

Risk Level of the Factors Affecting Quality in Design Phase of Construction Projects of Sindh

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ABSTRACT

Objective: Implementation of construction project involved several phases and design phase is vital in ensuring the success of the project. Hence, this paper presents the research on identifying the factors affecting quality and assesses the risk level of identified factors in design phase of construction projects of Sindh. Quality in design is the main factor for the success of the construction projects and can be considered as the fulfillment of expectations. Presently, construction industry is paying the utmost attention towards the achievement of quality in construction projects. This paper aims to identify the factors affecting quality and assessed the risk level of identified factors in design phase of construction projects.

Research Method: Twenty (20) factors affecting quality of construction projects were identified through the extensive literature review. Questionnaire survey was carried out for data collection to solicit the views of construction practitioners and received the Ninety Seven (97) completed questionnaires which were analyzed statistically.

Findings: The results revealed that top five factors which are the most important for improving the quality of construction projects: last minute changes by client, lack of fund for staff job training on quality, insufficient project budget, insufficient overall design time and method of selecting the designer based on lowest price offer.

Originality: This research will provide guidance for professional experts in order to achieve the quality during the design phase of construction projects.

Keywords: Quality, Construction projects, Design phase

1. INTRODUCTION

Pakistan's social and economic progress depends heavily on the construction industry. Growth in the construction industry often indicates that the economy is improving (Bhangwar et al. 2022). The success of a building project depends in large part on its quality (Jose & Ambili, 2017). Quality is regarded as main challenged which is faced by construction industry. When it comes to defining quality, it's all about making clients happy and meeting their needs within the given budget (Ahzahar et al. 2011). Construction projects in both developed and developing countries are plagued by low quality (Sohu et al. 2018). Construction projects of poor quality occur all around the world. Similarly, construction industry in Pakistan is also recognized by poor quality. Quality has risen to the top of the global priority list as a result of conceptual changes in the construction industry. All those involved in the construction process have quality as one of their ultimate goals (Ofori, 2006). Products and services are judged on their capacity to meet expressed and implied needs by their totality of features and attributes. Conformance to the client's specifications (Atkin & Potheary, 1994), effective goal attainment between the client and the contractor (Fan, 1995) and meeting the needs of design, construction, regulatory agencies, and the owner (Arditi & Gunaydin, 1997) are all examples of quality in construction.

One of the fundamental demands of the project owners is achieving quality. Quality is an intangible factor that cannot be readily assessed (Memon et al. 2014). Construction industry of Pakistan has been endeavoring for quality since long time (Shah et al. 2014). Besides this, the construction quality of public projects has also not attained proper level of acceptance and is usually criticized for being substandard. However, there is necessity to achieve the desirable quality in construction projects. Quality issues occur due to various factors which are important to understand. There is a scarcity of literature on the elements that affect the quality of construction projects in Pakistan, which is frequently criticized owing to its poor quality performance. Throughout the life of a building project, quality is a critical consideration.

Quality is an important factor for all stages of the project life cycle and important phases for the project life cycle are conceptual planning, design, procurement, construction, and operation & maintenance. Design phase is the important phase in project life cycle in achieving the quality of construction projects. Quality, during design phase, of construction projects is hindered due to various factors. As a result, the goal of this research is to identify the quality affecting factors and to assess the risk level of the factors affecting quality during the design phase of Sindh's public sector building construction projects.

2. LITERATURE REVIEW

Quality is the parameter that cannot be measured directly but depend on the value and satisfaction level of the client (Memon et al. 2018). Quality may be achieved only if the entire management team participates in the implementation of quality programs (Oberlender, 1993). Fewer results that affect the quality of a building project have been analysed and discussed hereafter from numerous earlier literatures that have been evaluated and studied.

Sheikh et al. 2019 found that the quality of building projects in Pakistan is influenced by numerous critical aspects, including the selection and supervision/inspection of an appropriate contractor by a designated owner representative, as well as the existence of an effective feedback system, and shop drawings quality obtained from subcontractors. Akampurira & Windapo (2018) uncovered the most important determinants of South African design documentation quality. To a large extent, these issues arises from inadequate time, low fee of design, design firm selection as per low offering of price and resources to thoroughly verify and coordinate all the documentation required for each project, as well as from a general lack of coordination amongst multidisciplinary teams. According to a study carried out by Mbijiwe (2017), there are four variables that contribute to the quality of government-funded projects: communication of design, design revisions, design faults, and design requirements. There is a correlation between the efficiency of a construction project and the quality of the design specifications, with well-written design requirements being more efficient than those with design flaws.

Jraisat et al. (2016) defined the concept of quality which can be described by meeting the requirements of design professional, owner, constructor, regulatory agencies and also identified the important factors affecting quality in construction projects i.e., customer satisfaction, human resource management and construction specific factors. Zidan (2013) conducted a study and found that insufficient total design time, technique of selection of the designer based on the lowest price offer, changes to the requirements of the client and the lack of documentation are the most significant design factors. According to the research conducted by Memon et al. (2011), quality plays the key role for the success of construction projects and improvement in quality is linked up with the quality management in all phases of project life cycle, particularly in the design and construction phases that mainly affect the final quality outcome of entire construction projects.

According to research conducted by Dodoo et al. (2010), a project's quality can be affected during the design phase for a variety of reasons. Categories i.e., adherence to project management principles was found to be the lowest and participants involving in Department of Building and Engineering Services (DBES) building projects did not adhere to these standards satisfactorily during the project design phase. Design and contractual document quality in the construction sector is influenced by a number of different elements, some of which were highlighted by Abdel Aziz (2009). These factors were found to be particularly damaging: lack of qualified consultants' personnel; insufficient time; inexperienced designers unfamiliar with construction materials and techniques. Darwish (2005) carried out the research and identified the most significant factors that affect the design and documentation quality in construction industry are: less overall design time, last minute changes by client, waiting for client decision, unstable client's requirements, copy and modify by consultants from past projects to reduce cost and time, architectural consultants being engaged on a 'design only' basis, increasing difficulty in getting paid on time by the clients etc.

Zeng et al. (2005) identified the critical factors affecting design quality are: project design team's leader commitment regarding the quality, technical skills of the project team's leader affect the quality of design, designer commitment on quality, organizing skills of project design team leader, project design team leader experience, and supervision and control regarding the quality by design organizations. According to Andi & Minato, (2003), the important factors i.e., Clients' proclivity to "shop about" for design services, as well as the low fees charged by designers, that influence the quality of design documents. Oyedele et al. (2003) identified the design factors affecting the quality of building projects and most important design factors are: design changes, insufficient and unrealistic constraints of project cost, inadequate involvement of other professionals during the design phase, making design decision on cost and not value of work, poor level of commitment to quality improvement among design professionals.

According to Tilley & McFallan (2000), Insufficient overall design time, an inadequate or shifting brief from the client, and unrealistic expectations from the client in terms of fees, service, timing, etc. are the issues affecting the quality of design & documentation. Arditi & Gunaydin (1998) identified the generic factors and also investigated the building industry - specific factors that affect the process quality in design, construction and operation phases of project life cycle of building projects. Design phase is very important of project life cycle that designs the construction project as per needs & requirements of client and after the approval of design phase, construction activities are commenced. The most important specific factors related to building industry in design phase are: cooperation of parties, specifications of project, team work in design firm, management leadership and selection of design firm. Kanji & Wong, 1998 carried out the research and highlighted the need for creation of quality culture in the construction industry based on the results of case study. The results revealed that creation of quality culture is necessary in the construction industry for achieving the good performance and in the absence of quality culture, project partnering, application of supply chain management and adopting of total quality management cannot provide good quality performance.

The above literature review shows the factors that affect the quality in different geographical locations according to the specific situations of the country. The factors also vary due to different consideration of the researchers. Various design factors affecting quality of construction projects in design phase identified from the literature. Twenty (20) factors identified which were used in this research for survey purpose to assess the risk level of the factors affecting quality in design phase of construction projects of Sindh. Table 1 presented these design factors affecting quality of various research studies.

Table 1: Design factors influencing the project quality

S.No.	Identified factors	Tilley & McFallan (2000)	Andi & Minato (2003)	Oyedele et al. (2003)	Darwish (2005)	Abdalaziz (2009)	Zidan (2013)	Mbijiwe (2017)	Akampurira & Windapo (2018)
1	Low design fee structure	✓	✓		✓	✓			✓
2	Lack of funds for staff job training on quality	✓	✓		✓	✓			✓
3	Inadequate client briefing	✓	✓	✓	✓				
4	Insufficient overall design time	✓	✓		✓		✓		
5	Unrealistic expectations by client – In relation to the fees, services and timings etc.	✓	✓		✓				✓
6	No one person or office being responsible for design coordination	✓	✓		✓				✓
7	Improper use of design software	✓	✓		✓				✓
8	Lack of constructability review of design			✓		✓			✓
9	Poor communication among design team members			✓				✓	✓
10	Method of selecting the designer based on lowest price offer					✓	✓		✓
11	Insufficient project budget	✓	✓		✓				
12	Unstable client's requirements		✓		✓	✓			
13	Waiting for client decision		✓		✓	✓			
14	Difficulty in finding good staff (e.g. Specification writers and construction detailers... etc.)	✓	✓		✓				
15	Last minute changes by client		✓		✓	✓			
16	Client requesting design changes, without being prepared to pay for them	✓	✓		✓				
17	Uncertainty of design brief at bid stage	✓	✓		✓				
18	Request for unpaid design submissions	✓	✓		✓				
19	Additional work is required to meet Quality Assurance requirements.	✓	✓		✓				

20	Fellow consultants are not clearly defining the required work task.	✓	✓		✓				
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3. METHODOLOGY

To gather the information and opinion of different respondents on the factors affecting quality in design phase of construction project, questionnaire survey was prepared for data collection process. It is to assess the Probability of Occurrence and Level of Significance of factors affecting quality in design phase of construction projects of Sindh. The first part of this questionnaire contains the demographic information of respondents and the second part contains to scale the Probability of Occurrence and Level of Significance of factors affecting quality in design phase. Questionnaire survey was distributed to the employees of government and private firms through by emails and posts. Total 150 questionnaire survey was distributed and 97 professional experts responded and returned the completed questionnaire survey. The respondents participated in data collection are depicted in Figure 1.

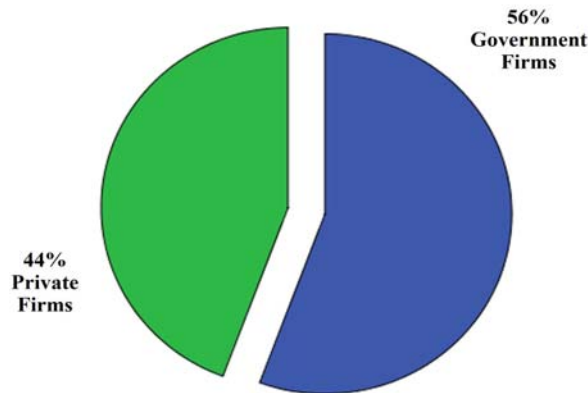


Figure 1: Category of Organization of Respondents

Figure 1 depicts that 54 (56%) respondents participated in data collection work with government firms and 43 (44%) respondents providing services with private firms. Majority of the respondents belong to the government firms who participated in the survey process.

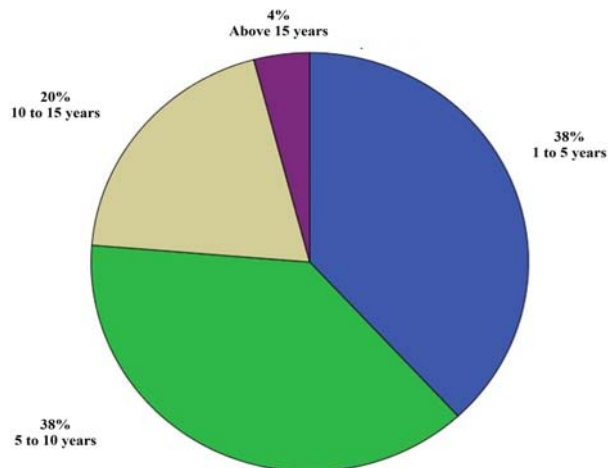


Figure 2: Experience of Respondents

Figure 2 indicates that 38% respondents participated in process of data collection having experience within the construction industry from 1 to 5 years followed by respondents from 5 to 10 years work experience are also 38%. Further, 20% professional experts have an adequate experience from 10 to 15 years while only 4% respondents participated with an experience of more than 15 years.

4. RESULTS AND DISCUSSION

Through the questionnaire survey, each respondent of construction firms was asked to assess the PO and LOS on the basis of their experience by using the likert scale from 1-5 as shown in Table 2 below adopted from Memon et al. (2018). Analysis of data collection concerned with the computation of average index (A.I) values based on formula adopted from Ahsen et. Al. (2021) on the basis of frequencies which is calculated by using SPSS software.

Table 2: Description of probability of occurrence and level of significance

Indexing Value	Probability of Occurrence	Level of significance	Scale
$1.00 < AI < 1.50$	Not Occur	Not significant	1
$1.50 \leq AI < 2.50$	Slightly occur	Slightly significant	2
$2.50 \leq AI < 3.50$	Moderately occur	Moderately significant	3
$3.50 \leq AI < 4.50$	Often occur	Very significant	4
$4.50 \leq AI < 5.00$	Always occur	Extremely significant	5

Results on the Table 2 related to probability of occurrence and level of significance. After calculating the A.I of Probability of occurrence and Level of Significance, the risk level of each factor was identified by multiplying the both A.I value of PO and LOS. Based on risk matrix by using Figure 3, zone of each factor was identified.

Risk Matrix comprises of three difference zones i.e, green, yellow and red wherein each zone is highlighted with difference risk level as under;

- Green zone: Risk in this zone is of low level that can be ignored;
- Yellow zone: Risk is of moderate level in this zone that keeps moderate importance which needs to be controlled by taking actions and precautions.
- Red zone: Risk in this zone is of high level and is critical importance that needs to pay utmost attention and swift actions are required to deal with.

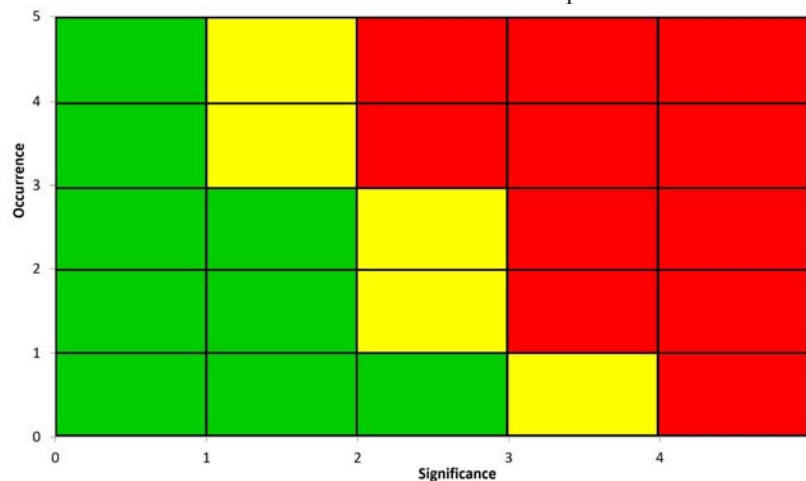


Figure 3: Risk Matrix

Source: Alameri et al. (2021); Bachayo et al. (2022)

Table 3 shows the results of level of risk for all factor affecting the quality in construction project where it can be examined that Average Index value of probability of occurrence of all factors comes in the range between 3.1 to 3.5 that shows all factors are “Moderately Occur” in the construction projects which should be controlled by taking mitigation measures. Further, A.I values of LOS of each factor affecting quality lies in the range of 3.1 to 3.5. However, it can be observed that 20 factors occur in the category of “Moderately Significant”. Plotted Risk matrix of risk level of all factors is shown in Figure 4 and it can be examined that all 20 factors are located in red zone that indicates the high risk in the construction projects. It observes that all design factors are important which should be considered in order the enhance and improving the quality of construction projects.

Table 3: Statistical Analysis of Design factors influencing the quality of construction project

Sr. No.	Factors	A.I of P.O	Level of P.O	A.I of LOS	Significance Level	Risk Value	Risk Level
1	Low design fee structure	3.1	M.O	3.2	M.S	9.9	High
2	Lack of funds for staff job training on quality	3.5	M.O	3.4	M.S	11.9	High
3	Inadequate client briefing	3.1	M.O	3.3	M.S	10.2	High
4	Insufficient overall design time	3.3	M.O	3.5	M.S	11.6	High
5	Unrealistic expectations by client – In relation to the fees, services and timings etc.	3.4	M.O	3.4	M.S	11.6	High
6	No one person or office being responsible for design coordination	3.1	M.O	3.3	M.S	10.2	High
7	Improper use of design software	3.2	M.O	3.3	M.S	10.6	High
8	Lack of constructability review of design	3.2	M.O	3.4	M.S	10.9	High
9	Poor communication among design team members	3.3	M.O	3.4	M.S	11.2	High
10	Method of selecting the designer based on lowest price offer	3.4	M.O	3.3	M.S	11.2	High
11	Insufficient project budget	3.4	M.O	3.5	M.S	11.9	High
12	Unstable client's requirements	3.4	M.O	3.2	M.S	10.9	High
13	Waiting for client decision	3.3	M.O	3.3	M.S	10.9	High
14	Difficulty in finding good staff (e.g. Specification writers and construction detailers... etc.)	3.2	M.O	3.3	M.S	10.6	High
15	Last minute changes by client	3.5	M.O	3.5	M.S	12.2	High
16	Client requesting design changes, without being	3.4	M.O	3.3	M.S	11.2	High

	prepared to pay for them						
17	Uncertainty of design brief at bid stage	3.2	M.O	3.3	M.S	10.6	High
18	Request for unpaid design submissions	3.1	M.O	3.2	M.S	9.9	High
19	Additional work is required to meet Quality Assurance requirements	3.3	M.O	3.2	M.S	10.6	High
20	Fellow consultants are not clearly defining the required work task	3.1	M.O	3.2	M.S	9.9	High

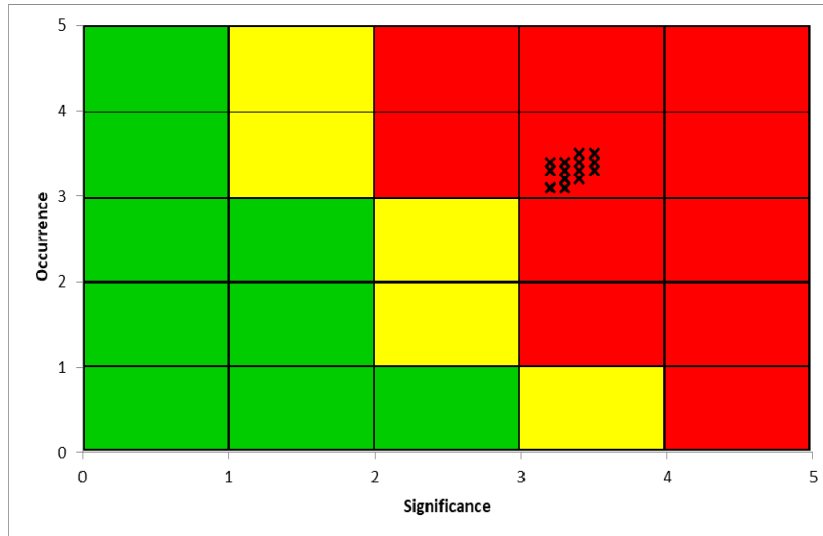


Figure 3: Plotted Risk Matrix of factors affecting quality

5. CONCLUSION

This paper presents research on identifying the factors affecting quality and assesses the risk level of identified factors in design phase of construction projects of Sindh. It adopted questionnaire survey amongst the professional experts of several construction firms of Sindh for assessing the probability of occurrence and level of significance of identified factors affecting quality in construction projects. Twenty (20) factors affecting quality in design phase were identified through literature review which is used for this research purpose. The risk level of each factor calculated on the basis of PO and LOS by Average Index Method and plotted risk matrix. The result of this study shows that all 20 factors fall in red zone of risk matrix that indicates the high level of risk. The result shows that the most important factors based on A.I values are last minute changes by client, lack of fund for staff job training on quality, insufficient project budget, insufficient overall design time and method of selecting the designer based on lowest price offer in comparison with other factors. Hence, identified factors affecting quality should be considered for achieving and improving the quality of construction projects.

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