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Risk Level of the Factors Affecting the Quality of Construction Projects in Pakistan

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Abstract

Construction is an indispensable and major production of any developed and developing country from economic and social view. It provides the required infrastructure for living a successful happy life. Hence, it is always deemed that all construction projects must be completed successfully in order to get full advantage of the project. Among the measure indicating success of any project, quality is amongst key decisive factor. Objective: Hence, this paper has discovered factors which affect quality of construction projects. Methods/Analysis: The initial identification of the factors was made through previous published research works related to quality factors of construction projects worldwide. A total of 32 factors were identified and a structured questionnaire survey was conducted where 46 completed questionnaires were received from the construction practitioners which were analyzed statistically. Findings: The analyzed results highlighted that improper selection and use of equipment, poor quality construction materials, lack of training for staff, delay of interim payments from Client and shortage of Technical persons are top 5 factor affecting quality of construction projects. Novelty/Importance: Unfortunately, worldwide including construction sector in Pakistan, there are many projects which have suffered from poor quality standards, which have been discovered in this study. The quality of the projects is caused by several factors which are very essential to identify and corrective actions should be taken for improving the level of quality of construction projects.

Keywords: Affecting Factors, Construction Management and Pakistan, Quality

1. Introduction

Construction industry is an indispensable and major production for development of a country that relies on the quality of construction projects. Nowadays quality is one of critical challenges faced by construction industry. There are various types of projects such as buildings, infrastructural that may involve roads, drainage, etc. to improve the social qualities of a society. If the projects are completed with poor quality, it affects whole the infrastructure of any country[1]. Hence, quality and quality systems are receiving increased attention worldwide[2–5]. The customer's satisfaction rests over the quality of manufactured product as per desired standards. Similar fact is also true with the construction industry, and therefore, the cost element of the building must satisfy the quality of its build.

Quality is the parameter which cannot be measured directly but depend on the value and satisfaction level of the client. It is defined in different way by different practitioners. Quality is always considered as the set of criteria

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which measured the satisfaction level of the whole product or any kind of task[6]. In construction of a building, quality is defined character of meeting fitness for purpose the effective achievement the stakeholder's goals.

Quality of a construction projects is obstructed by several factors. This paper has explored various factors affecting quality of construction projects of Sindh (Pakistan) including Sukkur, Dadu, Khairpur Mirs, Hyderabad and Karachi. Recently completed construction projects of different region of Sindh were examined and assessed. Average index method and Risk matrix method were used for analysis, factors affecting the quality of construction projects.

Quality is an imperative aspect which decides the overall excellence of a construction project. Deficiency of one quality parameter leads to overall deficiency of the project because all quality of all the components of any construction project is integrated. It has become a incredibly widespread theme in current days due to intangible variations in the construction industry and is receiving high attention worldwide[7]. All the stake holders and especially end users are looking the finished product in any manufacturing industry must satisfy the desired standards. Such, requirement not only provides the customer with extended levels of satisfaction, but also adds the value for money.

In discovering the factors which hinder the achieving required quality standards of construction projects, many research works have been carried out in both developed and developing countries. A study of was carried out in Egypt in revealing the factors of quality of construction projects by reference[8]. The study involved Delphi method consisting three rounds of questionnaires, of the two questionnaire rounds dependent upon the feedback of selected respondents. Based on feedback received from 159 respondents 16 of 52 investigated quality elements were determined important by the comparison scores of different respondents from the construction industry of Egypt. Most critical factors of quality of construction projects found in this study drew attention towards lacking to design, need of quality control system and overcoming the lack of accuracy in estimating as well as financial management[9].

Similarly, the study about the factors influencing the quality of public housing schemes in Hong utilizes factor analysis and multiple regression techniques to perform the comparison of the mean values of the factors was performed. This study highlighted that experience and expertise level of management staff as well as working staff on site and enforcement of policies from administration play key role in improvement[10].

Review of several research works published was useful in identifying common factors of quality. Major factors as identified from literature were client, project team leaders, conformance to codes and standards, financial issue, material, equipment, labor, time factor, environmental factor, subcontractor, lack of communication, work execution, selection of designer, top management support, site staff, etc. Summary of the factors of quality identified from literature is shown in Table 1.

Table 1 presented an appraisal of various research studies showing the factor that affect the quality of construction projects of different regions in world. This review resulted in uncovering 32 factors which were for survey purpose to investigate their level of effect and risk in construction project of Sindh region especially in large cities of including Sukkur, Dadu, Khairpur Mirs, Hyderabad and Karachi.

2. Research Objective

The foremost aim of this research study was to identify the main affecting quality of construction projects especially during execution. These factors were ranked with respect to degree of importance evaluated based on risk matrix level of each factors.

3. Research Methodology

To gather comprehensive opinions of respondents on the quality affecting factors, different construction firms of Sindh regions were selected. Questionnaire survey method was an accurate technique for this exercise. The designed questionnaire consists on main two sections, 1) Demographic details of involved respondents during survey, 2) identifying the factors affecting quality of construction projects. Questionnaire sets were distributed through by hand to person to person, emails, posts and monkey survey method. Consultant, constructors, client and consultant and constructor organization and their representatives were chosen. A total of 46 out of 77 construction practitioners from construction firms returned the completed questionnaire forms. Figure 1 depicts the number and percentage of construction practitioners participating in data collection process.

Table 1. Factors affecting construction project quality

S.No	Identified factors	In^{1}	In^{2}	In^{8}	In^{12}	In^{13}	In^{14}	In^{15}	In^{16}	In^{17}	In^{18}	In^{19}	In^{20}	In^{21}	Fq
1	Improper selection and use of equipment	√	√	√		√					√	√	√	√	8
2	Poor quality construction materials	√		√		√		√			√		√	√	7
3	Lack of training for staff	√							√	√	√	√		√	6
4	Delay of interim payments from Client	√		√		√		√		√					5
5	Shortage of Technical persons		√					√		√	√			√	5
6	Bad weather conditions	√		√	√		√							√	5
7	Non-Conformance to codes and standards	√				√			√		√			√	5
8	Owner not emphasis on quality			√	√		√						√		4
9	Lack of Management Commitment	√					√		√	√					4
11	Shortage of labour	√		√		√							√		4
11	Non-implementation of quality control			√		√						√	√		4
12	Lack of cooperation between supervision		√	√						√		√			4
13	Lack of communication between parties	√	√			√				√					4
14	Insufficient period of the project	√								√					3
15	complete Drawings		√	√			√								3
16	No adherence to specifications			√		√							√		3
17	Inaccuracy in Bill of quantity	√		√		√									3
18	In complete contract document/conditions			√		√							√		3
19	Wrong interpretation of contract					√	√			√					3
20	Un clear procedure for accepting performed activities									√			√	√	3

21	Testing for final products only							√		√					2
22	Lack of management Leadership							√							2
23	Poor Planning and control techniques													√	2
24	Lack of management commitment to	√		√											2
25	Resource wastage on site	√								√					2
26	Lack of previous experience of contractor	√				√									2
27	Poor Communication infrastructure	√				√									2
28	In competent Subcontractor							√							1
29	Planning and Control Technique							√							1
30	Poor Management team of constructor							√							1
31	Escalation of material prices							√							1
32	Policy of awarding contractor on Lowest Bid							√							1

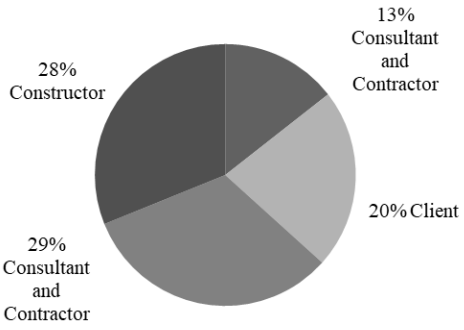

Figure 1. Types of organization of the respondents.

Figure 1 depicts that 18 (39%) respondent's work with consultant firms. These represent highest number from respondent groups. This is followed by 13 (28%) respondents from constructor, 9 (20%) responses from client's representative and 6 (13%) forms were received back from those respondents whose organizations act both as consultant and constructor. Among these organizations, they were registered as either Government or private firm. The summary of the firms participating in survey with respect to their registration entity are summarized in Figure 2.

Figure 2 shows that 39 (85%) of firms participating in survey process are registered as Private Organization while only 7 (15%) respondents belonged to the government organizations. These respondents were handling the projects of various sizes in terms of the cost of the projects. The summary of the respondents distributes from perspective of size of the projects handled is presented in Figure 3.

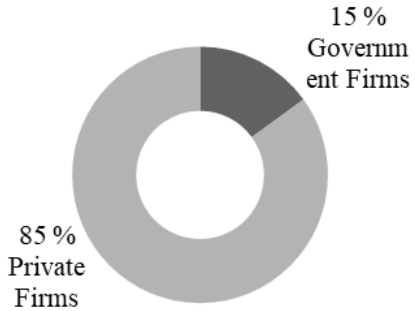

Figure 2. Category of organization of respondents.

From Figure 3, it is evident that the majority of the respondents (i.e. 40%) participating in data collection were handling large projects of project with contract sum of above 3000M. While 8% of the respondents were involved in projects costing 1800M to 3000 M, 10% of the respondents were handling project with contract amount of 400M to 1800M. Remaining 42% of the respondents had experience of projects of cost below 400M.

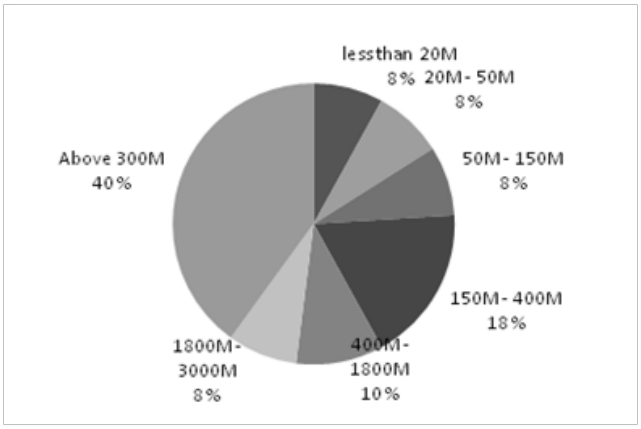

Figure 3. Size of construction projects handled by respondents.

4. Results and Discussion

The questionnaire developed was based on probability of occurrence (PO) and level of significance (LOS), so each respondent was asked to assess them by using scale of 1-5 as shown in Table 2. Data analysis involved calculation of average index (A.I) values based on frequencies calculated with the help of SPSS software package.

Evaluation of the results involved the level of occurrence and significance based on the Table 2 above. By multiplying AI value of probability of occurrence and level of significance of each factor, the risk level of each factors was calculate. Level of risk was assessed based on risk matrix adopted from[11] as shown in Figure 4.

Table 2. Description of probability occurrence and significance level

Indexing Value	Probability of occurrence	Level of significance	Scale
1.00 ≤ AI < 1.50	Not Occur	Not Significant	1
1.50 ≤ AI < 2.50	Slightly Occur	Slightly Significant	2
2.50 ≤ AI < 3.50	Moderately Occur	Moderately Significant	3
3.50 ≤ AI < 4.50	Often Occur	Very Significant	4
4.50 ≤ AI < 5.00	Very often Occur	Extremely significant	5

Risk matrix combines the AI values of probability of occurrence and level of significance to calculate the level of risk. It has three different zones in which each zone refers to different level of risk as follows:

- Green zone: Risk is in low level and can be ignored;
- Yellow zone: Risk is in moderate level and moderate importance, if the factors occur it should be controlled with some actions and mitigations.
- Red zone: Risk is in high level and critical importance; immediate actions are required to cope.

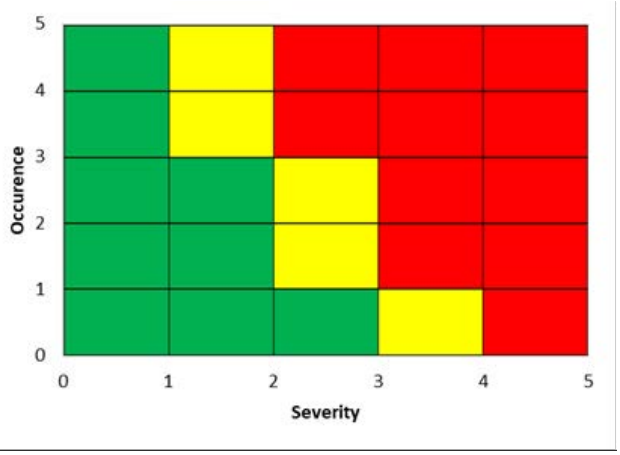

Figure 4. Risk matrix.

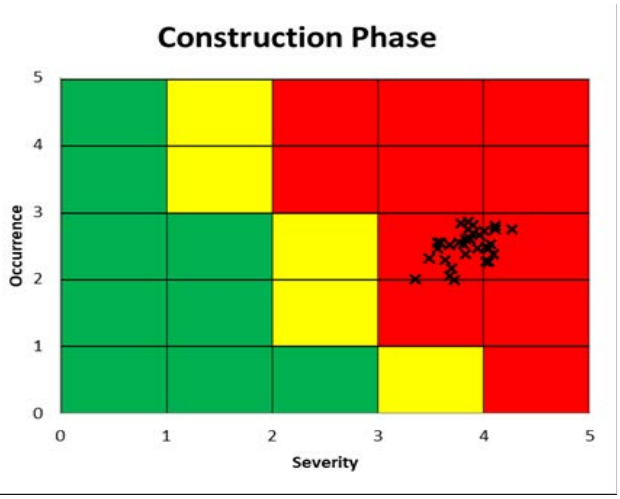

Figure 5. Plotted risk matrix for the quality factors.

Results of the level of risk calculated for the factors are shown in Table 3 it can be observed that AI value of probability of occurrence for quality factors occur in the range of 1.98 to 2.85. There are 18 factors in the category of Moderately Occur "MO" which are moderately significant in the construction and 14 are in the category of Slightly Occur "SO" which are slightly significant. Similarly, the

Table 3. Statistical analysis for factors affecting the quality of construction projects

No.	Factors	A.I of P.O	Level of P.O	A.I of LOS	Significance Level	A.I values		Risk Level
						PO	LOS	
1	Improper selection and use of equipment	2.5	M.O	3.9	V.S	2.5	3.9	
2	Poor quality construction materials	2.7	M.O	4.1	V.S	2.7	4.1	
3	Lack of training for staff	2.7	M.O	4.0	V.S	2.7	4.0	
4	Delay of interim payments from Client	2.2	S.O	3.7	V.S	2.2	3.7	
5	Shortage of Technical persons	2.4	S.O	3.8	V.S	2.4	3.8	
6	Bad weather conditions	2.5	M.O	3.6	V.S	2.5	3.6	
7	Non-Conformance to codes and standards	2.7	M.O	4.0	V.S	2.7	4.0	
8	Owner not emphasis on quality	2.5	M.O	4.0	V.S	2.5	4.0	
9	Lack of Management Commitment	2.5	M.O	3.8	V.S	2.5	3.8	
10	Shortage of labour	2.6	M.O	3.8	V.S	2.6	3.8	
11	Non-implementation of quality control	2.4	S.O	4.1	V.S	2.4	4.1	
12	Lack of cooperation between supervision	2.5	M.O	3.6	V.S	2.5	3.6	
13	Lack of communication between parties	2.5	M.O	3.6	V.S	2.5	3.6	
14	Insufficient period of the project	2.6	M.O	3.9	V.S	2.6	3.9	
15	complete Drawings	2.3	S.O	4.0	V.S	2.3	4.0	
16	No adherence to specifications	2.3	S.O	3.5	V.S	2.3	3.5	
17	Inaccuracy in Bill of quantity	2.3	S.O	4.0	V.S	2.3	4.0	
18	In complete contract document/ conditions	2.0	S.O	3.7	V.S	2.0	3.7	
19	Wrong interpretation of contract	2.0	S.O	3.7	V.S	2.0	3.7	
20	Un clear procedure for accepting performed activities	2.8	M.O	3.8	V.S	2.8	3.8	

21	Testing for final products only	2.0	S.O	3.3	M.S	2.0	3.3	
22	Lack of management Leadership	2.5	M.O	4.0	V.S	2.5	4.0	
23	Poor Planning and control techniques	2.8	M.O	3.9	V.S	2.8	3.9	
24	Lack of management commitment	2.7	M.O	4.3	V.S	2.7	4.3	
25	Resource wastage on site	2.7	M.O	3.8	V.S	2.7	3.8	
26	Lack of previous experience of contractor	2.3	S.O	3.6	V.S	2.3	3.6	
27	Poor Communication infrastructure	2.5	M.O	3.7	V.S	2.5	3.7	
28	In competent Subcontractor	2.7	M.O	3.9	V.S	2.7	3.9	
29	Planning and Control Technique	2.5	M.O	3.8	V.S	2.5	3.8	
30	Poor Management team of constructor	2.8	M.O	4.1	V.S	2.8	4.1	
31	Escalation of material prices	2.8	M.O	3.8	V.S	2.8	3.8	
32	Policy of awarding contractor on Lowest Bid	2.5	M.O	4.1	V.S	2.5	4.1	

above-mentioned A.I results of level of significance states that the AI values for significance level of quality factors occur within the range of 3.35 to 4.26. Among these factors, 30 factors in the category of VS which are very significant and only 2 factors are in MS which are moderately significant. Based on these evaluated results, Risk level for the factors affecting the construction projects' quality, Figure 5 depicts the plotted area of the Risk level in risk matrix it can be perceive that all the 32 identified common factors fall in red zone indicating the high risk. This indicates that all the factors are very important to consider for controlling so that quality of the works can be improved.

5. Conclusion

Focus of the current research study was to identify the main affecting quality of construction projects especially during execution. Probability of occurrence and level of significance of quality affecting factors was identified through questionnaire survey from the respondents in the different construction organizations of Sindh. A total of risk factors 32 affecting quality were determined from an extensive literature review which were used for investigation. Based on the probability of the occurrence and level of significance, risk level of each factor was calculated through AI method as well as plotted on risk matrix. From the findings of this study, it was observed all the investigated factors have high level of risk and they were falling in the red zone of the risk matrix. However, based on the AI values, it can be concluded that Lack of management commitment, Poor quality construction materials, Non-implementation of quality control, and Policy of awarding contractor on Lowest Bid are more critical compared to other factors. Thus, in order to maintain high level of quality, identified factors are required to be considered.

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