

Recognize the latent menaces in construction projects: An empirical study in construction sector in Jeddah, KSA

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Abstract. This paper seeks to highlight the potential menace in construction projects in Jeddah, KSA, and its influence on project objectives in terms of time, cost, quality, safety and environmental sustainability. The researcher used a total of 25 key risks, which were determined based on a comprehensive assessment of their probability of occurrence and magnitude of consequence on project objectives in China and Australia. Herein the researcher test the magnitude effect of each factor upon the project objectives mentioned above. with an assortment of menaces consequence on project elements: Clients, design, government bodies, contractors and subcontractors, and suppliers, This study concluded that 92.3% of the respondents believe that price inflation of construction materials has a high effect on project construction. Moreover, The results show that there are factors have a high load, which are: Variations by the client, Project funding problems, Suppliers' incompetency to deliver materials on time, and excessive procedures of government approvals, the study recommended that, the enterprise should review and rewords their clients contracts to clear identification of project scoop and payments arrangement. Besides, selecting subcontractors based on specific standards to insure they will add value to the project. Obtain and maintain talent to manage government and public relations.

Keywords: risk management, construction project management.

1 INTRODUCTION

The rapid growth of the Saudi Arabian economy calls for enormous development of infrastructures and assets. While this brings opportunities to project stakeholders, utilizing effective RM techniques to control risks associated with variable construction activities, which led to manage the projects with high grade of effectiveness and efficiency, considering the project objectives including time, cost, quality, safety and environmental sustainability.

Effective RM methods can help to understand not only what kinds of risks are faced, but also how to manage these risks in different phases of a project. Owing to its increasing importance, risk management has been recognized as a necessity in almost all sectors today, and a set of techniques have been developed to control the influences brought by potential risks (Baker and Reid, 2005).

Compared with many other industries, the construction industry is subject to more risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organization structures (Smith, 2003).

In this study researcher selected the 25 key risk factors, which had been used to study the potential risks might be affect the construction sector in China an Australia. The paraphrase of the survey questionnaire from English into Arabic was carefully fulfilled and checked by the researcher to guarantee the consistence between the two versions. All sample members selected were practitioners, questionnaire had distributed and data collected with 65% of

respond. Data collected entered into SPSS program for statistical and social sciences package Ver.16. Then variables coded, labeled and treated. The study reveals that 92.3% of the respondents believe that price inflation of construction materials has a high effect on project construction. Besides, the results show that there are (seven factors) have a total load (68.2%). These Seven factors include: Variations by the client, Project funding problems, Suppliers' incompetency to deliver materials on time, excessive procedures of government approvals, Low management competency of subcontractors, Contractors' poor management ability, Unavailability of sufficient professionals and managers. Researcher recommend for more investigation and further study to determine the proper strategies to come over those risk.

2 BACKGROUND AND RELATED PAST RESEARCHES

Risk management may be described as “a systematic way of looking at areas of risk and consciously determining how each should be treated. It is a management tool that aims at identifying sources of risk and uncertainty, determining their impact, and developing appropriate management responses” (Uher, 2003). As per Berkeley et al.(1991) RM is A systematic process of risk management has been divided into risk classification, risk identification, risk analysis and risk response, where risk response has been further divided into four actions, to be exact: retention, reduction, transfer and avoidance (Flanagan and Norman, 1993).

Substantive research has been done in the field of RM for construction projects, a significant outcome of which is the identification of many risks that may affect the construction project delivery.

Chen et al. (2004) proposed 15 risks concerned with project cost and divided them into three groups: (resources factors, management factors and parent factors). Through a case study on the West Rail Project of Hong Kong, Chen found that (price escalation of material pertaining to resource factors, “inaccurate cost budget, supplier or subcontractors’ default pertaining to management factors, and excessive interface on project management pertaining to parent factors) are the most significant risks in this particular sector projects.

Summarizing other researchers’ work, Shen (1997) identified eight major risks accounting for project delay and ranked them based on a questionnaire survey with industry practitioners. Shen also proposed risk management actions to cope with these risks and validated their effectiveness through individual interview surveys.

Tam et al. (2004) conducted a survey to examine the elements of poor construction safety management in China and as a result, identified the main factors affecting safety performance including (poor safety awareness of top management, lack of training, poor safety awareness of project managers, reluctance to input resources to safety and reckless operation).

3 PROBLEM STATEMENT

Total of 25 potential menaces had been selected .These menaces consequences had been verified in China and Australia. This study aimed to answer following questions:

1. Do these factors affect local construction projects in Jeddah KSA?
2. What is the influence on project objectives in terms of: time, cost, quality, safety and environmental sustainability?

4 METHODOLOGY OF SOLUTION

The preferred research methodology for this project risk management study encompass a previous studies review, dispensed survey questionnaire to the construction sector practitioners and a statistical analysis of the survey data.

The questionnaire consisted of two sections. Section 1 conceded a total of 25 risks associated with construction projects and asked respondents to review and indicate the likelihood of occurrence of these risks as highly, medium or low, besides, the level of impact on each project objective that would result in as high, medium or low. These 25 factors were the main effected menaces in China as per the study of Patrick X.W. Zou, Guomin Zhang, and Jiayuan Wang in 2007. Section 2 solicits general information about the respondents.

The paraphrase of the survey questionnaire from English into Arabic was carefully fulfilled and checked by the researcher to guarantee the consistence between the two versions. The researcher conducted the survey in September 2014. Prior to the questionnaire distribution, a pilot study was accomplished with two academic and three project manager to test whether the questions are intelligible, easy to answer, unambiguous, etc. precious feedbacks were obtained to improve the quality of the questionnaire. After a small alteration, the questionnaires were disseminated to 60 construction practitioners in Jeddah.

All respondents were contacted earlier to make sure that they were familiar with construction projects and were enthusiastic to join this survey. Within 3 weeks waiting time, 41 feedbacks were received in which 2 feedbacks were identified as invalid due to incomplete or invariable answers. This represents a legitimate response rate of 65 %, which is acceptable according to Moser and Kalton's assertion (1971).

Data collected and entered into SPSS program for statistical and social sciences package Ver.16. Then variables would be coded, labeled and treated. Data analysis would be undertaken according to the following scenario:

- 1 examines the sample demographic characteristics, including (education level, experiences, and project type).
- 2 Test the reliability of a questionnaire and its validity.
- 3 Respondents evaluations to the risks factors according to the following themes:
 3. 1 Risks factors related to clients,
 3. 2 Risks related to designers,
 3. 3 Risks related to contractors,
 3. 4 Risks factors related to subcontractors (suppliers),
 3. 5 Risks factors related to government agencies,
 3. 6 Risks factors related to external issues.

5 DATA ANALYSIS AND INTERPRETATION

5. 1 Introduction

This study is basically intended to discover the risks factors that affect the construction projects in Jeddah municipality. Therefore, a survey was conducted to achieve this objective. Hence secondary data have been collected through distributing a study questionnaire to the selected sample to answer the questions. Data collected entered into SPSS program for statistical and social sciences package Ver.16. Then variables are coded, labeled and treated.

5.2 Data analysis

In the following, I would undertake the previously mentioned steps in detail:

5.2.1 Sample demographic characteristics analysis.

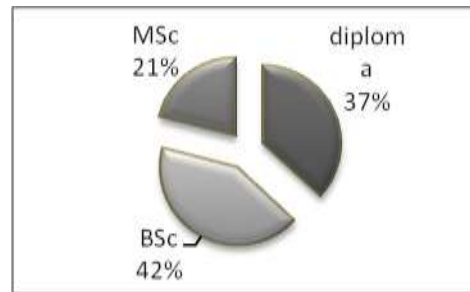


Figure. 1. sample distributed according to educational level.

From Figure 1 above, it is observed that 36.8% of the sample members who respond to education level have diploma, whereas 42.1% have Bachelor degree, while 21.1% have master degree.

Hence, we conclude that most of the sample participated in the current study their education level will enable them to give accurate responses about the survey questionnaire questions.

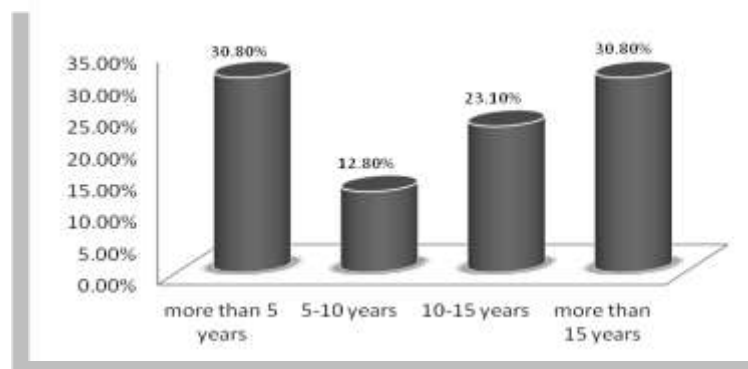


Figure. 2. sample distributed according to work experiences.

From figure 2 above, it is obviously seen that 31.6% of the total sample who determined work experiences have more than 5 years work experience, whereas 13.2% have work experience between 5- to less than 10 years, where 23.7% have work experience between 10- less than 15 years, while 31.6% have work experience more than 15 years.

Hence, work experience shows different work experiences to the sample of the study.

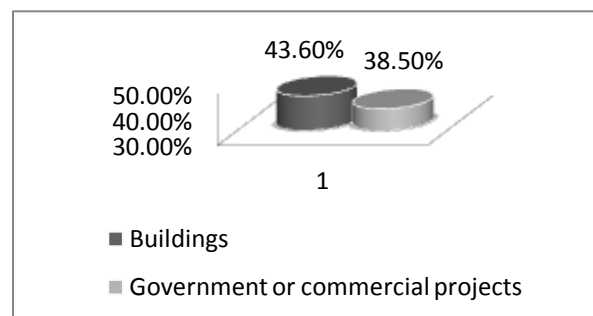


Figure. 3. sample distributed according to work project type.

From figure 3 above, it appeared that about 53.1% of the respondents are participating in buildings projects, whereas 46.9% engaged into government or commercial projects.

Therefore, we conclude that two types of projects are available to participate in.

5.2.2 Questionnaire reliability and validity

Questionnaire reliability has been measured through using Cronbach's Alfa coefficient as shown in the table below:

Table 1. Shows reliability analysis

Cronbach's Alpha	N of Items
.817	28

From the above table it is clearly observed that Cronbach' Alfa Coefficient is reaching (0.817), which is high, and this indicate that the questionnaire method used to collect data from respondents has a very high validity, and would give more trust to the results reached at the end of the study.

5.2.3 Sample responses to risks factors that affect projects construction.

Table 2. Shows sample responses concerning risk factors to clients.

Factors	High		Medium		Low		Average	Effect
	F	%	F	%	F	%		
Tight project schedule TPS	21	56.8	14	37.8	2	5.4	2.51	High
Project funding problems PFP	29	74.4	5	12.8	5	12.8	2.62	High
Variations by the client VC	15	39.5	18	47.4	5	13.2	2.26	Medium

From the above table 2, it is clearly seen that, the most important risk factor that have a high effect during projects construction phases is project funding problems, and the second risk factor is tight project funding, whereas variations by the clients have a medium effect on project construction.

Table 3. Shows sample responses concerning risk related to designs.

Factors	High		Medium		Low		Average	Effect
	F	%	F	%	F	%		
Design variations DV	16	41.0	15	38.5	8	20.5	2.21	Medium
Inadequate program scheduling IPS	14	40.0	17	48.6	4	10.3	2.29	Medium
Inadequate site information (soil test and survey report) ISI	18	46.2	8	20.5	13	33.3	2.13	Medium
Incomplete or inaccurate cost estimate ICE	20	52.6	11	28.9	7	18.4	2.34	High

From the above table, it is obviously observed that, the most important risk factor that related to design which has a high effect on projects construction is the incomplete or inaccurate cost estimates, whereas the other three factors have medium effects on projects construction.

Table 4. Shows sample responses concerning risk related to contractors.

Factors	High		Medium		Low		Average	Effect
	F	%	F	%	F	%		
*Contractors' poor management ability	33	84.6	6	15.4	0	0.0	2.85	High
*Contractors' difficulty in reimbursement	24	61.5	14	35.9	1	2.6	2.59	High
*Poor competency of laborer PCL	27	69.2	1	25.6	2	5.1	2.64	High
*Unavailability of sufficient professionals and managers UPM	20	51.3	8	20.5	11	28.2	2.23	Medium
*Without buying insurance for major equipment WIME	14	35.9	16	41.0	9	23.1	2.13	Medium
*Without buying safety insurance for employees WSIE	18	47.4	12	31.6	8	21.0	2.26	Medium
*Inadequate safety measures or unsafe operations ISM	27	69.2	10	25.6	2	5.2	2.64	High
*Lack of readily available utilities on site	18	46.2	19	48.7	2	5.1	2.41	High
*Unavailability of sufficient amount of skilled laborer USL	26	68.4	10	26.3	2	5.3	2.63	High
*Prosecution due to unlawful disposal of construction waste PUDW	24	61.5	12	30.8	3	7.7	2.54	High
*Serious air pollution due to construction activities SAP	20	51.3	14	35.9	5	12.8	2.38	High
*Serious noise pollution caused by construction SNP	18	46.2	12	30.8	9	23.1	2.23	Medium
*Water pollution caused by construction	9	24.2	14	37.8	14	37.8	1.86	Medium

From table 4 above, it is clearly observed that, the most important risk factors that related to contractors and which have high effects on projects construction are arranged as follows based on the level of effect:

- 1 Contractors' poor management ability
- 2 Poor competency of laborer
- 3 Inadequate safety measures or unsafe operations
- 4 Unavailability of sufficient amount of skilled laborer
- 5 Contractors' difficulty in reimbursement
- 6 Prosecution due to unlawful disposal of construction waste
- 7 Lack of readily available utilities on site
- 8 Serious air pollution due to construction activities.

The high responses of the sample views are supported by the mean value which ranged from (2.85- to 2.38).

Also from the results in table 4 above, we notice that the following risks factors that related to contractors, have medium effects, are arranged as follows based on the level of the effects of each one:

- 1 Without buying safety insurance for employees.
- 2 Unavailability of sufficient professionals and managers.
- 3 Serious noise pollution caused by construction.
- 4 Without buying insurance for major equipment.
- 5 Water pollution caused by construction.

The respondents' views are supported by the mean values which come as follows: (2.26, 2.23, 2.23, 2.13, and 1.86).

Table 5. shows sample responses concerning risk factors related to subcontractors (suppliers).

Factors	High		Medium		Low		Average	Effect
	F	%	F	%	F	%		
Low management competency of subcontractors	31	79.5	8	20.5	0	0.0	2.79	High
Suppliers' incompetency to deliver materials on time	26	66.7	13	33.3	0	0.0	2.67	High

From the above table 5, it is clearly seen that, the most important risk factor that related to suppliers and has a high effect on projects construction is the low management competency of subcontractors, and the second factor is suppliers' incompetency to deliver materials on time.

Therefore, these two factors have serious effect on the delay of the project.

Table 6. shows sample responses concerning risk factors related to government agencies

Factors	High		Medium		Low		Average	Effect
	F	%	F	%	F	%		
Bureaucracy of government	22	57.9	10	26.3	6	15.8	2.42	High
Excessive procedures of government approvals	26	66.7	7	17.9	6	15.4	2.51	High

From table 6 it is obviously observed that the two risks factors that related to government agencies, which are bureaucracy of government agencies, and excessive procedures of government approvals, have high effect on projects construction.

Table 7 shows respondents' views concerning Price inflation of construction materials as an external issue.

	Frequency	Percent Valid	Percent Cumulative
Valid medium	3	7.7	7.7
high	36	92.3	100.0
Total	39	100.0	100.0

From the above table 7, it is generally seen that 92.3% of the respondents believe that price inflation of construction materials has a high effect on project construction, whereas 7.7% saw that it has a medium effect.

Therefore, we conclude that the majority of responses indicate that price inflation of construction materials has a high effect on project construction, which definitely delay the completion of the project in its determined time.

Table 8. Risks factors that have high effect on project construction classified according to the risk coefficient.

Risks factors	Mean values	Standard deviation	Risk coefficient
Price inflation of construction materials	2.92	0.27	9.2%
Contractors' poor management ability	2.85	0.37	13.0%
Low management competency of subcontractors	2.79	0.41	14.7%
Suppliers' incompetency to deliver materials on time	2.67	0.48	18.0%
Poor competency of laborer	2.64	0.58	22.0%
Inadequate safety measures or unsafe operations	2.64	0.58	22.0%
Unavailability of sufficient amount of skilled laborer	2.63	0.59	22.4%
Project funding problems	2.62	0.71	27.1%
Contractors' difficulty in reimbursement	2.59	0.55	21.2%
Prosecution due to unlawful disposal of construction waste	2.54	0.64	25.2%
Tight project schedule TPS	2.51	0.61	24.3%
Excessive procedures of government approvals	2.51	0.76	30.3%
Bureaucracy of government	2.42	0.76	31.4%
Lack of readily available utilities on site	2.41	0.59	24.5%
Serious air pollution due to construction activities	2.38	0.71	29.8%

According to risk coefficient calculated in the last column, it is obviously observed that the most important ten risks factors that have negative effects on projects construction are as follows:

- a. Bureaucracy of government
- b. Excessive procedures of government approvals
- c. Serious air pollution due to construction activities
- d. Project funding problems
- e. Prosecution due to unlawful disposal of construction waste
- f. Lack of readily available utilities on site
- g. Tight project schedule TPS
- h. Unavailability of sufficient amount of skilled laborer
- i. Poor competency of laborer
- j. Inadequate safety measures or unsafe operations

5.2.4 The impact of risks variables on project objectives

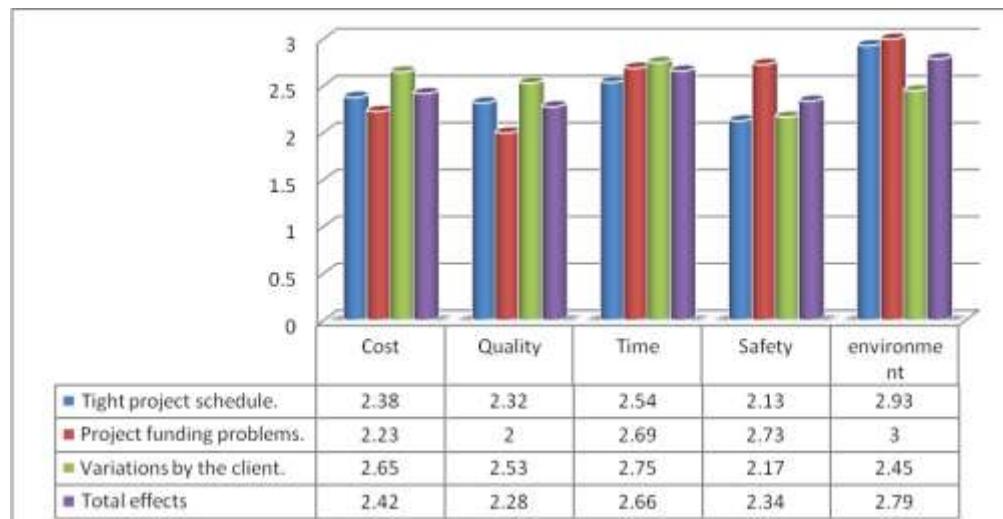


Figure 4. The effect of risks factors related to clients on project objectives.

From the above figure 4, it is clearly seen that the risks factors related to clients have an obvious effects on the project objectives. We can observe from the above table, they have strong effects on project costs, time of project completion, and on the environment, whereas they have medium effects on quality and safety.

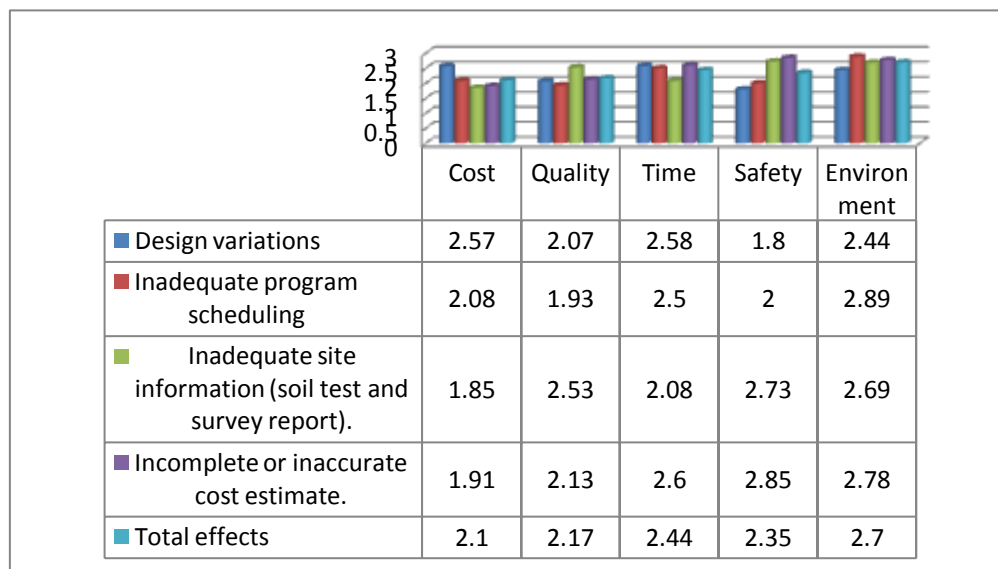


Figure 5. The effects of risks related to designers.

From the statistics figure 5, it is observed that the risks factors related to designers affect project objectives in different level. We can notice that they have strong effect on time and environment, and they have medium effects on costs, quality, and safety.

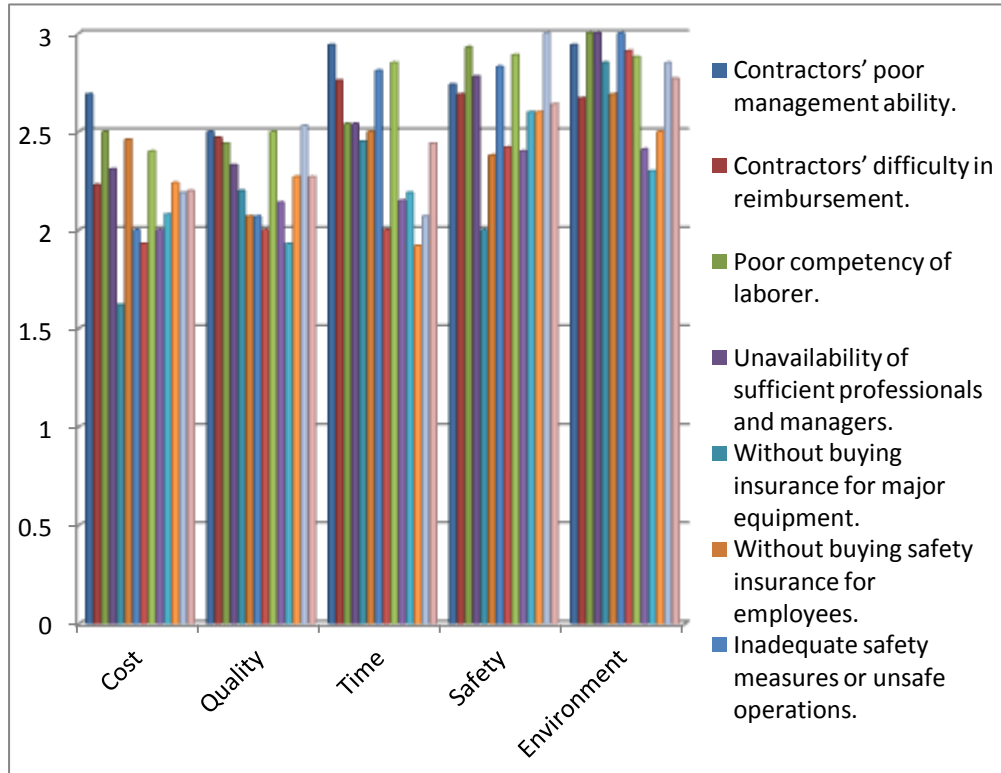


Figure 6. The effects of risks related to contractors on project objectives.

From the above statistics, it is clearly seen that risks factors related to contractors (13 factors) have various effects on project objectives. We notice from the above table, on average, they have strong effects on time, safety and environment, while they have medium effects on cost and quality.

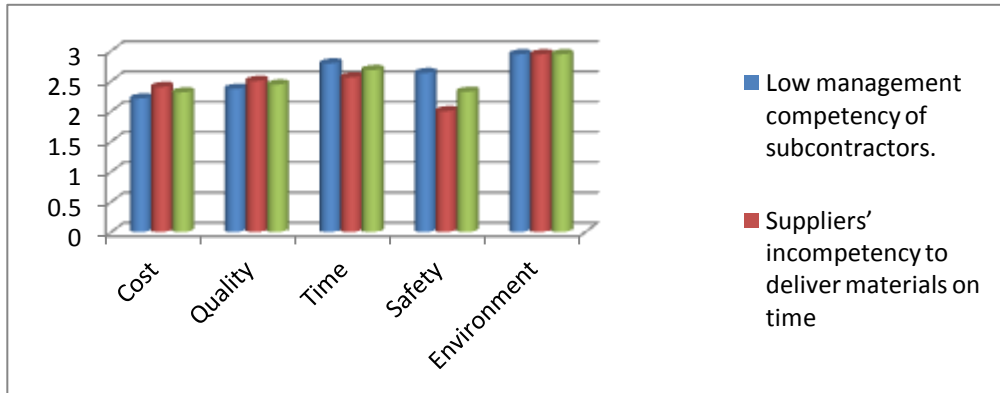


Figure 7. The effects of risks factors related to subcontractors – suppliers

From the above figure 7, we notice that the risks factors related to subcontractors have strong effect on quality, time, and environment, while they have medium effects on cost and safety.

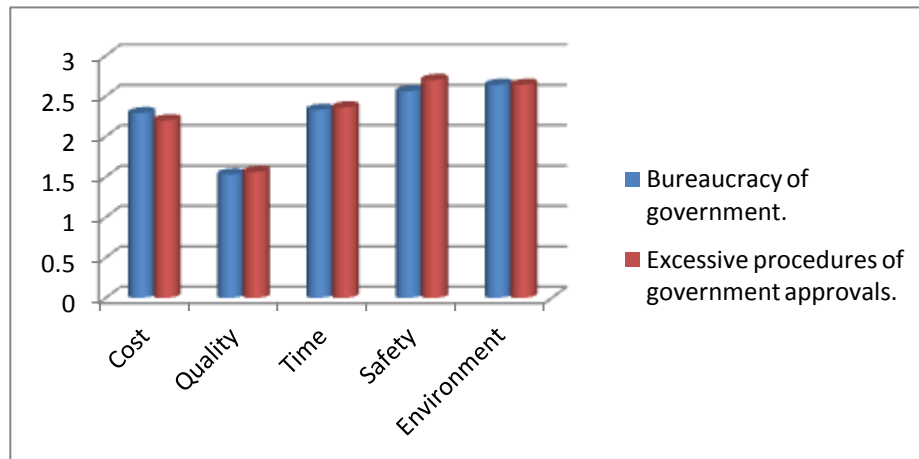


Figure 8. The effects of risks factors related to government agencies

From the above table, concerning the risks factors related to government agencies, it is obviously seen that they have medium effects on the project objectives including, quality, time and environment, where they have strong effects on cost and safety.

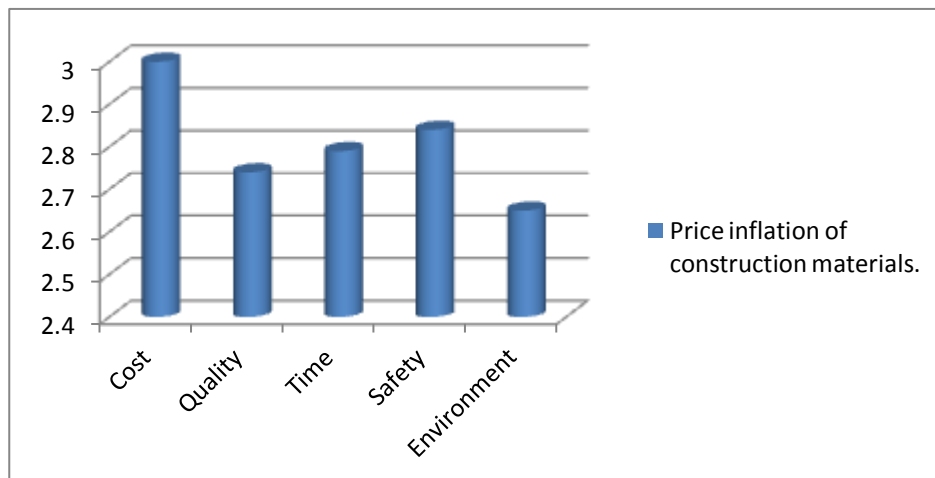


Figure 8. The effects of risks factors related to government agencies

From figure 8 above, the risks related to external issues, it is clearly seen the price inflation of construction materials have strong effects on the project objectives.

5.2.4 Factor analysis

To specify the most important factors within the (25) risks factors, and to determine which factors that mostly have high effects on project objectives, factor analysis has been performed

to extract these factors. Using factors analysis through employing the principal components under extraction method image factoring, and rotation method varimax with Kaiser normalization. The results show that there are (seven factors) have a total load (68.2%). These Seven factors include:

1. Variations by the client.
2. Project funding problems.
3. Suppliers' incompetency to deliver materials on time.
4. Excessive procedures of government approvals.
5. Low management competency of subcontractors
6. Contractors' poor management ability.
7. Unavailability of sufficient professionals and managers.

6 NUMERICAL RESULTS

From the above study and analysis we conclude the following results:

1. Most of the sample participated in the current study their education level and work experience will enable them to give accurate responses about the survey questions.
2. Questionnaire' reliability has been measured through using Cronbach's Alfa coefficient. It was reaching (0.817), which is high, and this indicate that the questionnaire method used to collect data from respondents has a very high validity, and would give more trust to the results reached at the end of the study.
3. The study showed that, the most important risk factors that have a high effect during project construction phases, which are related to clients is the project funding problems, and the second risk factor is tight project funding, whereas variations by the clients have a medium effect on project construction.
4. It is obviously observed that, the most important risk factor that related to design which has a high effect on projects construction is the incomplete or inaccurate cost estimates, whereas the other three factors have medium effects on projects construction.
5. The most important risk factors that related to contractors which have high effects on projects construction are arranged as follows based on the level of effect:
 1. Contractors' poor management ability.
 2. Poor competency of laborer.
 3. Inadequate safety measures or unsafe operations.
 4. Unavailability of sufficient amount of skilled laborer.
 5. Contractors' difficulty in reimbursement.
 6. Prosecution due to unlawful disposal of construction waste.
 7. Lack of readily available utilities on site.
 8. Serious air pollution due to construction activities.

6. Generally speaking, the study showed that risks factors related to suppliers has high effects on project construction, they include low management competency of subcontractors, and suppliers incompetency to deliver materials on time, what delay the project completion.

7. The study detected that the two risks factors that related to government agencies, which are bureaucracy of government agencies, and excessive procedures of government approvals, have high effect on projects construction.

8. It is generally seen that 92.3% of the respondents believe that price inflation of construction materials has a high effect on project construction.

9. When calculating the risks coefficient, it is obviously observed that the most important ten risks factors that have negative effects on projects construction are as follows:

1. Bureaucracy of government
2. Excessive procedures of government approvals
3. Serious air pollution due to construction activities
4. Project funding problems
5. Prosecution due to unlawful disposal of construction waste
6. Lack of readily available utilities on site
7. Tight project schedule (TPS).
8. Unavailability of sufficient amount of skilled laborer
9. Poor competency of laborer
10. inadequate safety measures or unsafe operations

6 concerning the effect of the (25) risks factors on project objectives, the study revealed that through using factor analysis there are seven basic factors has been extracted (with a load of (68.2%) that have strong effects on project objectives. These seven factors are as follows:

1. Variations by the client.
2. Project funding problems.
3. Suppliers' incompetency to deliver materials on time.
4. Excessive procedures of government approvals.
5. Low management competency of subcontractors
6. Contractors' poor management ability.
7. Unavailability of sufficient professionals and managers.

7 Conclusions and recommendations

The study concluded that, the major affect on construction projects come from the following factors: government processes and approvals, clients funding, suppliers, contractors and subcontractors. Besides, lack of experts in construction projects in term of managing projects, skilful labourer.

Based on the conclusion of this study, and in order to come over these menaces factors, the study provides for the construction enterprises in Jeddah; kingdom of Saudia Arabia the following recommendations:

It is mandatory for the construction enterprises to come up with suitable policies to control and modified their performance in the following issues:

1 client's contracts must identify in clear crystal, the scoop of the project and the payments in terms of amount and time.

2 contractors and subcontractors must be selected carefully according to appropriate standards to assure their competencies will add value to the project operations.

3 selecting multiple contractors and suppliers will create a competition environment, which must be managed carefully for the benefit of the project.

4 obtaining and maintaining talents such as: project manager, government relations and public relations manager.

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