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MANAGING QUALITY ON CONSTRUCTION SITES IN SOUTH AFRICA: AN EASTERN CAPE STUDY

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ABSTRACT

In South Africa, construction projects still experience non-conformance to quality requirements as well as cost and schedule overruns to the detriment of clients. For project success to be attained, conformance to these parameters is the minimum expectation in the face of other considerations related to client satisfaction. Thus, through the use of existing literature, and a field study conducted among site management employees working for general contractors (GCs) in the Eastern Cape province of South Africa, the management of quality on construction sites was examined. The study that was descriptive in nature shows that lack of skilled general workers and artisans contribute to poor quality control and management processes; while defects and rework form the main reason for project quality deviations on the sampled sites. The quality deviations in turn influence the level of cost and time overrun experienced on construction projects. The study corroborates the literature reviewed in that there is an interrelationship between cost, quality, and time in South African construction. For example, when the quality of work is below the required threshold, it leads to cost and time overruns due to rework that requires extra effort and expense. The value of this explorative study is that both site management and workers should be hands-on in terms of managing quality on project sites as failure to do so could have a domino effect relative to other project considerations.

Keywords: Contractors, Construction, Production, Quality, South Africa

1. INTRODUCTION

The construction industry contributes immensely to the global economy. As a result, there appears to be a relatively vigorous competition among construction firms for various business reasons. Most firms therefore compete with their prowess in production efficiency. The quality of site production activities are often taken into consideration in order to satisfy internal and external stakeholders while building good reputation for the firm. However, the literature is full of examples of project deviations in the form of non-conformance to quality requirements and other objectives. These deviations constitute a hindrance to the competitiveness of the firm on one hand, and the entire industry on the other hand.

Oakland and Marosszeky (2005) state that organizations compete on reputation for quality, reliability, price and delivery, and as such people now recognize that quality is crucial to the sustenance of a competitive advantage. As an illustration, when firms become known for poor quality product, it could take a long time to recover that reputation. Hence, quality is a key competitive weapon in the construction industry (Oakland and Marosszeky, 2005).

In particular, the industry in South Africa is currently facing problems related to the standard of construction quality expected by clients (Emuze and Smallwood, 2011). It is notable that project delivery that occurs within expected duration, cost, healthy and safe conditions, and to quality standards is a 'difficult' task because least duration and minimal cost tend to conflict with quality and health and safety (H&S) (Patrick, 2004). According to Ali and Kamaruzzaman (2010), scope, cost, time, and quality are the four fundamental constraints needed to be considered when managing construction projects, regardless of location. This quality focused paper discuss the relationships between these parameters from the production perspective in sections that explain the research problem and objectives, the synthesis of the literature, and the methodology that show how the field work was conducted. The findings and related discussions provide insights that were closed-out in the concluding remarks.

Research Problem and Objectives:

Based on the reviewed related literature, it was observed that projects experience non-conformances related to quality, which exacerbate cost and time overruns in the construction sector (Sommerville, 2007; Love, Irani and Edwards, 2004). The immediate effects of these problems are exemplified in dissatisfied clients and end-users of construction products. This research thus investigated the reasons for poor quality in construction production processes so as to evolve ways to improve it in the South African context. Also, the research investigated the relationship between cost, quality and time in a production setting. For instance, to ensure that work conforms to requirements, construction managers have to consider the performance of completed work via functionality, appearance, durability and maintenance.

2. DEVIATION FROM QUALITY REQUIREMENTS IN CONSTRUCTION

The quest for optimum reputation by a general contractor (GC) in the construction industry demands project performance considerations that would improve the satisfaction of clients. General contractors (GCs) gain reputation through fulfilling the needs of clients and the gain of reputation is the major requirement for a GC to be more competitive in the sector (Ashworth, 2004). The interdependence between the business and project aspects of construction management has been argued to be crucial in the quest for improved profitability in the sector (Smallwood, 2006).

The interdependence can be gleaned from various construction management related researched findings from South Africa. Ncwadi and Dangalazana (2006) report that South African construction is faced with productivity and quality problems. The authors contend that productivity and quality in South Africa has dropped, while H&S have only marginal improved. As a result, the industry is continuously experiencing confrontations with regard to dissatisfaction of clients (Ncwadi and Dangalana, 2006). This may suggest that contractors have realized the importance of H&S in the construction industry, and then started to focus on H&S, at the expense of other project considerations such as quality. The lack of quality is recognized through non-conformance of work to the established requirements that is evident when constructed project does not meet client's needs and specifications (Battikha, 2002).

2.1 Implications of Quality Deviations in Construction

Concealed quality related problems such as rework during construction process can be projected to other phases of the process (Ford and Sterman, 2003). The quality of work is one of the factors that reduces the incidences of rework and then, determine clients' satisfaction levels. Client dissatisfactions conversely could lead to a drop in the market share and profit of the construction firm that is responsible for a project through its implications for productivity (Rivas, Borcherding, Gonzalez and Alarcon, 2011). Quality deviations affect clients and other members of the supply chain, especially contractors. This means non-conformances affect the contractor because it yields penalties in the form of rework, which can significantly reduce productivity (Rivas et al., 2011). Furthermore, this demonstrates that quality; time, cost, and productivity are always linked together in construction (Battikha, 2002).

According to Joubert, Cruywargen and Basson (2005), who cited Grobbelaar (2001) and Ngowi (2001), top management in construction firms, both in South Africa and Botswana; do not show enough commitment to quality because of a skewed focus on profit maximization and construction time reduction. In some cases, it might happen that management's commitment is not clearly communicated to the workforce of a project in terms of access to the quality policy and goals of a firm and / or workers are not motivated to deliver work that conforms to requirements (Joubert et al., 2005).

The non-conformance of work to requirement could also arise when top management involved in a project is focusing too much on minimizing cost and reducing schedule. In order to cut time and cost in construction industry, management tend to ignore quality (Love, Holt, Shen, Li and Irani, 2002; Eden, Williams, Ackermann and Howick, 2000).

This illustrated scenario contradicts the needs of clients nowadays as they require quality more than price, especially in the public sector. The analogy means that clients do not necessarily look towards minimizing cost at the expense quality. To deal with this problem, commitment to quality is the main factor to focus on because management is the one that has a great influence on what is happening within a project (Rahman, Karim, Danuri and Wen, 2007). The extent to which management shows involvement and support to applying a total quality management (TQM) system within the construction project environment is very vital to producing work that conforms to requirements. When the commitment of management is lacking, quality improvement cannot be implemented adequately and if top management clearly shows commitment to quality, the employees would logically follow suit (Pheng and Teo, 2004).

In addition, the literature appears to indicate that employees who are physically involved in construction activities and quality improvements are not well trained to deliver the required results, and this is the major reason for the non-conformances in South African construction (Emuze and Smallwood, 2013). It has been reported (Zietsman 1997 in Joubert et al., 2005) that in South Africa, there is very little, if any, correlation between the performance of workers and their remuneration and this observation contributes to the tendency not to strive to produce a quality product. For example, a poorly remunerated qualified artisan has leverage in terms of changing jobs due to the scarcity of skilled tradespeople in the country. In contrast, unskilled or non-qualified artisans that stay in a firm with limited morale would continue to produce poor workmanship that manifest in rework, which affect the quality of delivered projects (Cooper, Lyneis and Bryant, 2002). Therefore, a balancing strategy is needed when deliberating remuneration, morale and performance of construction workers.

Another dimension that has implication for quality is the relative increase in the use of subcontracting by general contractors (GCs). Joubert et al. (2005) suggest that the increased use of subcontractors has led to increased fragmentation of the process, with the results that such subcontractors performs their tasks almost in isolation. This is particularly precarious when the GC and the subcontractor have varying project aims. As an illustration, the subcontractors may aim to complete the work as soon as possible while spending as little as possible by employing cheap labor; and to get remuneration as quickly as possible in a particular project to stay financially afloat. When a project by chance experiences a mismatch of interests among the project team, non-conforming work is a strong likelihood (Joubert et al., 2005). If works does not conform to requirement, this means that quality management and control by the main contractor is inadequate, because when it is planned and managed properly, subcontractors will be properly engaged and supervised.

Supervision in South African construction is however under strain because of reported shortage of experienced supervisory employees (van Wyk, 2008). The reported shortage results in a situation where monitoring and supervision do not take place on a regular basis and therefore defects are not identified at an early stage and continuous rectification of defective work abounds. As the work is not monitored and supervised regularly, and / or when the quality of supervision is below expectations, continuous corrective work occurs on project sites (Joubert et al., 2005).

3. METHODOLOGY

This research was conducted by collecting data relevant to the research problem. The descriptive research method was used to obtain information in the subject area (Leedy and Ormrod, 2010). The literature in turn informs the methodology and the design of the study. The data were collected using a semi-structured questionnaire that aided the interviews that were conducted among site management employees on different project sites in the Eastern Cape Province of South Africa.

The sampling method was therefore purposive as ten project sites were visited for observation and interview purposes within six weeks. The reason for sampling the Eastern Cape is to increase accessibility and get different views due to separation of towns in the province where the researchers were domiciled. Logistics also play a role in the decision to only sample the province. This approach was adopted so as to ensure that contextual and inductive approaches to understand local meanings and rules for behaviour underpin the findings (Tracy, 2013).

The semi-structured questionnaire comprised both close- and open-ended questions. The instrument was design to enable minimal participant response time. The Likert scale was used for eliciting responses to close-ended questions. The study that was conducted at the exploratory level allowed the student researcher to pay visits to project sites within the province. Fifty (50) construction professionals were approached in the course of the study. These respondents were found on the visited project sites. Hard copies of the interview guide were shown to the site personnel and the researcher was able to facilitate the completion process by talking with site management employees that agreed to be interviewed. Despite this hands-on approach, only thirty three (33) responses were validly recorded and analyzed. This equates to a 66% response rate.

4. DATA ANALYSIS AND INTERPRETATION

When the respondents were asked to indicate if dedicated personnel are specifically responsible for quality control in their firms, most (79%) of them responded in the affirmative. The comments from 21% of the participants who said ‘no’ show that the supervisory team is responsible for quality in their firms. The supervisory team is mandated to ensure that work is executed up to the required standard and is done according to requirements of the client. The supervisory team can be foremen, site agents and site engineers.

In particular, all the respondents suggest that site agents, site managers, construction managers, and foremen are individually and collectively responsible for quality during site production activities. Some of the respondents mention that their firms normally have dedicated quality personnel on large projects, while on project that are not large, the architect is responsible for quality control. In contrast, a respondent said that everyone is responsible for quality control, especially quality control of their section of work. Meaning that everyone is conscious about the importance of achieving work standard that conforms to clients' requirements. Furthermore, the interviewee comment that the client and / or promoter of a project appoints the engineer to ensure that the activities of the GC conforms to agreed specifications.

The respondents were also requested to indicate the reason for their diligence in terms of conformance to project specifications. The response which was based on a response percentage of 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) and 5 (strongly agree), shows that client satisfaction, good reputation, and profitability are the primary motive behind quality related diligence on project sites. The mean score (MS) of all the top three motive is greater than or equal to 4.24, which means that these motives are either 'agree' or 'strongly agree'. In particular, majority of the respondents strongly agreed that the main reason why firms try to provide work that conforms to requirements is to satisfy the client. In addition, more than half of them strongly agreed with the option that firms attend to quality in order to foster and retain good reputation. Similarly, about half of them were also strongly in agreement with the statement that a quality focused firm improves its bottom line and avoid claims.

Table 1: Why provide work that conforms to specified requirements

Motive	**Mean Score**	**Rank**
Satisfy clients	4.73	1
Improve bottom line	4.30	2
Foster and retain a good reputation	4.24	3
Avoid claims	3.79	4

The next question asked the respondents to rate the factors that have an impact on non-conformance to requirements. As indicated in Table 2, these factors are arranged according to their individual rank in terms of the observed MS. These factors are ranked according their extent of impact on non-conformance of work to requirements. In this case, lack of skilled labor is perceived by the respondents as the factor with the most impact.

The responses also show that the respondents were relatively confident while completing this question as no one was unsure of his / her response. The MS of the top three factors are all above 3.0, which represent 'moderate' on the Likert scale. This suggests that the responses proves that it is has an impact, but in certain situations. Furthermore, it is notable that slightly more than half of respondents support the statement that lack of skilled labor has an impact on non-conformance of work to requirements. Some of the respondents equally perceive that inadequate quality control has an impact on the non-conformance of work to requirements.

Table 2: Factors that impact non-conformance to work requirements

Factor	**Mean Score**	**Rank**
Lack of skilled labour	3.36	1
Inadequate quality control	3.30	2
Inadequate quality management	3.18	3
Lack of suitable material	2.76	4

When the respondents were asked if there is a strategy for total quality management (TQM) in their respective firms, majority of them responded in the affirmative. This particular response is interesting as these firms still grapple with quality related problems despite their assertion of the use of TQM in their firms. Out of the minority of the respondents who have no TQM strategy in their firms, three provided reasons for its absence in their firms. Their reasons include:

- "Supervision provides quality control at all levels".
- "Site agent is responsible for the quality management".
- "Conformity to standard specifications such as the SABS 1200".

It is instructive to note that the respondent that made the first comment presume that supervision that provide quality control is part of TQM. This shows a gap in how such employees perceive a TQM strategy. These comments all shows that even when the construction firm has no TQM strategy in place, there is always a way of improving quality of work. Nevertheless, all the respondents were of the opinion that their firms make use of a strategy to assure quality of work. With respect to this assertion, the scale indicates response percentages of Never (1), Rarely (2), Sometimes (3), Often (4), and always (5), that were used to examine the issue. The MSs are all greater than 4.28, which indicates that all the strategies are either 'often' or are 'always' applied to ensure that work conforms to requirements. In particular, almost all the respondents contend that the use of quality material as specified in the contract data is always applicable to ensure that work conforms to clients' requirements. Some of them were of the opinion that regular supervision is always taken into account in order to ensure that quality is achieved.

Similarly, half of the respondents perceive that adequate management and control of quality and training of laborers respectively are the best strategy to apply in order to achieve work that conforms to requirements. Hence, it can be argued that all the strategies are important to ensure that work conforms to requirements.

Table 3: Strategies to ensure that work conforms to specified requirements

Strategy	**Mean Score**	**Rank**
Use of specified materials	4.59	1
Regular supervision	4.48	2
Adequate management and control of quality	4.39	3
Trained general workers	4.28	4

The study further corroborates the literature findings in terms of the relationships between different project parameters. A look at Table 4 indicates the extent to which non-conformance of work requirements impact other project parameters. The rating scale for the question ranged from 1 (strongly disagree) to 5 (strongly agree), and an unsure option. The recorded MSs were greater than 3. This suggests that non-conformance to requirements has impact on the four project parameters that were mentioned in the study. Even though the last ranked parameter is 3.72, it can still be argued that the impact exist to a certain extent. In all, almost all the interviewees strongly agreed that non-conformance of work to requirements has a pronounced impact on client satisfaction; meaning that it is one of the major reasons for client to be dissatisfied with the work done. Moreover, more than half of respondents strongly agreed that non-conformance of work to requirements also impact productivity. The analysis also shows that more than half of them strongly agreed that non-conformance impact cost, meaning that it plays a role in cost overrun that may arise through the agency of rework relative to defects. Therefore, all the top three parameters can be influenced by non-conformance of work to requirements.

Table 4: Impact of quality deviation on other project parameters

Parameter	**Mean Score**	**Rank**
Client satisfaction	4.88	1
Productivity	4.50	2
Cost	4.44	3
Environment	3.72	4

4.1 Discussion

Construction, especially in developing economies, often pulls together employees with different capabilities to complete a given project. When the project is finished, the project parties go their separate ways without further interactions that will lead to improved work practices. Failure to take advantage of 'lessons learned' can have a detrimental effect on the bottom line and reputation of a GC (Frank, 2011). As indicated in the findings of this explorative study, the major reasons for quality related diligence on construction sites have to do with the bottom line and reputation of the GCs as suggested by Frank (2011).

Client satisfaction is however central to the ability to engender profitability in a given construction business. However, a series of construction issues have continued to manifest in the industry to the extent that they have devastated the credibility of many firms, GCs and subcontractors alike (Forbes and Ahmed, 2011). Some of such issues, inter-alia, include (see Frank, 2011):

- Uneducated, unaware and incapable supervision.
- The fallout from poor site supervision.
- Factors that affect job harmony.
- Lack of or insufficient documentation.
- Quality assurance as opposed to quality control.

The aforementioned affect quality of construction products in various forms. For instance, insufficient knowledge of work, inexperience, limited knowledge of quality standards, inability to coordinate work activities, and poor scheduling competency (Frank, 2011) contribute to the manifestation of incapable supervision that often engender poor workmanship and quality in construction. In spite of the call for continuous improvement in construction (Egan, 1998; CIDB, 2004; Lopez, Love, Edwards and Davis, 2010), these issues have persisted unabated. The completion of most construction project within scheduled time has been a problem for a long time as maximizing quality, minimizing cost and meeting scheduled milestone are ever present challenges in construction, especially in large and complex projects (Corsar, 2011). As a result, construction clients are often exposed to poor satisfaction levels because of cost overrun and inferior quality that always accompany project delays (Ali and Rahmat, 2010). According to Love, Edwards, Watson and Davis (2010), project rework is a global plaque of the construction industry that tend to escalate the failure to deliver infrastructure needs on time. The inability of the construction industry to innovate and deliver projects on scheduled time has therefore cause widespread dissatisfaction among clients of the industry (Love, Edwards, Smith and Walker, 2009).

A study that mapped rework related empirical findings in South Africa in order to assess how the industry is addressing this problem that has been said to be pervasive and cyclic in construction was conducted by Emuze and Smallwood (2013). Emuze and Smallwood used various authored conference papers that discussed South African findings as the source of their primary data and conclude that rework is a problem that beget a range of consequences in South African construction.

Such consequences are not limited to cost and time overruns, but they also include reduced quality, productivity and profitability. Though, the knowledge of, and encountered with, rework has percolated in the industry, the phenomenon cannot be said to be adequately tracked and monitored in South Africa (Emuze and Smallwood, 2013). In other words, there appears to be a major scope and motivation for additional effort that is required to address rework as an immediate cause of non-conformance to quality that beget a range of negative consequences in South African construction.

From this particular study, it is evident that signed conventional construction contracts defines what is to be built, and provides the framework of a quality management system that can be said to be less detailed, and partly effective (Rwelamila, 1995). This deduction resonates with the work of Rwelamila (ibid) that examined construction quality in the SADC region. After analyzing results of opinion surveys and interviews that were conducted among construction professionals in the region, Rwelamila (1995) suggests that a gap exists between how standards of quality within established practice of the construction industry are defined, and how standards of quality are established on project sites. He noted that it would appear that site management establishes quality in a situation that is characterized with arbitrary decisions. Experiences and management abilities therefore determine the level of quality that occurs on project sites. This perspective offered by Rwelamila in 1995 persist today as the projects sites that were visited in the course of this specific study equally rely on experiences and management abilities for the achievement of quality on site.

The CIDB report that is entitled "Construction Quality in South Africa; a client perspective" (CIDB, 2011) support the 1995 findings of Rwelamila. The report noted that site management and the supervision of works marginalizes quality in South Africa. The report further mention that it is notable that design and construction processes anomalies often manifest as rework, defects and non-conformances in the works in South Africa. More so, the annual construction industry indicators (CII) by the CIDB have continuously highlighted the need to improved quality. The 2007, 2008 and 2009 CII reports show that more than 18% of clients were either neutral or dissatisfied with the quality of works delivered as recorded defects in the period were more than 12%. Even in the recent CII report, around 8% of the projects surveyed had levels of defects which are regarded as inappropriate (CIDB, 2014). These findings show that quality as excellence relative to site management should be addressed.

5. CONCLUSION AND RECOMMENDATION

This study that was conducted to explore the impact of non-conformance to requirements on construction projects was qualitatively done so as to contextualize rather than general the findings. With a succinct literature review and a field study conducted among site based construction professionals, it can be concluded that there is a major possibility for quality improvement in South African construction.

The analysis of the obtained data show that the firms that took part in the study view the achievement of quality products as a key to their continued business growth through improved bottom line and reputation that is backed-up by optimal satisfaction of clients and other end-users of delivered projects. The research further shows that there is a relationship between quality, and other project parameters in production settings. And so, it can be said that when quality is achieved, there a tendency to attain enhanced construction production performance. For this to occur, it is imperative to avoid pitfalls associated with lack of skills among site management and workers so that adequate quality assurance and control processes can be assured. The study reinforces the view that conventional quality management for assuring client satisfaction and compliance with specification is based on a system, which partially fulfills the requirements for an effective quality system.

Although the use of specified materials and regular proper supervision of works have major impact on the reduction of defects and rework, quality related problems would persist except the tenets of TQM is properly interpreted and embraced by GCs. Quality improvement imply excellence in how the 'works' are carried out on project sites. Thus, 'learning, unlearning and relearning' should form the cornerstone of firms that are keen on the development and sustenance of competitive advantages in an industry that is noted for low barriers to entry. The enhancement of cost, productivity, and time performance of a project should thus be driven by a 'quality focus' approach by GCs. When planning for a project, more focus is needed for how to achieve and improve quality without escalating project cost. When avoiding increased cost, informed decisions should be made because such a decision would affect quality and exacerbate mistakes that increase avoidable rework, morale and other aspects of a project.

To sum up, this study has shown that managing quality on project sites requires additional efforts from site management and workers in the employ of GCs, especially in relation to the firms that took part in the study. Future research should examine the extent that supervision affects the quality of works carried out in a particular site. Even the dynamics between supervision and quality initiatives such as quality assurance (QA), quality control (QC) and TQM, should be examined as QA is preferred to QC. In other words, executed work should meet expected conformance requirements when they are done right 'first time.'

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