ON SITE QUALITY ASSESSMENT OF BUILDING PROJECTS IN KHARTOUM, SUDAN

Yasir Mohamed Hassan Amin[1]and Bachan Singh[2]

[1] Murtada Maaz Consultancy Company, Obied Khatim Street, Khartoum, Sudan.
yasseramin_06@yahoo.com

[2] Faculty of Civil Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia

مُسْتَخْلَص

تم التركيز على قضايا جودة المباني في صناعة التشييد بغض النظر عن المشاكل المتعلقة بالتكلفة والوقت .هناك العديد من الخلافات التي تحدث بين الملاك والمقاولين في مشاريع التشييد في السودان .يعد مستوى الجودة للأعمال المنجزة من أهم الأسباب التي تؤدي إلى نزاع بين الأطراف .الهدف من هذه الدراسة هو تقييم مستوى جودة مشاريع التشييد في السودان .تركز هذه الدراسة على بناء المشاريع التي تنفيذها في منطقة الخرطوم ، السودان .ووزع ما مجموعه 80 استبيانا وتمت الإجابة على 50 استبيانا .يتم تحليل البيانات باستخدام متوسط الفهرس .وقد وجد أن هناك العديد من الطرق لتقييم مستوى الجودة في مشاريع البناء وهي CONQUAS و QLASSIC و PASS. ومع ذلك ، في السودان لا يوجد معيار للمواصفات و يتم الإعتماد على خبرات الشركات

ABSTRACT

The issues of the quality of the building has been given emphasis in the construction industry apart from the problems related to cost and time. There are many disputes occurring between owners and contractors in the construction project in Sudan. Level of quality for completed works is one of the most important reasons that leads to dispute between parties. The aim of this study is to assess the level of quality of construction projects in Sudan. This study focus on building projects carried out within the area of Khartoum, Sudan. A total of 80 questionnaires were distributed to the respondents and 50 questionnaires were returned answered. The data is analyzed using Average Index. It was found that there are many ways to assess level of quality in construction projects namely by CONQUAS, QLASSIC and PASS. However, in Sudan there is no standard for the specification and it depends mainly on the companies' experience.

Keywords: CONQUAS, QLASSIC, PASS, Quality Assessment

1 Introduction

Construction in Sudan is very old industry and its current practice is historically imported from Egypt, Turkey and England during the English colonization. In the early period significant owners would hire directly all construction labor and purchase all materials from supplies, to carry out the work under the on-site supervision of a master mason. This tradition of construction work with "own forces" continues till now in Sudan, but it represents an insignificant share of the overall construction activity. Recently, the owner retains an independent professional, such as consultant engineer, to prepare design and supervise according to his requirements.

According to Project Management Institute the quality is a degree to which the product or project or service fulfill the requirement. Also, quality is defined as a measure of excellence or a state of being free from defects, deficiencies and significant variations [1] (PMBOK,2013). Project Quality Management (PQM) includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken [1] (PMBOK,2013) The PQM uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization.

Different quality assessment systems are being used in the world for the construction industry to increase satisfaction of residents and quality. These systems also determine the standards for construction.

1.1 Aims and Objectives

The aim of this study is to assess methods for assessing quality levels in construction projects in Sudan. To attain this aim, the following objectives of the study are undertaken:

1. To study the various method of quality assessment of projects on site.
2. To assess the perception of parties, concern on the level of quality of construction projects in Sudan.
3. To identify the factors that influence the quality of construction projects in Sudan.
4. To evaluate the level of understanding of parties regarding the quality assessment method.

The substantial increase in quality problems in construction projects in Sudan has brought a lot of dispute between the clients and contractors and also a loss of confidence between them. Therefore, there is a need to eliminate the dispute and also to assist the contractors to do the work the right way from the first time.

1.2 Problem statement:

There are many disputes occurring between owners and contractors in the construction project in Sudan. Level of quality for completed works is one of the most important reasons that lead to dispute between parties. As mentioned earlier, there is a head to head competition between construction companies which makes them not to focus on the level of quality and rather on time, cost and etc. Quality may sometimes be ignored in construction projects in Sudan to cut the costs or to shorten the project time.

One of the major causes of quality problem in Sudan is shortage of qualified and experienced human resources among contractors. Generally, lack of capacity among contractors lead to quality shortfalls and consequently cost escalation as well as schedule overruns. Lack of capacity among contractors appears not to be unique to the Sudanese construction industry, but could also be affecting other countries worldwide, especially those in the developing world.

Unfortunately, in Sudan there is no quality assessment system. The absence of the evaluation system and standards in the construction industry is one of the key problems because systematic evaluation works to the benefit of all who use buildings or are otherwise involved in their creation and operation. Due to the absence of the evaluation system, quality of buildings is not measured and it is not clear that whether occupants are satisfied with their houses or not. Thus, a standard quality level in a construction project is not attained. Implementation of the quality assessment system is very difficult because it is known as in the construction industry, factors such as change, customer demands, competitive pressure and cost affect an organization's ability to understand the client's requirements and meet first time, at minimum cost and high quality. So we need to change culture of quality management system in Sudan.

1.3 Literature review

1.3.1 Factors affecting quality performance of construction industry

In order to address quality related issues, a number of studies have been conducted in different countries. [2] Chua et al. (1999) have developed a hierarchical model for construction project success for different project objectives. For quality objectives, they find that it is influenced by four main project aspects, namely, project characteristics, contractual arrangements, project participants, and interactive processes. [3]Arditi & Gunaydin (1998) find that management commitment to continuous quality improvement, management leadership in promoting high process quality; quality training of all personnel; efficient teamwork to promote quality issues at the corporate level; and effective cooperation between parties taking part in the project are generic factors that affect process quality. **[4]**Pheng (2004)، through case studies, has shown that total quality

management (a successful management philosophy in the manufacturing and service industry) could be replicated in the construction industry with similar benefits. The benefits may be in terms of reduction in quality costs, and better employee job satisfaction. [5] Abdel-Razek (1998) has studied the quality improvement methodology and finds that 'improvement of employee satisfaction' is the most important area in contributing quality improvement in Egypt. [6] Ledbetter (1994) has developed a quality performance management system (QPMS) that tracks labor costs in three main categories: normal work, quality management work (prevention and appraisal)، and rework (deviation correction). He has assumed the cost of quality to be the sum total of quality management and rework. He finds QPMS to be useful in promoting awareness and improving the understanding of the quality process in addition to facilitating communication, reducing the overall cost of quality, and directing the management to the areas where quality improvements could be made.

1.3.2 Quality assessment in construction

Building evaluation is defined as 'the systematic assessment of building performance relative to defined objectives and requirements.' [7] (Ho 1999) An effective quality assessment system should be able to detect and measure all types of defects and capture all aspects of construction quality that affect the performance of buildings. The quality assessment can be carried out by measuring the constructed works against workmanship standards and specifications. Such measurements have to be comprehensive, straightforward, consistent and effective. Comprehensive quality standards alone do not assure the effectiveness of the quality assessment system. The integrity of the tests and inspection methods are as important as the quality standards. Such measurements without proper and accurate tests and detection methods, defects cannot be detected. Each building material, component, and assembly should be examined with regards to its quality, compatibility, and interactions with its adjacent materials and components. Thus to effectively ensure conformance of quality of the entire system, quality assessment tools should be employed.

CONQUAS: The short form of the Construction Quality Assessment System is CONQUAS, it was introduced by the Building and Construction Authority [8](BCA, 2014). The BCAis developed by the Singapore government, this agency is classified under the Singapore's Ministry of National Development. The main objective of CONQUAS is assessing the quality of construction works to ensure the quality of the project fulfill the quality standard. Besides, it also enables the assessment of quality can be carried out within reasonable cost and time systematically.

QLASSIC: Quality Assessment System in Construction (QLASSIC) is an independent method to measure and evaluate the quality of workmanship and finishes of construction works based on approved standards. This [9] Construction Industry Standard (CIS:2006) was managed and developed by the Construction Industry Development Board Malaysia with the assistance of the Technical Committee on Quality Assessment System for Building Construction Work. QLASSIC enables the quality of workmanship between construction projects to be objectively compared through a sampling and statistical approach.

PASS: the short from Performance Assessment Scoring Scheme was introduced by the Hong Kong Housing Authority to improve the level of quality management. The PASS assessments are conducted through site inspections, desk-top assessments and record checks by relevant Project Team (PT) members and PASS Assessment Team (PAT).

2 Research Methodology

2.1 Data collection

The data has been collected by using online questionnaire (survey monkey) As shown in table 2 this questionnaire delivered to 80 responded and the respondents are the consultants, contractors and project managers.

Average Index:

The data was studied and analyzed using Microsoft Excel for Microsoft Professional Windows 8. The analysis of the data from the received feedback from the questionnaire gives average index calculation. This index **was** calculated as follows

Average Index Formula:

$$\boldsymbol{Average\ Index\ (AI)} = \frac{\sum \boldsymbol{ai} * \boldsymbol{Xi})}{\sum \boldsymbol{Xi}}$$

Where: ai: constant which represent the weight of the "i ".

Xi: the variable of represent the frequency of the represent "i ".

i = 1, 2, 3, 4, 5 …

Table 1 Rating scale of Average Index

Average Index	Rating scale
1.00 ≤ Average Index < 1.50	Very poor
1.50 ≤ Average Index < 2.50	Poor
2.50 ≤ Average Index < 3.50	Fair
3.50 ≤ Average Index < 4.50	Good
4.50 ≤ Average Index ≤ 5.0	Very good

3 Data analysis:

This study has focused on the assessment and method of improvement of building projects in Khartoum, Sudan. Questionnaire was design online and the data collected were analyzed to achieve the objectives of this projects. Therefore, the following results were found in relation to the selected objectives for the study.

Table 2: Detailed of administered questionnaire

Questionnaires	Quantity	Percentage %
Delivered	80	
Responded	50	62.50%
No Response	30	37.50%
Total		100%

Table 3: Level of experience of the respondent

Level of experience	Frequency	Percentage (%)
less than 5 years	14	28%
5-10 years	25	50%
10-15 years	4	8%
more than 15 years	7	14%

As shown in Table 3, the majority of the respondent have experience more than 5 years, which is good to make sure the results are more accurate.

3.1 To assess level of quality for elements of building projects in Sudan

Table 4 shows the level of quality of elements from the respondent's point of view. It was divided in to three categories which are the; Structural works, Mechanical & Electrical works and Finishing works

3.2 To investigate the factors affecting quality of building projects in Sudan

Table 5 show that the factors affecting quality of building projects. The factors divided into six main factors which are; Design factors, financial factors, Materials factors, labors factors, Management factors and other factors.

3.3 To assess level of understanding of parties regarding quality assessment methods

Table 6 show that the level of understanding regarding traditional methods of assessing the quality and also modern methods. The following results were obtained from the respondents of the questionnaire.

Table 4: level of quality for the elements

No	Elements	Scale					Average index
		1	2	3	4	5	
Structural works							
1	foundation	4	9	11	22	4	3.26
2	columns	2	7	16	22	3	3.34
3	slabs	3	7	13	25	2	3.32
4	staircases	3	18	15	12	2	2.84
Mechanical and Electrical works							
5	Air conditioning	5	14	22	8	1	2.72
6	Electric installation	4	15	17	14	0	2.82
7	Plumbing	11	15	15	9	0	2.44
Finishing works							
8	Brick works	1	14	16	18	1	3.08
9	plastering	5	18	14	12	1	2.72
10	Floor finishes	3	11	20	14	2	3.02
11	Wall finishes	2	12	20	14	2	3.04
12	External wall finishes	2	13	19	16	0	2.98
13	Ceiling finishes	3	13	18	14	2	2.98
14	windows	4	14	18	12	2	2.88

Poor	Fair	Good

Table 5: Factors affecting quality in building projects

No	Factors	Scale					Average index
		1	2	3	4	5	
Design factors							
1	Location of project	6	9	16	15	4	3.04
2	Consistency of design drawing	3	6	13	20	8	3.48
3	Specifications	1	3	6	18	22	4.14
4	Bill of quantity detailed and accurate	1	3	13	15	18	3.92
Financial factors							
5	Funding	0	4	8	21	17	4.02
6	Financial capability of contractor	0	8	8	19	15	3.82
7	Delay of interim payment	1	8	15	19	7	3.46
Material factors							
8	Quality of materials	1	3	5	18	23	4.18
9	Escalation of materials price	0	5	10	17	18	3.96
10	Shortage of materials	2	11	9	17	11	3.48
Labors factors							
11	Level of experience of labors	2	5	6	14	23	4.02
12	Income level of labors	4	9	10	17	10	3.40
13	Custom and traditions in Sudan	5	10	11	15	9	3.26
Management factors							
14	Communication between contractor and consultant	3	13	9	8	17	3.46
15	Communication between contractor staff	1	12	13	10	14	3.48
16	Communication between consultant staff	2	10	14	13	11	3.42
17	Communication between contractor and subcontractor	1	5	11	18	15	3.82
18	Communication between contractor and supplier	2	6	12	15	15	3.70
19	Lack of knowledge in contractor staff	2	5	4	18	21	4.02
20	Testing of final project	1	4	5	17	23	4.14
21	Using of time management	2	15	7	11	15	3.44
22	Using of cost control system	3	10	11	14	12	3.44
Other factors							
23	Fraudulent practice	1	9	16	14	10	3.46
24	Government policy	3	9	13	15	10	3.40
25	Inflation	2	5	12	12	19	3.82

Table 6: Methods of measuring quality in building projects

No	Method of assessing quality	Scale					Average index
		1	**2**	**3**	**4**	**5**	
1	visual	1	4	7	26	12	3.88
2	specification	1	1	2	23	23	4.32
3	CONQUAS	12	18	6	12	2	2.48
4	QLASSIC	10	19	10	10	1	2.46
5	PASS	8	16	9	15	2	2.74

4 Conclusion:

Objective 1: The various method of quality assessment of projects

The above objective of the project has been achieved through the literature review, from the study, it was found that there are many ways to assess level of quality in construction projects:

- According to specification: in Sudan there is no standard for the specification and it depends mainly on the consultant companies, so in Sudan there is big variation in the level of quality between building projects.
- CONQUAS: The short form of the Construction Quality Assessment System is CONQUAS, it was introduced by the Building and Construction Authority (BCA). The Building and Construction Authority (BCA) is developed by the Singapore government, the main objective of CONQUAS is assessing the quality of construction works to ensure the quality of the project fulfill the quality standard.
- QLASSIC: Quality Assessment System in Construction (QLASSIC) is a method to measure the quality of workmanship of a construction work based on the approved standards. It was introduced by QLASSIC enables the quality of workmanship between construction projects to be objectively compared.
- PASS: the short from Performance Assessment Scoring Scheme is PASS, it was introduced by the Hong Kong Housing Authority in order to improve the level of quality management.

Objective 2: The assessment by perception on the level of quality of construction projects in Sudan.

From finding it was found that:

- The level of quality for structural, mechanical & electrical and finishing works in building projects in Sudan is consider at neutral level of quality
- The level of quality for plumbing works is consider poor.

Objective 3: The factors that influence the quality of construction projects in Sudan

The third objective of the study have been achieved by analyzing the questionnaire. From the study the main factors that affect the quality in building projects are design, financial, materials, labors and management factors

- Critical design factors: Specifications and Bill of quantity detailed and accurate.
- Critical financial factors: Financial capability of contractor and Funding.
- Critical materials factors: Quality of materials and Escalation of materials price.
- Critical labors factors: Level of experience of labors.
- Critical management factors: Communication between contractor and subcontractor, Communication between contractor and supplier, Lack of knowledge in contractor staff and Testing of final project.

Objective 4: The level of understanding of parties regarding the quality assessment method

From the study, it was found that the respondents are understand the assessment according to specifications and visually. The respondents are not understanding the assessment according to CONQUAS and QLASSIC and that because lack of knowledge in Sudan and the level of understanding regarding modern quality assessment system is not good at all.

References

[1] A Guide to The Project Management Body of Knowledge - Fifth Edition (2013)

[2] Chua, D.K, Kog, Y.C, and loh, P.K (1999) Critical success factors for different project objectives.

[3] [Arditi, D. & Gunaydin, H. M. (1998) Factors that affect process quality in the life cycle of building projects.

[4] Pheng, L. S. (2004) Implementing total quality management in construction firms.

[5] Abdel-Razek, R. H. (1998) Quality improvement in Egypt: methodology and implementation.

[6] Ledbetter, W. B. (1994). Quality Performance on Successful Project.

[7] HO, D.C.W. (1999) Preferences on office Quality Attributes Proceedings from PRRES Conference 26-31 January Kuala Lumpur Malaysia.

[8] Building and Construction Authority, Singapore (2014), Construction quality assessment system

[9] Construction industry standard, Malaysia (2006), Quality assessment system for building construction work.

[10] M. Abas, S.B. Khattak, I. Hussain, S. Maqsood, I. Ahmad. (2015) Evaluation Of Factors Affecting The Quality Of Construction Projects. Technical Journal, University Of Engineering And Technology (Uet) Taxila, Pakistan, Vol. 20(Si) No.Ii(S)-2015