organizations has brought about poor quality of the finished building projects [1]. The construction industry is therefore criticized for not taking the

lead from the manufacturing industry that has successfully implemented the philosophy of quality in all spheres of its activities. However, before making any attempt to draw parallel between the two industries it is important to examine the kind of environment under which they operate because according to (Yazdani, [2] environmental uncertainty to some extent has influence on employees outcomes and performance. Manufacturing industry operates under a closely monitored environment where it is possible to control all variables that have bearing on product quality. Construction on site is not an automated process and unlike engineering goods, it is the people rather than the machines and technology that influence the project outcome. Construction is a very complex process that involves multiple parties and interests, ranging from owner, architect, consultants, contractors and vendors. The very nature of construction appears to be the real barrier to quality management success [3]. Several studies in construction industry concluded that fragmented nature, lack of coordination and communication between parties, adversarial contractual relationships, and lack of customer focus inhibit the construction industry's performance [4]. The quality management system needs to evolve around the specific characteristics of the project and its environment. Traditional quality management systems are often unrepresentative of workface and, are usually preoccupied with instruments of control and its administration rather than the outputs that are important to the customers [5]. Total Quality Management (TQM) has become a key philosophy to assist organizations in becoming the most efficient, the most competitive, and the most successful in the market place. Although, TQM has been suggested in principle to improve the performance of the practical application, it involves several difficulties. The literature mentions that TQM implementation is a complex, difficult, lengthy, involving huge efforts from organizations. There are a multitude of studies that address very different ways for the identification of the factors that hinder the successful implementation of TQM. Understanding the factors that are likely to impede the implementation of the TQM allows managers to develop more effective strategies for improving the chances of successfully deploy TQM and thereby to achieve excellence in the business [6]. The objective of this study was to establish the barriers that affect the successful implementation of Total Quality Management in the construction industry.

2. Literature Review

Some studies in the field of TQM attempt to provide reasons why in such extensive and growing manner, the rate of TQM failure is high [7, 8] and also attempt to outline factors that are likely to impede the TQM implementation [9, 10; 11, 12, 13]. Hamidi and Zamanparvar [8], in their study outlined problems and barriers for implementing TQM as lack of senior and middle management commitment. They stressed that without management commitment and creating appropriate and supportive organizational culture, there would be no progress. They added that in both developed and developing countries, lack of senior management commitment was identified as an important factor that leads to failure reports in TQM implementation. According to Roberts [14], the

degree of support and commitment by top management is critical for TQM success. He explains that true test of top management commitment lies in the amount of resources (time, money and people) that it is willing to allocate to TQM implementation effort. Pheng and Teo [15], also support the assertion that the degree of support that management takes in the implementation of total quality environment is very critical for the success of TQM implementation. They explained that commitment of top management enables employees to follow their direction and way of working. Hamidi and Zamanparvar [8], in their study also mentioned training programs for managers and staffs for increasing their ability in techniques and total quality tools as important factors for effective TQM accomplishment. They emphasised that, for TQM to be successful, organizations must commit to training employees at all levels. Although organizations invest heavily in quality awareness, statistical process control, and quality circles, often the training is too narrowly focused. Frequently, Duran's warning against training for specific organizational levels or product lines is unheeded [16]. This has also been underscored by Newall and Dale [17], who argue that poor education and training present a major obstacle in the development and implementation of a quality program. Hence, comprehensive training, including technical expertise, communication skills, small-team management, problem-solving tools, and customer relations should be recognised in the TQM implementation.

Oakland [18], explained that lack of long-term objectives and targets will cause a quality implementation program to lose credibility. Keys [19], on the other hand, warned that an adversarial relationship between management and non-management should not exist. He emphasized that a cooperative relationship is necessary for TQM success. A TQM project must be supported by employee trust, acceptance and understanding of management's objectives. Employees therefore, should be recognized by the management as vital players in the decision-making processes regarding to quality improvement as involving them would have motivating effect on implementation of quality programs.

It should also be noted that the absence of a sound strategy planning has often contributed to ineffective quality improvement. Duran [16], noted that deficiencies in the original planning could cause a process to run at a high level of chronic waste. Duran [16], also reported that although some managers were not pleased with their progress on their quality implementation agenda, they gave quality planning low priority. Newall and Dale [17], observed in their study that a large number of companies are either unable or unwilling to plan effectively for quality improvement. It is therefore important that companies using TQM should always strive towards impressing upon owners the need to spend money and time on planning. If management took reasonable time to plan projects thoroughly and invest in partnering to develop an effective project team, a lot could be achieved in terms of product performance as these investments in prevention-oriented management can significantly improve the quality of the goods or services offered by an organization.

Since most companies do not involve quality in their strategic plan, little attention is paid to TQM in terms of human and financial resources. Much of the attention is drawn to increasing profit margins of the organization with little regard as to whether their offers/supply to customers is of expected quality. There is paltry budgetary allocation made towards employee training and development which is critical for total quality management implementation. Employee training is often viewed as unnecessary cost which belittles the profits margins which is the primary objective for the existence of businesses and as a result TQM has been neglected as its implementation may not necessarily bring gains to the organization in the short term. Most strategic plans of organizations are not customer driven. They tend to concentrate much on profit-oriented objectives within a given time frame.

A competitive market is a driving force behind many of the other obstacles to quality. One of the effects of a competitive market is to lower quality standards to a minimally acceptable level. This barrier to quality is mainly a mental barrier caused by a misunderstanding of the definition of quality. Unfortunately, too many organizations equate quality with high cost. Their definition leads to the assumption that a company can't afford quality. A broader definition needs to be used to look at quality, not only in the company's product, but in every function of the company. All company functions have an element of quality. If the quality of tasks performed is poor, unnecessary cost is incurred by the company and, ultimately, passed to the customer. TQM should work by inspiring employees at every level to continuously improve what they do, thus rooting out unnecessary costs. Done correctly, a company involved with TQM can dramatically reduce operating costs.

Excess layers of management quite often lead to duplication of duty and responsibility. This has made the lower employees of an organization to leave the quality implementation to be a management's job. In addition, quality has not been taken as a joint responsibility by the management and the employees. Coupled with the notion that management is infallible and therefore it is always right in its decisions, employees have been forced to take up peripheral role in quality improvement. As a result, employees who are directly involved in the production of goods or delivery of services are not motivated enough to incorporate quality issues that have been raised by the customers they serve since they do not feel as part of the continuous process of quality improvement.

2.1 Barriers to the Implementation of Total Quality Management

In the literature there are a multitude of studies that address very different ways for the identification of the factors that hinder the successful implementation of TQM. Whalen and Rahim [9], identified poor planning, lack of management commitment, the strength of the labour, lack of appropriate training, complacency team, use of an invalid program (outside of shelf-life), the inability to change the organizational philosophy (culture), insufficiency of resources, the lack of improvement of the quality of the measurement as the factors that hinder the successful implementation of TQM.

Sebastianelli and Tamimi [10], also identified Poor planning, practice management and development of human resources insufficient and inadequate, lack of quality planning, the lack of leadership in the development of a quality culture, inadequate resources for TQM, Lack of customer orientation as the factors that hinder the successful implementation of TQM. On the other hand, Johnson and Kleiner [11], listed the barriers to successful implementation of TQM as lack of benchmarking, employee resistance to change, and insufficient resources. Mosadeghrad [12], study identified ineffective or inappropriate TQM models, ineffective or inappropriate methods for the implementation of the TQM, the wrong environment for the implementation of the TQM as the barriers to successful implementation of TQM. The barriers that prevent the implementation of TQM have been grouped into five categories, namely:

i. ***Strategic barriers***: strategic issues are significant barriers for implementation of TQM and have the greatest negative impact on its success. These barriers are mainly related to the management and leadership of the organization.

ii. ***Structural barriers***: are related to the structure, systems and physical resources necessary to implement the TQM.

iii. ***Human resources barriers*:** are those obstacles that are related to human factors, such as lack of employee engagement and resistance to change in TQM.

iv. ***Contextual barriers*:** are those difficulties that arise when there are developed a context and a culture appropriate to achieve the highest potential of the deploying of the TQM.

v. ***Procedural barriers***: mainly are generated by the complexity of the processes, the lack of focus on the client, the lack of partnership with suppliers, the bureaucracy and the lack of a system of evaluation and self-assessment.

The categories of barriers to TQM implementation and their examples are further presented in Table I.

2.2 Table I: Categories of barriers to the implementation of TQM

Categories	Example of barriers to TQM implementation
Strategic barriers	Inappropriate TQM program
	Unrealistic expectations
	Deficient leadership
	Poor management
	The lack of top management support
	Poor involvement of managers
	The strength of the middle management
	Inadequate planning
	The lack of consistency of objectives
	Lack of long-term vision
	The lack of a vision and a clear direction
	Conflicting objectives and priorities
	The lack of priority of improving the quality
	The previous failures in terms of initiatives of change
	The lack of Government support
	Political uncertainty
Structural barriers	Organizational structure inappropriate
	Lack of organizational flexibility
	Lack of physical resources
	Lack of information systems
	Lack of financial support, the cost of implementation
	Lack of time
Human resources barriers	The lack of interest of employees
	The lack of commitment and involvement of employees
	Employee resistance to change
	A deficient human resources management
	Poor delegation at all hierarchical levels
	Few employees work tasks and increasingly higher
	Lack of training and education of employees

	Lack of motivation and satisfaction of employees
	The lack of recognition and rewarding for success
Contextual barriers	Inadequate organizational culture
	Difficulties in changing organizational culture
	Lack of guidance teams
	Poor communication and ineffective
	Poor coordination
	The lack of confidence of employees in the management
	Cultural issues resolution
	Lack of innovation
	Political behaviour
	The diversity of the workforce
Procedural barriers	Lack of focus
	The lack of an adequate process management
	Lack of concentration on the client
	The lack of involvement of suppliers
	Bureaucracy
	Lack of evaluation and self-evaluation
	The change agent or counsel incompetence in implementing quality
	Ineffective corrective action
	Efforts to improve quality are time consuming

Source: Ansah et al. [13].

It can be seen from Table I that strategic barriers are the most common types of barriers that hinder the successful implementation of TQM system. Also, the human resources barriers have a very large impact on the success of TQM implementation. It can be affirmed that, within both the strategic-level barriers and the barriers related to human resources, leadership is a key factor in managing change necessary to implement the TQM.

3. Methodology

The research was conducted by using a structured questionnaire survey. It is always essential for questionnaires intended to bring forth data for research to be easy to answer, unbiased, concise, and clear to be analysed [20; 21]. Additionally, to retrieve a more reliable and also to aid in measuring the perception of the population on the quality system evaluation features for TQM implementation, survey question was adopted. Personally, administered or face-to-face structured questionnaire for data collection was the preferable

option used for the study. The population for the study was made up of all the Small to Large Sized (D4K4 to D1K1) construction firms in Ghana. The respondents were asked to rate each of the items on a Five Point Likert scale regarding the extent to which they agreed or disagreed with quality system evaluation features for Total Quality Management implementation in the construction industry. The sample frame was established by obtaining a list of registered construction companies in good standing from the Association of Building and Civil Engineering Contractors of Ghana (ABCECG). Good standing construction companies which have registered with the ABCECG as at the time of collecting the data for the research was one thousand two hundred and eighty-two (1282). The study decided to target a sample size of 50% from the entire population of the study. This decision was based on Leedy and Ormrod [22], assertion that if the population size is around 1500, then 20% or more of the population should be sampled. Therefore, because the entire population of the study was 1282, a sample size of 50% (641) chosen from the population deemed adequate for the study. The study used the probability sampling technique, which allows all segments of the construction companies as defined earlier, to be represented in the sample, making sure that a representative sample of companies was selected for the study. Hence, a simple random sampling technique was used, which allows each member of the population to have an equal chance of being selected [23]. The rationale for selecting this method of sampling was based on the nature and composition of the companies in Ghana. The selection of a representative sample for the study was also based on the justification by Smith [24], who informed that random sampling must be used for a study of this nature.

Out of 641questionnaires administered to top management in the Ghanaian construction industry, 536 were fully completed and retrieved for the analysis representing a response rate of 83.62 percent. The data collected was coded and analyzed through Statistical Package for Social Sciences (SPSS) version 20 to evaluate the Kaiser-Mayor Olkine and Bartlett's test. Also Data suitability test was conducted to circumvent multicollinearity and to ensure satisfactory internal reliability of variables using the Cronbach's alpha (Attakora-Amaniampong et al., [25], Attakora-Amaniampong et al., [26], and validity (convergent and discriminate). Furthermore, Exploratory Factor Analysis (EFA) was performed to gather information on the unidimensionality of the factors to yield their factor-analysability. The Maximum Likelihood, with a minimum eigenvalue of one, together with Principal Axis Factoring with Oblimin Kaiser Normalization was specified as the analysis method for this study. Factor analysis is deemed appropriate when the Kaiser-Meyer-Olkin (KMO) is higher than the satisfactory minimum limit of 0.5 and a desirable limit as 0.8 or greater [27]. Hair et al. [28], also suggested a cut-off value of KMO should be greater than or equal to 0.7. According to Hair et al. [28], Bartlett's test with a significance level of less than 0.0001 substantiates the appropriateness of the factor. The output from the analysis was presented as Means, Standard Deviations, Factor Loading, Corrected Item-Total Correlation and Cronbach's Alpha which helped to establish the factors as barriers to TQM implementation in the construction industry.

4. Results and Discussion

Table II indicates the factors that serve as barriers to successful implementation of TQM in the construction industry in terms of percentage responses on a scale of 1 (strongly disagree) to 5 (strongly agree), and a Means (MS) ranging between 1.00 and 5.00.

Table II: Barriers to the implementation of TQM

Barriers/Factors	Strongly disagree…Strongly agree					MS	SD	Rank
	1	2	3	4	5			
Lack or limited knowledge of TQM	0.00	3.54	12.87	30.60	52.99	4.33	0.83	1
Lack of enforcement from the legislative bodies overseeing the implementation of TQM	0.00	2.43	18.47	33.96	45.15	4.22	0.83	2
Lack of efficient TQM management system	0.93	4.48	15.49	35.63	43.47	4.16	0.91	3
Lack of interest in the application of TQM	0.37	4.10	16.23	41.23	38.06	4.13	0.85	4
Absent of TQM policy	0.56	6.16	20.15	30.04	43.10	4.09	0.96	5
Lack of commitment from management	0.37	6.90	17.72	33.40	41.60	4.09	0.95	5
Reluctance to change old management technique	1.87	3.73	18.66	36.19	39.55	4.08	0.95	6
Lack of coordination of the implementation of TQM policy within the organization	0.00	9.33	13.62	38.25	38.81	4.07	0.95	7
Lack and inability to train and educate employees on TQM	2.05	2.24	19.59	39.74	36.38	4.06	0.91	8
Complex nature of TQM technique	0.19	3.54	23.13	36.57	36.57	4.06	0.87	8
Lack of TQM expert	0.00	7.46	21.08	32.09	39.37	4.03	0.95	9

Lack of finance in the management of TQM experts	1.12	8.21	20.52	33.77	36.38	3.96	1.00	10
Lack of understanding among construction professionals in applying TQM	0.00	5.78	24.81	38.99	30.41	3.94	0.88	11
Perception that TQM may not yield any better results	3.92	5.41	23.32	34.70	32.65	3.87	1.06	12
TQM technique is costly	1.87	8.21	24.81	32.65	32.46	3.86	1.02	13
TQM technique is time consuming	0.37	10.07	28.17	33.40	27.99	3.79	0.98	14

All the MS are above the midpoint score of 3.00, which indicates that the respondents agreed with the factors identified as barriers to successful implementation of TQM in the construction industry. It is notable that all the sixteen ranked factors (barriers) affecting the implementation of TQM in the construction industry have a MS > 3.50 ≤ 5.00, which indicates that the respondents perceive the factors affecting the implementation of TQM in the construction industry to be between 'agree' and 'strongly agree'. The relatively high MS achieved suggests that these variables are the major barriers preventing construction firms from implementing or adopting TQM. Among the sixteen barriers identified, Lack or limited knowledge of TQM was rank first, followed by Lack of enforcement from the legislative bodies overseeing the implementation of TQM, Lack of efficient TQM management system, Lack of interest in the application of TQM, Absent of TQM policy, Lack of commitment from management, Reluctance to change old management technique, Lack of coordination of the implementation of TQM policy within the organization, Lack and inability to train and educate employees on TQM, Complex nature of TQM technique, Lack of TQM expert, Lack of finance in the management of TQM experts, Lack of understanding among construction professionals in applying TQM, Perception that TQM may not yield any better results, TQM technique is costly, and TQM technique is time consuming was rank last as shown in Table II.

Exploratory Factor Analysis was also conducted to assess the unidimensionality and reliability of factors that serve as barriers to successful implementation of TQM in the construction industry. Principal axis factoring with oblimin rotation (PAF Oblimin) was specified as the extraction and rotation method. The reliability of the study's instrument was measured using Cronbach alpha. Hair et al. [28], established that Cronbach alpha values higher than 0.7 were considered as being reliable. This further elucidates that, the higher the alpha coefficient, the more

reliable the test. In the context of this current study, the lowest Cronbach Alpha value was 0.938 while the highest value was 0.944. The result of Factor Loading, Corrected Item-Total Correlation and Cronbach's Alpha is reported in Table III.

Table III: Factor Loading, Corrected Item-Total Correlation and Cronbach's Alpha Results

Factors/Attributes	Factor Loading	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Reluctance to change old management technique	0.926	0.694	0.940
Lack or limited knowledge of TQM	0.853	0.765	0.939
Lack and inability to train and educate employees on TQM	0.851	0.809	0.938
TQM technique is costly	0.800	0.524	0.944
Lack of enforcement from the legislative bodies overseeing the implementation of TQM	0.790	0.676	0.941
TQM technique is time consuming	0.772	0.577	0.943
Lack of understanding among construction professionals in applying TQM	0.738	0.752	0.939
Absence of TQM policy	0.732	0.707	0.940
Lack of commitment from management	0.720	0.693	0.940
Complex nature of TQM technique	0.715	0.763	0.939
Lack of TQM expert	0.662	0.679	0.941
Lack of coordination of the implementation of TQM policy within the organization	0.636	0.685	0.940
Lack of interest in the application of TQM	0.634	0.640	0.941
Lack id finance in the management of TQM experts	0.628	0.751	0.939
Perception that TQM may not yield any better results	0.596	0.728	0.940
Lack of efficient TQM management system	0.586	0.717	0.940

The corrected item-total correlation was greater than the suggested cut-off value of 0.30, suggesting that the items were good measures of the Barriers to the implementation of TQM and the Cronbach's alpha was greater than 0.700 at 0.944 (Table IV), indicating acceptable internal reliability [29]. The Kaiser-Meyer-Olkin (KMO) of 0.927 with Bartlett's test of sphericity of $p<0.000$ (Table V) was also obtained, indicating consistency with the recommended KMO cut off value of 0.70 and Bartlett's test of sphericity of $p<0.05$ suggested by Hair et al [28].

Table IV: Reliability of barriers to successful implementation of TQM

Construct	Number of Items	Cronbach's alpha value	Cronbach's alpha based on Standardized Items
Barriers to successful implementation of TQM	16	0.944	0.945

Table V: Sampling Adequacy Test (KMO and Bartlett's Test)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.927
Bartlett's Test of Sphericity	Approx. Chi-Square	6235.118
	Df	120
	Sig.	0.000

The factor loadings for all items were greater than 0.586 reported in Table III, which were greater than the recommended value of 0.40 as suggested by Field [30], and Hair et al. [31]. All the sixteen attributes identified (Lack or limited knowledge of TQM, Lack of enforcement from the legislative bodies overseeing the implementation of TQM, Lack of efficient TQM management system, Lack of interest in the application of TQM, Absent of TQM policy, Lack of commitment from management, Reluctance to change old management technique, Lack of coordination of the implementation of TQM policy within the organization, Lack and inability to train and educate employees on TQM, Complex nature of TQM technique, Lack of TQM expert, Lack of finance in the management of TQM experts, Lack of understanding among construction professionals in applying TQM, Perception that TQM may not yield any better results, TQM technique is costly and TQM technique is time consuming) were found suitable and good measures for the analytical test to be carried out. The result of this study has no much difference with other authors results presented in their study.

Mosadeghrad [12], identified major barriers to TQM implementation as ineffective or inappropriate TQM models, ineffective or inappropriate methods for the implementation of the TQM, and the wrong environment for the implementation of the TQM. On other hand, Hamidi and Zamanparvar [8], stressed that one of the major problems and barriers for implementing TQM in both developed and developing countries is lack of senior management commitment. The result of this study also affirms the work of Newall and Dale [17], which argue that poor education and training present a major obstacle in the development and implementation of a quality program.

5. Conclusion

Total Quality Management has been suggested in principle to improve the performance of the organization but its implementation in practical application terms involves several difficulties. It was emphasized in the literature that Total Quality Management implementation is complex, lengthy, involving huge efforts from organizations. This study intended to establish major factors that serve as barriers to successful implementation of Total Quality Management implementation in the construction industry based on participants' perception of various relevant variables. The conclusions of the study are anticipated to fill the gap in the literature on the very important barriers which affect Total Quality Management implementation in the construction industry. Conclusively, the main barriers to Total Quality Management implementation as established by the study are: Lack or limited knowledge of TQM, Lack of enforcement from the legislative bodies overseeing the implementation of TQM, Lack of efficient TQM management system, Lack of interest in the application of TQM, Absent of TQM policy, Lack of commitment from management, Reluctance to change old management technique, Lack of coordination of the implementation of TQM policy within the organization, Lack and inability to train and educate employees on TQM, Complex nature of TQM technique, Lack of TQM expert, Lack of finance in the management of TQM experts, Lack of understanding among construction professionals in applying TQM, Perception that TQM may not yield any better results, TQM technique is costly, and TQM technique is time consuming. These identified TQM implementation barriers can be grouped into the following categories: strategic barriers, human resources barriers, structural barriers, contextual barriers, and procedural barriers. It can be concluded from the findings that all the barriers considered in the study have a high effect on TQM implementation in the construction industry. The authors argue that the implementation of TQM is a process of transformational change within the organization and to cope with this change it is necessary that the top management of the organization (leadership) to be able to motivate, maintain enthusiasm through organization and to identify effective ways to overcome barriers they face in order to successfully complete the implementation of TQM system.

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