



Factors affecting the risk management system of the Mumbai Metro Project

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Abstract:

Every construction project has certain risk associated with it and need to be mitigated properly for the good execution. The management related to the risk is very important parameter for the project to get successful. Most of the time there are three phases involved in the management of the risk and that is identification of the risk assessment of the risk and response of the risk. The implementation related to the management of the risk need to consider all those things so that there will not be much impact related to the quality or time for cost for the completion of project. The mitigation of the risk involved in the project is very important so that there will not be any kind of dispute in between the contractor or the client while it is also lead to the reduction in the risk in both of the cases. The present paper is related to identify the risk factors involved in the Mumbai metro project. This paper different factors involved for the risk management have been studied and results are mentioned for the mitigation of the risk involved in the construction project of Mumbai metro.

Keywords: Risk, Mumbai, metro and factors.

1. Introduction

1.1 Mumbai city

Mumbai is considered to be the capital related to the area nearby to it. Mumbai also the economic capital of country and considered to be one of the biggest city in the Asian countries. Activities related to the economy been increasing day by day in the city as well nearby location. There are many challenges in this city especially related to the infrastructure the population is going there by day and that the reason the demand is also increasing related to it.

Mumbai is also need to be increased the opportunity to the infrastructure as there a many population having the immigration background particularly from the village to Mumbai. Since 1951 the population has vitamin does growth in these city is many people are getting accommodation and there's suburbs while the job have been also the reason for the integration of people. This considered that the job is also increasing day by day in this Mumbai city.

1.2 Risk factors

There are different construction project in which this is also involved about the risk and it is to resolve properly. There are certain factors associated with the risk management. Risk management is considered to be the systematic process involving task for the identification, analysis of the risk and response to such risk.

The present work deals with the detailed analysis related to the metro project as well as the risk management involved in this project for the Mumbai metro project.

2. Literature Review

Risk management is considered to be very important parameter and the factors involved in it are to be studied properly. If planning is not proper in the construction project then this leads to the bad management in the resources as well as the factors involved in the project will also get affected. The author of carried out the statistics related to the qualitative data and there are different 30 respond received. The sample is selected from the different background letter to the construction sector so that these factors may be involved in it and can be identified properly. The authors suggested that the proper planning is very important when the starting phase of the construction project is involved. There should be responsibility of the proper rules as well as safety and regulation is important so that the construction can be properly executed.

Questionnaire prepared based upon the 50 questions which are related to the risk management have been put forward to the respondents from the construction sector background. The data was completely analyzed so that the proper results can be generated with the help of software called social science which statistical package with the version 21. The effective utilization can be carried out when the machineries or the resources and equipment have been supplied properly to the construction site as per the schedule of the project.

Exploratory research are been carried out so that the identification of the different factors involved in the risk management it is possible. The properly structure interview related to the risk management have been carried out for the person working in the top management as well as in the middle management in particular to the construction projects which are considered to be mega project. Thematic analysis have also been carried out with the help of software NVIVO. The factors which involved are considered to be politics location of the project demography attributes of the finance. The framework which is conceptual in nature have been identified in the work and put forward for the identification of the factors which are involved in the risk related to the project which is called as mega project.

Construction period are considered to be having the Novelty as well as complexity involved in it and how the stakeholders performed with the engagement in the section project apart from this day intensity related to the capital as well as surrounding behavior is also to be studied. It is observed that author have carried out the work related to the risk management with the help of certain tools so that the risk factors can be identified in the construction sector. There are certain factors involved in the risk of the health and safety while it is also involved in the components of the building the procedure of the construction is considered.

3. Methodology

The consideration of the future public transportation the government have proposed and identify 146 metric linear unit letter to the longest path on the railway and the government which is involved in this is metropolitan regional development authority. This system is family related to the mass public transit system in particular to the urban region. This project is considered to be the passageway for the case of mass public transit system required for the urban area. Elevated line is considered for the case of versova City Andheri city and Ghatkopar City where II 11 km of the root length is involved which have around 12 stations while depot is completely automobile and how the location in in DN Nagar. The minimum curvature involved in this project is 100 m while the minimum clearance of the ground involved in this project is 5 metres. There are around 22 m of the length for the case of route. The route of the metro line is mentioned in the figure number 1.



Fig.1: Route of Metro line 1

3.2. Risk Identification

3.2.1. Questionnaire survey:-

A single survey which is consisting of a sample there is the full population for the senses and collection of the data how the method related to the questionnaire while the questions as well as the data is to be analyzed with the help of statistics. Single server is a mostly how the topics based upon the preferences behavior information which is actual and also it has to be depend upon the purpose. The questionnaire survey which have been circulated to the respondents are mentioned as follows. Question answer of the first part is related to the general information of a respondent and there in the questionnaires consisting of preoperative risk which are the factors involved in the survey as delay in land acquisition planning third party liability risk regulatory administrative and approval delays. The second part is consisting of the construction phase race which are the factors of design release construction rules change in scope risk and financial risk. The third part is related to the operational phase risk and that have the factors involved in it has technological risk operation and maintenance is market risk and performances. The fourth part of the survey in was other risk and that consist of force majeure, political and social risk safety risk environment legal risk and interference risk.



1. Contact name *

Your answer _____

2. Designation

Your answer _____

3. Organization *

Your answer _____

4. Choose from below options, whom you are part of ? *

1. Contractor

2. Consultant

3. Employer

4. Others

Risk assessment survey in metro projects

*Required

Please select the risks experienced and assign marks ranging from 1 to 5 in terms of their Likelihood/probability in the operation of your company's project.

Where

- 1- Negligible
- 2- Marginal
- 3- Moderate
- 4- Severe
- 5- Hazardous

A. Pre Operative Risk *

	1	2	3	4	5
Delays in land acquisition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Third party liability risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regulatory administrative and approval delays	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

B. Construction Phase risk *

	1	2	3	4	5
Design risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Change in scope risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financing risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

C. Operational Phase risk *

	1	2	3	4	5
Technology risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operation and maintenance risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performance risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

D. Other risk *

	1	2	3	4	5
Force majeure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Political and social risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Safety risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
environment risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legal risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
interfance risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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3.3. Risk Assessment

Risk matrix is considered to be that kind of matrix where the use of it consisting of the risk assessment so that the risk extent can have the outline and the consideration of the probability as well as the consequence severity which have the class. This mechanism is considered to be very easy so that the risk management as well as the factors involved in it can be decided.

3.3.1. Risk Priority Number (RPN):

Identification of the risk is very important so that proper management can be possible with the help of good rating system that involves probability in the risk. The rating in terms of low medium and high is to be given to the particular factor so that the individual risk can be assessed with the impact related to the risk. This kind of matrix is considered as risk priority number and to have the construction related to it. The following table number 3 shows the risk category involved in the factors which have been included in the questionnaire survey. This table have certain description as well as probability number impact number RPN and the sensitivity involved in it. The probability number is varied from one number to 4 number. Impact has range varying from one to five. The value of RPN is ranging from 1 to 20. The sensitivity is marked as low medium and high for different factors involved in the description of the risk category.

Table no.3 Risk Category

NO	Discription	Probabilty	Impact	RPN	Sensitivity
A	Pre-Operative Risks				
1	Delays in land Acquisition	4	5	20	high
2	Planning	1	2	2	low
3	Third party Liability risk	3	2	6	low

4	Regulatory, administrative & approval delays	2	1	2	low
B	Construction Phase Risks				
5	Design Risk	3	3	9	medium
6	Construction Risk	3	4	12	medium
7	Change in Scope Risk	1	1	1	low
8	Financing Risk	2	4	8	medium
C	Operational Phase Risk				
9	Technology Risk	2	2	4	low
10	Operations & Maintenance Risk	3	4	12	medium
11	Market Risk	4	4	16	high
12	Performance Risk	4	4	16	high
D	Other Risks				
13	Force Majeure	1	2	2	low
14	Political and social risks	3	2	6	medium
15	Safety Risk	2	3	6	low
16	Environment risk	3	3	9	medium
17	Legal Risk	1	3	3	low
18	Interface Risk	3	4	12	Medium

3.3.2. Sensitivity Analysis

This analysis perform so that the identification of the project which are having uncertainty components and this have the impact considering the output related to the construction project. Once the risk model is completed there in analysis of the sensitivity is to be performed so that the sensitivity related to the different parameters in the case of model which have the outcome. The following table shows the risk factor involved in construction project.

Table no.4 Risk Factor

probability			impact		
NO	Responded score	score	Responded score	score	Risk Factor
1	4	0.8	5	1	0.8
2	1	0.2	2	0.4	0.08
3	3	0.6	2	0.4	0.24
4	2	0.4	1	0.2	0.08
5	3	0.6	3	0.6	0.36
6	3	0.6	4	0.8	0.48
7	1	0.2	1	0.2	0.04
8	2	0.4	4	0.8	0.32
9	2	0.4	2	0.4	0.16
10	3	0.6	4	0.8	0.48
11	4	0.8	4	0.8	0.64
12	4	0.8	4	0.8	0.64
13	1	0.2	2	0.4	0.08
14	3	0.6	2	0.4	0.24
15	2	0.4	3	0.6	0.24
16	3	0.6	3	0.6	0.36
17	1	0.2	3	0.6	0.12
18	3	0.6	4	0.8	0.48

Table no.5 Risk priority

Risk Prioritization	Risk Sr No
1st Priority	1
2nd Priority	11,12

3rd Priority	6,10,18
4th Priority	5,16
5th Priority	8
6th Priority	3,14,15
7th Priority	9

3.4. Risk Mitigation:-

The proper strategy should be developed so that the risk exposure can be reduced sufficiently and this can be done when the probability related to the risk that may occur if produced sufficiently. Impact related to the risk or impact related to the probability having the risk should be reduced accordingly while the severity related to the risk can have the mitigation process involved in this. The following risk mitigation measures have been proposed in the present study

3.4.1 Delays in land acquisition

The land can be handed over to the concerned authority and it is to be followed according to the schedule which have been submitted in the case of contract. It is found that MMRDA is not considered to follow this in that case the provision is to be given so that the access to certain parts related to the site which have the reason especially having the exception of force majeure and in that case MMRDA should give the extension to the date of completion of the project also extension for the date of finance closer while the concession should also be given.

3.4.2 Planning

There can be the risk related to the planning as well as the risk to the execution in terms of the construction project when there could be the operator private it is considered for the execution according to the specification as well as the standards associated with this. This should be followed according to this schedule of the agreement.

3.4.3 Third party liability risk

In this case the inclusion of the insurance as well as the cost associated with the insurance as well as cash flow tips to be followed properly.

3.4.4 Regulatory administrative and approval delays

Such kind of risk is especially in the case of cooperative is private and need to have the clearance as well as permission from the case of Government of India as well as Government of Maharashtra so that their proper implementation of the project can be carried out.

3.4.5 Design risk

The operative is private in that case he has to follow all the procedure required for the submission in the case of drawings as well as the schedule of the construction project to the concerned authority that is MMRDA.

3.4.6 Construction risk

In this case the operator who is private should follow the proper procedures as well as the performance should be carried out with all the faith involved in need as well as the obligations and there should be the security e in terms of performance and how the value of 14 Cr.

3.4.7 Change in scope risk

It may be the reason where the government it may require some kind of work which is addition to the scope of the work related to the construction project and in this case that kind of services should be given.

3.4.8 Financial risk

It is considered that out of the all phases of the construction related to the project in that case maximum 85% of the gap related to the viability can be released.

3.4.9 Technology risk

The risk of the technology is related to the private operator or sometimes with the government since the execution of the project is to be followed with the help of specifications as per the agreement or the standards as per the agreement.

4. Conclusions

The proper management of the risk and the method involved then it should be followed in the company's so that the process of quantification of the risk as well as containment related to the risk and the reduction in the process of policies involved in the risk. The construction company really need to manage properly the risk involved in the project why there can be the efficiency when the savings in the money is possible as well as productivity can be improved with proper following of the standards. The risk management involved in this system can have the comprehensive nature as well as the nature of systematic where the distinguish factors related to the risk is to be attained.

Top Mumbai metro around 18 risks involved and that consists of categorization in high risk is medium risk and low risk. Some of the factors which involved in the highest delay in land acquisition and market risk, some of factors involved in the medium risk are designed risk financial risk, some of the factors related to the low risk or safety risk planning and third party liability risk.

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