1st Conference on Sustainability in Civil Engineering, August 01, 2019,
Capital University of Science and Technology, Islamabad, Pakistan.

Proposed Method for Risk Management of Small Size Residential Housing Construction Projects – A Case Study

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Abstract

Risk Management is an organized process used to identify, analyze, and proactively respond to the risks that directly or indirectly affect the project objectives. This process focuses to increase the chances and benefits of positive events and to minimize the likelihood and severity of undesirable events. Risk management has been widely discussed by different researchers. But unfortunately it is not commonly practiced in real life projects. There are various excuses that Construction Managers show to avoid proper risk management. One of the most common excuses is, "RM is just scaremongering". This paper focuses to propose a solution and make it easy to work out Risk Management during project initiation phase. Construction of a residential bangalow has been taken as a case study. A model is developed and explained through a practical example that can be applied to any small scale building construction.

Keywords: Risk, Risk Management, Risk Score, Probability, Impact

1. INTRODUCTION

The execution of construction work is a very complex endeavor. It is linked to numerous potential risks (here, we recognize risk as an event results in negative impact). Risk Management is the integration of all processes needed to identify, analyze, and respond to potential project risks. This paper proposes a model supporting the management of project risk.

Unfortunately in most of the developing countries like Pakistan, the construction practices are poorly followed. The factors contributing to the poor management are not well known. To the best of the author knowledge limited research has been done to evaluate the management flaws in construction industry. This paper focuses on the key factors contributing the project failure in the residential construction in developing countries.

In developing countries the risk management is an ad-hoc activity. However there is no systematic way of handling risks properly. This paper focuses on the analysis of risks related to the housing construction. The study will provide a reference guideline for all the concerned of the residential sector. It will also be helpful in establishing a basis for decision makers to invest in residential construction sector.

1.1 Risk

Loosemore et.al, (2012) defined risk as a potential event that if occur; will have either a positive or negative impact on the project objectives. The traditional view about risk deals with negativity; often synonymous to harmful, adverse, hazardous and unwelcome. But some uncertainties may be desirable.

Risk is quantified as a magnitude of incapability to accomplish the project objectives within distinct project needs and constraints. Risk consists of three components: (i) the chances of incidence, (ii) the impact of that threaton the project, and (iii) the exposure time- duration in which the risk will impact, if it is not mitigated.

1.2 Probability of Occurrence

The subsequent table defines the probability of occurrence.

Table 1 – Risk Scores for the Probability of Occurrence

Likelihood	Description	Probability	Score
91% - 99%	Almost Certain	> 0.90	5
61% - 90%	“Probably” will occur	0.61-0.90	4
41% - 60%	“Likely” to occur	0.41-0.60	3
11% - 40%	“Unlikely” to occur	0.11-0.40	2
1% - 10%	“Very unlikely” to occur	< 0.05	1

1.3 Risk Impact

Similar to the probability table the risk impact is also divided into five levels. But it is not simple as the probability. Impact depends on various factors such as impact on cost, Schedule and world view. Impact can be of absolute values or some percentages of cost and Schedule. Table 2 defines the risk impact categories and terms. Percent values are used for ease in understanding. These values may vary depending upon the client and the project team risk attitude.

Table 2 – Risk Impact score table against respective parameters.

Impact Description	Parameters	Descriptor	Score
An event that if it occurred, would result in project failure	Schedule delay>2 months Impact on Project Cost> 40%	Extraordinary	5
An event that if it occurred, would cause major cost/ Schedule increases	Schedule delay>1 month Impact on Project Cost> 20%	Major	4
An event that if it occurred, would cause moderate cost/ Schedule increases	Schedule delay>2 weeks Impact on Project Cost> 10%	Moderate	3
An event that if it occurred, would cause minor cost/ Schedule increases	Schedule delay>1 week Impact on Project Cost> 5%	Minor	2
An event that if it occurred, would cause negligible effect on the project objective.	Schedule delay>2 days Impact on Project Cost> 5%	Insignificant	1

**Note: Similar table can be used for the positive risks, but instead of avoiding we wish to exploit them.*

1.4 Risk Score

The magnitude of risk, also known as risk score is the value that can be found out by multiplication of both the probability of and consequences of that particular event. This value is been used to prioritize the risks accordingly. A matrix consisting risk scores is been developed as shown in table-3 and can be used to compare with the risk score. Risks are classified into three categories: Low, Moderate and High risks. Risks having magnitude of less than 10 exclusive are low, between 10 to 16 inclusive are moderate and above 16 are risks.

*Table 3 – Risk Score

Probability of Occurrence	Negligible(1)	Minor (2)	Moderate (3)	Major (3)	Critical (5)
Very likely to occur (5)	5	10	15	20	25
Probably will occur (4)	*4*	*8*	*12*	*16*	*20*
50% chance of occurring (3)	*3*	*6*	*9*	*12*	*15*
Unlikely (2)	*2*	*4*	*8*	*10*	*10*
Rare (1)	*1*	*2*	*3*	*4*	*5*

Low, moderate and high risks are illustrated as follows,

- ***Low Risks**: It has generally low or negligible threat for cost, no significant schedule or cost effect. Typical management attention would be needed to show ad-hoc response.*

- ***Moderate Risks:*** *It might result in raise in expenditure, schedule disturbance, or might affect the performance. There is need of some preliminary studies and plans to overcome these risks.*
- ***High Risk:*** *More likely to severely affect the cost, Schedule, or influence the performance. Additional action and high priority management attention will be required to control on high-risk. Proactive action plan is highly recommended.*

2. RISK IDENTIFICATION AND ANALYSIS

This section is about the identification of risks, analysis and managing risk. The data process and analysis techniques are described.

2.1. Identification

Risk estimate does not limit its scope to recognize risk and to make a strategy for its response. It represent a ‘‘best estimate’’ or a ‘‘best assignment’’, depending on the basis of its analysis. For estimating risk the two fundamental parameters cannot be compromised: (a) a probability of that specified event, defined as the event occurrence frequency over a long period. This element is uncertain and is estimated in different ways. In construction management the term subjective probability is commonly used, which is computed by asking some specified questions from a group of experts (Aven, T. 2008). (b) The consequences in terms of benefit and threat of a potential event. It is defined as the amount of effect on the project objectives especially on cost, time and quality of the project. This effect may be positive called opportunity or negative, known as threat.

Brainstorming is an efficient method that uses social interaction for the risk identification process. Using this technique, stakeholders are divided into group of 5-8 people. Each group is briefed about the project. Brainstorming technique of risk identification is being used. These groups are asked to share their experiences they face related to the project. Fishbone diagram is being developed and risks are categorized accordingly. Besides that a risk breakdown structure (RBS) is also being developed cross related with work breakdown structure.

Ishikawa diagrams became famous among the managers in the 1960s.It pioneered excellence in management process, and in the process became one of the most important parts in modern management. It is known as fishbone diagram because of its shape, similar to the side view of a fish skeleton. Figure-1 shows the Ishikawa diagram of identified risks.

2.2. Semi-Quantitative Risk Analysis

The semi quantitative risk analysis is an easier approach of analyzing the risk in which the risk can be very accurately estimated. (Del Bianco, et. al. 2010). In this approach semi-quantitative analysis, the values attributed to different categories of likelihood and consequences reflect the relative magnitude of consequences and likelihood. Although both the percentage and absolute values can be attributed to

it. Here in this paper we use percent values to make it easy to understand. Refer to the Section 2 of this document the Risk score is calculated.

Based on the risk score, the risk having the higher value is the "Change in Scope". In general the risk related to the scope of the project is critical because of the effect on time and schedule is high. Scope sometimes even leads to rework. The second most critical risks are financial risks. Financial risks are directly related to the cost of the project and also effect on schedule in case of risks like project no funded properly.

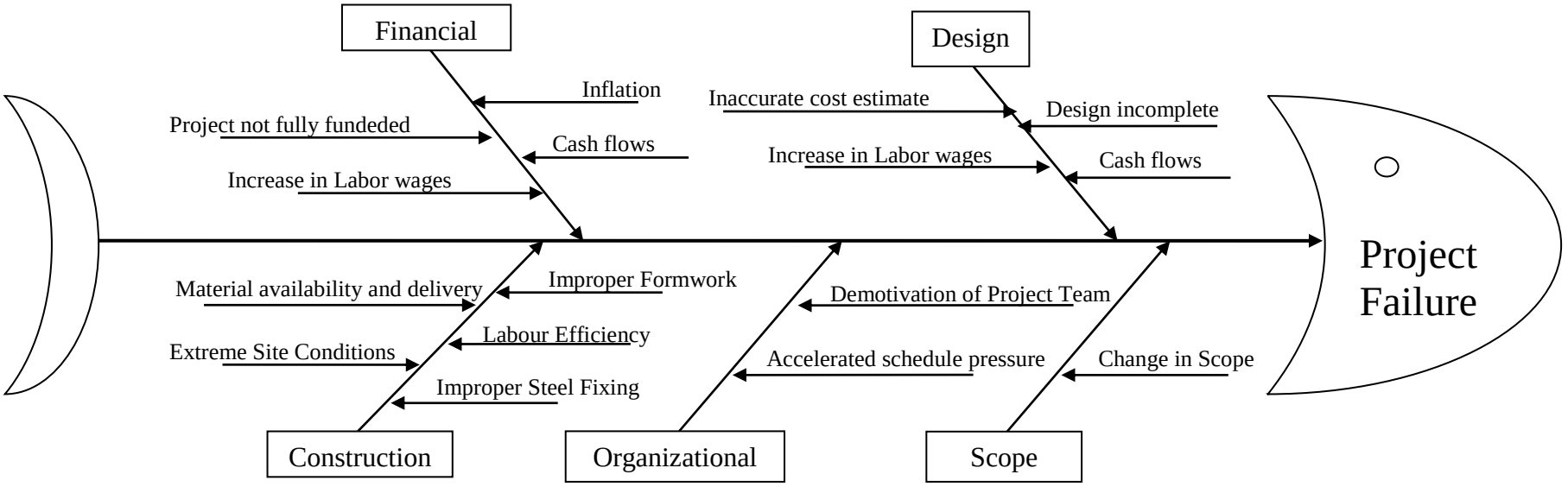

Figure 1: Ishikawa diagram shows the causes of Project Failure.

Table 4: Risk Summary after Identification, Analysis and Proposed strategies for the particular project.

#	Risk Event	Reference	Risk Category	Cause	Effect	Risk Type	Objective	Probability	Impact	Rating	Strategy / Response
R1	Project not fully funded	Nabil and Kartam (2001)	Financial	Stakeholder Interest	Project halted	Threat	Cost	4	3	12	Mitigate
R2	Increase in labour wages	Lo et al., (2006)		Government Polices	Profit Decrease	Threat	Cost	3	2	6	Accept
R3	Inflation	Fang et al., (2004)		Government Polices	Cost Overrun	Threat	Cost	2	3	6	Accept
R4	Cash Flow	Frimpong et al., (2003)		Contract Dispute	Project halted	Threat	Time	2	2	4	Mitigate
R5	Inaccurate cost estimate	Lo et al., (2006)	Design	Un Experienced Staff	Cost over run	Threat	Cost	1	3	3	Accept
R6	Design incomplete	Ayodeji (2006)		Inexperienced Designer	Project Delayed	Threat	Time	2	5	10	Mitigate
R7	Surveys incomplete	El-Sayegh (2008)		Lazy Surveyor	Project Delayed	Threat	Time	2	2	4	Mitigate
R8	Improper Formwork	Fang et al., (2004)	Construction	Unskilled Labour	Project Delayed	Threat	Time	2	2	4	Mitigate
R9	Improper Steel Fixing	Lo et al., (2006)		Complex Design	Cost over run	Threat	Cost	2	4	8	Mitigate
R10	Labour Efficiency	Lo et al., (2006)		New Labour	Quality	Threat	Quality	2	3	6	Mitigate
R11	Extreme Site Conditions	Frimpong et al., (2003)		Heavy Rain Fall	Project Delayed	Threat	Time	2	2	4	Accept
R12	Subcontractor capability	El-Sayegh (2008)		Competition	Quality	Threat	Quality	2	2	4	Mitigate
R13	Material availability	Lo et al., (2006)		Land Slide	Project Delayed	Threat	Time	2	3	6	Mitigate
R14	Demotivation of staff	Nabil and Kartam (2001)	Organizational	Wages not paid	Project objective	Threat	Time	2	2	4	Mitigate
R15	Accelerated Schedule	Fang et al., (2004)		Management pressure	Quality affected	Threat	Quality	3	2	6	Mitigate
R16	Change Scope	Lo et al., (2006)	Scope	Inexperienced designer	Project delayed	Threat	Time	3	5	15	Transfer

Conclusion

After studying the past literature and consulting the experts of the field following conclusions are being made,

- Risks may be a threat for the project objective or it can be a good opportunity to exploit. In developing countries risks are commonly considered as threat and that is why people don't invest in it.
- Scope and Financial risks are the top most serious risks. Risks affecting on the scope of the project are the most critical risks affecting budget and schedule of the project.
- Proper risk management leads to the successful completion of the project.

Acknowledgement

The author would like to show gratitude to all those who shared their pearls of wisdom during the course of this research. Author is also immensely grateful to Engr. Dr. Majid Ali for his comments on an earlier version of this manuscript, although I claim all the errors are my own and should not tarnish the reputation of the esteemed person.

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