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The Rank of Risk Factors Affecting Time Delay and Cost Overrun of Building Constructions Projects in Yangon

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ABSTRACT

In Yangon City, Myanmar, most of the building construction projects fail to meet their cost and time constraints, which will lead to low return on investment. The purpose of this paper is to understand risk management of building construction and the study area is Yangon. This study illustrates that how to manage risks in building construction to become a successful project with best possible outcome by reducing risks that delay the project. The study was conducted through a questionnaire survey administered to 39 construction projects and 148 professionals in Yangon for finding risk rating and prioritization of risk. Risk prioritization was done by Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

KEYWORDS: *Construction building projects, Project risk management, Qualitative analysis, Group technique for order preference by similarity to ideal solution and sensitivity analysis (GTOPSIS)*

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I. INTRODUCTION:

To achieve this involves identifying and managing the risks to the project at all project stages from through its planning, execution and control phases up to its completion and closure. Due to the rapid growth in the infrastructure of the project, the management of risk plays a vital role in the construction sector.

Risk management involves identification, analysis, evaluation, treating and monitoring. The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It is considerable importance since the process of risk analysis and response management may only be performed on identified potential risks. Risk analysis and evaluation is the intermediate process between risk identification and management. It incorporates uncertainty in a quantitative and qualitative manner to evaluate the potential impact of risk.

The evaluation should generally concentrate on risks with high probabilities, high financial consequences or combinations thereof which yield a substantial financial impact. Risk management can be considerably improved by improving the performance and the knowledge of labors, machinery, money, materials etc. which facilitates the entire construction industry.

II. Resrarch Methodology

To study the risk management building construction in Yangon, the following research methodology was employed in the study. Firstly, construction risks related to schedule delay were identified. The required data for the study were collected from past projects and the selected project and questionaries' survey was used. The survey data were analyzed by qualitative risk analysis to produces risk rating and based on risk rating prioritization of risks was done by using TOPSIS Method. The flow chart of the study is described with Figure 1.

Fig. 1 Flow Chart of the Study

III. DATA SOURCES

Data collection was carried out using questionnaire survey from building constructions in Yangon, Myanmar. A total of 200 questionnaire sets were distributed and 148 responders were received back. All the responders were having working experience of 1 year to more than 15 years in carrying out similar buildings projects in Yangon. Risks were identified by objective and subjective sources. Objective sources are recorded experience from past projects and the current project as it proceeds. Subjective sources contain experiences based upon knowledgeable experts. To carry out qualitative risk analysis, two criteria were selected namely,(a) probability of occurrence (b) impact on project duration and cost. Responders were asked to provide estimate for these criteria which respect to various risks. The data collected were used for prioritization of risk using GTOPSIS method.

A. Stage of the TOPSIS Method

Step 1: Calculate an evaluation matrix consisting of n alternatives and J attributes with the intersection of each alternative and attribute given as.

Step 2: Calculate the normalized decision matrix. The normalized value of the alternative with respect to the attribute is calculated as

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}}, \quad j = 1, 2, 3, \ldots, J, i = 1, 2, 3, \ldots, n$$

Step 3: Calculate the weighted normalized decision matrix. Its value:

$$V_{ij} = w_j r_{ij} = w_j \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}}, j = 1, 2, 3, \ldots, J, i = 1, 2, 3, \ldots, n \text{ Where is the weight of the attribute, } = 1$$

Step 4: Determine the positive ideal solution and negative ideal solution.

$$A^{\pm} = \{ v_1^{\pm}, v_2^{\pm}, \ldots, v_j^{\pm} \} = \{ \max/\min v_{ij} \mid j \in J \}$$

$$= \{ \max/\min \mid j J \}, j = 1, 2, 3, \ldots, J, i = 1, 2, 3, \ldots, n$$

Step 5: Calculate the separation measures, using the n-dimension Euclidean distance. The separation of each alternative form the ideal solution is given as:

$$D_i^{\pm} = \sqrt{\sum_{j=1}^{J} (v_{ij} - v_j^{\pm})^2}, j = 1, 2, 3, \ldots, J, i = 1, 2, 3, \ldots,$$

Step 6: Calculate the relative closeness to the ideal solution . The relative closeness of with respect to is defined as: $C_i^{+} = \frac{D_i^{-}}{D_i^{+} + D_i^{-}}$, i = 1, 2, 3, ..., n

Step 7: Rank the alternative according to C_i^{+}

IV. RISK IDENTIFICATION

The 54 number of risks factors which may occur in Yangon are identified and classified design related risks, financial /economic risks, political risks, management risks, construction risks, environmental risks, technology risks. These risk factors are shown in the following table 1.

Table1. Risk Factors

Risk Category	Risk Factors	Code No
Design	Inadequate design	D 1
	Non-compliance with design standards	D 2
	Owner-driected design change request	D 3
	Defective design by designer	D 4
	Inadequate and inaccuracies site information	D 5
	Poor understanding of rules and regulations	D 6
	Changes in design standards	D 7
Financial	Inadequate and inaccurate cost estimation	F 1
	Insufficient funds of client	F 2
	Delay payment in contract	F 3
	Contractor cash flow problem	F 4
	Financial instability of sub-contractor	F 5
	Community or adjoining business impacts	F 6
	Prosecution by third party	F 7
	Price escalation and fluctuation	F 8
	Interest rate increase	F 9

Political	Union Issue	P 1
	Poor altitude towards foreign companies	P 2
	Immuaturity of legal system	P 3
	Lack of transparency	P 4
	Change in Law	P 5
	Change in sales tax or other tax structures	P 6
	Poster actions and Disputes	P 7
	Pressure from any political party	P 8
Management	Failure to provide documents and information	M 1
	Improper scope of work definition in contract	M 2
	Poor site management and supervision	M 3
	Third Party delay	M 4
	Shortage and delay of machine/material supply	M 5
	Lack of incentives and motivation	M 6
	Labor disputes and strikes	M 7
	Poor planning for safety	M 8
Construction	Improper construction methods	C 1
	Defective construction, rework	C 2
	Coordination with utilities, adjoining neighbors	C 3
	Earthwork issue	C 4
	Unskilled labor	C 5
	Low producity of machine	C 6
	Changing sequences in construction activity	C 7
	Scaricity and high prices of man/machine/ material	C 8
	Poor coordination among subcontractor	C 9
	Delay in work execution of sub-contractor	C 10
	Site access, traffic,parking issue	C 11
	Property damage or theft issue	C 12
	Change in quantities of work	C 13
	Accident on sites	C 14
Environmen -tal risks	Environmental permits and approvals	E 1
	Archeological findings/unknown burial sites	E 2
	Hazardous materials or site contaminations	E 3
	Adverse Weather Condition	E 4
	Pollution by construction waste	E 5
Technology Risk	Knowledge on equipments	T 1
	Service for damaged equipments	T 2
	Loss of data or software/hardware of computer	T 3

V. RESULTS AND DISCUSSION

A. Demographic Result

A total of 200 questionnaire sets were distributed of which 148 valid responses with a rate of 74% were received back. Respondents who are specialized in building construction were asked to obtain probability and impact of identified 54 risks identified for construction of buildings Respondents are classified into five groups according to their working fields and their experiences. They are G1, G2, G3, G4, and G5.G1 is group of construction engineers whose experience is under two years. G2 is group of construction engineers whose experience is between two to five years. G3 is construction engineers whose experience is between five to ten years. G4 is construction engineers whose experience is eleven to fifteen years. G5 is construction engineers whose experience is above fifteen years. The percentage of number of respondents contained in each group is expressed in the Figure 2.

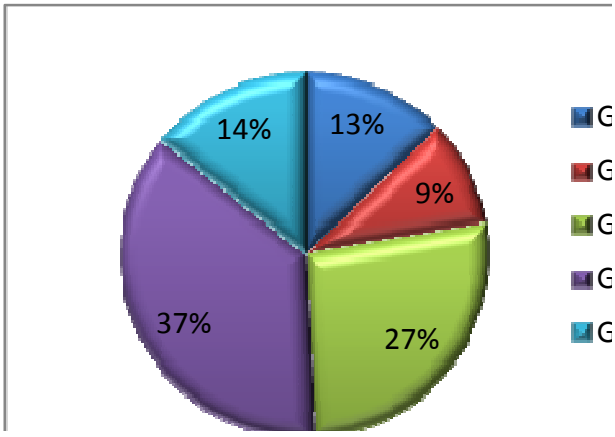

Fig. 1 Rate of Respondent Based on Working Experience

B. Given Weightages

The classified groups are needed to give weight for TOPSIS Method. The weight given to each group is based on their experience. The more experience they have, the greater the weight is. Since the total weightage must be equal to one, the weightage is calculated. The calculated weightage is obtained by the ratio of given weight to each group to total weight. The calculated weightage is expressed in Table 2.

Table2. Risk Factors

Group	Weightage Given	Calculated Weightage
G 1	1	0.0667
G 2	2	1.333
G 3	3	0.2
G 4	4	0.2667
G 5	5	0.333

C. Ranking Study of Risk Factors by TOPSIS Analysis

The five most important risk factors at building constructions in Yangon are owner directed design change request, poor planning for safety, poor site management and supervision, unskilled labor and insufficient funds of client. The following table (3) shows ranking of risk factors results for the building constructions in Yangon, Myanmar by TOPSIS analysis.

Table3. Ranking of Risk factors

Risk Factor	Ci^+	Rank	Group
D 3	0.514093479	1	Design
M 8	0.384881975	2	Management
M 3	0.381943669	3	Management
C 5	0.32856525	4	Construction
F 2	0.331685657	5	Financial
D 1	0.293145471	6	Design
C 3	0.297091808	7	Construction
D 2	0.292120698	8	Design
D 5	0.316853076	9	Design
M 5	0.254076989	10	Management
D 6	0.293413749	11	Design
D 7	0.256595557	12	Design
F 3	0.254502698	13	Financial
D 4	0.247222027	14	Design
C 2	0.239271906	15	Construction
C 6	0.231156166	16	Construction
M 2	0.237015654	17	Management
C 1	0.238168325	18	Construction
C 9	0.216443912	19	Construction
C 10	0.214217661	20	Construction
E 1	0.200863688	21	Environmental
C 8	0.193547667	22	Construction
M 1	0.185664717	23	Management
C 4	0.189574717	24	Construction
F 5	0.180052039	25	Financial
E 4	0.181772488	26	Environmental
F 8	0.178767076	27	Financial
P 3	0.181890829	28	Political
P 1	0.172523354	29	Political
F 1	0.181819748	30	Financial
T 3	0.176862263	31	Technology
C 11	0.171489926	32	Construction
M 7	0.174155323	33	Management
C 13	0.170439962	34	Construction
C 7	0.168469914	35	Construction
F 4	0.159769507	36	Financial
M 4	0.16211021	37	Management
P 2	0.165711123	38	Political
T 1	0.159968398	39	Technology
T 2	0.151702713	40	Technology
E 3	0.154258954	41	Environmental
P 5	0.144685605	42	Political

E 2	0.152144532	43	Environmental
M 6	0.138955941	44	Management
C 14	0.142585585	45	Construction
P 4	0.136255405	46	Political
E 5	0.128850875	47	Environmental
P 6	0.133188703	48	Political
F 7	0.129056859	49	Financial
F 6	0.120560109	50	Financial
P 8	0.109246147	51	Political
F 9	0.107681846	52	Financial
C 12	0.105623483	53	Construction
P 7		54	Political

Almost these, owner directed design change request is the most dominant factor that is placed at rank 1. It is very important component in construction project. Therefore, designers should be discussed and explained the customers about design at the design stage not to delay the constructions.

Poor planning in safety and poor site management and supervision are two major risk factors in management risk group at rank 2 and 3.

Unskilled labor is the fourth ranked risk factor. Unskilled labor factor impact project time, budget and quality that leads to project failure.

Cash flow difficulties as the finance risk factor are the fifth most critical risk factor. This can affect the procurement of material that causing delay in the completion of project within target time. As the recommendation, contractors are urged to have enough cash to minimize the financial problems.

VI. CONCLUSION

This study has shown that risk factors are the critical component in achieving project objectives. The significant risk-contributing factors found are owner directed design change request, poor planning for safety, poor site management and supervision, unskilled labor and insufficient funds of client. These significant factors are from four major categories of design, management, construction and finance group. To minimize the chances of failure of the construction projects, the significant risk factors should be properly handled in managing the risk.

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