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A CONCEPTUAL FRAMEWORK FOR QUALITY IMPROVEMENT BY CONSTRUCTION MANAGERS IN SOUTH AFRICA

RESEARCH ARTICLE[1]

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ABSTRACT

Construction managers are important in delivering quality projects in the construction industry. Their perspective on quality improvement is thus important, but there is no framework to expedite it in South African construction. Employing a quantitative survey approach, the research uses a stratified sampling method, distributing 272 questionnaires among construction managers across South Africa. The survey explored construction managers' comprehension of quality and engagement with quality management. The objective of this study is to identify the factors that have an influence on project quality, offering insight into the perception of construction managers towards these factors, in order to develop a quality improvement framework for construction managers in South Africa. The analysis, facilitated by SPSS v27, incorporates descriptive and reliability statistics, as well as KMO and Bartlett's test. The results show that construction managers' emphasis on quality is pivotal to project success. The research found that construction managers exercise meticulous control over quality by overseeing deliverables for accuracy and flawlessness. This vigilance is achieved through constructability reviews, meticulous planning,

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seamless organisation, and coordinated teamwork. These results are used to propose a quality improvement framework comprising five categories, namely the construction manager's understanding of quality; the construction manager's perspective on quality; the implementation of a QMS; internal and external factors that affect quality, and the benefits of having a skilled construction manager on board. The integration of these five factors within a comprehensive framework empowers construction managers to effectively manage and improve the quality of construction projects. This approach ensures that projects are executed with precision, adhere to industry standards, and meet or exceed client expectations, thereby enhancing the overall success and reputation of the construction management firm.

ABSTRAK

Konstruksiebestuurders is belangrik om kwaliteitprojekte in die konstruksiebedryf te lewer. Daarom is hul perspektief op kwaliteitverbetering belangrik, maar daar is geen raamwerk om dit in Suid-Afrikaanse konstruksie te bespoedig nie. Deur 'n kwantitatiewe opnamebenadering te gebruik, gebruik die navorsing 'n gestratifiseerde steekproefmetode, wat 272 vraelyste onder konstruksiebestuurders regoor Suid-Afrika versprei. Die opname het konstruksiebestuurders se begrip van kwaliteit en betrokkenheid by kwaliteitbestuur ondersoek. Die doel van hierdie studie is om die faktore te identifiseer wat 'n invloed op projekkwaliteit het, deur insig te bied in die persepsie van konstruksiebestuurders teenoor hierdie faktore om 'n kwaliteitsverbeteringsraamwerk vir konstruksiebestuurders in Suid-Afrika te ontwikkel. Die ontleding, gefasiliteer deur SPSS v27, sluit beskrywende en betroubaarheidstatistieke sowel as KMO en Bartlett se toets in. Die resultate toon dat konstruksiebestuurders se klem op kwaliteit deurslaggewend is vir projeksukses. Die navorsing bevind dat konstruksiebestuurders noukeurige beheer oor kwaliteit uitoefen deur toesig te hou oor lewerings vir akkuraatheid en foutloosheid. Hierdie waaksaamheid word bereik deur hersiening van konstrueerbaarheid, noukeurige beplanning, ononderbroke organisasie en gekoördineerde spanwerk. Hierdie resultate is gebruik om 'n gehalteverbeteringsraamwerk voor te stel wat uit vyf kategorieë bestaan, naamlik die konstruksiebestuurder se begrip van kwaliteit; die konstruksiebestuurder se perspektief op kwaliteit; die implementering van 'n QMS; interne en eksterne faktore wat kwaliteit beïnvloed, en die voordele van 'n bekwame konstruksiebestuurder aan boord. Die integrasie van hierdie vyf faktore binne 'n omvattende raamwerk bemagtig konstruksiebestuurders om die kwaliteit van konstruksieprojekte effektief te bestuur en te verbeter. Hierdie benadering verseker dat projekte met presisie uitgevoer word, aan industriestandaarde voldoen en aan kliënte se verwagtinge voldoen of oortref, en sodoende die algehele sukses en reputasie van die konstruksiebestuursfirma verbeter.

1. INTRODUCTION

Construction projects are a multifaceted process, involving diversified construction activities and a heterogeneous mix of materials and components (Neyestani, 2016). Many factors such as design, materials, machinery, topography, geology, hydrology, meteorology, construction technology, methods of operation, technical measures, and management systems affect the quality of construction (Mallawaarachchi & Senaratne, 2015). Due to the fixed project location, large volume and different locations of different projects, the poor control of these factors may produce quality problems. Clients will not be satisfied if the project fails to meet their price, quality, time frame, functionality, and delivery performance standard.

The construction industry in South Africa faces issues that include the shortages of skills; non-conformance to standards; payment delays; price increase; competitiveness, and lack of quality in projects (Thulo, Emuze & Theron, 2023). Poor quality of construction projects not only affects the project but also the country's development, growth, credibility, and reputation (Zaray *et al*., 2022). Quality management is essential in the construction industry from conception to completion of projects. Mallawaarachchi and Senaratne (2015: 84) add that "quality of construction projects is observed as the attainment of requirements of all the project stakeholders and ensuring the satisfaction of everyone, especially the client". Hoque and Hasan (2022) regard quality as a sensitive and high-priority issue. If the quality outcomes are not according to the required standards of a project, that project is regarded as a defective construction project and sometimes becomes unsuccessful and is stopped until corrective measures are taken.

Quality is described as meeting specifications and approved standards agreed by stakeholders (Oke, 2017) or as a degree of excellence (Mallawaarachchi & Senaratne, 2015). Quality is one of the critical factors in the success of construction projects. In view of this, the construction manager must have the skills and knowledge to make the effort to design and manage processes of project construction (Shadan & Fleming, 2012). The construction manager applies flexible skills to attain the quality requirements of a project, by working together with all the different stakeholders to ensure that they produce satisfactory results (Oke, 2017).

Poor-quality construction results in additional costs and delays when work is redone or mended; injury and death if the structure fails during or after construction; additional costs to clients when defects must be repaired later, for increased maintenance costs or for disruptions to their operations while defects are repaired, and a bad reputation for the construction company (Abramsson *et al*., 2006; Thulo *et al.*, 2023).

Failure to meet the quality requirements can have serious negative consequences for any or all the project's stakeholders (Mallawaarachchi & Senaratne, 2015). Therefore, construction managers must have adequate education, skills, and knowledge to deliver a quality project. This study thus proposes a framework for improving quality on construction projects in South Africa from the perspective of construction managers. This framework is significant in view of the criticism against the quality of constructed projects, despite using the services of a construction manager.

2. LITERATURE REVIEW

2.1 Construction managers and project quality

Construction managers are stakeholders of a project appointed to manage and coordinate the project design and construction (Laedre *et al.*, 2006). Construction managers usually lead the building process, working with engineers, architects, contractors, government officials, and technical specialists (Gharehbaghi & McManus, 2003). They are the driving force behind the scenes and control the *modus operandi* of the construction project (Harvey, 2007). Construction managers are responsible for arranging, coordinating, controlling, and assessing the construction processes of a construction company following the directions of project managers and clients (Steyn, 2016). They are equipped with education, knowledge, skill set, technology, and an attitude of analytical thinking which helps them take a holistic approach towards the construction project (Oke, 2017).

Proper utilisation of construction managers' expertise produces a high-quality project within an expected timescale and given budget. Construction managers pay attention to the materials, labour, equipment, tools, and methods used in producing the end-product (Preethi & Monisha, 2017: 94). Construction managers supervise the application of a quality management plan for a project; therefore, it is essential that they understand the clients' requirements from the start, as this helps construction managers work together with clients (Oke, 2017).

2.2 Quality management

Quality management is vital to the success of an organisation because an effective quality management system (QMS) will identify the risks to an organisation and provide ways to mitigate them (Howarth & Greenwood, 2018). In identifying and managing these risks, a QMS provides customer satisfaction and loyalty; identification and elimination of waste; better performance from suppliers, and employees committed to quality and improvement (Ali & Rahmat, 2010). Quality is a crucial parameter that differentiates an organisation from its competitors (Ying, 2010). Quality management has the potential to deal with some of the problems such as rework, material wastage, and inadequate skills most associated with construction projects.

Quality management in a construction project takes place in three different phases, namely quality planning, quality assurance, and quality control. Quality planning is the first phase of quality management which takes place as soon as the project documents are made available to the project management team. Quality planning is viewed as a systematic process that converts quality policy into measurable objectives and requirements (Nyakala, Ramoroka & Ramdass, 2021). Quality planning is a disciplined process to ensure that a structured activity sequence is completed (Howarth & Greenwood, 2018). These activities will ensure that an organisation can provide a quality product on time, at the lowest cost, and to the customer's specific specifications (Senaratne & Jayarathna, 2012). The aim of quality planning is to produce a project quality plan (PQP) (Aized, 2012). Therefore, the planning phase is important to ensure that the project is adequately planned (Thulo *et al.*, 2023).

The second phase is quality assurance, known to preserve quality standards and consistency (Mallawaarachchi & Senaratne, 2015). Basically, it is how the company manages quality in a construction project, by specifying various checks at different levels as well as constantly improving its attributes (Senaratne & Jayarathna, 2012). It addresses both the quality of a finished product or service (the effectiveness of the operation) and the efficiency (costs and resources) of producing it at the required quality level (Howarth & Greenwood, 2018; Tempa, 2015).

Quality control is the intermittent investigation to guarantee that the project requirements are met (Mallawaarachchi & Senaratne, 2015). It is performed by setting up specific construction standards, identifying the variations from the standards, correcting or minimising the variations, and improving the standards for future purposes. Howarth and Greenwood (2018) add that quality control consists of making sure that things are done according to the plans, specifications, and permit requirements during the construction project, using continuous monitoring process control. For construction firms, this implies skilled employees who are actively involved in the firm, commitment from management, open communication channels, training and education, as well as active subcontractor involvement (Albert, Shakantu & Ibrahim, 2021).

The construction manager carefully ensures throughout the project that the project to be delivered will meet the requirements in the quality management plan (Oke, 2017). The construction manager prepares technical reports used by team members to enhance the project, as well as non-technical reports that are elevated to management, describing the current status of the project from a quality perspective (Mane & Patil, 2015).

2.3 Factors affecting construction quality

Construction firms are proactively trying to achieve internationally accepted quality levels to ensure sustainability in the current competitive market (Albert *et al.*, 2021). The construction industry faces challenges that affect the quality and output of the endeavour (Oyedele *et al.*, 2015). Identifying potential critical factors that affect the quality of a project before the commencement will ensure client satisfaction upon completion of the project (Oke, 2017), in order to ensure long-term competitiveness and business survival (Albert *et al.*, 2021). Quality performance has been considered a function of procedures adopted during the construction process (Oyedele *et al.*, 2015). These procedures include that the construction manager must identify the factors that might affect the quality of a project and apply flexible skills to attain the quality requirements of a project by working together with all the different stakeholders to ensure that they produce outstanding results (Preethi & Monisha, 2017: 92). The factors that affect quality that was considered for this study were use of unskilled labour and subcontractors, failure of conforming to regulations, design issues, supervision, low-quality materials, procurement, inclement weather, and variation orders.

2.3.1 Labour and subcontractors

Thulo *et al.* (2023) believe that an effective QMS in the construction industry should include enlightening and incentivising employees about quality management principles. Quality management ensures increased revenue and higher productivity for the organisation (Oyedele *et al.*, 2015). In the intricate framework of a free-market or capitalist society, the roles of both proficient and unskilled workers emerge as indispensable (Makhene & Twala, 2009). An employee equipped with education and training possesses a distinct edge in efficiency compared to an untrained counterpart (Woudhysen & Abley, 2004), because of their understanding of the intricacies of the job. Notably, skilled labourers excel in executing their designated tasks with competence (Howarth & Greenwood, 2018).

"If employees are empowered to plan and perform work activities, it is vital that they also possess the necessary skills and competencies to complete set tasks" (Howarth & Greenwood, 2018: 54). However, the problem encountered in the South African construction industry is the severe shortage of construction skills, due to inefficient induction and training (Thulo *et al.*, 2023). The industry is also plagued by ignorance and lack of knowledge by unskilled workers that produce poor quality work, resulting in re-work (Howarth & Greenwood, 2018). Construction managers play a pivotal role in upholding work that aligns seamlessly with designated standards and design criteria. Their responsibility encompasses the implementation of quality assurance systems across the project landscape. This encompasses a mindful oversight of subcontractors' performance and the assurance of compliance with specified standards by all subcontractors and suppliers. This role is vital in maintaining quality throughout the project (Howarth & Greenwood, 2018). Through monitoring and control, management can commit and show dedication to quality, and workers will logically follow suit (Thulo et al., 2023).

2.3.2 Regulations

South Africa has a well-developed set of technical standards that can be used to describe the standards of materials and workmanship for construction works (Nyide, 2018). The quality regulations mostly adhered to in South African construction industry include the International Organisation for Standardisation (ISO) 9000 standards and the South African National Standards (SANS) 10155 (ISO, 2015).

Any discrepancies in information or deficiencies in the design must be promptly communicated to the construction manager. This communication is integral to the comprehensive quality-assurance process. Thorough documentation and subsequent actions are imperative for both internal and external correspondence, on-site evaluations, and arising issues that could impact on the project's successful culmination. These actions need to align meticulously with the stipulated quality procedures manual (Howarth & Greenwood, 2018). Moreover, any steps necessitated by the quality assurance documentation process should be initiated and diligently monitored using the appropriate protocols. For the seamless integration of these quality procedures, effective communication with the construction manager is essential to ensure their incorporation into the company's broader quality assurance system (Howarth & Greenwood, 2018).

2.3.3 Design

Oyedele *et al*. (2015) note that the quality of drawings and specifications received from designers affect the quality of the design and construction phases and consequently the quality of the constructed facility. Defective designs have an adverse impact on project performance (Stamatiadis, Sturgill & Amiridis, 2017). The realisation of these dynamics becomes evident when a project falls short of fulfilling the client's precise needs and specifications (Biadacz, 2020: 36). Bikitsha and Amoah (2020: 7) highlight a decline in productivity and construction quality within South Africa, resulting in frequent conflicts arising from quality deviations among dissatisfied stakeholders in the sector. The oversight and management of deviations from design specifications within the construction realm significantly impact not only on quality, but also on factors such as time, cost, and productivity (Thulo *et al.*, 2023).

2.3.4 Supervision

Supervision is a combination of procedure, process, and situations that are smartly designed to improve effectiveness of individuals and groups (Oyedele *et al.*, 2015). Good supervision must involve mutual agreement, respect, and personal trust between supervisors and supervisee (Zulu &

Chileshe, 2008). Managers need to ensure that employees have a desire to improve and progress. This will, in turn, improve the competitiveness of the company (Howarth & Greenwood, 2018). However, there is a shortage of adequately trained supervisors in the South African construction industry, which means that errors are not recognised early enough, there is no regular monitoring or supervision, and poor work must be continuously corrected (Thulo *et al.*, 2023).

2.3.5 Materials and equipment

Quality influences the types of materials used for a project and how the budget transforms over the course of a project. Construction managers must consider how the potential impact from low-quality materials will affect the outcome of the project (Mahajan, 2016). If a project manager opts for a less expensive item, the overall budget could be reduced but the quality might be poor (Zulu & Chileshe, 2008). Incorrect materials and materials that do not conform to specifications can have a detrimental effect on the project such as increased costs because of defects, replacements, and re-work (Thulo *et al.*, 2023).

The use of old equipment and frequent equipment breakdowns lead to low productivity and idle employees, resulting in poor quality of work and project delays (Albert *et al.*, 2021).

2.3.6 Procurement

Although procurement procedures need to be tailored to enhance the fulfilment of different project objectives (Eriksson & Vennstrom, 2012), clients tend to choose those procurement procedures they have a habit of using, regardless of any differences between projects (Laedre *et al*., 2006). To enhance change, an increased understanding of client involvement, number of projects, and how different procurement procedures affect different aspects of project performance in different types of projects is, therefore, vital (Gharehbaghi & McManus, 2003).

2.3.7 Inclement weather conditions

Effective construction managers must lay out the most optimal work schedule and execute the plan to the best of their abilities (Stamatiadis *et al.*, 2017). In many instances, however, unforeseen circumstances such as unpredictable weather or logistical issues may arise (Oke, 2017). In these cases, construction managers must assess their new situation and be able to re-prioritise their activities to ensure the project stays on track. Failure to adjust to these circumstances may derail the progress already made (Oke, 2017).

2.3.8 Uncontrolled variation orders

Variations comprise all adjustments of the original contract and affect the quality of work adversely (Memon & Hasan, 2014). Variations arise for many reasons, some of which include unavailable equipment, complex designs, and poor workmanship. These frequently originate in clashes as well as frustrations for the construction project team. Consequently, it is vital to control variation orders. According to Oyedele *et al*. (2015), the quality of work is commonly influenced by regular varieties since contractors must make up for the losses by compromising. Construction managers and other project stakeholders should try to avoid excessive variations since it not only affects the quality of a project, but also causes delays and rework which escalates the project costs (Memon & Hasan, 2014).

3. RESEARCH METHOD

3.1 Research design

The research is rooted in the deductive approach, which allows one to make informed predictions and systematically assess the relationships between variables. As a positivist study, the aim was to employ a rigorous and structured research method that emphasizes objectivity and the generalisation of findings. The generalisability of the results is ensured by using a large and representative sample of construction managers from different regions, sectors, and organisations, as well as applying appropriate statistical methods and tests.

The descriptive research design was used to comprehensively examine the pivotal role of construction managers in ensuring quality on construction projects. A quantitative research method in the form of questionnaires was used. This is ideal for theory testing, especially when dealing with data that can be numerically measured and subjected to statistical analysis (Kothari, 2004).

The quantitative approach allowed for the data to be systematically analysed using both descriptive and inferential statistics, ensuring a robust evaluation of the construction managers' quality assurance role. In the survey, 53 factors were assessed and categorised into five distinct categories that encompassed various aspects of quality management within construction. To distil and manage this rich dataset, Principal Component Analysis (PCA) was applied, a statistical technique designed to reduce a complex cases-by-variables data table to its fundamental components, known as principal components (Greenacre, 2023). This process facilitated the approximation of the original data table by retaining only the most significant factors with the highest eigenvalues. Subsequently, regression analysis was conducted, allowing for deductive inferences to be drawn so that a deeper understanding of the relationship between construction managers and quality in construction projects could be gained.

3.2 Population, sample, and response rate

Stratified sampling was used as the sampling strategy wherein the total populace is divided into strata (in this case, the 9 provinces in South Africa) to carry out the sampling process (Creswell, 2013). After partitioning the population into strata, the researcher randomly selected the sample. The population comprised of 850 construction managers registered with the South African Council for the Project and Construction Management Professions (SACPCMP), with a ±5% precision level (e = ±5%), the confidence level is 95%, the calculated sample size for this study was approximately 272. The overall response rate was 44% (indicated in Table 1), 119 respondents. Keeter *et al*. (2006) consider a survey response rate of 40% or higher to be excellent.

Table 1: Response rate for questionnaire

Provinces	*CMs per province*	*Sample size (n)*	*Responses*
Eastern Cape	82	18	7
Free State	39	20	14
Gauteng	372	70	18
KwaZulu-Natal	121	54	47
Limpopo	25	20	4
Mpumalanga	25	20	5
Northern Cape	11	5	4
Northwest	11	5	3
Western Cape	164	60	17
Total	850	272	119

3.3 Data collection

The questionnaire was piloted with three construction managers to test the duration, appropriateness of the questions, and general logic of the questions. Feedback from the pilot study was used to revise the questionnaire. The questionnaire was uploaded on Google forms and links were forwarded to the 272 respondents via emails. Questionnaires were deemed appropriate for this study, as a large number of respondents could be reached. The questionnaire was formulated based on the literature review and objectives of the study. The questionnaire consisted of two parts. Part A contained questions on the demographic data of the respondents, including gender, age, race, level of education, industry experience, and region. Part B consisted of 53 statements categorised under five headings:

general understanding of quality, construction managers' perspective of quality, quality management systems in general, factors affecting quality, and the benefits of a construction manager in a project. The respondents were asked to rate these statements based on their level of agreement on a 5-point Likert scale. The researchers applied for and received ethical approval prior to commencing the study. Informed consent letters were designed and signed by the respondents before their participation in the study.

3.4 Data-analysis method

For capturing and analysing the data obtained from the questionnaire, Microsoft Excel and the Statistical Package for Social Sciences (SPSS) version 27 was used to obtain descriptive and non-parametric statistics (Pallant, 2013). The items under the five factors were ranked using a five-point Likert scale, based on mean scores. According to Singh (2006), opinions can be measured with the help of Likert-type or rating scales that use fixed choice response formats. Mean scores were measured, using a scale where 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree, and 5 = Strongly agree.

For analysis of the internal reliability of the items in the questionnaire, Cronbach's *alpha* values were tested with a cut-off value of 0.70 (Tavakol & Dennick, 2011: 54-55). Data appropriateness for factor analysis was validated, using the Meyer-Olkin (KMO) and the Bartlett's Test of Sphericity (Hair *et al*., 2014: 110). The Kaiser-Meyer-Olkin measure of sampling adequacy is a statistic that indicates the proportion of variance in the variables that might be caused by underlying factors (Shrestha, 2021). High values (close to 1.0) generally indicate that a factor analysis may be useful with one's data. If the value is less than 0.50, the results of the factor analysis will probably not be very useful (Hoque *et al.*, 2018). For this study, 0.50 was used to retain factors. For factor analysis, principal components extraction was used with Kaiser normalisation and Promax rotation with a kappa 4 (Pett, Lackey & Sullivan, 2003).

4. RESULTS

4.1 Participant profile

Table 1 indicates that 50% of the respondents were aged between 30 and 65 years and that 40% of the respondents had between 6- and 26-years' experience as construction managers. All of them had either a degree/ diploma (41%) or a post-degree qualification (59%). Although 60% of the respondents had between 1 to 5 years' experience, all of them were registered with the SACPCMP. This implies that most of the respondents have the required tertiary qualifications and experience to provide information on quality improvement in the construction industry.

Table 1: Demographics of the respondents

Demographic	*Category*	*Frequency (n=119)*	*%*
Age	25-29	59	50
	30-34	26	22
	35-39	14	11
	40-44	12	10
	45-49	5	4
	50-65	3	3
Province	Eastern Cape	7	6
	Free State	14	12
	Gauteng	16	13
	KwaZulu-Natal	47	40
	Limpopo	4	3
	Mpumalanga	4	3
	Northern Cape	4	3
	Northwest	6	5
	Western Cape	17	15
Educational Qualifications	Diploma	30	25
	BSc	19	16
	Honours	45	38
	Masters	17	14
	PHD	8	7
Experience (years)	1-5	71	60
	6-10	24	20
	11-15	13	11
	16-20	6	5
	21-26	5	4

4.2 Descriptive analysis

Tables 2 to 6 show the ranking results from the descriptive analysis.

4.2.1 General understanding of quality

Table 2 shows the ranking for general understanding of quality, using mean score ratings. An average MS of 4.90 indicates that respondents had a very good understanding of quality. The Cronbach's *alpha* was greater than 0.70 at 0.831, indicating acceptable internal reliability.

Table 2: General understanding of quality

Statement *Cronbach's alpha = 0.831*		*Mean*	*Std. deviation*	*Rank*
A1	Quality is one of the critical factors in the success of construction projects	4.96	0.302	1
A4	The main aim of quality is to ensure customer satisfaction	4.92	0.266	2
A5	When defining objectives for construction project quality, it is essential to consider the available budget and time	4.92	0.266	3
A2	Construction projects are a balance between cost, time, and quality	4.92	0.279	4
A3	For construction projects, the goal and desire of all project stakeholders, a construction manager, in particular, is to ensure that projects are delivered according to acceptable and agreed standards	4.92	0.279	5
A6	Quality is delivering customer service or products without a defect being present	4.90	0.302	6
A7	The managers consider the skills and knowledge employed to the construction of the project; *i.e.*, they look at the material, labour, equipment, tools, and methods to producing the end-product of quality	4.87	0.333	7
A8	Clients are satisfied if the product meets their expectations in terms of price, time frame, functionality, and delivery performance standard	4.84	0.368	8
A9	Quality reflects the quantity of attributes that a project contains	4.81	0.437	9
	Average mean score	4.90		

The respondents strongly agreed that quality is one of the critical factors in the success of construction projects (MS=4.96) and ranked this first. All the respondents agreed that the main aim of quality is to ensure customer satisfaction (MS=4.92). Ranked third and fourth, the respondents agreed that construction projects are indeed a balance between cost, time, and quality (MS=4.92) and that, in construction projects, the objective and goal of all project stakeholders, construction managers, in particular, is to guarantee that projects are delivered according to the acceptable and agreed standards (MS=4.92).

4.2.2 Construction managers' perspective of quality

Table 3 ranks the mean scores in terms of the construction managers' perspective of quality. An average MS of 4.78 indicates that respondents had a very good perception of quality in construction projects. The Cronbach's *alpha* was greater than 0.70 at 0.757, indicating acceptable internal reliability. All the respondents strongly agreed that a project is of quality if it is in conformance to specifications (MS=4.92); fit for its purpose after construction (MS=4.92), and meets or exceeds customer expectations (MS=4.88). Respondents agreed that quality is construed as perfection or consistency (MS=4.88) and that construction managers do define the quality objectives and ensure that they are achieved (MS=4.71).

Table 3: Construction managers' perspective of quality

Statement *Cronbach's alpha = 0.757*		*Mean*	*Std. deviation*	*Rank*
B1	Project is of quality if it is in conformance to specifications	4.92	0.279	1
B2	A project must be fit for purpose for it to be of quality	4.92	0.279	2
B3	Quality is construed as perfection or consistency	4.88	0.324	3
B4	Quality is known as meeting or exceeding customer expectations	4.88	0.454	4
B5	Construction managers define the quality objectives and ensure that they are achieved	4.71	0.472	5
B6	CMs develop the Quality Management Plan after consulting with the project manager and the stakeholders	4.67	0.539	6
B7	Construction managers create quality policy of a project	4.50	0.623	7
	Average mean score	4.78		

4.2.3 Understanding of quality management systems (QMS)

Table 4 ranks QMS in terms of the mean scores. An average MS of 4.82 indicates that construction managers regard quality management systems as important in construction projects. The Cronbach's *alpha* was greater than 0.70 at 0.846, indicating acceptable internal reliability.

Table 4: Understanding of quality management systems (QMS)

Statement *Cronbach's alpha = 0.846*		*Mean*	*Std. deviation*	*Rank*
C1	Quality control is a process through which a business seeks to ensure that product quality is maintained or improved	4.89	0.313	1
C2	Quality control tools include checklists, check sheets, statistical analysis, etc	4.89	0.313	2
C3	Quality planning is the task of determining what factors are important to a project and figuring out how to meet those factors	4.87	0.333	3
C4	Quality assurance are processes to ensure a high level of quality in production during the development of products or services	4.87	0.333	4
C5	QMSs assist in reducing costs of rework and waste	4.84	0.368	5
C6	QMS provides the superior customer satisfaction and loyalty	4.82	0.404	6

Statement *Cronbach's alpha = 0.846*		*Mean*	*Std. deviation*	*Rank*
C7	QMSs assist in meeting the organisation requirements	4.80	0.403	7
C8	A quality management plan is created by a construction manager	4.55	0.673	8
	Average mean score	4.82		

The respondents agreed that quality control is indeed a process through which a business seeks to ensure that product quality is maintained or improved (MS=4.89) and that quality control tools include checklists, check sheets, statistical analysis, etc. (MS=4.89). Quality planning is important in determining which factors are important to the project (MS=4.87).

4.2.4 Factors affecting quality

The average mean score of 4.67 in Table 5 indicates that respondents agreed that all the factors affect quality. The Cronbach's *alpha* was 0.878, which means that there is a 'good' reliability between items. The mean item score was used to rank the criteria. The use of unskilled trade subcontractors was regarded as the number one factor contributing to poor quality on construction projects (MS=4.90). Non-conformance to regulations (MS=4.87), lack of communication (MS=4.87), and non-conformance to specifications (MS=4.87) ranked second as factors that negatively affect the quality of projects. This was followed by poor on-site supervision (MS=4.84), lack of knowledge (MS=4.84), and uncontrolled variation orders (MS=4.84).

Table 5: Factors affecting quality

Statement *Cronbach's alpha = 0.878*		*Mean*	*Std. deviation*	*Rank*
D17	Use of unskilled trade subcontractors	4.90	0.329	1
D3	Non-conformance to specifications	4.87	0.343	2
D7	Lack of communication	4.87	0.343	3
D1	Non-conformance to regulations	4.87	0.366	4
D4	Poor on-site supervision	4.84	0.368	5
D8	Ignorance and lack of knowledge	4.84	0.368	6
D14	Uncontrolled variation orders	4.84	0.368	7
D12	Average delays in decision-making	4.82	0.404	8
D11	Poor procurement planning and management	4.81	0.397	9
D10	Poor material and plant management	4.80	0.403	10
D6	Poor planning and scheduling	4.78	0.415	11
D2	Use of unskilled labour	4.71	0.570	12
D9	Low productivity and efficiency of equipment	4.67	0.489	13
D5	Lack of induction and training	4.65	0.480	14

Statement *Cronbach's alpha = 0.878*		*Mean*	*Std. deviation*	*Rank*
D16	Inclement weather conditions	4.34	0.716	15
D15	Involvement of end-user client	4.09	0.930	16
D13	Number of projects at hand	3.64	1.087	17
	Average mean score	4.67		

4.2.5 Benefits of a construction manager in a project

Table 6 ranks the mean scores for the benefits of having a construction manager in a project. The average mean score was 4.71 and the Cronbach's *alpha* of 0.836 is regarded as 'good', as it is higher than 0.70. The most important benefit of having a construction manager in a project is that proper project feasibility studies (constructability reviews) can be obtained (MS=4.96). Effective strategic planning was ranked second (MS=4.93). Proper coordination between the construction team and adequate planning and organising were ranked third (MS 4.92). The respondents agree that, if the construction manager is employed in a project, the project will likely conform to specifications, suitable construction methods will be used, conform to construction drawings, there will be clear information and communication channel and proper coordination between the construction team.

Table 6: Benefits of a construction manager in a project

Statement *Cronbach's alpha = 0.836*		*Mean*	*Std. deviation*	*Rank*
E18	Proper project feasibility study (constructability reviews)	4.96	0.201	1
E11	Effective strategic planning	4.93	0.251	2
E8	Adequate planning and organising	4.92	0.279	3
E6	Proper coordination between the construction team	4.92	0.279	4
E5	Clear information and communication channel	4.91	0.291	5
E10	Proper and up-to-date project planning and scheduling	4.88	0.324	6
E4	Conformance to construction drawings and specification	4.87	0.333	7
E14	Having frequent progress meetings	4.84	0.368	8
E3	Use suitable construction methods to suit specific project	4.83	0.376	9
E1	Conformance to specifications	4.79	0.409	10
E12	Use of appropriate construction methods	4.76	0.464	11
E13	Ensure proper material procurement	4.74	0.441	12
E9	Efficient and timely supply of materials	4.71	0.458	13

Statement *Cronbach's alpha = 0.836*		*Mean*	*Std. deviation*	*Rank*
E15	Have complete and suitable design at the right time	4.71	0.523	14
E2	Use proper and modern construction equipment	4.61	0.584	15
E17	Ensure up-to-date technology utilisation	4.53	0.550	16
E16	Allowance of material price escalation in original tender document	4.25	0.773	17
E7	Appointment of experienced contractors	3.61	1.202	18
	Average mean score	4.71		

4.3 Principal component analysis

The 33 factors affecting quality and the benefits of a construction manager in terms of ensuring quality were subjected to PCA to assess their validity and reliability. The results report the suitability of the data to be analysed, factor extraction and rotation, and interpretation.

4.3.1 Factors affecting quality

Table 7 shows a KMO value (0.812) greater than the suggested value of 0.50 and the Barlett's test of sphericity reached statistical significance ($p<0.05$), thereby supporting the factorability of the correlation matrix.

Table 7: KMO and Bartlett's test for factors affecting quality

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.812
Bartlett's test of sphericity	Approx. *chi*-square	1522.279
	df	136
	Sig.	.000

Table 8 indicates the structure matrix of the factors affecting quality. The results revealed the loadings of each of the items which were extracted through principal axis factoring, resulting in a four-factor solution. All seventeen of the items loaded on the components and were considered to be factors influencing the co-variation among multiple observations.

Table 8: Structure matrix of the factors affecting quality

Item		*Component*			
		1	*2*	*3*	*4*
D1	Non-conformance to regulations	0.756	0.281	-0.217	0.142
D2	Use of unskilled labour	0.639	0.175	-0.327	0.374
D3	Non-conformance to specifications	0.797	0.241	-0.187	0.076
D4	Poor on-site supervision	0.834	0.123	-0.220	-0.043
D5	Lack of induction and training	0.558	-0.305	0.326	0.373

Item		*Component*			
		1	*2*	*3*	*4*
D6	Poor planning and scheduling	0.749	-0.337	0.231	-0.139
D7	Lack of communication	0.771	-0.341	0.168	-0.372
D8	Ignorance and lack of knowledge	0.745	-0.377	0.183	-0.340
D9	Low productivity and efficiency of equipment	0.585	-0.417	0.291	0.408
D10	Poor material and plant management	0.787	-0.307	0.103	0.063
D11	Poor procurement planning and management	0.802	-0.221	-0.023	0.001
D12	Average delays in decision-making	0.720	0.163	-0.316	-0.176
D13	Number of projects at hand	0.362	0.529	0.495	0.406
D14	Uncontrolled variation orders	0.735	0.015	-0.261	-0.132
D15	Involvement of end-user client	0.380	0.740	0.362	-0.148
D16	Inclement weather conditions	0.385	0.604	0.420	-0.350
D17	Use of unskilled trade subcontractors	0.644	0.273	-0.319	0.071

Extraction method: Principal axis factoring

Rotation methods: Promax with Kaiser normalization

Table 9 indicates a four-factor extraction which comprised all seventeen items, with eigenvalues greater than one, that are meaningful to retain. PCA technique using principal axis factoring shows that these four factors explain 46.09%, 13.28%, 8.10%, and 6.56% of the variance, respectively and 74.01% of the total variance.

Table 9: Total variance explained for factors affecting quality

Total variance explained						
Initial Eigenvalues				*Extraction sums of squared loadings*		
Component	*Total*	*% of variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
D1	7.834	46.085	46.085	7.834	46.085	46.085
D2	2.257	13.275	59.360	2.257	13.275	59.360
D3	1.377	8.103	67.462	1.377	8.103	67.462
D4	1.113	6.550	74.012	1.113	6.550	74.012
D5	0.725	4.264	78.276			
D6	0.629	3.700	81.976			
D7	0.592	3.482	85.458			
D8	0.486	2.859	88.317			
D9	0.395	2.323	90.640			
D10	0.346	2.035	92.675			
D11	0.276	1.624	94.299			
D12	0.230	1.351	95.650			
D13	0.221	1.301	96.951			
D14	0.201	1.183	98.134			
D15	0.147	0.864	98.997			
D16	0.123	0.722	99.720			
D17	0.048	0.280	100.000			

Table 10 reveals the correlation of items based on their factor loadings after rotation in PCA. Items with the highest loadings (values of 0.5 and above) in a component are most strongly correlated with that component. The names given to the components were derived from a close examination of the items within each of the components, with Component 1 being labelled internal factors and Component 2, external factors. Component 1 internal factors explained 46.09% of the total variance and has fourteen correlated items. Component 2, external factors explained 13.28% of the total variance and has three correlated item loadings, number of projects at hand (0.526), involvement of end-user client (0.740) and inclement weather conditions (0.604).

Table 10: Pattern matrix for factors affecting quality

Item		*Component*	
		1	*2*
D1	Non-conformance to regulations	0.756	
D2	Use of unskilled labour	0.639	
D3	Non-conformance to specifications	0.797	
D4	Poor on-site supervision	0.834	
D5	Lack of induction and training	0.558	
D6	Poor planning and scheduling	0.749	
D7	Lack of communication	0.771	
D8	Ignorance and lack of knowledge	0.745	
D9	Low productivity and efficiency of equipment	0.585	
D10	Poor material and plant management	0.787	
D11	Poor procurement planning and management	0.802	
D12	Average delays in decision-making	0.720	
D14	Uncontrolled variation orders	0.735	
D17	Use of unskilled trade subcontractors	0.644	
D13	Number of projects at hand		0.529
D15	Involvement of end-user client		0.740
D16	Inclement weather conditions		0.604

Extraction method: Principal axis factoring

Rotation methods: Promax with Kaiser normalization

4.3.2 Benefits of a construction manager in a project

Table 11 shows a KMO value (0.830) greater than the suggested value of 0.50 and the Barlett’s test of sphericity reached statistical significance ($p<0.05$), thereby supporting the factorability of the correlation matrix.

Table 11: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.830
Bartlett's Test of Sphericity	Approx. Chi-square	1263.453
	df	171
	Sig.	.000

Table 12 indicates the structure matrix of the benefits of a construction manager in a project. The results revealed the loadings of each of the items which were extracted through principal axis factoring, resulting in a five-factor solution. Eighteen items loaded on the components.

Table 12: Structure matrix of the benefits of a construction manager in a project

Item		*Component*				
		1	*2*	*3*	*4*	*5*
E1	Conforming to specifications	0.650	0.229	-0.460	0.449	0.225
E2	Use proper and modern construction equipment	0.715	0.189	0.211	-0.084	-0.288
E3	Use suitable construction methods to suit specific project	0.732	0.026	-0.120	0.020	-0.104
E4	Conformance to construction drawings and specification	0.771	-0.094	-0.096	0.176	-0.110
E5	Clear information and communication channel	0.757	-0.419	0.148	0.196	0.136
E6	Proper coordination between the construction team	0.775	-0.399	0.137	0.097	0.189
E7	Appointment of experienced contractors	0.105	0.508	0.605	-0.007	0.230
E8	Adequate planning and organising	0.607	-0.323	-0.031	0.289	0.323
E9	Have complete and suitable design at the right time	0.643	0.259	-0.231	0.041	-0.350
E10	Proper and up-to-date project planning and scheduling	0.706	-0.393	0.305	-0.063	0.056
E11	Effective strategic planning	0.706	-0.294	0.043	-0.160	0.057
E12	Use of appropriate construction methods	0.701	0.223	-0.110	-0.161	-0.142
E13	Ensure proper material procurement	0.552	0.557	-0.214	-0.142	-0.136
E14	Having frequent progress meeting	0.642	-0.035	-0.220	-0.362	0.123
E15	Efficient and timely supply of materials	0.573	0.438	-0.138	0.149	0.309
E16	Allowance of material price escalation in original tender document	0.320	0.512	0.492	-0.182	0.236
E17	Ensure up-to-date technology utilisation	0.498	0.539	-0.094	-0.044	0.157
E18	Proper project feasibility study (constructability reviews)	0.675	-0.324	0.116	-0.238	-0.338

Extraction method: Principal axis factoring

Rotation methods: Promax with Kaiser normalization

Table 13 illustrates how much variance is explained by a five-factor solution that comprised eighteen statements. The PCA technique, using principal axis factoring, shows that, with eigen values greater than one, these five factors explain 37.27%, 12.42%, 7.26%, 5.89%, and 5.44% of the variance, respectively, and 68.28% of the total variance.

Table 13: Total variance explained for the benefits of a construction manager in a project

Total variance explained						
Initial Eigenvalues				*Extraction sums of squared loadings*		
Component	*Total*	*% of variance*	*Cumulative %*	*Total*	*% of variance*	*Cumulative %*
E1	7.081	37.266	37.266	7.081	37.266	37.266
E2	2.360	12.422	49.688	2.360	12.422	49.688
E3	1.379	7.257	56.945	1.379	7.257	56.945
E4	1.119	5.890	62.836	1.119	5.890	62.836
E5	1.034	5.441	68.277	1.034	5.441	68.277
E6	0.966	5.084	73.361			
E7	0.820	4.314	77.675			
E8	0.703	3.698	81.373			
E9	0.586	3.082	84.455			
E10	0.566	2.977	87.432			
E11	0.506	2.661	90.093			
E12	0.429	2.256	92.349			
E13	0.290	1.528	93.877			
E14	0.276	1.453	95.330			
E15	0.256	1.347	96.677			
E16	0.221	1.165	97.842			
E17	0.169	0.887	98.729			
E18	0.150	0.788	99.516			
E1	0.092	0.484	100.000			

Table 14 reveals the correlation of items based on their factor loadings after rotation in PCA. Items with the highest loadings (values of 0.5 and above) in a component are most strongly correlated with that component. The names given to the components were derived from a close examination of the items within each of the components, with Component 1 being labelled internal project planning and Component 2, external project planning. Component 1 internal project planning explained 37.27% of the total variance and has fifteen correlated item loadings, as indicated in Table 14. Component 2, external project planning explained 12.42% of the total variance and has three correlated item loadings, appointment of experienced contractors (0.508), allowance of material price escalation in original tender document (0.512), and ensure up-to-date technology utilisation (0.539).

Table 14: Pattern matrix for the benefits of a construction manager in a project

Item		*Component*	
		1	*2*
E1	Conforming to specifications	0.650	
E2	Use proper and modern construction equipment	0.715	
E3	Use suitable construction methods to suit specific project	0.732	
E4	Conformance to construction drawings and specification	0.771	
E5	Clear information and communication channel	0.757	
E6	Proper coordination between the construction team	0.775	
E8	Adequate planning and organising	0.607	
E9	Have complete and suitable design at the right time	0.643	
E10	Proper and up-to-date project planning and scheduling	0.706	
E11	Effective strategic planning	0.706	
E12	Use of appropriate construction methods	0.701	
E13	Ensure proper material procurement	0.552	
E14	Having frequent progress meetings	0.642	
E15	Efficient and timely supply of materials	0.573	
E18	Proper project feasibility study (constructability reviews)	0.675	
E7	Appointment of experienced contractors		0.508
E16	Allowance of material price escalation in original tender document		0.512
E17	Ensure up-to-date technology utilisation		0.539

Extraction method: Principal axis factoring

Rotation methods: Promax with Kaiser normalization

5. PROPOSED QUALITY IMPROVEMENT FRAMEWORK

A framework for improving quality, from a construction manager's perspective, must be comprehensive and multifaceted, addressing various aspects that contribute to the successful execution of projects, as indicated in Figure 1. The five key categories and four components outlined provide a structured approach to enhancing quality from a construction manager's perspective and are crucial to the effective implementation of the framework. The integration of these five factors within a comprehensive framework empowers construction managers to effectively manage and improve the quality of construction projects. This approach ensures that projects are executed with precision, adhere to industry standards, and meet or exceed client expectations, thereby enhancing the overall success and reputation of the construction management firm.

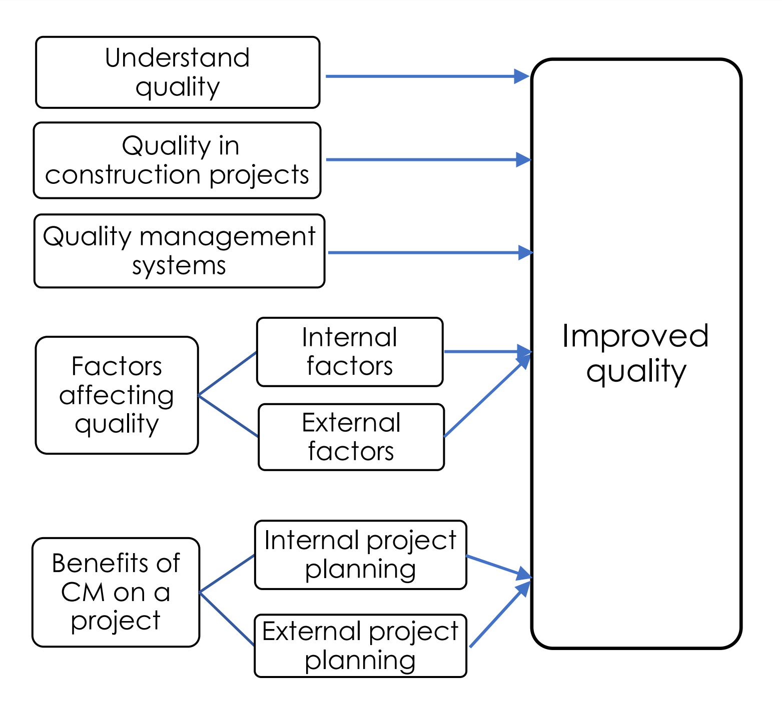

Figure 1: Conceptual quality improvement framework for construction managers

5.1 Understanding of quality

Results in this study show that quality is a significant part of construction projects, making it vital for a construction manager to remain attentive and maintain the nature of quality through the project lifecycle (Mane & Patil, 2015). Therefore, the construction manager's understanding of quality is important in ensuring that they can perform their duties to ensure that they deliver good-quality projects (Waje & Patil, 2016).

Quality is widely known as a degree of excellence (Mallawaarachchi & Senaratne, 2015). Juran (1999: 11) defines quality as "delivering customer service or products without a defect being present". Construction managers who participated in this study agreed that the main aim of quality is to ensure customer satisfaction. This finding agrees with Preethi and Monisha (2017) and Mallawaarachchi and Senaratne (2015: 84), who stated that "quality of construction projects can be regarded as the fulfilment of expectations of the project participants by optimising their satisfaction".

Respondents also agreed that quality is to guarantee that projects are delivered according to the acceptable and agreed standards. This finding agrees with Oke, (2017) that quality can be described as meeting specifications and approved standards agreed by stakeholders, a construction manager, in particular, to ensure that projects are delivered according to acceptable and agreed standards.

Failure to meet the quality requirements can have serious, negative consequences for any or all the project's stakeholders (Mallawaarachchi & Senaratne, 2015). This means the contractor must carry out the work with reasonable skill and care, to the reasonable satisfaction of the construction manager, which is why their understanding of quality is important.

The construction manager's deep understanding of quality standards and requirements serves as the foundation for ensuring that projects are executed with meticulous attention to detail. Their expertise in this area allows for effective communication with stakeholders. This, in turn, fosters a shared understanding of project expectations and ensures that the final deliverables meet or exceed the client's requirements.

5.2 The perspective of a construction manager towards construction quality

The construction manager's perspective on construction quality serves as a driving force behind the motivation and efficiency of the entire workforce. Construction managers who participated in this study agreed that quality is construed as perfection or consistency and a project is of quality if it is in conformance to specifications and fit for its purpose after construction. This indicates that construction managers have a very good perception of quality in construction projects, as indicated by Harvey (2007), who stated that construction managers perceive quality of the project as fitness for purpose, conformance to specifications, meeting or exceeding the requirements of a client, value for money, and consistency.

Respondents also agreed that defining the quality objectives and ensuring that they are achieved to meet or exceed customer expectations is needed to guide a project to success. This finding agrees with Ayegun and Olawumi (2018: 30) who indicate that construction managers need to be skilled in both the technical skills required for the job and leading and directing their team. Construction managers are regarded as the driving force behind the scenes and control the *modus operandi* of the construction project (Harvey, 2007). Their perspective of quality is what guides a project to success.

Clients are satisfied if the product meets their expectations in terms of price, time frame, functionality, and delivery performance standard (Oke, 2017). Whereas the construction managers look far beyond and focus their skills and knowledge at the materials, labour, equipment, tools, and methods to producing the end-product of quality (Preethi & Monisha, 2017). Construction managers could encourage a culture of excellence to ensure an appropriate level of quality during all phases of the construction project, by emphasizing the importance of quality throughout the construction process (Preethi & Monisha, 2017). This perspective towards construction quality can provide powerful motivation to a workforce so that the entire team remains focused on achieving the highest standards of quality and can lead an institution to focus on efficiency, and compels management to keep abreast of changes in client demands (Harvey, 2007).

5.3 Quality management

Results from this study show that construction managers regard quality management as important in construction projects, which agrees with Boljevi (2007) who states that quality management ensures superior quality projects. The purpose of quality management is to guarantee every time a process is performed, the same information, methods, skills, and controls are used and applied in a consistent manner (Oke, 2017). A quality management system (QMS) is a management technique used to communicate to employees what is required to produce the desired quality of products and services and to influence employee actions to complete tasks according to the quality specifications (ISO 9001, 2015). QMS helps the construction manager determine if deliverables are being produced to an acceptable quality level and if the project processes used to manage and create the deliverables are effective and properly applied (Hammar, 2018; PMI, 2017).

QMS used in construction comprises of quality planning, quality assurance, and quality control (PMI, 2017). Construction managers who participated in this study agreed that quality planning is important in determining which factors are important to the project. This finding agrees with Howarth & Greenwood (2018: 68), indicating that quality planning is a disciplined process to ensure that a structured sequence of activities is completed. Respondents also agreed with Tempa (2015) who states that quality assurance are processes to ensure a high level of quality in production during the development of products or services. They also agreed that quality control is indeed a process through which a business seeks to ensure that product quality is maintained or improved and that quality control tools include checklists, check sheets, and statistical analysis. These findings agree with Mallawaarachchi and Senaratne (2015) and Hammar (2018) that quality control is a process employed to ensure a certain level of quality in a product or service. According to Hammar (2018), a quality plan establishes the resources required and associated documents (lists, purchasing documentation, machinery, equipment, etc.) and the control activities (verification of compliance to specifications, validation of specific processes, monitoring of activities, inspections and tests). These activities can be defined through inspection, testing plans, action plans and, where applicable, specific tests (*e.g.*, load tests for structures).

Quality measures and techniques are specific to the type of deliverables being produced by the project. Therefore, construction projects should adhere to an approved QMS (Thulo *et al.*, 2023; Ying, 2010). QMS gives confidence that standards and requirements are being met by implementing a set of planned and systematic acts and processes (PMI, 2013). Implementing and using QMS may reduce possible errors in all project phases by proper quality control, finding faults/errors soon, measuring to avoid repeated mistakes, and determine and initiate corrective action/ preventive measures (Aized, 2012). An effective QMS will identify the risks to an organisation and provide ways to mitigate them (Ali & Rahmat, 2010). In identifying and managing these risks, a QMS provides customer satisfaction and loyalty; identification and elimination of waste; better performance from suppliers, and employees committed to quality and improvement (Ali & Rahmat, 2010).

Quality of a project can be measured in terms of performance, reliability, and durability (Boljevi, 2007). Quality is a crucial parameter which differentiates an organisation from its competitors. By incorporating a QMS, construction managers can systematically monitor and improve the quality of projects, thereby safeguarding the reputation of the organisation and minimising costs (Aized, 2012).

5.4 Factors affecting quality

Respondents agreed that all the factors investigated in this study affect quality. This finding agrees with Oyedele *et al*. (2015) and Oke (2017) that the construction industry is faced with challenges that affect performance and output. Identifying potential critical factors that affect the quality of a project before commencement will ensure client satisfaction at project completion. For the proposed framework, these factors were reduced to internal and external factors. Results from the study showed the top three internal factors that affect quality on construction projects were the use of unskilled trade subcontractors, non-conformance to regulations and specifications.

The use of unskilled trade subcontractors agrees with Oke (2017) that skilled labourers are more valuable to the construction industry than the unskilled labourers because they possess a certain artisan skill, and it is difficult to replace. Skilled labourers understand quality outcomes and specifications and can read and appraise the design drawings. Skilled labourers and subcontractors require less supervision, and they use company resources properly without wasting any raw materials (Oyedele *et al*., 2015). They have a higher production rate which decreases production costs and increases returns. Therefore, the quality of a construction project depends on how skilled the labours and subcontractors are (Oyedele *et al*., 2015). It is, therefore, the responsibility of a construction manager to ensure that skilled and unskilled labour are appropriately utilised to deliver a project of high quality.

Regulations such as the South African National Standards (SANS) and the International Organisation for Standardisation (ISO) are used to define the standards of workmanship and materials for construction works (CIDB, 2011). Non-conformance to regulations and specifications also results in poor quality (CIDB, 2011; Oyedele *et al*., 2015). Respondents agreed that it is possible to find some project stakeholders who are not abiding to regulations because of negligence or lack of knowledge. Construction managers know all the industry-related rules and regulations and should transfer the knowledge to all the stakeholders on site. The quality of drawings and specifications provided by the architects and engineers has a huge effect on the quality of the construction project (Oyedele *et al.*, 2015). Construction managers perform constructability reviews on all the project design drawings to identify the errors to the drawing before the planning phase commences (Stamatiadis *et al*., 2017). This helps detect errors in the quality of project designs, solve them, and produce the best construction methods possible before the actual construction begins.

Other internal factors that affect quality include the lack of supervision (Mahajan, 2016); lack of communication channels within the project (Stamatiadis *et al*., 2013), and uncontrolled variation orders (Memon & Hasan, 2014).

Respondents regarded inclement weather conditions as the top external factor that affects quality on construction projects. This agrees with Oke (2017) who states that unforeseen circumstances such as unpredictable weather or logistical issues may arise and construction managers must then assess the new situation and be able to re-prioritise activities to ensure the project stays on track.

By comprehensively analysing and addressing both internal and external factors that affect quality, construction managers can proactively manage risks and optimise project outcomes. Proactive measures such as ensuring skilled labour utilisation, adherence to industry regulations, and effective material management help mitigate internal challenges. Furthermore, the ability to adapt to external influences such as unpredictable weather and project constraints demonstrates the construction managers capacity to maintain project progress despite unforeseen challenges.

5.5 Benefits of a construction manager in a project

Respondents agreed that having a skilled construction manager on board provides several tangible benefits that contribute to the successful execution of construction projects. This finding agrees with Oke (2017), stating that construction managers have a responsibility of arranging, sorting out, coordinating, controlling, and assessing the construction processes. They are equipped with education, knowledge, skill set, technology, and an attitude of analytical thinking which helps them take a holistic approach towards planning the construction project. For the proposed model, these benefits were reduced to internal project planning benefits and external project planning benefits. Respondents agreed that the top three internal project planning benefits of having a construction manager on projects were that proper project feasibility studies (constructability reviews) can be obtained, effective strategic planning, and proper coordination between the construction team and adequate planning and organising.

By conducting thorough feasibility studies and constructability reviews, construction managers ensure that projects are properly executed and that the project will not waste essential resources such as money, time, and energy before the project execution plan (Harris *et al*., 2020: 13).

Effective strategic planning, proper coordination between the construction team, and adequate planning and organising means that construction managers have the skills to manage quality and to deal with some of the problems most associated with construction projects (Harris *et al*., 2020: 13). Construction managers manage the quality of projects from inception to completion (Neyestani, 2016; Oke, 2017). The construction manager defines the quality objectives harmonised with the quality policy which are integral parts of the project general strategic goals (Oke, 2017). The construction managers develop the quality management plan (QMP) after consulting with the various stakeholders and ensure that all staff under their direction comply with the QMP (Neyestani, 2016).

The respondents agreed that, if a construction manager is employed in a project, it is likely the project will conform to specifications, suitable construction methods will be used, conforming to construction drawings, and there will be clear information and communication channels. This finding agrees with Eriksson and Vennstrom (2012) who stated that an effective construction manager can communicate clearly and confidently, in order to create stronger relationships between workers and managers.

Respondents agreed that external project planning benefits of having a construction manager includes appointment of experienced contractors, allowance for potential price fluctuations, and the utilisation of up-to-date technologies. Construction projects are multifaceted and complex processes that involve several different activities and specialised workers (Oke, 2017). It involves the choice of technology, the definition of work tasks, the estimation of the required resources and durations for individual tasks, and the identification of any interactions among the different work tasks. Effective construction managers understand the importance of these activities, lay out the most optimal work schedule, and execute the construction plan to the best of their abilities (Stamatiadis *et al.*, 2013).

In many instances, however, unforeseen circumstances such as unpredictable weather, end-user involvement, price fluctuations, and the number of projects at hand can affect the project (Oke, 2017). In these cases, effective construction managers must assess their new situation and be able to re-prioritise their activities to ensure that the project stays on track (Oke, 2017; Stamatiadis *et al.*, 2013).

6. CONCLUSION

The management of quality in the construction industry is of paramount importance, as it directly influences customer expectations and, in turn, client loyalty. The focus on quality, while often overshadowed by cost and time considerations, cannot be understated, given the financial implications of subpar quality in construction projects. This article shed light on the importance of quality from the perspective of construction managers and the framework for enhancing it, encompassing five key categories. The study underscored the importance of the construction manager's profound understanding of quality standards and requirements. This foundational knowledge is vital for effective communication with stakeholders, ensuring a shared understanding of project expectations and driving a commitment to meeting or exceeding client requirements. The construction manager's perspective on quality encourages efficiency and a relentless focus on quality standards throughout the institution, aligning the team with consumer demands and quality expectations. The framework emphasizes the significance of a robust QMS for construction managers. This systematic approach ensures that projects conform to both client requirements and industry regulations, thereby safeguarding the reputation of the organisation and minimising costs. Included in the framework are the internal and external factors that impact on quality. It underscores the importance of proactive measures such as skilled labour utilisation, adherence to industry regulations, and effective material management, while also emphasizing the construction manager's adaptability to external influences such as unforeseen challenges or unpredictable weather. The final category considered in the framework was the invaluable benefits that construction managers offer by conducting feasibility studies and constructability reviews, ensuring that projects adhere to specifications, employing suitable construction methods, and maintaining clear communication channels.

Considering these findings, it is recommended that construction managers adopt a continuous learning approach to stay abreast of evolving construction methods, regulations, and technologies. By implementing the comprehensive proposed framework discussed in this article, construction managers can successfully navigate the multifaceted landscape of construction quality. This approach empowers them to drive construction projects towards success, meet customer expectations, and foster client loyalty, ultimately contributing to the advancement of the construction industry.

This study is limited to Professional Construction Managers who were registered with the South African Council for Project and Construction Management Professionals. Future studies can examine other organisations such as the CIOB, with which construction managers affiliate themselves. A further qualitative study could be carried out to obtain a deeper understanding of quality issues experienced by construction managers.

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