

## Risk Management Practices in Road Construction Projects

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**Abstract:** Addis Ababa the capital city of Ethiopia and the diplomatic capital of Africa with more than 92 embassies and consular representatives cluster in the city where the Organization of African Union and the UN Economic Commission for Africa have their headquarters has been lacking an adequate road network to secure the economic and social welfare of the city. The road network of the city has coverage of about 20%, which is below the minimum standard of the international road coverage of 25%. Addis Ababa City Roads Authority (AACRA) has engaged different local and foreign road contractors in the city's road construction projects, planning to achieve the minimum standard by the year 2020 (AACRA 2017). However, previous researchers revealed that road construction projects undertaken in the city has serious problems. They are cost and time overrun. The major drawbacks are improper project management and use of the project management tools. This research focus on the study Risk management practices on Road Construction Projects in Addis Ababa city. The objectives of the research are identifying the likelihood of occurrence of risk factors in road construction projects, investigating their impact on project goals (i.e. cost, time, quality and etc.) and evaluating the degree of significance of the identified risk factors. This research work revealed that delay in possession of site is the highest significant risk factor among with delay in payments and defective design, which are ranked second and third respectively. This research work focuses on the risk management culture and practices of construction firms involved in road construction projects. This research attempts to assess the risk management culture from the perspective of awareness about risk management and commitment of the senior staffs in practicing the risk management process and the development and implementation of a risk strategy also assessed. In addition, the risk management practice of construction firms has been assessed throughout the different phases of risk management process. The result disclosed that construction firms have moderate level of awareness of the risk management process, but they did not implemented the right techniques of risk management process.

**Key words:** Risk, Risk management, Risk management process

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### I. Introduction

Globally, the construction industry highly influences the economy, the business environment and the society. The construction industry sector's contribution is greater in the case of developing countries including Ethiopia and the industry has been playing a crucial role in sustaining country's rapid socio-economic development and changing the livelihood of millions of people.

According to the National Bank of Ethiopia Annual Report 2017/2018, the construction industry has accounted for 71.4 % of the industrial output, which in turn registered 27 % share in the GDP. Thus, the construction industry had a 19.28% share of the GDP signifying the leading role of the construction sector in the nation's macro economy.

#### Statement of the Problem

The construction business, like any other business is risky. However, construction projects are perceived to have more inherent risks due to the involvement of many contracting parties such as owners, designers, contractors, subcontractors, suppliers, etc.. Construction projects are unique and built only once. They also involve a temporary project team that is gathered from different companies, countries, cultures, etc. Moreover, the size and complexity of construction projects are increasing which adds to the risks. This is in addition to the economic, political, social and cultural conditions where the project is to be undertaken (Sameh Monir and El-Sayegh 2007).

Thus, construction projects are exposed to an extremely large matrix of hazards and risks. This sensitivity is due to some of the inherent characteristics of construction projects as stated above. Exhaustive list of all the risks is time consuming and unproductive. Thus, the best method is to identify the most significant

risks. This paper attempts to identify the most significant risks in the road construction projects in Addis Ababa. This paper tries to assess on the principles and practice of risk management process by identifying, assessing, responding and control of risks within the construction firms engaged in the road construction projects, particularly projects undertaken in Addis Ababa city. The motive for conducting this study was more of personal observation of the poor performance of Asphalt road construction projects in Addis Ababa City.

Despite the remarkable achievements in recent years of improving the city's road network coverage, the overall performance of the road projects found to be unsatisfactory. Research revealed that road projects have serious time and cost overrun Feten (2008), Siraw (2014).

### **Objectives of the study**

1. To identify and assess the significant risks in the Addis Ababa city road construction projects based on their risk rating.
2. To study the culture and risk management practice of Road Construction projects in Addis Ababa City.
3. To provide practical suggestions and recommendations towards upgrading the risk management practice for the Contractors, Clients, Consultants and other stake holders involved in the road construction projects.

## **II. Review of Literature**

According to the broad based International Standard ISO 31000, risk is defined as “effect of uncertainty on objectives”. A further definition, again focusing on the realization of objectives, is provided by the Management of Risk: Guidance for Practitioners (2010 edition) guide, which states risk is “an uncertain event (or set of events) that should it occur will have an effect on objectives”. The UK Association for Project Management (APM 2006) definition is very similar and describes risk as “an uncertain event or set of circumstances that should it occur or they occur will have an effect on achievement of one or more project objectives”. Other definitions go on to draw attention to the fact that a risk may be negative or positive. These two types of project risk are called threat and opportunity respectively (Chapman 2014).

According to Chapman (2014), definition of Risk Management (RM) should include the fact that its principal goal is to secure the achievement of a project's objectives, not only the process of identification, assessment, allocation, and management of all project risks. Thus project risk management refers to the management of that exposure in the pursuit of achieving predefined goals. Hence, RM has two primary functions: a management activity (the “what”) to drive down the exposure to threats and exploit opportunities, and a goal-seeking function to support the satisfaction of a project's aims or objectives (the “why”). Consequently, RM requires both a support management process and comprehension of the project's objectives (Chapman 2014).

PMBOK Guide (2013) defines planning risk management as the process of developing and documenting an organized, comprehensive, and interactive strategy and methods for identifying and analyzing risks, developing risk response plans, and monitoring and controlling how risks have changed or deciding how to approach and plan the risk management activities for a project. Proper planning is essential to the success of the overall risk management process.

The risk management plan describes how each of the risk processes (Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning, and Risk Monitoring and Control) will be implemented, monitored, and controlled throughout the life of the project (Heldman 2005).

### **Research Methodology**

This study has used both primary and secondary data. The survey questionnaire is prepared and forty eight respondents are identified for this study. The respondents are classified into three categories. They are contractors, consultants and clients.

III. Results and Discussion

Table 1: Probability of risk factors generated based on contractors, consultants and client’s responses

S.No.	Risk Factor	Contractor's Response		Consultant's Response		Clients's Response		Overall response	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank
<b>1. Design and Tender Related Factors</b>									
1	Defective Design	3.85	3	3.83	4	3.90	3	3.86	3
2	Deficiencies in drawings and specifications	3.65	11	3.28	16	3.70	11	3.54	15
3	Poor definition of scope of work	3.60	12	3.61	13	3.70	11	3.64	13
4	Inaccurate contract quantities (increase or decrease)/ Poor cost estimate	3.40	18	3.17	18	3.30	16	3.29	17
5	Unfairness in tendering	3.00	26	2.89	32	2.90	37	2.93	31
6	High competition in bid	3.10	24	3.11	21	3.10	20	3.10	23
7	Low margin of profit due to high competition	3.15	21	3.28	16	3.10	20	3.18	20
<b>2. Construction Related Factors</b>									
<b>2.1 Legal and Contract Administration Related Factors</b>									
1	Delay in Possession of Site (RoW)	4.75	1	4.83	1	4.90	1	4.83	1
2	Poor communications among the parties in the contract	3.00	26	3.00	25	3.00	28	3.00	26
3	Inadequately compensated variation orders	2.90	29	2.94	29	3.00	28	2.95	29
4	Inadequate project duration	2.80	33	2.83	35	3.00	28	2.88	34
5	Delay inspection/ Poor supervision	2.90	29	2.72	40	3.10	20	2.91	33
6	Delay in claims and dispute resolution	2.90	29	2.94	29	3.10	20	2.98	27
7	Unfair decision on cost and/ or time claims	2.95	28	2.78	37	3.00	28	2.91	32
8	Delay in payments	4.20	2	3.83	4	3.80	5	3.94	2
9	Change in Legislations ( regulations, laws, ...)	2.35	43	2.72	40	2.90	37	2.66	41
10	Inadequate compensation for costs incurred due to changes in legislations	2.65	38	2.78	37	2.90	37	2.78	38
11	Customs and duty related problems	2.70	35	2.89	32	2.90	37	2.83	36
<b>2.2 Resource Related Factors</b>									
12	Shortage of project managers and construction professionals	3.15	21	3.06	22	3.20	17	3.14	22
13	Shortage of skilled and unskilled labor	3.15	21	3.06	22	3.10	20	3.10	24
14	Shortage of material and equipment	3.60	12	3.44	15	3.20	17	3.41	16
<b>2.3 Contractors' Management Related Factors</b>									
15	Inadequate planning	3.60	12	3.78	7	4.00	2	3.79	6
16	Delay in delivery of material and equipment	3.70	7	3.56	14	3.60	15	3.62	14
17	Wastage of materials (site)	2.90	29	2.94	29	3.10	20	2.98	27
18	Supply of low quality/ defective materials	2.65	38	2.78	37	2.90	37	2.78	38
19	Frequent breakdown of equipment	3.80	5	3.78	7	3.70	11	3.76	9
20	Poor commitment and coordination in Contractor's team	3.40	18	3.78	7	3.90	3	3.69	12
21	Turnover of Contractor's project management staff	3.10	24	3.00	25	3.10	20	3.07	25
22	Poor cash control/ Financial failure	3.70	7	3.72	11	3.70	11	3.71	11
23	Reworks/ poor workmanship	2.80	33	3.00	25	3.00	28	2.93	30
24	Low labor productivity	3.70	7	3.72	11	3.80	5	3.74	10
25	Low equipment productivity	3.70	7	3.89	2	3.80	5	3.80	5
<b>3. Financial Related Risks</b>									
1	Inflation	3.85	3	3.83	4	3.80	5	3.83	4
2	Shortage of foreign currency	3.75	6	3.78	7	3.80	5	3.78	7
3	Lack of access for financial support, like bank loan	3.60	12	3.89	2	3.80	5	3.76	8
4	High interest rate	3.50	16	3.17	18	3.10	20	3.26	18
5	High tax rate	3.45	17	3.06	22	3.00	28	3.17	21
<b>4. Site Condition Related</b>									
<b>4.1 Physical Related Factors</b>									
1	Unavailability of construction materials	3.20	20	3.17	18	3.20	17	3.19	19
2	Unforeseen ground conditions	2.45	42	2.83	35	3.00	28	2.76	40
3	Adverse climatic condition	2.55	40	3.00	25	3.00	28	2.85	35
4	Site safety/accident	2.55	40	2.89	32	3.00	28	2.81	37
5	Labour dispute and strike	2.70	35	2.72	40	2.20	45	2.54	42
6	Stoppage of work by local government/ local people	2.70	35	1.94	48	2.40	42	2.35	43
7	Natural disaster (land slide, flood)	2.00	47	2.06	47	2.00	48	2.02	48
8	Corruption/ bribery	2.20	44	2.22	45	2.40	42	2.27	44
9	Theft	2.15	45	2.17	46	2.30	44	2.21	47
<b>4.2 Social and Environment Related Factors</b>									
10	Pollution/ contamination	2.10	46	2.50	43	2.20	45	2.27	45
11	Ecological damage	1.95	48	2.50	43	2.20	45	2.22	46

Source: Compiled from SPSS 25.0 output

Mean scores and ranking mechanism are used to rate the probability of occurrence of various risks based on stakeholder’s view. For rating the probabilities, this study used the overall perceptions since there is a linear relationship between the stakeholder’s views based on Pearson’s correlation. As shown in the above table,

all the stakeholders have agreed to the high probability occurrence of right of way obstacles in the road construction projects. Delayed payment is one of the high severity risk factors with an overall mean score of 3.94 and it is ranked second. Defective Design which can be related with inadequate site investigation is in third place with an overall mean of 3.86.

Over the decades, inflation turned out to be inevitable in the Ethiopian economy. This risk factor is also given high overall mean score of 3.54 and ranked fourth. The likelihood of low equipment productivity was ranked fifth, the reason behind this risk factor can be due to the traffic and the limited space disrupts and reduces the equipment efficiency. Inadequate planning is considered highly probable by the respondents and ranked sixth with a mean score of 3.79. An overall mean score of 3.78 and 3.76 are calculated regarding to shortage of foreign currency and lack of access to financial support like bank loan and were ranked seventh and eighth respectively. Frequent break down of equipment, low labor productivity, poor cash control take the next rank in their probability of occurrences consecutively. Labor dispute strike, corruption, theft and natural disaster, resulted in least ranks ranging from 44 to 48th based on the overall mean scores given.

### **Impact of Risk Factors**

During the questionnaire survey respondents are asked to rate the impact of the identified risks factors. Their responses are generated in respect of mean scores and they were ranked. The alpha reliability coefficient was calculated, and an acceptable, good, and very good consistency was found based George and Malley's (2003) recommendation.

The below table shows the right of way obstruction stood in the 1<sup>st</sup> rank with mean 4.97. Defective design with an overall mean score of 4.47 has ranked second. High scores are calculated in the case of technical risk factors. i.e. inadequate site / geotechnical / investigation, incomplete design and design errors, scope and design change, defect in the quality of work, and improper planning and costing of projects. Regarding the socio-political risk of right of way problem, they are ranked first for their impact on cost and time. This implies that technical risk factors and RoW problem are main reasons for cost overruns, delays, and quality problems in road projects. Ethiopia's economic condition, regulatory changes, unavailability of dispute resolution body, local taxes, occurrence of accidents and return of funds are given less points compared to other risk factors. Below table presents the impacts of identified risks on costs, quality, and time of a road construction projects.

Table 2: Impact of identified risks

S.No.	Risk Factor	Contractor's Response		Consultant's Response		Clients's Response		Overall response	
		MS	Rank	MS	Rank	MS	Rank	MS	Rank
1	Defective Design	4.55	2	4.56	3	4.30	2	4.47	2
2	Deficiencies in drawings and specifications	4.30	4	4.06	5	4.00	5	4.12	5
3	Poor definition of scope of work	4.10	9	3.89	25	3.50	35	3.83	26
4	Inaccurate contract quantities (increase or decrease)/ Poor cost estimate	4.10	9	3.83	31	3.70	27	3.88	19
5	Unfairness in tendering	3.80	28	3.83	31	3.80	23	3.81	28
6	High competition in bid	3.85	23	3.78	35	3.90	13	3.84	25
7	Low margin of profit due to high competition	3.85	23	3.83	31	3.90	13	3.86	24
	<b>2. Construction Related Factors</b>								
	<b>2.1 Legal and Contract Administration Related Factors</b>								
1	Delay in Possession of Site (RoW)	4.90	1	5.00	1	5.00	1	4.97	1
2	Poor communications among the parties in the contract	3.85	23	3.78	35	3.60	30	3.74	33
3	Inadequately compensated variation orders	3.65	36	3.94	17	3.40	40	3.66	37
4	Inadequate project duration	3.85	23	3.94	17	3.80	23	3.86	22
5	Delay inspection/ Poor supervision	3.75	32	3.83	31	3.50	35	3.69	36
6	Delay in claims and dispute resolution	3.55	37	3.89	25	3.90	13	3.78	30
7	Unfair decision on cost and/ or time claims	3.55	37	3.89	25	3.90	13	3.78	30
8	Delay in payments	4.40	3	4.78	2	4.20	3	4.46	3
9	Change in Legislations ( regulations, laws, ...)	2.80	46	3.22	44	3.20	44	3.07	46
10	Inadequate compensation for costs incurred due to changes in legislations	3.15	43	3.56	40	3.50	35	3.40	40
11	Customs and duty related problems	3.10	44	3.33	42	3.50	35	3.31	42
	<b>2.2 Resource Related Factors</b>							0.00	
12	Shortage of project managers and construction professionals	3.80	28	3.94	17	3.90	13	3.88	18
13	Shortage of skilled and unskilled labor	3.80	28	4.00	9	3.80	23	3.87	20
14	Shortage of material and equipment	3.85	23	3.94	17	4.00	5	3.93	14
	<b>2.3 Contractors' Management Related Factors</b>								
15	Inadequate planning	4.20	5	4.06	5	4.00	5	4.09	6
16	Delay in delivery of material and equipment	4.15	6	4.06	5	4.00	5	4.07	7
17	Wastage of materials (site)	3.20	42	3.00	46	3.50	35	3.23	44
18	Supply of low quality/ defective materials	3.80	28	3.89	25	3.90	13	3.86	23
19	Frequent breakdown of equipment	4.15	6	4.06	5	4.00	5	4.07	7
20	Poor commitment and coordination in Contractor's team	3.90	21	4.00	9	4.00	5	3.97	11
21	Turnover of Contractor's project management staff	3.70	34	3.94	17	3.70	27	3.78	29
22	Poor cash control/ Financial failure	4.05	11	4.33	4	4.00	5	4.13	4
23	Reworks/ poor workmanship	3.35	40	3.33	42	3.20	44	3.29	43
24	Low labor productivity	3.90	21	3.94	17	3.60	30	3.81	27
25	Low equipment productivity	3.95	14	4.00	9	3.90	13	3.95	12
	<b>3. Financial Related Risks</b>								
1	Inflation	4.15	6	3.94	17	4.10	4	4.06	9
2	Shortage of foreign currency	4.00	12	4.00	9	3.60	30	3.87	20
3	Lack of access for financial support, like bank loan	3.95	14	3.89	25	3.90	13	3.91	16
4	High interest rate	3.95	14	3.67	37	3.70	27	3.77	32
5	High tax rate	3.95	14	3.67	37	3.60	30	3.74	34
	<b>4. Site Condition Related</b>								
	<b>4.1 Physical Related Factors</b>								
1	Unavailability of construction materials	3.95	14	4.00	9	3.80	23	3.92	15
2	Unforeseen ground conditions	3.95	14	4.00	9	3.90	13	3.95	12
3	Adverse climatic condition	4.00	12	4.00	9	4.00	5	4.00	10
4	Site safety/accident	3.25	41	3.67	37	3.10	46	3.34	41
5	Labour dispute and strike	3.70	34	3.94	17	3.30	43	3.65	38
6	Stoppage of work by local government/ local people	3.75	32	4.00	9	3.40	40	3.72	35
7	Natural disaster (land slide, flood)	3.95	14	3.89	25	3.90	13	3.91	16
8	Corruption/ bribery	3.40	39	3.44	41	3.60	30	3.48	39
9	Theft	2.95	45	3.06	45	3.40	40	3.14	45
	<b>4.2 Social and Environment Related Factors</b>								
10	Pollution/ contamination	2.75	47	2.94	47	3.00	47	2.90	47
11	Ecological damage	2.60	48	2.94	47	2.90	47	2.81	48

Source: Compiled from SPSS 25.0 output

### Significance of Risk Factors

One of the specific objectives of the study is to identify the most significant risk factors on affecting the objectives of road construction projects in Addis Ababa. Cumulative mean score is calculated by multiplying mean score of rate of occurrence of the risks with their impact to identify the significance of the risk factors. The

results are presented in the table. The result shows top 10 risks in the road construction projects in Addis Ababa. Delay in possession of sites free of RoW obstructions is found out to be the risk factor with the most severity, i.e. high occurring probability and high impact, which certainly have high detrimental impact upon both project time and cost. This suggests that steps to mitigate this most significant risk should be taken urgently by AACRA. This requires that a practical response plan. In this case a response would be to commence land acquisition and compensation procedures in time to complete them before awarding the contract. Risk monitoring and control would require that the project management team monitors the factors influencing the granting of possession of site. This would ensure that procedures are in place to manage events having an impact upon the possession of site and that these procedures are being implemented. In the case of land acquisition and compensation it would be necessary to confirm that the process has commenced at the appropriate time and to monitor the activity to ensure that it is proceeding on schedule.

Delay in payment and defective design are ranked second and third based on their significance of affecting project objectives. Maintaining proper cash flow is critical for the smooth execution of the project works. However, it has been observed that not effecting payments timely has lead projects to reduce or even stop project activities. The client has to secure the budget required to execute the project and effect payments timely. Defective design is observed to materialize mostly due to inadequate time for investigation, consultation of the public and incompetency of the firms involved in the design works. Thus, it is advisable to allocate more time to the design process, so that risks associated with design can be identified, assessed and addressed properly.

Inflation and inadequate planning are identified as the fourth and the fifth risk factors affecting objectives of the projects. Another important risk factor is related to the contractor's weak management is poor cash control is ranked 6<sup>th</sup>. With cumulative mean score of 15.3, frequent breakdown of equipment ranked 7<sup>th</sup>. The risk factor is related to scarcity of spare parts, which in turn relates to shortage of foreign currency. Contractors improper resource management also observed to be a factor for frequent break down of equipment. Low equipment productivity (CMS=15.00) is stood in 8<sup>th</sup> place. The equipment efficiency is much reduced in road construction in town sections due to many factors related to limited working space, obstructions, operators' efficiency and etc.

Table 3: Overall Risk Significance

S.No.	Risk Factor	Contractor's Response		Consultant's Response		Clients's Response		Overall Response	
		CMS	Rank	CMS	Rank	CMS	Rank	CMS	Rank
1.1	Defective Design	17.52	3	17.46	3	16.77	2	17.25	3
1.2	Deficiencies in drawings and specifications	15.70	6	13.29	16	14.80	9	14.60	13
1.3	Poor definition of scope of work	14.76	11	14.04	14	12.95	15	13.92	15
1.4	Inaccurate contract quantities (increase or decrease)/ Poor cost estimate	13.94	15	12.14	20	12.21	18	12.76	17
1.5	Unfairness in tendering	11.40	27	11.07	32	11.02	31	11.16	29
1.6	High competition in bid	11.94	24	11.75	24	12.09	20	11.93	23
1.7	Low margin of profit due to high competition	12.13	21	12.56	18	12.09	20	12.26	20
	<b>2. Construction Related Factors</b>								
	<b>2.1 Legal and Contract Administration Related Factors</b>								
2.1	Delay in Possession of Site (RoW)	23.28	1	24.17	1	24.50	1	23.98	1
2.2	Poor communications among the parties in the contract	11.55	25	11.33	29	10.80	34	11.23	28
2.3	Inadequately compensated variation orders	10.59	30	11.61	25	10.20	36	10.80	33
2.4	Inadequate project duration	10.78	29	11.18	31	11.40	29	11.12	30
2.5	Delay inspection/ Poor supervision	10.88	28	10.44	37	10.85	32	10.72	35
2.6	Delay in claims and dispute resolution	10.30	32	11.45	27	12.09	20	11.28	27
2.7	Unfair decision on cost and/ or time claims	10.47	31	10.80	33	11.70	25	10.99	31
2.8	Delay in payments	18.48	2	18.31	2	15.96	4	17.58	2
2.9	Change in Legislations ( regulations, laws, ...)	6.58	45	8.77	42	9.28	41	8.21	43
2.10	Inadequate compensation for costs incurred due to changes in legislations	8.35	41	9.88	39	10.15	37	9.46	38
2.11	Customs and duty related problems	8.37	40	9.63	40	10.15	37	9.38	40
	<b>2.2 Resource Related Factors</b>								
2.12	Shortage of project managers and construction professionals	11.97	22	12.05	21	12.48	17	12.17	21
2.13	Shortage of skilled and unskilled labor	11.97	22	12.22	19	11.78	24	11.99	22
2.14	Shortage of material and equipment	13.86	16	13.59	15	12.80	16	13.42	16
	<b>2.3 Contractors' Management Related Factors</b>								
2.15	Inadequate planning	15.12	8	15.32	6	16.00	3	15.48	5
2.16	Delay in delivery of material and equipment	15.36	7	14.42	13	14.40	12	14.72	9
2.17	Wastage of materials (site)	9.28	39	8.83	41	10.85	32	9.65	37
2.18	Supply of low quality/ defective materials	10.07	35	10.80	33	11.31	30	10.73	34
2.19	Frequent breakdown of equipment	15.77	5	15.32	6	14.80	9	15.30	7
2.2	Poor commitment and coordination in Contractor's team	13.26	19	15.11	10	15.60	5	14.66	11
2.21	Turnover of Contractor's project management staff	11.47	26	11.83	23	11.47	27	11.59	25
2.22	Poor cash control/ Financial failure	14.99	10	16.13	4	14.80	9	15.30	6
2.23	Reworks/ poor workmanship	9.38	38	10.00	38	9.60	39	9.66	36
2.24	Low labor productivity	14.43	13	14.68	12	13.68	13	14.26	14
2.25	Low equipment productivity	14.62	12	15.56	5	14.82	7	15.00	8
	<b>3. Financial Related Risks</b>								
3.1	Inflation	15.98	4	15.12	9	15.58	6	15.56	4
3.2	Shortage of foreign currency	15.00	9	15.11	10	13.68	13	14.60	12
3.3	Lack of access for financial support, like bank loan	14.22	14	15.12	8	14.82	7	14.72	10
3.4	High interest rate	13.83	17	11.61	26	11.47	27	12.30	19
3.5	High tax rate	13.63	18	11.20	30	10.80	34	11.88	24
	<b>4. Site Condition Related</b>								
	<b>4.1 Physical Related Factors</b>								
4.1	Unavailability of construction materials	12.64	20	12.67	17	12.16	19	12.49	18
4.2	Unforeseen ground conditions	9.68	37	11.33	28	11.70	25	10.90	32
4.3	Adverse climatic condition	10.20	33	12.00	22	12.00	23	11.40	26
4.4	Site safety/accident	8.29	42	10.59	36	9.30	40	9.39	39
4.5	Labour dispute and strike	9.99	36	10.74	35	7.26	46	9.33	41
4.6	Stoppage of work by local government/ local people	10.13	34	7.78	44	8.16	43	8.69	42
4.7	Natural disaster (land slide, flood)	7.90	43	7.99	43	7.80	45	7.90	45
4.8	Corruption/ bribery	7.48	44	7.65	45	8.64	42	7.92	44
4.9	Theft	6.34	46	6.62	48	7.82	44	6.93	46
	<b>4.2 Social and Environment Related Factors</b>								
4.1	Pollution/ contamination	5.78	47	7.36	46	6.60	47	6.58	47
4.11	Ecological damage	5.07	48	7.36	46	6.38	48	6.27	48

Source: Compiled from SPSS 25.0 output

**Table4: Top 10 Significant Risk Factors**

S.No.	Risk Factor	Contractor's Response		Consultant's Response		Clients's Response		Overall Response	
		CMS	Rank	CMS	Rank	CMS	Rank	CMS	Rank
2.1	Delay in Possession of Site (RoW)	23.28	1	24.17	1	24.50	1	23.98	1
2.8	Delay in payments	18.48	2	18.31	2	15.96	4	17.58	2
1.1	Defective Design	17.52	3	17.46	3	16.77	2	17.25	3
3.1	Inflation	15.98	4	15.12	9	15.58	6	15.56	4
2.19	Inadequate planning	15.12	8	15.32	6	16.00	3	15.48	5
1.2	Poor cash control/ Financial failure	14.99	10	16.13	4	14.80	9	15.30	6
2.16	Frequent breakdown of equipment	15.77	5	15.32	6	14.80	9	15.30	7
2.15	Low equipment productivity	14.62	12	15.56	5	14.82	7	15.00	8
3.2	Delay in delivery of material and equipment	15.36	7	14.42	13	14.40	12	14.72	9
2.22	Lack of access for financial support, like bank loan	14.22	14	15.12	8	14.82	7	14.72	10

Source: Compiled from SPSS 25.0 output

### Risk Management Culture

The respondents are presented with questions targeted to know the general risk management culture and their responses are summarized.

The result shows that 72% of the respondent's awareness on the value of risk management is at moderate level. However, a quarter of the respondent's awareness level is low. Despite the majority of the respondents have moderate level of awareness the attitude and commitment of senior staffs towards risk management is found to be low. The results revealed that more than 50% of the senior staffs have low attitude and commitment in implementing or practicing risk management principles and methodology. The role of the senior management staffs on the risk management practice is critical, for the senior management as leader should guide, coach and instruct for the implementation of the risk management process. Needless to say for a project success a dedicated and committed leadership is critical.

A risk management strategy is a structured and coherent approach to identifying, assessing and managing risk. The response for at what degree of level that risk management strategy is consistently communicated and shared at all levels of the construction companies has disclosed that 56.2% of the respondents believed that the level is low and about 41.7% think it is moderate the rest 2.1% replied high.

### Formalization of Risk Management Process

A formal and standardized risk management should be applied at organizational and project level for managing different risks and attaining organizational missions and project objectives. The results regard to formalization of risk management process indicated that majority of the respondents about 87.5% have disagreed with the existence of a clear risk management policy in the construction companies. Also about 89.6% of respondents disagreed with the statement that construction companies have adopted formal and standardized risk management process both at the project and company level. In regard to effectiveness of adopted risk management process for dealing with risks, the 58.3 of respondent disagreed and about 33.3% of them responded neutral and 8.3% of the respondents agreed. The overall result in effect shows that there is almost no formalized or standard risk management process. One cannot talk about effectiveness of adopted formal risk management process in a situation where one is not in place to conduct the risk management process.

### Risk Identification

Risk Identification is the first and very important step in risk management process. Risk identification can be applied to all phases of a construction project and will affect the later processes of risk management. Therefore, care should be taken to properly identify exhaustively the known potential risks. Based on the survey results, 81.2% of the respondents don't employ appropriate risk identification system and only about 10.4% and 2.1% agree and strongly agree respectively. This implies that majority of the construction firms rely on the traditional methods of risk identification system. This can be attributed to lack of commitment from the senior management to exercise the appropriate risk identification tools.

The results also revealed that new and emerging risks are rarely identified in a timely and proactive manner. About 83.3 % respondents are disagreed and even 4.2% strongly disagreed. About 12.5% of the respondents are agreed that they practicing this as a very important activity in risk identification.

Identified risks have to be consistently revised and re-evaluated throughout the company and projects for risks are time sensitive. In this regard 87.5% of the survey result indicated that identified risks are not revised and re-evaluate consistently at the company or enterprise level and the project level. 12.5% of the respondents are agreed presence of the practice of consistently revise and re-evaluate identified risks during the project time. About 41.7% and 45.8 have strongly disagreed and disagreed to the question presented whether construction companies involve employees in the risk identification process. Only about 6.2% agreed the rest 6.2% are neutral. The role of every employee in the risk identification process is crucial. Though, it is seems mainly the duty of a dedicated team assigned for risk management or the overall management, participating employee at all level will benefit in capturing all the potential risk factors that can easily be overlooked or ignored by others.

### **Risk Analysis**

All risks identified during the identification stages cannot be taken care due to the shortage of resources available to conduct the risk management process. Hence the need for prioritizing the list of risks in some way is required. Prioritization enables the effective use of limited resources as well as enables management attention to be focused on the more important individual risks and also on those parts of the organization most at risk. According to the survey result, 79.2% and 2.1% of the respondents have disagreed and strongly disagreed with the statement that firms analyze the likelihood of occurrence of the identified risks and their impact magnitude. 16.7% of the respondents have agreed and 2.1% have been neutral. Thus, majority of the construction firms (over 81%) are not practicing the important steps of risk management process and risk analysis. Respondents are also posed with the question whether risks are prioritized for decision making or not. 79.2% and 2.1% have disagreed, 18.8% agreed and 2.1% were neutral. 77.1% and 20.8% have disagreed and agreed to the statement that appropriate applicable risk analysis tools are exploited during risk analysis. 2.1% of the respondents are neutral. The respondents have also replied with 79.2% disagreement and 18.8% agreement to the statement that resources are allocated based on the results of risk analysis. 4.2% are neutral. The overall survey result in respect of risk analysis has revealed that construction companies are not practicing or properly assess the likelihood of occurrences and their impact magnitude of identified risks. This implies that risks are not prioritized and appropriate risk assessing tools are not in use.

### **Risk Response/Treatment**

Risk avoidance, risk mitigation/reduction, risk transfer/sharing, and risk retention are identified as the commonly used risk treatment strategies. Since in almost all of the projects standard conditions of contracts are in use, risks treatment with respect to risk allocation is included and clearly stated in the contract documents. In line with this 87.5% of the respondents have agreed that risks in contracts are properly apportioned among the parties, and 12.5% of the respondents have disagreed. However, on the contrary majority of the respondents have disagreed regarding the question that appropriate risk response strategy is developed and suitable risk responses are designed to deal with critical risks at their source. About 89.6% disagreed and 10.4% of them agreed. This indicates that there is a gap in the implementation of risk response or risk management process, even though the contract documents are properly allocated risks to the parties involved in the contact. About 89.6% and 10.4% of the respondents have disagreed and agreed respectively with the statement of appropriate risk response strategy is developed in construction companies. In addition, with the same figure the respondents have responded for the statement that suitable risk responses are designed to deal with critical risk at their source. Thus, majority of the construction firms have not developed risk response strategy.

### **Risk Monitoring and Control**

The survey result indicates that majority, about 87.5% of the respondents have declined the existence of generic process for actively track identified risks, monitoring residual risks, identify new risks, ensure that risk response plans are executed at the appropriate time, and evaluate their effectiveness throughout the project life cycle. About 12.5% of the respondent agreed for the existence of the practice. In addition, 85.5% of the respondent also disagreed to the implementation of the other important activity of risk monitoring and control phase of risk management, i.e. continuously monitor, review and improve the risk management process. Also 14.5% of the respondents have agreed with the present practices.

### **Risk Management Records**

Risk documentation starts with establishing a project database to collect historical information on risks encountered and related resolutions. Documentation includes a historical database and post-project assessment data. According to the survey result 91.78% have disagreed to the statement that risk management process are properly recorded and documented in the database system for future reference or decision making. Only about 8.3% of the respondents have agreed, implying that there are very few companies that practice the proper record

and documentation system of risk management process. In line with the above response; 93.8% of the respondents disagreed with the statement that firms have developed comprehensive risk management record system and shared to users and decision makers. About 6.2% agreed for the existence of a developed comprehensive risk management record system and information is shared to users and decision makers. Therefore, one can safely conclude that there is no proper record and document in the database of risk management process because of construction companies have not developed comprehensive risk management record system. As a result there is information lacking and not shared for decision making.

#### **IV. Conclusion**

Delay in possession of sites and clearance of RoW obstructions are the major risk factors. These risk factors are identified as a most severe risk by the contractors, clients and consultants. Delay in payments is a risk factor basically occurs due to failure of the client for non-payments. Defective design is the next risk factor, because of limited time and budget. The Client mostly sets inadequate time for design and investigation. Thus, detail design and in-depth investigations of geotechnical and material are less likely accomplished. Inflation, which is currently a macro economic problem of the country, has impact also on the construction sector. Inadequate planning is the major problem for most local contractors due to the less attention for planning activity.

The survey result has revealed that construction firms have moderate level of awareness about risk management. However, the level of senior staffs' commitment and attitude towards risk management practice is found to be low. In addition, the communication and sharing of risk management strategy is also turned out to be unsatisfactory. In fact, the commitment of the senior management to develop and implement a risk management strategy aligned with the firms' business strategy shall improve the risk culture of the organization. Establishing the context is the very important and first step in the risk management process. Developing risk management policy is important for the effective implementation of the risk management process. However, the survey result disclosed that firm's accomplishment in this regard to be low. Most of the construction firms neither have clear risk management policy nor adopted formal and standardized risk management process both at the project and company level. Laying the foundation, the approach, methodology, the communication and etc. has to be worked out before proceeding in to the detail implementation of the risk management process. In regard to the risk management process starting from the planning up to the monitoring and controlling phase, the survey result indicates that, construction firms risk management is at the initial maturity level or level 1 as measured against the Project Management Maturity Model as benchmark.

#### **V. Recommendation**

Construction firms are advised to implement well established risk management system in which project risk identified, analyzed and appropriate response applied in order to minimize the negative effect of risks on the project objectives, size and maximize the opportunities as well. It is essential to take actions to improve risk management system in the construction industry at all stages of the project from feasibility to construction stage. This includes adoption of risk register to record and update the risk management activities at all project stages of the project. Appropriate framework, standards and guideline would be helpful to enhance the movement to risk management practice in the industry. It is also useful if the subject is included in the curriculum of the formal learning institutes and universities. Establish risk management department at company level. Provide necessary training and workshop to the construction professionals to change their perspective about risk management, to improve their knowledge about risk management and to foster the risk culture in the industry.

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