Total Quality Management Practices in Construction Project Delivery in South Africa

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Abstract. Due to its ability to provide quality through effective management practices, Total Quality Management (TQM) has attracted significant attention in most academic discussions in recent times. This attention became necessary as a result of the overarching need to increase the quality of products being delivered within the Architecture, Engineering and Construction industry (AEC). Based on this knowledge, this study assessed TQM practices in construction project delivery in Gauteng, South Africa. The study adopted a quantitative approach through a questionnaire survey, and information was harnessed from construction participants involved in the delivery of civil engineering projects within the study area. The data gathered were analysed using percentage, mean score and standard deviation, while the reliability of the research questionnaire was tested using Cronbach alpha test. The findings of the study revealed that the most adopted TQM practices are customer focus, supplier quality management, strategic planning, and employee relations. In order to improve the adoption of TQM practices, measures such as ensuring customer involvement, top management involvement, and commitment, education, and training of engineers on TQM practices, effective customer-supplier relationship, effective communication (internal and external), and primary customer focus, are important. This study adds value to the body of knowledge as it gives an insight on the TQM practices being adopted in the delivery of civil engineering projects within the study area as well as the measures to be put in place in order to ensure improved adoption of TQM.

1. Introduction

Despite the availability of diverse beneficial management practices and tools, project delivery within the Architecture, Engineering, and Construction industry (AEC) of most developing countries are still characterised by poor performance. Construction projects are still being delivered beyond schedule, above budget and below quality [1]. In most of these countries (South Africa inclusive), achieving the desired projects is more of a dream than a reality for construction clients [2] as poor-quality delivery has left most clients dissatisfied [3]. Chan and Chan [4] have earlier noted that the built environment, in general, has been battling with quality problems for a long time, and this has its own significant effect on the economy. To help solve this problem, Total Quality Management (TQM) has ended up being viewed as a gainful tool in guaranteeing the success of set standard for projects in the built environment.

As a result of its ability to provide quality through effective management processes, TQM has garnered significant attention in most academic discussion over the years. Gatiss [5] described TQM as a theory which ceaselessly tries to reduce waste, and attempts to enhance quality throughout everyday life. Mohrmmma et al. [6] also described TQM as a methodology adopted by organisations that are keen on achieving continuous improvement of quality and consumer satisfaction. According to Osman et al. [7], TQM can be seen as “managerial devices used in ensuring continuous improvement of customer
satisfaction and retention as well as ensuring product or service quality”. Akinlolu et al. [8] therefore concluded that the idea of TQM is to make sure that attempts to gain the required level of quality are well planned and organised from the onset of the project.

Considering the obvious importance of TQM in the delivery of quality services particularly in the AEC were providing quality infrastructure for the public is important, assessing the use of the available TQM practices is deemed consequential. It is based on this knowledge that this study assessed the TQM practices in construction project delivery in South Africa with a specific focus on civil engineering projects in Gauteng province. This was done with a view to providing better quality in civil engineering projects within the study area. The subsequent part of this paper includes the review of related literature, the methodology adopted for the study, the findings and the conclusion drawn from the findings. Based on the conclusion of the study, recommendations were made.

2. Literature Review
Greenwood and Howarth [9] noted the need for construction companies to increase the quality of their services, and provide more value to their customers if they want to attain significant competitive edge over their counterparts. Studies have proven that TQM is a perfect methodology in achieving this feat as it allows for input of ideas from all project participants, thus decreasing the tendency of error in the completion of projects [10; 11]. Over time, different TQM practices have been identified in a quest to attain quality delivery. Some of these practices include; Strategic planning which incorporates a plan of vision/statements of purpose, quality policy, utilisation of quality control and other administration tools [12]. These plans are fashioned by way of considering the best idea. Suitable ways of strategic quality planning would enhance the quality of products and consequently consumer fulfilment [13]. There is also the aspect of Customer focus which according to Greenwood and Howarth [9] is one of the most important targets for companies. It was stated that it is important to ensure customer’s needs are ensured all together to get a productive result. In fact, this aspect of TQM was discovered to come second in terms of significance in the US and Japan. Yusr et al. [14] noted that an organisation ought to decide the present and future needs of customers and think about their necessities as prerequisites for the entire organisation. This according to Barouch and Kleinhans [15] will result in more steadfast customers and higher organisational performance. Employee Relations has also been identified as key TQM area as it is believed that involving employees in some decision making can go a long way in the attainment of quality on projects [16; 17]. Also, Kanji et al. [18] submitted that joining forces is the logic of collaboration and participation, and is one of the pillars of TQM. Organisations have to build internal and external partnerships in order to achieve their overall goals. This, therefore, points to the role of partnership and resources management as a key element of TQM. Aside from partnering and ensuring effective management of resources, supplier quality management is also seen as an important TQM practice. Bolatan et al. [19] described supplier’s quality management as the strategy of evaluating supplier’s quality performance and in addition initiating a long-term organisation-supplier partnership with product quality as the determination for supplier choice. Another important practice is process management which focuses on a precise and organised way to deal with, control, oversee and enhance the processes design outline, so that profitability, value, quality, and innovation can be attained [20]. Fotopoulos et al. [21] noted that innovation is essential in process management, therefore, organisations that have implemented TQM has to be on the watch for innovation to improve their process management.

For TQM to be a success, a greater amount of commitment is required [22]. As indicated by Graeme [23] “on the off chance that we wish to make an incentive for our customers we have to end up being obsessive about understanding our customers and their necessities and desires”. Engagement with customers helps with feedback. Thus, customer’s involvement and satisfaction are considered an important measure for proper TQM implementation. There must also be an effective customer-supplier relationship if TQM is to be properly implemented. Evaluating the satisfaction level of supplier relationship is of utmost important to get to measure work delivered and general performance. These partnerships are dependent on the kind of work done and recorded activities to improve the ongoing process of quality levels [24]. Another crucial measure is education and training of participants. Employees perform better with simplicity and less effort when they are well trained. Time and resources
are lessened and skills and abilities are increased. Human capital is built when participants are trained in the organisation [25]. Effective communication (internal and external) has also been highlighted as an important measure for improving TQM implementation [26]. In a similar vein, improved organisation structure, encouraging teamwork, and top management involvement and commitment have been noted to be important measures that can help proper TQM implementation [12; 27]. TQM depends intensely on teamwork. Each organisation needs teamwork and it can accomplish objectives in light of the fact that each association without teamwork will fail [12]. Similarly, studies have shown that effective quality performance requires top management to be committed. Top management must show understanding, commitment and be involved in the total quality improvement process from the start in order to ensure and improve quality in all departments of the organisation. Aside from these measures, there must also be a primary customer focus [28], well-developed planning, and continuous improvement measurement [29].

3. Research Methodology
This study assessed TQM practices in construction project delivery in South Africa with a specific focus on civil engineering projects in Gauteng province. The choice of focusing on civil engineering projects was premised on the fact that most of these projects are public infrastructures such as road, bridges and the likes, and delivering quality public infrastructure is deemed important. A survey approach was adopted and quantitative data were gathered from construction participants involved in the delivery of civil engineering projects within the study area. These participants were drawn from civil engineering contracting firms, consulting firms, and department of public works using a convenience sampling approach. The study adopted the use of a questionnaire as the instrument for data collection due to its ability to cover a large range of respondents within a short period of time [30]. The reliability of the questionnaire used was analysed using Cronbach’s alpha test with alpha values of 0.884 and 0.949 derived for the TQM practices being adopted and possible measures respectively. This shows that the instrument used was reliable as the degree of reliability of an instrument is more perfect as the value tends towards 1.0 [31]. In analysing the data gathered, information on the respondent’s background was analysed using percentage, while mean item score (MIS) was used to rank in descending order the level of usage of the identified TQM practices and the possible measures for improving same. The variables were ranked from the highest mean score down to the lowest. However, where two variables have the same mean score the one with the lowest Standard Deviation (SD) is ranked first as suggested by [32].

4. Findings and Discussion

4.1. Background Information
Analysis of the data gathered on the background information of the respondents revealed that majority of the respondents (43%) were from contracting firms, while 29% were from consulting firms and 28% were from the public works department. In terms of years of experience within the civil engineering field, result revealed that 37% of respondents have 1 to 5 years of experience, 15% have 6 to 10, years 14% have 11 to 15 years, 20% have 16 to 20 years of experience, and 14% had more than 20 years of experience. On a unified view, 63% of the respondents have 6 years and above years of working experience thus putting them in a capable position to give significant responses to the questions of this study.

4.2. TQM practices in Construction Project Delivery in South Africa
In determining the TQM practices being adopted in civil engineering project delivery in South Africa, certain practices were identified from the review of existing literature. Respondents were presented with these practices and were asked to rate them based on their level of usage using a Likert scale of 1 to 5. The result in Table 1 shows the mean value of each of the identified practices as well as their standard deviation. From the table, it is evident that all the assessed TQM practices have a mean value of above average of 3.0. This implies that to a considerable extent all the identified practices are being adopted in the delivery of civil engineering project in the study area. It is, however, important to note that while the mean values of these variables are high enough to indicate considerable adoption; SD reveals a
significant level of disparity in their rating. The SD of 8 out of the 9 assessed practices is above 1.0 which indicates that there exists some inconsistency in the way the respondents rated the level of adoption of these 8 practices. Chief of these practices are customer focus (mean = 4.08, SD =1.115), supplier quality management (mean = 4.02, SD =1.199), strategic planning (mean = 3.94, SD =1.144), and employee relations (mean = 3.69, SD =1.122).

The importance of customer focus has been noted in previous researches. It is believed that only through ensuring customer’s needs are met, that the productivity of an organisation can increase [9; 14]. This finding is similar to the submission of Greenwood and Howarth [9] that customer focus is an important target for companies in the US and Japan. Similarly, there is the need to strategically plan the activities of the organisation on how it will go about its activities and delivering its services [12]. Findings of this current study further corroborate this submission as strategic planning is seen as a key TQM practice within the study area. Also, carrying employees along with the ideas and objectives of the organisation has been noted as a key practice that can help achieve quality project delivery [17]. At the same time, properly managing supplier’s quality is germane to the quest for quality as observed by Bolatan et al. [19]. Findings of this study support these submissions as supplier quality management and employee relations are rated among the top TQM practices being adopted within the study area.

### Table 1: TQM practices in construction project delivery

| TQM Practices                          | Mean  | SD    | Rank |
|----------------------------------------|-------|-------|------|
| Customer Focus                         | 4.08  | 1.115 | 1    |
| Supplier Quality Management            | 4.02  | 1.199 | 2    |
| Strategic planning                     | 3.94  | 1.144 | 3    |
| Employee Relations                     | 3.69  | 1.122 | 4    |
| Quality systems                        | 3.59  | 0.814 | 5    |
| Quality information and performance management | 3.53  | 1.043 | 6    |
| Process Management Quality             | 3.33  | 1.125 | 7    |
| Partnership and resources management   | 3.31  | 1.122 | 8    |
| Human Resource Management              | 3.14  | 1.291 | 9    |

### 4.3. Measure for Improving TQM Implementation in Construction Project Delivery in South Africa

In order to encourage the implementation of TQM in civil engineering project delivery in South Africa, the possible measures needed to be in place were also assessed. In achieving this, certain possible measures were identified from the review of existing literature. Respondents were presented with these measures and were asked to rate them based on their level of significance using a Likert scale of 1 to 5. The result in Table 2 shows the mean value of each of the identified measures as well as their SD. From the table, it is evident that all the assessed measures have a mean value of above average of 3.0. This implies that the respondents believe that if put in place these identified measures can help increase the implementation of TQM on civil engineering project delivery in the study area. It is, however, worthy of note that while the mean values of these variables are above average; SD reveals a significant level of disparity in some of their ratings. The SD of 10 out of the 16 assessed possible measures is above 1.0 which indicates that there exists some inconsistency in the way the respondents rated these 10 measures. The key significant measures identified are ensuring customer involvement (mean = 4.16, SD = 1.196), education and training of engineers on TQM practices (mean = 4.14, SD = 0.935), top management commitment (mean = 4.14, SD = 1.155), top management involvement (mean = 4.12, SD = 1.111), effective customer-supplier relationship (mean = 4.12, SD = 1.130), effective communication (internal and external) (mean = 4.08, SD = 1.096), and primary customer focus (mean = 4.00, SD = 1.021).

The significant role of customers in attaining quality service delivery by organisations has been noted. Understanding customer’s desires as well as engaging them will give feedback on the quality of services being rendered [23]. In the case of public infrastructure delivery, engaging the end-users of these infrastructures is important. The end-user satisfaction of these infrastructures should be a primary focus of organisations saddled with the responsibility of providing same. This submission is in line with that of Schlickman [28] which recognised the need for primary customers focus as a key TQM measure.
Although the result in Table 1 above revealed that customer focus as one of the major TQM practices being adopted in the delivery of civil engineering projects within the study area, more can still be done to ensure this remains a major practice within the AEC industry. Similarly, educating and training engineers on TQM practices will go a long way in improving the use of TQM practices on project delivery. For this to be achieved, top management will have to be committed. The influence of top management in the adoption of TQM as part of the daily activities within an organisation has been noted [12; 27]. Only with the support of top management and their commitment, can customer focus be a primary objective of an organisation and can training of the engineers be achieved.

Table 2: Measures for improving TQM implementation in construction project delivery

| Measures                                         | Mean | SD    | Rank |
|--------------------------------------------------|------|-------|------|
| Customer involvement and satisfaction            | 4.16 | 1.196 | 1    |
| Education and training of participants           | 4.14 | 0.935 | 2    |
| Top management commitment                        | 4.14 | 1.155 | 3    |
| Top management involvement                       | 4.12 | 1.111 | 4    |
| Effective customer supplier relationship         | 4.12 | 1.130 | 5    |
| Effective communication (internal and external)  | 4.08 | 1.096 | 6    |
| Primary customer focus                           | 4.00 | 1.021 | 7    |
| Encouraging Teamwork                             | 3.98 | 0.946 | 8    |
| Workers trained in TQM                          | 3.94 | 1.126 | 9    |
| TQM applied to all field operations              | 3.82 | 1.185 | 10   |
| Continuous improvement measurements              | 3.78 | 0.941 | 11   |
| Improved Organisation structure                  | 3.78 | 0.985 | 12   |
| Well-developed planning                         | 3.71 | 0.957 | 13   |
| Participative management style                   | 3.55 | 1.001 | 14   |
| Rewards for TQM contributions                    | 3.49 | 1.063 | 15   |
| Process involvement and management               | 3.29 | 0.957 | 16   |

5. Conclusion
This study assessed TQM practices in construction project delivery in South Africa with a specific focus on civil engineering projects using a survey of construction professionals that have participated in the delivery of this specific type of project in Gauteng province. Based on the findings of the study, it is concluded that the major TQM practices adopted in the delivery of civil engineering projects in the study area are customer focus, supplier quality management, strategic planning, and employee relations. If TQM adopting is to improve, measures such as ensuring customer involvement, top management involvement, and commitment, education, and training of engineers on TQM practices, effective customer-supplier relationship, effective communication, and primary customer focus, are important. It is believed that the findings of this study will help civil engineering firms and participants in the delivery of quality projects through the adoption of TQM practices.

The study adds value to the body of knowledge as it gives an insight on the TQM practices being adopted in the delivery of civil engineering projects within the study area as well as the measures to be put in place in order to ensure improved adoption of TQM. However, despite this significant contribution, care must be taken in generalising the result of the study due to some identified limitations. The study was limited to a single province within the country, thus, there is a need for further studies in other provinces within the country, in order to compare results. There is also the need for further studies conducted with a much larger sample size than what is obtainable in this current study.

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