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The Effect of Risk Allocation on Minimizing Disputes in Construction Projects in Egypt

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***Abstract* - Construction projects in general experience a lot of undetermined or unexpected events that are called risks. These risks are of the main reasons that cause disputes in the construction industry between the various parties. So as a step forward in the approach of mitigating these risks, a survey questionnaire was developed to assess the perceptions of key parties in construction on risk allocation. A minimum percentage of 50% was required for the risks to be allocated to a certain party. If the minimum isn't met, the risk is to be left undecided. Till the time this paper is written, forty three respondents answered the survey questionnaire and allocated the various risk factors listed to the appropriate party, either owner, contractor, or shared between both parties. The survey questionnaire also assessed two other factors; the risks' frequency in construction process and the risk significance in causing construction disputes. The results of risk allocation allocated thirteen risks to the contractor, thirteen to the owner and eleven to be shared between both of them. No risks were left undecided. The risk significance results showed that the selected risks were of the actual causes of construction disputes so it was concluded that by fairly allocating the risks to the corresponding parties, the dispute level will decrease automatically.**

Keywords—Risk Management, Construction Projects, Egypt, Risk Allocation

I. INTRODUCTION

Construction of a project involves a lot of relevant activities to reduce the gap between the conceptual and execution stages. For a construction project to be viewed as complete, the project team needs to experience and overcome numerous abnormalities and uncertainties. One of those challenges is the 'Construction Risk', which is dominant in most if not all of the construction projects. The risk is usually characterized as an instance of uncertainties where the results fluctuate from the planned or anticipated ones, leading to misfortunes, losses or unforeseen returns. The risk is thought to be a potential difficulty particularly in the construction industry, considering the investments and time barriers.

Project risk management is one of the important aspects of the project management. Because of the uncertainty of construction risks, the losses due to risk directly impact all project participants' benefits. Risk allocation is explicitly one of the causes that raise significant concerns by practitioners and researchers well as. Risk allocation is the process of allocating risk events with related and responsible project participants. It also provides another way for project participants to identify and classify risk issues (Issa et al. 2015). The concept of risk allocation is the process that allocates the potential risk loss or returns to each project participant to promote them for improving the enthusiasm of risk controlling and reducing the cost of risk-taking. One of the primary goals of risk allocation is to minimize disputes in construction contracts. Also, risk allocation is crucial to project success (Odunusi & Bajracharya 2014). The risk allocation process can be performed qualitatively and quantitatively (Rouhparvar et al. 2014). In recent years, the researchers for risk allocation were mostly focusing on project risk allocation principles as well as problems in contracts (Hartman & Snelgrove 1996; Hanna & Swanson 2007; Zhenyu et al. 2003; and Dingjun et al. 2007). Allocating project risks is always a thorny problem that project risk management couldn't solve (Gao et al. 2008). Traditionally, in construction projects, owner seeks to pass almost of the risks to a contractor. Due to the discriminatory attitude to the risk allocation and unfair transfer of risks, the parties that these risks are imposed on adopting defensive strategies such as lowering the work quality, imposing large contingency charges, conservative design and eventually resort to claims, disputes, and litigation. Such defensive strategies may lead to project delays and project cost overruns (Nasirzadeh et al. 2013). The Construction Industry Institute (1993) points out that the predictability of risks can allocate the risks during the construction of a project. The risks, which could be forecasted by the experienced contractors, should be undertaken by the contractor; whereas risk that couldn't be forecasted should be carried out by the owner (Construction Industry Institute 1993; Chuang 2002). "Construction Risks and Liability Sharing," published by American Society of Civil Engineering, proposes a manageable risk allocation principle: the risk should be assigned to the participant who can best manage and reduce the risk (Chuang 2002).

II. METHODOLOGY

A. Introduction

The term methodology is used to establish a step by step procedure for arriving at the desired results. In every research project, the chapter on research methodology holds great prominence. The main sections of this chapter are based on the development of a survey questionnaire, survey sample size, data analysis, and the scoring system. A flow chart of the research methodology is demonstrated subsequently to get a clearer picture of the methodology that has been followed.

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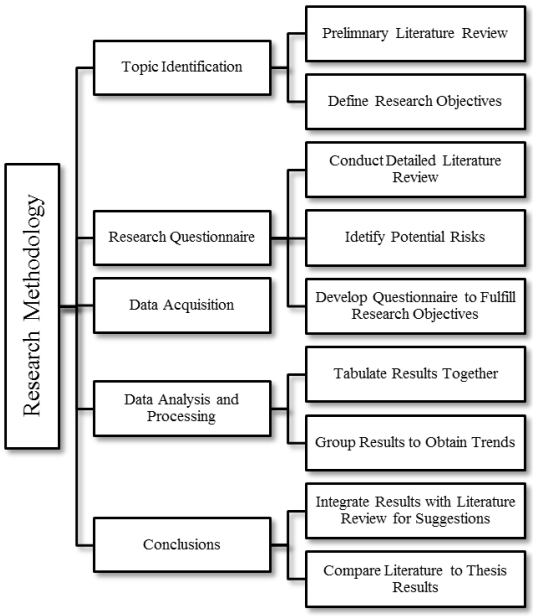

Figure II.1 The research methodology

B. General Research Design

The General Research Design was divided into the following processes:

Literature Review
Planning the Research Methodology and Procedures
Development of the Survey Questionnaire
Data Collection
Data Analysis

Immediately after the literature review which resulted in identifying the potential risks facing the construction projects in Egypt, a detailed plan of the research design was sketched out, and it was decided that survey questionnaire would be used for gathering the data. In the case of this thesis, it was the various construction risks evident in the construction market, their allocation to the corresponding party and their effect on construction disputes that hold prominence to frame the survey questionnaire. The details about the questionnaire design are provided in the subsequent stages of this chapter. Data management and analysis were planned after receiving the completed questionnaires from the respondents followed by drawing conclusions about findings brought from data analysis.

C. Survey Questionnaire

The questionnaire development phase was based on the following two procedures:

First: the construction of the survey questionnaire based on an extensive literature review. Second: data collection by sending the questionnaire to the concerned participants and people working in the construction field.

The next phase was related to the data analysis and drawing conclusions about the given results which hopefully would prove out to be useful to the regional constructional industry.

a. Questionnaire Construction

The questionnaire consists of two main components:

The first component covers general details or background information about the respondents. This includes the name and level of experience of each respondent as well as the name of the company he works for, the number of employees in the enterprise, and the party to which his company belongs (contractor, owner, project management consultant, …etc).

The second component was the main survey question in a tabular format for the ease of answering. The research question can be broken into three main sections.

The first section asks the respondents to allocate fairly given risks to the party they see most suitable to handle the risk, regardless of what happens in practice. The party options are the owner, the contractor, and risk sharing between the owner and the contractor.

The second section tests the frequency of the risks to happen in construction projects. The answers for this section range from very frequent, to rare.

The third section assesses the significance of all those construction risks in the construction disputes. This section asks the respondents to rate the effect of the risks in causing disputes between the various parties. The answers for this part range from "very significant in causing disputes" to "does not cause disputes".

It is of great importance that the questionnaire would be quick and easy to complete. This was crucial, as there were too many risks to be allocated, and frequency and impact rated. Therefore, the objective was to keep the respondents answering these questions quickly, but efficiently. The main answering technique chosen was a simple tabular format in which respondents select the choices of their preference quickly and easily.

At the final stage of the questionnaire, contact information of the researcher is provided so that the respondents can interact to clarify the issues related to the study. After that, the questionnaire is passed onto the respondents to proceed to the analysis and findings stage.

b. Survey Sample Selection

The overall objective of the survey was to allocate the construction risks and determine their frequency and effect on construction disputes, so it was necessary to involve various construction companies and project management firms, to gather different points of view from various key parties within the industry and make the research more efficient and representative. By carefully considering the research theme of different angles and to avoid any possible conflict and discrepancies in the collected data, only construction contractors, developers, suppliers, consultants and owners from Egypt or working in the Egyptian construction field were selected. Only companies operating in Egypt were chosen to avoid irrelevant results about projects held abroad.

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The practical procedures implemented to obtain results were as follows:

1. Select people working in the construction companies, the project management firms, and project management experts through information collected from previous experience, colleagues, professors, and formal authorities.
2. Many versions of the questionnaire were piloted out to some project management experts before the final version was dispatched.
3. The questionnaire is then posted on the internet and sent to selected professionals and relevant people.
4. The data was extracted from the responses given to be analyzed.

c. Data Analysis

The data collected from respondents is analyzed to arrive at the results of the research activity. The risk allocation of the construction risks to the most suitable party is the primary objective to be derived from the survey questionnaire. The other aim is assessing the significance of construction risks in the construction disputes as well as rating the frequency of the risks in construction projects to value their importance, and the data for this purpose is analyzed by determining the importance index.

Statistical methods are used to interpret the results. The results are demonstrated in tabular columns, charts and in terms of comparative percentiles. Graphical representations have a tendency to make the comparisons clearer and thus were used especially in the case of showing the risk importance levels for all the risks. In an event of risk allocation, the party (owner, contractor, shared) achieving the highest response rate is supposed to carry that risk. There would be some risks where two sides meet the same score and for such hazards, the risk allocation remains undecided.

d. Scoring System

The initial section of the survey questionnaire doesn't require any scoring system as it is related to the demographics of the respondents. Hence, the usage of scoring system initiates in the section of the questionnaire that deals with the frequency and significance of construction risks which uses an ordinal scale. This ordinal scale is a qualitative 3 points scale, namely very frequent, common and rare for the frequency scale and very significant in causing disputes, might cause disputes and does not cause disputes for the significance in construction disputes section. This scale will be transformed into an interval scale by assigning a weight to each interval to facilitate the required parametric statistics. No scoring is needed for other sections of the questionnaire; however, the greatest percentage for a specific result is taken as the decision. Scoring will be as follows:

- "Very frequent" or "Very significant in causing disputes" equals 5 points
- "Common" or "Might cause disputes" equals 3 points
- "Rare" or "Does not cause disputes" equals 1 point

Frequency Index of each risk category will be calculated as follows:

$F1 = 5*X1 + 3*X2 + 1*X3 / (X1 + X2 + X3)$

Where:

F: Frequency Index (F1 denotes risk number 1 in this case)

X1: Number of respondents answering "Very Frequent"

X2: Number of respondents answering "Common"

X3: Number of respondents answering "Rare"

Microsoft Excel is used as software to perform weighting, ranking and to calculate the percentage of each risk category.

Frequencies and ratio calculation will be used for other sections of the questionnaire.

Frequency or Significance (%) = $n / N_t *100$

Where:

n = number of respondents (frequency)

N_t = Total respondents

III. Risk Classification and Categories

For the purpose of this study, and for the ease of classification and grouping of construction risks, it was chosen to abide by El-Sayegh's (2008) trend of risks' classification. The project risks evident in the Egyptian construction market were selected and classified into internal and external risks as shown in the following section.

Table III.1 Risk categorization in this study

Internal Risks	External Risks
Delayed payment to contractors	Acts of God
Unreasonably imposed tight schedule	Difficulty in claiming insurance compensation
Improper intervention	War threats and political instability
Change of design requirements	Labor strikes and disputes
Lack of scope of work definition	Changes in laws and regulations
Delays in obtaining site access & right of way	Corruption and bribes
Breach of contracts and disputes	Criminal acts
Sudden bankruptcy	Conflicts due to differences in culture
Defective design	Inflation and sudden changes in prices
Deficiencies in drawings and specifications	Currency fluctuation
Frequent changes in design	Shortage in manpower supply and availability
Drawings and documents not issued on time	Unexpected inclement weather
Accidents during construction	Unforeseen site conditions
Poor quality of work	Delays in resolving disputes
Low productivity of labor and equipment	Unfairness in tendering
Unpredicted technical problems in construction	
Contractors' incompetence	
Lack or departure of qualified staff	
Poor performance	
Breach of contracts	
Delay of material supply	
Quality problems of supplier material	

IV. Results and Discussion

Results obtained from the data analysis are displayed here in the form of tables, charts, and percentiles.

The number of respondents who filled the survey till the time of this paper is forty three.

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A. Respondents' Demographics

The first question in the survey questionnaire asked for the professions of the respondents. 28% of the respondents were contracts administrators, 32% were project managers, and 40% of the total respondents were either site engineers, design engineers, or planning engineers.

It was also found that 15% of the respondents had two or less years of experience, 23% had from three to five years, 20% from six to ten years and 42% were more than ten years experiences in the construction field.

Regarding the size of the company, 35% of the respondents worked for companies having from ten to fifty employees, 10% were in companies having from fifty one to hundred employees, 25% were in companies having from one hundred and one employees to one hundred and fifty, while 30% of the total respondents worked for companies of more than 150 employees.

B. Risk Allocation Results

The results of risk allocation showed that the respondents to the survey questionnaire allocated thirteen risks to the contractor, thirteen risks to the owner, and eleven to be shared between both parties. Some risks scored 0% allocation to the owner like the subcontractors' poor performance, low productivity of labor and equipment, subcontractors' breach of contracts, shortage in manpower supply and availability, conflicts due to differences in cultures, and accidents during construction.

In the following table, C is the Contractor, O is the Owner, S is Shared between both parties and D is the Decision taken for risk allocation.

Table IV.1 Risk allocation percentages and decision

Risk Factors	C	O	S	D
Change of design requirements by owner	10	70	20	*O*
Currency fluctuation	15	10	75	*S*
Delay of material supply by suppliers	74	2	24	*C*
Subcontractors' poor performance	75	0	25	*C*
Delayed payment to contractors	22	57	21	*O*
Delays in resolving disputes	2.5	3.5	94	*S*
Poor quality of work	62	6	32	*C*
Low productivity of labor and equipment	79	0	21	*C*
Drawings and documents not issued on time	28	64	8	*O*
Inflation and sudden changes in prices	11	8	81	*S*
Frequent changes in design by designers	18	63	19	*O*
Defective design	9	57	34	*O*
Quality problems of supplier material	72	5	23	*C*
Deficiencies in drawings and specs	14	52	34	*O*
Lack or departure of qualified staff	66	11	23	*C*
Corruption and bribes	32	9	59	*S*
Shortage in manpower supply and availability	60	0	38	*C*
Owner's unreasonably imposed tight schedule	16	80	4	*O*
Unforeseen site conditions	72	6	22	*C*
Accidents during construction	74	0	26	*C*
Delays in obtaining site access and right of way	28	70	2	*O*
Contractors' incompetence	60	20	20	*C*
Unpredicted technical problems in construction	60	11	29	*C*
Owner's improper intervention	33	57	10	*O*
Lack of scope of work definition by owner	15	58	27	*O*
Subcontractors' breach of contracts	80	0	20	*C*
Difficulty in claiming insurance compensation	33	12	55	*S*
Owner's breach of contracts	14	67	19	*O*
Unfairness in tendering	24	60	16	*O*
Labor strikes and disputes	56	2	42	*C*
Unexpected inclement weather	18	9	73	*S*
War threats and political instability	4	15	81	*S*
Changes in laws and regulations	3	29	68	*S*
Conflicts due to differences in culture	11	0	89	*S*
Owner's sudden bankruptcy	8	64	28	*O*
Criminal acts	25	6	69	*S*
Acts of God (Force majeure)	15	23	62	*S*

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C. *Risk Frequency Results*

The assessment of risks frequency showed was done using this equation: F1 = 5*X1 + 3*X2 + 1*X3 / (X1 +X2 + X3). All risks were given scores according to the previous formula. The greater score means more frequent occurrence. The risks are arranged from the most frequent to the least frequent in the following table.

The risk scoring the greatest score is the change of design requirement by the owner which means that respondents considered this the most frequent risk. While the least occurring risk from the respondents' perception is Acts of God or Force Majeure.

Table IV.2 Risk frequency scores

Risk Factors	*Score*
Change of design requirements by owner	4.067
Currency fluctuation	3.648
Delay of material supply by suppliers	3.605
Subcontractors' poor performance	3.512
Delayed payment to contractors	3.465
Delays in resolving disputes	3.419
Poor quality of work	3.419
Low productivity of labor and equipment	3.419
Drawings and documents not issued on time	3.419
Inflation and sudden changes in prices	3.327
Frequent changes in design by designers	3.280
Defective design	3.232
Quality problems of supplier material	3.140
Deficiencies in drawings and specifications	3.139
Lack or departure of qualified staff	3.047
Corruption and bribes	3.000
Shortage in manpower supply and availability	2.954
Owner's unreasonably imposed tight schedule	2.953
Unforeseen site conditions	2.861
Accidents during construction	2.860
Delays in obtaining site access and right of way	2.814
Contractors' incompetence	2.814
Unpredicted technical problems in construction	2.767
Owner's improper intervention	2.767
Lack of scope of work definition by owner	2.669
Subcontractors' breach of contracts	2.627
Difficulty in claiming insurance compensation	2.395
Owner's breach of contracts	2.349
Unfairness in tendering	2.302
Labor strikes and disputes	2.256
Unexpected inclement weather	2.075
War threats and political instability	2.070
Changes in laws and regulations	1.977
Conflicts due to differences in culture	1.791
Owner's sudden bankruptcy	1.791
Criminal acts	1.744
Acts of God (Force majeure)	1.698

D. *Risk Significance Results*

In this part of the questionnaire, the respondents are asked to rate the risks listed on a scale of "Very significant in causing disputes", "Might cause disputes", or "Does not cause disputes". The scoring for this part is the same as the previous section using the 3-point formula. The scores given for each risk type are given in Table IV.3.

Table IV.3 Risk significance scores

Risk Factors	*Score*
War threats and political instability	4.534
Change of design requirements by owner	4.442
Contractors' incompetence	4.397
Unexpected inclement weather	4.397
Owner's improper intervention	4.253
Labor strikes and disputes	4.119
Unfairness in tendering	4.117
Conflicts due to differences in culture	4.117
Inflation and sudden changes in prices	4.023
Shortage in manpower supply and availability	4.021
Unforeseen site conditions	3.932
Owner's breach of contracts	3.932
Owner's sudden bankruptcy	3.930
Drawings and documents not issued on time	3.842
Delayed payment to contractors	3.837
Owner's unreasonably imposed tight schedule	3.792
Changes in laws and regulations	3.742
Criminal acts	3.742
Difficulty in claiming insurance compensation	3.740
Acts of God (Force majeure)	3.698
Delays in resolving disputes	3.697
Unpredicted technical problems in construction	3.648
Lack of scope of work definition by owner	3.558
Corruption and bribes	3.427
Accidents during construction	3.421
Quality problems of supplier material	3.372
Low productivity of labor and equipment	3.371
Deficiencies in drawings and specifications	3.327
Currency fluctuation	3.231
Subcontractors' poor performance	3.231
Subcontractors' breach of contracts	3.186
Delays in obtaining site access and right of way	3.185
Lack or departure of qualified staff	3.093
Defective design	3.000
Delay of material supply by suppliers	3.000
Frequent changes in design by designers	2.579
Poor quality of work	2.486

The results shown in the previous table are organized from the most significant risk to the least significant. Almost all the risks ranged from very significant to might cause disputes. No risks were given the option "Does not cause disputes" which proves the results obtained from the literature review. The most significant risk in causing construction disputes is war threats and political stability, and the least significant is the poor quality of work.

V. CONCLUSION

Construction risks are a real hazard in the construction industry that causes a lot of disputes between the different parties in construction projects. The surveying method used for this study is a questionnaire to be distributed to various companies representatives in Egypt to fill it according t their own perception. The questionnaire tested the allocation of thirty seven listed risks that the respondents find reasonable and fair among the various parties in a project. The second thing that the questionnaire assessed was the frequency of occurrence of the various risk factors. And lastly, the significance of all risks in causing construction disputes. Results were collected, tabulated and analyzed using different methods. The allocation of risks

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was done by the allocating the risk to the party scoring more than 50% of the votes. For the frequency of occurrence of risks, a special formula was used to determine the weight of the listed risk factors. In the significance section, the same formula was used to obtain the results that show how the risk factors affect the construction disputes. Thirteen of the thirty seven risks were allocated to the owner, thirteen to the contractor, and eleven were shared between both of them. The risk scoring the greatest weight in frequency of occurrence was "Change of design requirements by owner" and the least occurring risk was "Acts of God (Force majeure)". The "War threats and political instability" and the least effective in causing construction disputes is "Poor quality of work".

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