A framework for assessing quality of tender documents

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Abstract

Purpose – Several researchers in the construction industry have mentioned that quality of tender documents is declining without tangibly assessing quality. Similarly, in practice, no standardised instrument exists to assess tender document quality. Therefore, the aim of this paper was to develop a framework to assess the quality of tender documents produced by built environment professionals in the construction industry. A framework was chosen to address the gaps in theory and practice as it provides a flexible but structured mechanism to assess tender document quality.

Design/methodology/approach – The research methodology contained three stages, namely: multi-investigator triangulation, a workshop with infrastructure experts and framework development and validation. A consolidated list of key quality indicators was developed following the literature review and multi-investigator triangulation. The indicators were discussed with ten experts in the South African construction industry, who were responsible for validating and providing insight on whether additional indicators were required. This informed development of the framework.

Findings – This paper proposes a framework to assess tender document quality by evaluating six key quality indicators namely: accuracy, clarity, completeness, standardisation, relevance and certainty.

Research limitations/implications – The framework is limited to the assessment of tender document quality in the construction industry and is suited to the "Design by Employer" contracting strategy. From an academic perspective, this paper provides researchers with a framework to measure and benchmark quality of tender documents in future studies.

Practical implications – This framework can be used by clients to continuously assess and benchmark quality of tender documents produced by professionals.

Originality/value – A comprehensive and standardised approach to assess tender document quality was not available in the construction literature or the construction industry. Therefore, this paper addressed this gap in knowledge, by providing consumers (clients and contractors) of tender documents and researchers a mechanism to assess quality.

Keywords Tender documents, Quality, Construction industry

Paper type Research paper

Introduction

Tender documents in the construction industry which includes drawings, specifications, Bills of Quantities (BoQs) and contract documentation, are produced by built environment professionals and used by contractors to construct infrastructure. High quality tender documents are important in construction projects as they enable contractors to construct infrastructure efficiently without significant delays and unnecessary additional costs (Abdel-Razek, 1998; Andi and Minato, 2003; Philips-Ryder *et al.*, 2013). However, in recent years, concerns have been raised in literature about the quality of tender documents produced by built environment professionals. A poor quality tender document contains inaccurate information, is unclear or omits critical information. Information in tender documents relates to either technical or commercial information. Some researchers and members of industry

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bodies argue that quality of professional service outputs (which includes tender documents) in the construction industry has declined (Akampurira and Windapo, 2018; Assaf *et al.*, 2018; Okonkwo and Wium, 2018; Marisa and Yusof, 2020; Ali and Au-Yong, 2021; Quapp and Holschemacher, 2021). However, these studies did not outline how quality of professional service outputs was determined, to enable benchmarking and a reliable comparison of quality across different projects.

In the construction literature, most of the approaches that have been developed to assess quality of professional services focus on assessing service quality (Samson and Parker, 1994; Hoxley, 2000; Siu *et al.*, 2001; Maloney, 2002; Lai and Pang, 2010; Awolesi and Ayedun, 2012). Although a few studies evaluate factors associated with deficient project documentation (Tilley and McFallan, 2000; Andi and Minato, 2003; Akampurira and Windapo, 2018), none of the studies specifically relate to the assessment of tender document quality. Similarly, in practice, there is no coherent or standardised framework available in the construction industry to assess quality of tender documents. This paper addressed a critical gap in knowledge by developing a framework for researchers and industry practitioners to assess quality of tender documents in the construction industry. The paper proposed a framework that is underpinned by the assessment of six key quality indicators.

Background literature

Assessing quality of tender documents is important to evaluate the adequacy of deliverables and provide a benchmark of quality produced by built environment professionals. Previous research shows that various factors influence quality of project documentation but does not explain how quality is operationalised or assessed (Tilley and McFallan, 2000; Andi and Minato, 2003; Phua, 2005; Wimalasiri *et al.*, 2010; Akampurira and Windapo, 2018). Research that assesses quality of professional services in the construction industry focuses on service quality rendered by professionals (Samson and Parker, 1994; Hoxley, 2000; Siu *et al.*, 2001; Arditi and Lee, 2003; Awolesi and Ayedun, 2012; Prakash and Phadtare, 2018). Additional research has also been developed to evaluate performance of consultants (Tang *et al.*, 2003; Abdul-Aziz and Ali, 2004; Ng and Chow, 2004; Chow and Ng, 2010; Lam, 2016; Kärnä and Junnonen, 2017) and client satisfaction with professional services (Cheng *et al.*, 2006; Oyedele and Tham, 2007; Yang and Peng, 2008; Tan, 2012; Oluwatayo *et al.*, 2014; Aluko *et al.*, 2021). Importantly, none of the research assesses or proposes a method to assess quality of tender documents.

Currently, the construction literature lacks a framework to assess quality of tender documents produced by built environment professionals. It is also alarming that most of the literature on this important topic is outdated. There is a dearth of recent literature in this area of study.

Assessing tender document quality in the South African construction industry

The Construction Industry Development Board (CIDB) is mandated to establish best practice related to procurement and project delivery in the South African construction industry. However, most of the processes related to procurement that have been developed by the CIDB, focus on standardising tender documents and administrative processes.

In practice, tender documents for infrastructure projects implemented by public sector clients in South Africa, are generally prepared by consultants. Thereafter, documents are reviewed by stakeholders in the client body before being passed on to a Bid Specification Committee (BSC). The review by stakeholders in the client body is not a standardised process and quality of the review is dependent on experience and capability of the review team. The purpose and duties of the BSC is outlined in supply chain management policies in various public sector entities, but essentially, the BSC is responsible for assessing administrative and commercial aspects in tender documents before letting them out to tender. From a technical

perspective, the BSC adds little value to the quality of tender documents. During both the review by stakeholders in the client body and BSC evaluation, a standardised instrument to systematically assess tender document quality is not available.

One of the biggest challenges associated with assessing tender document quality in South Africa is getting appropriately skilled professionals involved in infrastructure procurement (Watermeyer and Phillips, 2020). The lack of capacity and competence to administer the tender process in public sector entities has been highlighted in a few studies (Ambe and Badenhorst-Weiss, 2012; Watermeyer and Phillips, 2020). Infrastructure procurement is usually handled by resources with administrative backgrounds who do not understand the complexities of infrastructure procurement. These resources then focus on procedural compliance as they do not have the skills to assess technical aspects (Watermeyer and Phillips, 2020).

Watermeyer and Phillips (2020) highlighted inappropriate procurement practices (which includes preparation of poor quality tender documents) as one of the reasons for poor outcomes on infrastructure projects. A document published by National Treasury in 2015 entitled the *Standard for Infrastructure Procurement and Delivery Management (SIPDM)* sought to address the issue of poor quality tender documents. The *SIPDM* made provision for the review of tender documents used to solicit tender offers, by registered professionals. However, *SIPDM* was withdrawn in 2019 in favour of a greatly simplified document, namely, *Framework for Infrastructure Delivery and Procurement Management (FIDPM)*. A similar recommendation to review procurement documents is contained in *ISO 10845*. However, these documents stop short of providing a detailed framework to examine the scope of work aspects of tender documents which incorporates production information prepared by design professionals. Production information relates to information passed from the professional team to the contractor that enables construction to be undertaken (e.g. drawings, specifications and bill of quantities).

Defining quality of tender documents

Quality is an obscure concept that is challenging to describe and explain (Parasuraman *et al.*, 1985). Garvin (1983) posits that the product-based approach of defining quality entails a precise measurement of variables to determine quality. Lehtinen and Lehtinen (1991) add that output (or product) quality is the consumer's evaluation of the product derived from the service production process. In the context of quality management, the International Organization for Standardization (ISO) defines quality as the "degree to which a set of inherent characteristics fulfils requirements" (ISO, 2015).

Various indicators or characteristics are important when assessing quality of tender documents such as completeness, accuracy, consistency, etc (Tilley *et al.*, 1999; Andi and Minato, 2003). Watermeyer (2018) provides an appropriate definition that considers the different indicators/characteristics that are applicable when assessing quality of tender documents in the construction industry. Watermeyer (2018) defined quality as "the totality of features and characteristics of a product or service that bears on the ability of the product or service to satisfy stated or implied needs". The characteristics (or indicators) that have a bearing on quality of tender documents are outlined further in this paper and have been used as the primary criteria to assess tender document quality.

Assessing quality of tender documents in the construction industry

A literature review was conducted to identify indicators of quality tender documents. Twelve peer reviewed journal papers and one conference paper was assessed as part of the literature review. The literature review culminated with a list of quality indicators that were examined using frequency analysis. Indicators that were cited more than twice were shortlisted as part of the final list that would be validated during the data collection process. Quality indicators

with a low frequency (less than two references) were examined for relevance and possible consolidation with other quality indicators.

Tilley *et al.* (1999) and Andi and Minato (2003) are two studies that provided quality indicators to specifically assess document quality. However, the studies did not propose a mechanism to assess tender document quality. The quality indicators in the studies were also not given any weightings. Similarly, most of the other studies that broadly assessed quality or performance, did not provide weightings for the different quality indicators. Weighting of quality indicators is an important part of assessing quality, as some indicators may have a higher influence on quality than others and should be weighted accordingly.

Although a comprehensive instrument has not been developed to assess tender document quality in the construction industry, there are several quality indicators in various studies that can be used to develop a framework to assess tender document quality. Some of the indicators appear to be important as they are mentioned in several studies. A summary of the quality indicators from the literature is provided in Table 1.

Table 1. Summary of indicators used to assess document quality in the construction industry

Indicator of quality	Description	References	Frequency
Accuracy	Documents that do not contain omissions and errors	Tilley *et al.* (1999), Samson and Parker (1994), Tang *et al.* (2003), Andi and Minato (2003), Abdul-Aziz and Ali (2004), Aluko *et al.* (2021)	6
Clarity	Documents that are easy to understand and not ambiguous	Tilley *et al.* (1999), Samson and Parker (1994), Tang *et al.* (2003), Andi and Minato (2003), Chow and Ng (2010), Tan (2012), Kärnä and Junnonen (2017), Aluko *et al.* (2021)	8
Completeness	Documents that contain all the necessary information for a contractor to execute the project	Tilley *et al.* (1999), Tang *et al.* (2003), Andi and Minato (2003), Chow and Ng (2010), Aluko *et al.* (2021)	5
Timeliness	Documents that are prepared and submitted timeously to relevant parties	Tilley *et al.* (1999), Samson and Parker (1994), Hoxley (2000), Andi and Minato (2003), Abdul-Aziz and Ali (2004), Cheng *et al.* (2006), Oluwatayo *et al.* (2014), Lam (2016), Aluko *et al.* (2021)	9
Relevancy	Documents that contain all the relevant information related to the project	Tilley *et al.* (1999), Andi and Minato (2003)	2
Consistency	Documents that are consistent and exhibits relevant co-ordination amongst different disciplines	Tilley *et al.* (1999), Andi and Minato (2003)	2
Standardisation	Standardisation of documents in accordance with client requirements. Drawings and specifications standardised to simplify the construction process	Tilley *et al.* (1999), Andi and Minato (2003)	2
Certainty	Documents that are not constantly revised by the professional team	Tilley *et al.* (1999), Andi and Minato (2003)	2
Conformity	Documents that conform with relevant regulations and standards	Tilley *et al.* (1999), Andi and Minato (2003)	2
Presentation	Documents that are neatly compiled and formatted	Hoxley (2000)	1

Figure 1 provides an illustration of the distribution of tender document quality indicators amongst the various research papers. The four highest cited indicators were timeliness, clarity, accuracy and completeness.

Research methodology

The research methodology adopted in this study contained three stages, namely: multi-investigator triangulation, a workshop of infrastructure experts and framework development and validation.

Stage 1: Multi-investigator triangulation

Multi-investigator triangulation was undertaken by authors of this paper on the different quality indicators extracted during the literature review. Multi-investigator triangulation entails using multiple analysts (or investigators) to review findings (Patton, 1999). Patton (1999) posited that triangulation is an important technique to enhance quality of analysis and validity in a study.

Patton (1999) further stated that the experience of researchers undertaking a study is also important for credibility and validity of the investigation. The authors of this paper that conducted the mutli-investigator triangulation possess extensive knowledge and experience in the tender procurement process, having been involved in both preparation and review of tender documents. The multi-investigator triangulation entailed a robust debate amongst the authors regarding relevance of the different quality indicators. Quality indicators with low frequency were specifically scrutinised to determine if they could be consolidated or removed (this is detailed further in this paper). A consolidated list of key quality indicators was produced following this stage.

Stage 2: Workshop of infrastructure experts

A workshop was conducted to confirm that key quality indicators identified during Stage 1 of the research design are relevant in practice. Ørngreen and Levinsen (2017) posited that a workshop is a form of participatory research that is designed to achieve the research objective whilst producing valid data.

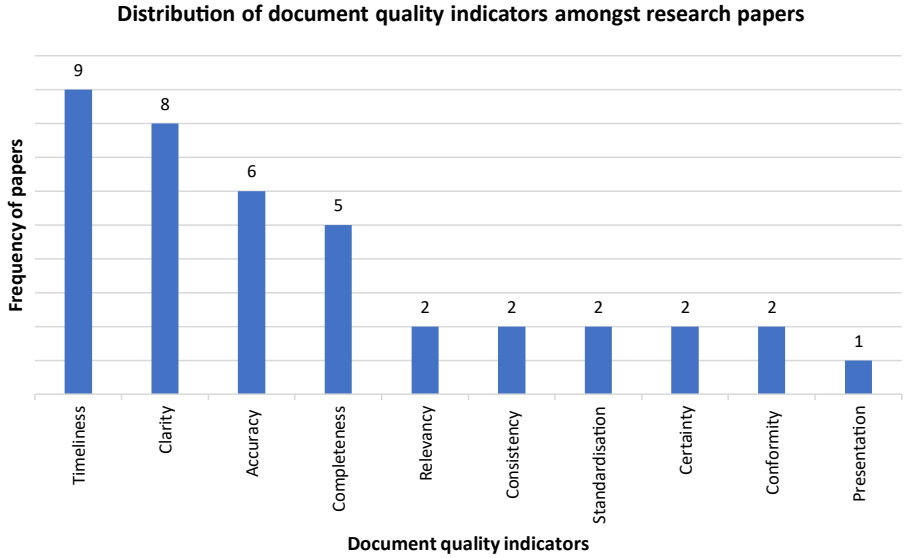

Figure 1. Distribution of document quality indicators

Participatory research involves developing research with partnerships between researchers and participants who share their lived experiences (Jagosh *et al.*, 2012). Cornwall and Jewkes (1995) asserted that participatory research differentiates itself from conventional methodologies by providing participants with more power during the research process. Some of the strengths of participatory research include flexibility, its iterative nature and ability to explore knowledge and perceptions of skilled people in the field (Cornwall and Jewkes, 1995). In this study, the consultative form of participatory research was undertaken whereby participants (i.e. infrastructure experts) were consulted by researchers before an intervention (i.e. a framework to assess tender document quality) was developed.

Workshops are typically aimed at gathering a group of participants sharing a "common domain" which is relevant to the topic being researched (Ørngreen and Levinsen, 2017). In this study, purposive sampling as described by Creswell (2013) was used to select participants. Infrastructure experts in the South African construction industry were identified to validate the key quality indicators (determined during Stage 1 of the study), provide insight on whether additional indicators were required and give guidance on weightings for the quality indicators. Infrastructure experts were chosen to participate in the study as they have appropriate experience to identify key indicators of tender document quality. Infrastructure experts had to satisfy the stringent criteria listed below before being considered for inclusion in the study:

(1) Hold a qualification in the built environment.

(2) Have a minimum of 40 years' experience in the construction industry.

(3) Be professionally registered with any of the built environment professional councils.

(4) Have extensive experience on construction projects including preparing or using construction tender documents.

Although Ørngreen and Levinsen (2017) mention that workshops usually contain a low number of participants, literature does not provide guidance on the actual number of participants required in a study. The number of participants in this study was guided by another form of participatory research, namely: focus groups. Morgan (1988, p. 43) asserted that between four and twelve participants are adequate for a focus group to produce valid results. On the other hand, Blackburn and Stokes (2000) mentioned that managing more than eight participants is difficult. The maximum range of participants based on the two papers is between eight and twelve. Therefore, a total number of ten participants were selected for this study.

Data collection during the workshop was conducted using focused interviews with participants. Bryman and Bell (2011) asserted that focused interviews can be administered to individuals or groups. In this study, focused interviews were administered to individuals that formed part of the workshop. Bryman and Bell (2011) further asserted that focused interviews are well suited to elicit information from participants that have expertise or knowledge on a particular topic. The focused interviews contained a combination of open ended and closed questions that provided both quantitative and qualitative data.

Data collection and analysis

A questionnaire in the form of an Excel spreadsheet was used to facilitate the focused interviews. Participants were requested to weight key quality indicators using the Excel spreadsheet. To minimise bias that may have resulted from shortlisting key quality indicators, participants were given an opportunity to propose additional quality indicators with their respective weightings if they felt any were omitted. Participants were advised that the sum of the weightings of all quality indicators had to equal 100%. Participants were also advised that quality indicators that were perceived to have more importance should be given a higher weighting, while those indicators with lesser importance should be given a lower

weighting. Participants that wanted to provide additional commentary on the different indicators submitted this input in a narrative format. This input was collated and is presented further in this paper. The feedback from the questionnaires culminated in a final list of key quality indicators that formed the basis of the framework to assess tender document quality.

Data collected from participants included weightings of the various key quality indicators. The following equation was used to determine the average weighting for each indicator:

$$\text{Average } IW_X\ (\%) = \frac{n_1 IW_X + n_2 IW_X \ldots n_j IW_X}{n_j} \quad (1)$$

Where n_1 to n_j are participants in the study and IW_X is the percentage weighting for the quality indicator under consideration. The weightings were used to understand the level of importance of quality indicators by participants in the study.

Stage 3: Framework Development and validation

The third stage of the methodology entailed development and validation of the framework. Results from the workshop were analysed and used to develop a draft framework to assess tender document quality. Thereafter, the draft framework was circulated to participants in the workshop for further feedback and improvement before finalisation. The framework validation is part of the iterative process that is synonymous with participatory research (Cornwall and Jewkes, 1995). However, only two of the participants from the workshop provided comments during the validation stage. This was not a major concern as Tongco (2007) asserted that there is no defined number of participants required to validate a framework. The important part of the validation process is to ensure that participants responsible for validation can provide credible feedback (Tongco, 2007).

Shortlisted indicators of tender document quality

Indicators for document quality identified from the construction literature were evaluated for similarity and their propensity to significantly influence the construction process. Since the quality indicators will ultimately be used by stakeholders in the construction industry and researchers to assess tender document quality, there was a need to condense the indicators where overlap existed and to ensure ease of understanding.

Following robust debate amongst authors of this paper, three indicators namely: presentation, consistency and conformity were consolidated or removed from the final list of key quality indicators. The rationale for consolidating or removing the three indicators were as follows: Firstly, presentation of tender documents should not have a substantial effect on the construction process and final construction output by a contractor therefore it was removed. Secondly, consistency can be consolidated with accuracy (i.e. if documents are inconsistent they cannot be accurate). Lastly, conformity was combined with relevance (i.e. for documents to be relevant they need to conform with certain project and regulatory standards).

Following discussions amongst the authors of this paper, seven key indicators of document quality made the final shortlist for further investigation during the workshop of infrastructure experts. A description of the seven key quality indicators is provided in Table 2.

Analysis of data

The background of the participants in the study is provided in Table 3.

Feedback from the participants is provided in Table 4. All participants provided weightings for the key quality indicators. However, two participants (P01 and P10 both civil engineers) mentioned that weightings would vary according to the task and priorities related

Table 2.
Description of seven key quality indicators

Quality indicator	Description
Accuracy	Production information and project documents that lack errors and omissions
Clarity	The ability of production information and project documents to effectively convey design and project specifics
Completeness	Production information and project documents that contain all relevant information to execute the project
Timeliness	Production information and project documents that are completed in accordance with durations provided in the project schedule
Standardisation	Utilising standardised production information and project documents and aligning all formatting
Relevance	Production information and project documents that are applicable to the project
Certainty	Production information and project documents that does not continuously change

Table 3.
Background of workshop participants

Participant	Position	Years of experience	Qualification	Professional registration
P01	Civil Engineer	50	BScEng (Hons), GDE, MBA	PrEng
P02	Civil Engineer	45	BSc Civil Engineering	PrEng PrCPM
P03	Structural Engineer	40	BScEng DEng	PrEng PrCPM PrCM CEng
P04	Electrical Engineer	49	BScEng (Electrical)	PrEng
P05	Electrical Engineer	45	BSc BEng	PrEng
P06	Structural Engineer	50	BScEng (Civil) MScEng	PrEng
P07	Civil Engineer	51	PhD	PrEng
P08	Mechanical Engineer	48	BScEng (Mech) MScEng (Mech)	PrEng PrCPM
P09	Architect	40	BArch	PrArch
P10	Civil Engineer	48	BSc (Civil Engineering) MSc (Bridge Engineering)	PrEng

to the project. This was important in the context of the framework development as it highlighted that the framework needed to be dynamic to adjust to a specific project.

Only three participants (P04, P05 and P07 – two of them being electrical engineers) weighted one indicator as being most important. The rest of the participants jointly weighted several indicators as most important. This highlights the relevance of the various key quality indicators identified from the first stage of the study. Four participants (P03, P06, P08 and P09) mentioned that all the indicators were of critical importance to provide quality construction tender documents, despite giving them slightly varied weightings. On a similar note, another participant (P10) mentioned that they had difficulty weighting some of the criteria as various indicators were important, with a few of them being "deal breakers".

The general consensus amongst participants was that several indicators were important. This was evident by numerous participants (P01, P02, P03, P06, P08, P09 and P10) providing more than one indicator with the highest weighting. The only item that was not weighted highest by at least one participant was "Standardisation of production information and project documents". Six participants (P02, P03, P06, P07, P08 and P09 – from the civil engineering, structural engineering, mechanical engineering and architectural disciplines) all weighted it as the most insignificant indicator. This shows consensus amongst various

Table 4. Feedback received from workshop of infrastructure experts

Participant	Indicators of document quality							Additional indicators	Total
	Accuracy of production information and project documents	Clarity of production information and project documents	Completeness of production information and project documents	Timely production and delivery of production information and project documents	Standardisation of production information and project documents	Provision of relevant technical information in production information and project documents	Certainty of production information and project documents		
P01	20.0%	20.0%	10.0%	5.0%	10.0%	20.0%	15.0%	N/A	100.0%
P02	20.0%	15.0%	12.5%	10.0%	7.5%	15.0%	20.0%	N/A	100.0%
P03	15.0%	15.0%	10.0%	10.0%	10.0%	20.0%	20.0%	N/A	100.0%
								Compliance of drawings and documents to local standards	
P04	15.0%	12.0%	10.0%	22.0%	16.0%	7.0%	8.0%	10.0%	100.0%
P05	20.0%	10.0%	10.0%	25.0%	20.0%	10.0%	5.0%	N/A	100.0%
P06	25.0%	25.0%	25.0%	5.0%	5.0%	10.0%	5.0%	N/A	100.0%
P07	13.0%	12.0%	14.0%	17.0%	12.0%	18.0%	14.0%	N/A	100.0%
P08	15.0%	15.0%	15.0%	15.0%	10.0%	15.0%	15.0%	N/A	100.0%
								Accuracy of services coordination	
P09	10.0%	10.0%	10.0%	15.0%	10.0%	15.0%	15.0%	15.0%	100.0%
P10	20.0%	20.0%	20.0%	0.0%	5.0%	20.0%	15.0%	N/A	100.0%
Average	17.3%	15.4%	13.7%	12.4%	10.6%	15.0%	13.2%		
Rank	1	2	4	6	7	3	5		

disciplines that "Standardisation of production information and project documents" is not an important quality indicator.

Based on the average weightings provided, "Accuracy of production information and project documents", "Clarity of production information and project documents" and "Provision of relevant technical information in production information and project documents", were the top three weighted quality indicators, respectively. Their average weightings ranged from 15 to 17.3%. Several of the participants (P01, P02, P03, P06, P07, P08, P09 and P10) across the disciplines assigned the highest weighting to either of the three indicators. This highlights the varying opinions amongst participants about the most important indicators.

"Completeness of production information and project documents" and "Certainty of production information and project documents" were two of the indicators with mid-level importance. Three participants (P06 structural engineer, P08 mechanical engineer and P10 civil engineer) weighted "completeness of production information and project documents" as the most important indicator. "Certainty of production information and project documents" was given the highest weighting by four participants (P02, P03, P08 and P09) while two participants (P04 and P05 – both electrical engineers) weighted it lowest.

Two of the participants (P04 and P05 – both electrical engineers) weighted "Timely production and delivery of production information and project documents" as the most important indicator. This was probably due to the importance of timely issue of information in the electrical engineering discipline. On the other hand, four participants (P01, P03, P06 and P10 – civil and structural engineers) weighted it as the lowest indicator. One of the participants (P10) was concerned that "Timely production and delivery of production information and project documents" should not be considered as a quality indicator.

Only two participants (P04 and P09) provided additional quality indicators that needed to be considered, namely: "Compliance of drawings and documents to local standards" and "Accuracy of Services Coordination". Coordination can be assessed as part of clarity and accuracy of documents (i.e. if services are well coordinated, documents will be clear and accurate). Compliance with local standards can be assessed as part of relevance (i.e. documents that are fully relevant will comply with the local standards, regulations, etc.).

Following analysis of feedback from participants, a final list of key quality indicators was developed for inclusion in the framework to evaluate tender document quality. The relative importance of the key quality indicators was based on the average weightings given by participants in the study. The key quality indicators are provided below:

(1) Accuracy

(2) Clarity

(3) Completeness

(4) Relevance

(5) Standardisation

(6) Certainty

The only quality indicator that was removed from the original list following feedback from participants, was "timeliness". It is evident that timeliness is not necessarily an indicator of quality but rather an indicator of performance. As one participant mentioned, a product delivered late can still be of superior quality to a product delivered on time. The rest of the quality indicators that were discussed with participants were all suitable for inclusion in the framework to assess tender document quality.

Framework to assess tender document quality in the construction industry

The concept of tender documents was not unbundled into separate components. Instead, they were examined holistically as production information (e.g. drawings, BoQs and specifications) and other project documents. The authors of this paper recognise that different document files (e.g. drawings, BoQs and specifications) make up a tender document. However, the same set of key quality indicators will apply to all documentation when assessing their quality.

A flowchart illustrating the framework to assess tender document quality in the construction industry is shown in Figure 2.

(1) Phase 1: Adjust weightings for quality indicators according to project priorities

The following quality indicators will be used to assess quality of tender documents:

- Accuracy of production information and project documents
- Clarity of production information and project documents
- Provision of relevant technical information in production information and project documents
- Completeness of production information and project documents
- Certainty of production information and project documents
- Standardisation of production information and project documents

Prior to assessing the various quality indicators, weightings for each indicator should be adjusted according to the level of importance of indicators based on project priorities. The indicators should be weighted relative to each other and equal 100% when added together. A

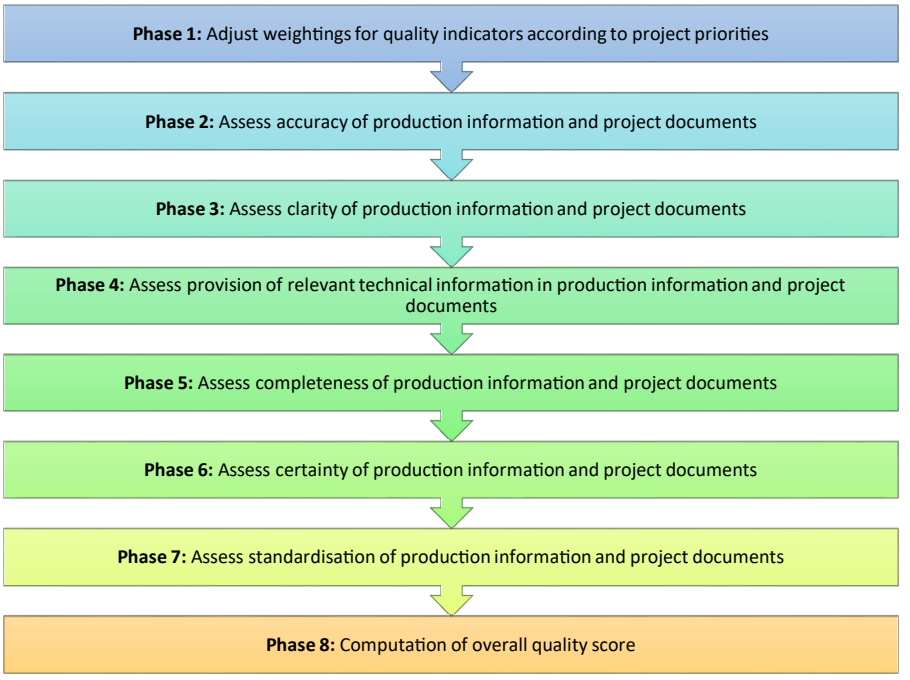

Figure 2. Framework to assess tender document quality in the construction industry

guideline on weightings for each indicator can be obtained using feedback from the construction industry experts if required (see average weightings in Table 4). The quality indicators described above should be the only indicators used to assess tender document quality. By using the indicators above, a standardised instrument for assessing tender document quality can be established. The quality indicators and weighting thereof form the basis of the framework to assess tender document quality.

(2) Phase 2: Assess accuracy of production information and project documents

The subsequent phases of the framework entail consumers of tender documents rating different quality indicators on a scale between 1 and 5. The ratings are defined as follows: 1 = very poor; 2 = poor; 3 = fair; 4 = good and 5 = excellent.

Accuracy of production information and project documents is the first quality indicator that will be assessed. The assessment of this indicator pertains to whether production information and project documents in the tender are free of errors or omissions. Tender documents that have a high level of accuracy should be given a score of 5.

(3) Phase 3: Assess clarity of production information and project documents

The next phase includes assessing clarity of production information and project documents. This entails reviewing production information and project documents to determine whether they are clear and unambiguous when communicating the project and design intent to the user of those documents. Tender documents with a high level of clarity should be given a score of 5.

(4) Phase 4: Assess provision of relevant technical information in production information and project documents

Phase 4 entails assessing whether relevant technical information was provided in production information and project documents. Provision of all the relevant technical information will enable a contractor to construct infrastructure without having to repeatedly engage the professional team for further information. Tender documents that contain all the relevant technical information should be given a score of 5.

(5) Phase 5: Assess completeness of production information and project documents

Phase 5 includes assessing production information and project documents to ensure they are complete and have not omitted any critical information that will impede a contractor from executing their duties. Tender documents that contain all the relevant information should be given a score of 5.

(6) Phase 6: Assess certainty of production information and project documents

Phase 6 entails assessing whether the information contained in production information and project documents were continuously changed by the professional team. Tender documents with a high level of certainty would not need to be changed by the professional team and should be given a score of 5.

(7) Phase 7: Assess standardisation of production information and project documents

Phase 7 involves assessing whether technical solutions in production information and project documents were standardised to simplify the construction process. Standardisation also encompasses documents being prepared in accordance with the client's procurement and technical standards. Tender documents that are standardised as far as reasonably possible should be given a score of 5.

(8) Phase 8: Computation of overall quality score

Once an assessment of all quality indicators has been undertaken, the overall quality score must be computed. A basic equation has been developed below to determine the overall quality score. The equation takes into consideration the weightings and scores obtained for different quality indicators under evaluation. The equation is described as follows:

$$Q = W_{C1}X_1 + W_{C2}Y_1 + W_{C3}X_2 + W_{C4}Y_2 + \ldots W_{Cn}X_n + W_{Cn}Y_n \quad (2)$$

Where Q = Total quality score between 1 and 5;

$X_{1 \ldots n}$ = Key quality indicator for production information;

$Y_{1 \ldots n}$ = Key quality indicator for project documentation; and

$W_{C1 \ldots n}$ = Weighting constants where $\sum_{i=1}^{n} W_{Ci} = 1$.

The overall quality score will range between 1 and 5, where 5 represents "excellent quality", 4 represents "good quality", 3 represents "fair quality", 2 represents "poor quality" and 1 represents "very poor quality".

Validation of framework

Two participants from the workshop were involved in validating the framework. Both participants mentioned that the framework was adequate to assess quality of tender documents, however the following suggestions were provided:

(1) The quality assessment in the framework should be carried out by professionally registered/competent stakeholders in the construction industry who understand the level of information required in tender documents. This will ensure that a credible assessment of tender document quality is provided.

(2) The framework is suited to a "Design by Employer" contracting strategy where most of the production information is provided upfront in the tender document. This is a limitation of the framework.

Discussion

Studies in the construction literature do not provide any guidance on how to assess quality of tender documents prepared by built environment professionals. Most of the literature focuses on assessing service quality (Samson and Parker, 1994; Hoxley, 2000; Siu *et al.*, 2001; Arditi and Lee, 2003; Awolesi and Ayedun, 2012; Prakash and Phadtare, 2018) or performance (Tang *et al.*, 2003; Abdul-Aziz and Ali, 2004; Ng and Chow, 2004; Chow and Ng, 2010; Lam, 2016; Kärnä and Junnonen, 2017) of professionals. A few papers identified indicators of quality documentation (e.g. Tilley *et al.*, 1999; Andi and Minato, 2003; Aluko *et al.*, 2021) however, they did not go further and explain how quality of tender documents should be assessed. Similarly, in the South African construction industry, the *SIPDM* fell short of providing a detailed assessment of how tender document quality should be assessed. Therefore, the purpose of this paper was to develop a framework to assess tender document quality in the construction industry.

A workshop was used to allow participants to weight key quality indicators obtained from the construction literature, according to level of importance. Several participants mentioned that all the proposed key quality indicators were important. This was consistent with studies by Tilley *et al.* (1999) and Andi and Minato (2003). Despite asserting that all the indicators were important, participants weighted the key quality indicators with minor variances between them. Only two participants felt that the proposed key quality indicators were incomplete and

proposed two additional indicators. However, the proposed additional indicators were extensions of the key quality indicators presented to participants. This confirms that the literature search yielded relevant key quality indicators which were subsequently validated by participants. A few participants indicated that the weighting of the indicators would be dependent on the project being implemented. This reinforced the need for a flexible framework to be developed. There was no consensus among participants regarding the most important indicator. However, the only indicator that was not weighted the highest by at least one participant was "Standardisation of production information and project documents". "Standardisation of production information and project documents" was only mentioned as being an indicator of quality in two studies (Tilley *et al.*, 1999; Andi and Minato, 2003). Therefore, it was not surprising that none of the participants weighted it highly. Various studies asserted that timeliness could be used as an indicator of tender document quality (Tilley *et al.*, 1999; Samson and Parker, 1994; Hoxley, 2000; Andi and Minato, 2003; Abdul-Aziz and Ali, 2004; Cheng *et al.*, 2006; Oluwatayo *et al.*, 2014; Lam, 2016; Aluko *et al.*, 2021). However, this was rejected during the workshop as "timeliness" was deemed to be an indicator of performance rather than quality. "Timeliness" was not included as an indicator in the framework.

Participants in the workshop were infrastructure experts with over 40 years' experience in the construction industry. This greatly improved validity of the workshop as those providing input were highly experienced and knowledgeable. Although the data collection was limited to South Africa, it is likely that results will be consistent with construction industries in other parts of the world. Especially since quality is a universal concept and the relevance of quality indicators should not be specific to a particular geographic region.

The key quality indicators identified during the workshop provided a set of parameters that were used to develop a framework to assess tender document quality. The framework is dynamic and allows weightings to be adjusted on a project-by-project basis. Although validation was only conducted by two participants, this was not a concern as Tongco (2007) asserted that the number of participants required for validation is not defined. The validation process highlighted that the framework was adequate to assess tender document quality. However, one of the validating participants mentioned that users of the framework should ideally be professionally registered/competent stakeholders in the construction industry, to ensure that the score and outcome of the quality assessment is accurate. This is important for academics using the framework in future studies, as they will need to ensure that quality assessments are completed by professionally registered/competent persons. Another participant mentioned that the framework in its current form may be more suited to a "Design by Employer" contracting strategy, where most of the production information is included upfront in the tender document. Other contracting strategies (e.g. turnkey) where limited upfront production information is provided may result in a lower quality score. This important observation has been highlighted in the limitations of the study.

The framework allows researchers and industry practitioners to develop a quantifiable score for tender document quality that can be used for benchmarking and comparison across a range of projects. Previous studies criticising quality of tender documents failed to measure quality (Tilley *et al.*, 1999; Andi and Minato, 2003). The framework developed in this paper can be used as an ongoing instrument to monitor quality of tender documents and identify aspects where tender document quality can be improved. This is an aspect that is currently not addressed in ISO 10845 or any of the South African procurement frameworks (i.e. *SIPDM* or *FIDPM*).

The framework can be improved in future research by identifying specific weightings for each quality indicator based on the type of project being executed (e.g. buildings, civils, roads, etc.). Another area of future research includes extending the framework to allow its use on projects with different contracting strategies (e.g. turnkey).

Conclusion

Various approaches were described in the construction literature to assess quality of services and performance. However, a comprehensive approach to assess tender document quality has not been developed. Similarly, in practice, a coherent or standardised framework was not available in the construction industry to assess quality of tender documents. Therefore, this paper proposed a framework to assess tender document quality. A workshop with experts in the South African construction industry was used to identify key indicators of tender document quality and their relative importance. The key quality indicators were developed into a framework that produces a quantitative assessment of tender document quality using different quality indicators as parameters for assessment. This paper contributes to knowledge by providing a comprehensive framework for researchers and industry practitioners to assess tender document quality. The framework enables measurement and benchmarking of tender document quality which can be used in future, to monitor and improve quality of tender documents.

Limitations of this framework

The framework is limited to the assessment of tender document quality in the construction industry and is suited to a "Design by Employer" contracting strategy.

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