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Risk Factors Affecting the Performance of Repair and Rehabilitation Construction Projects in Gaza Strip

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1. Abstract

Construction repair projects in Gaza Strip have complexity in its nature because it suffers from many problems and complex issues during project execution. This research attempts to shed more light on the different kinds of risk factors and its impact on construction repair and rehabilitation projects in Gaza Strip.

The current research primarily employed the method of questionnaire surveys to collect the required data. Following a thorough literature review and structured interviews with professionals who have work experience in the field of construction repair projects in Gaza Strip. Comprehensive list of risk parameters was identified and categorized into ten groups with total fifty- nine of risk parameters. Then, Fifty- two questionnaires were distributed to companies working in the field of construction repair projects in Gaza Strip.

A statistical analysis was conducted to calculate mean, standard deviation (SD) and standard error (SE) for each of the risk factors' parameters. The results were accepted when the value of the standard error is less than 0.2. A comment on the results that have been reached is shown in order to illustrate the extent of the impact of those risks on construction repair projects in Gaza Strip. Based on the analysis and corresponding probability - impact matrix, a total of twenty - three risk parameters were identified to be the most significant risk factors.

2. Introduction

This research presents the analysis and evaluation methods used to achieve the first and second steps in risk management cycle, namely risk identification and risk assessment. {This research introduces the analysis which is performed on the collected data}. It also presents a thorough discussion and interpretation of the findings. First, the data sample is described and its characteristics are presented. The sample description includes describing the characteristics of both the participating respondents to the questionnaires and the companies working in the field of construction repair projects in Gaza Strip. Next, descriptive and inferential statistics are performed on the data collected through the questionnaire survey to perform qualitative assessment for risk factors and determine the significant risk factors in construction repair projects in Gaza Strip.

Ragab (2003) recommended a systematic method to identify risks, as shown in figure (1).

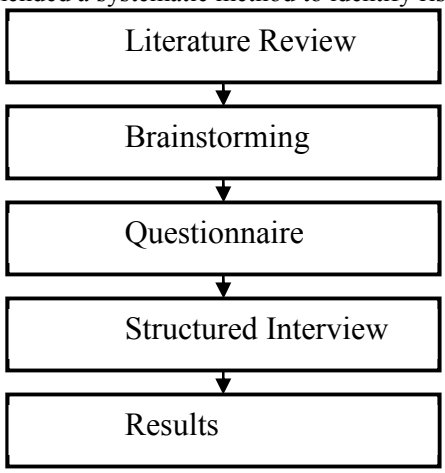

Figure (1): Combined method of risk identification (Ragab 2003)

3. Work Experience of Respondent

The number of work experience years of respondent who participated was categorized as follows: (1) 5 years (2) 10 years, (3) 15 years, (4) 20 years, and (5) 25 years. As shown in figure (2), with an average experience of the sample = 17.2 ???? years.

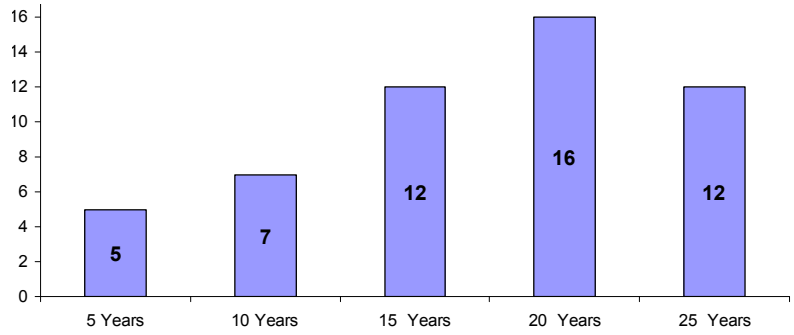

Figure (2): Frequency histogram for the numbers of respondent experience

4. Measurements of the Risk Parameters

A list of different risk factors was distributed among the respondents, and they are requested to judge on the significance of each risk factor through two parameters, the probability of occurrence, and cost impact. In order to be able to select the appropriate method of analysis, the Scale of measurement must be understood. In this research, ordinal scales were used. Table (1) (Ugwu and Haupt, 2007) shows which uses a ranking scale that normally uses integers in ascending or descending order. The numbers assigned to the important (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities.

Table (1): Ordinal scale used for data measurement (Ugwu and Haupt, 2007)

Item	Very high	High	Medium	Low	Very low
Scale	1	2	3	4	5

5. Risk Analysis

Risk analysis must lead to a more efficient allocation of resources. Even without producing quantitative results, the step of detailed breaking project down into its sources of risk and systematically examining them ensures that the estimator develops a much more realistic understanding for the project and its range of possible outcomes. Risk analysis may be useful to set priorities among programs and evaluate management options in order to finish project on budget and time (Abd El Said 2003).

6. Results of Statistical Analysis for Risk Parameters

Important statistical parameters (mean, standard error, and standard deviation) were calculated for the risk parameters individually (probability of occurrence, and cost impact) for each risk factor.

Mean: for ungrouped data, the mean is computed by summing the data values and divided by the number of values.

Standard deviation (SD): the standard deviation is a popular measure of variability. It is used in both as separate entity and as a part of other analyses.

Standard error of the mean (SE): the standard deviation of the sampling distribution of the mean, a measure of the extent to which we expect the means from different samples to vary from the population, owing to the chance error in the sampling process Abdul Gawad (2005) demonstrated that, the calculated standard error was then compared to 0.2, as this value is argued to indicate a relatively precise point estimate of the results as pointed out by Montgomery et al (1998).

If standard error (SE) < 0.2 then according to this rule, the assessment of the collected data implies an acceptable agreement among experts on the risk significance. The results of this part of study provide statistical analysis for probability of occurrence and cost impact. Table (2) demonstrates that all values of standard error are less than 0.2.

Table (2): Results of statistical analysis for probability of occurrence, cost impact and significant index (SI) for risk factors.

Group	No	Risk Factors	probability of occurrence			cost impact			(SI)
			Mean	SD	SE	Mean	SD	SE	
(1) Construction repair risks	1	Late delivery of shop drawings.	2.58	0.82	0.11	3.06	0.89	0.12	7.89
	2	Bad support for building	3.38	1.08	0.15	4.29	0.82	0.11	14.50
	3	Error in execution & rework.	2.19	0.88	0.12	3.13	0.92	0.13	6.85
	4	Damage to structure during repair.	2.21	0.84	0.12	4.00	0.81	0.11	8.84
	5	Efficient of supervision team.	2.92	1.05	0.15	3.73	0.98	0.14	10.89
	6	Shortage of skilled repair labor.	2.29	0.99	0.14	2.79	0.72	0.10	6.39
	7	Equipment breakdown	3.19	1.00	0.14	2.83	0.83	0.11	9.03
	8	Failure and poor equipment productivity	3.37	1.02	0.14	3.75	0.76	0.10	12.64
(1) Construction repair risks	9	There could be restrictions with laying out the temporary facilities	2.44	0.93	0.13	2.42	0.86	0.12	5.90
	10	Bad traffic conditions resulting in difficulties with transportation of labor and equipment	3.08	0.85	0.12	4.44	0.66	0.09	13.68
	11	Agreeing interim aluations on site	2.6	0.84	0.12	2.98	0.75	0.10	7.75
	12	Safety and healthy risks	3.21	0.88	0.12	4.02	0.60	0.08	12.90
	13	Unexpected site conditions and estimating error.	3.90	0.79	0.11	4.33	0.78	0.11	16.89
(2) Design Risks	14	Design errors	2.79	0.60	0.08	4.17	0.54	0.08	11.63
	15	Difference between the Actual and the design drawings	2.52	0.66	0.09	2.94	0.79	0.11	7.41
	16	Ambiguities , fault and inconsistency of specification	3.81	1.05	0.15	4.27	0.89	0.12	16.27
	17	Design difficulty then difficulty in construction	2.31	0.75	0.10	3.38	0.76	0.11	7.81

Table (2) continues.

	18	Incomplete in design and Information	3.29	0.77	0.11	4.00	0.78	0.11	13.16
(3) Client risks	19	public agencies lack of budget	3.75	0.93	0.13	4.02	0.80	0.11	15.08
	20	Delays in payments from client	3.54	0.98	0.14	3.83	0.81	0.11	13.56
	21	Retention proportion of cash payments from client	3.67	0.87	0.12	2.73	0.81	0.11	10.02
	22	Random selection of the contractor (lower prices only) in Gaza Strip.	3.40	0.99	0.14	3.79	0.63	0.09	12.89
	23	There is No vote for the technical evaluation of companies and strong financial	2.92	1.05	0.15	3.44	0.91	0.13	10.04
(4) Contractors Risks	24	Lack of Contractor expertise for the repair works.	3.26	0.90	0.13	3.94	0.72	0.10	14.26
	25	The inability of the contractors, especially small businesses to analyze price analysis.	3.12	1.10	0.15	4.04	0.88	0.12	12.6
	26	Pressures impose by other contractors.	3.23	0.97	0.13	3.94	0.84	0.12	12.73
	27	Unavailability of qualified subcontractors in this sector.	2.17	0.87	0.12	3.33	0.80	0.11	7.23
(5) Third Party Risks	28	Delay in agreeing variation.	4.15	0.76	0.10	3.92	0.67	0.09	16.27
	29	Delay in settling claims	3.02	0.99	0.14	4.10	0.69	0.10	12.38
	30	Provisions for phased handover.	3.19	0.92	0.13	4.17	0.64	0.09	13.30
(6) Repair material risks	31	Shortage of repairs materials in market	2.25	0.92	0.13	3.62	0.76	0.11	8.15
	32	Supplying defective repair materials	2.96	1.09	0.15	4.21	0.88	0.12	12.46
	33	Waste increases	2.98	1.08	0.15	3.06	0.74	0.10	9.12
	34	Actual quantities differ from the contract quantities	3.02	1.01	0.14	4.29	0.66	0.09	12.96
	35	Difficult storage of repair materials	2.90	0.86	0.15	3.04	0.71	0.10	8.82
	36	Some materials need to special requirements in storage	2.73	0.86	0.12	2.40	0.82	0.11	6.55
	37	Material delay due to Israeli closure.	2.71	0.91	0.13	3.31	0.73	0.10	8.97
	38	Quality risks	3.21	0.88	0.12	3.75	0.68	0.09	12.04

Table (2) continue.

(7) Financial risks	39	High prices of repair materials	2.81	0.90	0.12	4.38	0.66	0.09	12.31
	40	High prices of repair labor	2.94	0.86	0.12	3.48	0.77	0.11	10.23
	41	Taxation rate increase	2.79	1.06	0.15	3.29	0.67	0.09	9.18
	42	Changes in currency exchange rates	3.19	0.86	0.12	3.17	0.82	0.11	10.11
	43	Economic crisis	2.83	0.85	0.12	2.77	0.82	0.11	7.84
(8) Management risks	44	Poor communication and coordination between all parties in site	2.04	0.73	0.10	3.48	0.82	0.11	7.10
	45	There is no clear and explained Project time schedule for all Activities	3.21	0.88	0.12	2.69	0.67	0.09	8.63
	46	There is no update for Project time schedule Activities	2.9	0.95	0.13	4.10	0.74	0.74	0.10
	47	Delay in approval of contractor submittals by the consultant engineer as (tables - planning – samples)	2.96	0.96	0.13	4.1	0.74	0.10	12.14
	48	lack of experience in repair works, efficiency for teamwork	3.17	1.10	0.15	4.08	0.70	0.10	12.93
	49	Change in key staffing throughout the project	2.73	0.83	0.12	3.06	0.91	0.13	8.35
	50	Extent of float in contract schedule	2.67	0.75	0.10	2.85	0.57	0.08	7.61
	51	Separate design and supervision teams	2.21	0.77	0.11	3.42	0.95	0.13	7.56
	52	Accidents	3.46	0.54	0.07	4.04	0.81	0.11	13.98
	53	Theft	2.48	0.52	0.07	2.38	0.60	0.08	590
(9)Political Risks	54	Lack of equipment due to Israeli closure	3.81	1.05	0.15	4.27	0.89	0.12	16.27
	55	Lack of materials due to Israeli closure	2.67	0.89	0.12	3.17	0.83	0.11	8.46
	56	Increasing materials & equipment costs due to Israeli closure	2.65	0.96	0.13	2.79	0.74	0.10	7.39

Table (2) continue

	57	Ware occurrences.	3.90	0.79	0.11	4.33	0.78	0.11	16.89
(10) Natural Risks	58	Force Majeure (revolution –earthquake – wars)	1.02	0.14	0.02	4.83	0.38	0.05	4.93
	59	Inclement weather (humidity temperature).	1.42	0.49	0.07	2.35	0.65	0.09	3.34

7. Identification of Significant Index of the Risk Factors

The objective is to identify the most significant risk factors which are related to construction repair Projects in Gaza Strip. To perform this objective, a set of steps was performed:

1- Multiplying probability of occurrence with cost impact for each risk factors (based on the magnitude of mean). The result of this multiplication produced significance index (SI).

2- The risk factors were ordered based on that significance index (SI).

Table (2) shows the results of significant index (SI) of different risk factors, which were calculated via multiplying the probability of occurrence by cost impact.

8. Risk Assessment Using Matrix Method

A key to assessing and managing risk factors is the clarity, coordination and consistency among key project parameters: scope, quality, schedule, and construction budget. (Abd El Said 2003).

The following objective of this research is to perform qualitative risk assessment for construction repair Projects in Gaza Strip using matrix method (PRMH, 2003). To achieve that objective the significance risk matrix was used.

The significance risk matrix shown in table (3) was used to classify risk factors to three grades;

High Risk ---------- (SI) more than 12
Moderate Risk ---------- (SI) more than 8
Low Risk ---------- (SI) less than 8

This classification is adopted based on (PRMH, 2003).

Table (3) Significance risk matrix (PRMH, 2003).

		Probability of Occurrence				
		1	2	3	4	5
Cost Impact	1	1(L)	2(L)	3(L)	4(L)	5(L)
	2	2(L)	4(L)	6(L)	8(M)	10(M)
	3	3(L)	6(L)	9(M)	12(H)	15(H)
	4	4(L)	8(M)	12(H)	16(H)	20(H)
	5	5(L)	10(M)	15(H)	20(H)	25(H)

(L=Low, M= Moderate, H=High)

9. Results

The results of the questionnaire indicated the significance index (SI) for each risk factor as shown in table (4), twenty-three out of fifty- nine risk parameters could be considered as important risk factors that affect construction repair projects in Gaza Strip, and ranked according to the highly significance index as shown in table (4).

Table (4): Results of statistical analysis for highly ranking of risk factor

No.	Risk Factors	Significance index (SI).	Rank
57	Ware occurrences	16.86	1
54	Lack of equipment due to Israeli closure	16.27	2
55	Lack of materials due to Israeli closure	16.27	3
56	Increasing materials & equipment costs due to Israeli closure	15.08	4
2	Bad support for building	14.50	5
24	Lack of Contractor expertise for the repair works	14.26	6
52	Accidents	13.98	7
10	Bad traffic conditions resulting in difficulties with transportation of labor and equipment	13.68	8
20	Delays in payments from client	13.56	9
30	Provisions for phased handover	13.30	10
18	Incomplete in design and information	13.16	11
34	Actual quantities differ from the contract quantities	12.96	12
48	lack of experience in repair works, efficiency for teamwork	12.93	13
12	Safety and healthy risks	12.90	14
22	Random selection of the contractor (lower prices only) In Gaza Strip	12.89	15
26	Pressures impose by other contractors	12.73	16

Table (4) continue.

8	Failure and poor equipment productivity	12.64	17
25	The inability of the contractors, especially small businesses to analyze price analysis	12.60	18
32	Supplying defective repair materials	12.46	19
29	Delay in settling claims	12.38	20
39	High prices of repair materials	12.31	21
47	Delay in approval of contractor submittals by the consultant engineer as (tables - planning – samples)	12.14	22
38	Quality risks	12.04	23

10. Conclusions

The analysis of different risk factors was carried out to measure their impact on construction repair and rehabilitation of construction projects. Fifty nine critical risk factors were categorized into ten categories: construction, design, client, contractors, public and third party, material, financial, management, political and natural. These factors were investigated to measure the importance of each, based on their probability of occurrence and degree of impact. Twenty-three out of fifty- nine risk parameters were identified to be considered as high risk factors.

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