

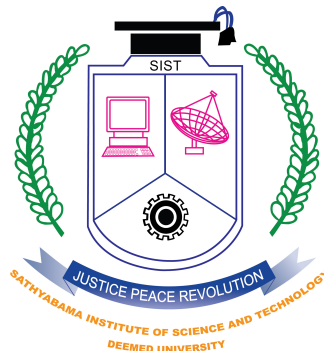
RISK MANAGEMENT

A Thesis

Submitted in partial fulfillment of the requirements for the award of
Master of Architecture degree in Building Management

By

SOWMIYA (39840018)



**DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Report is the bonafide work of **SOWMIYA (39840018)** who carried out the Thesis entitled “**RISK MANAGEMENT**” under our supervision from January 2021 to May 2021.

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ABSTRACT

My thesis topic was “**RISK MANAGEMENT**”. I have worked in 4stages. In stage 1 I have gave the synopsis of my thesis such as aim, objective, limitations and scope. Then I have done a risk management process and provided risk variables that impact on project. Then I have done a 2 journal study. In stage 2 I have done 1 literature case study and done a literature review. In that literature review, I have studied about the General overview of toll road concession and General risk management of toll road projects. Then in the stage 3 I have done a live case study. In a live case study I have analyzed and identified the risks based on stakeholder's perceptions. Then I have done a risk analysis according to the identified risks and at last in the 4th stage I have done a detailed risk analysis according to the contractors and owners perceptions and provided risk mitigation strategies as a results. By this way I have concluded my thesis.

Keywords: risk management, toll road construction, risk analysis, risk mitigation.

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LIST OF SYMBOLS AND ABBREVIATIONS

PMI	-	Project Management Institute
WBS	-	Work Breakdown Structure
RBS	-	Risk Breakdown Structure
PLC	-	Project Life Cycle
BOT	-	Build Operate Transfer
TNRDC	-	Tamilnadu Road Development Company

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

A crucial aspect of project design and management is risk management in the construction sector. In all the 9 data categories disseminated by the Project Management Institute, risk management is one. An crucial aspect of project success is the combination of excellent risk management. Building occurs often as extremely intricate and unsafe from many causes might develop. In order to handle efficiently unforeseen occurrences and feelings more and more, risk management is being developed into an important aspect of building project management. The harmful repercussions of risk and uncertainty are essential. It is crucial.

1.2 AIM

The general purpose of this master's thesis is to decide correctly how to use a tollbooth successfully based on risk management.

1.3 OBJECTIVE

To classify the hazards

Risk assessment

Analysis of the risk identified and mitigating measures

1.4 LIMITATION

This thesis is restricted to road building exclusively.

1.5 SCOPE

Understand the organization's past and risks in the development of the roads.

To assess the activities conducted so far with regard to risk management.

Develop a structure and follow-up controls for risk management efforts.

1.6 METHODOLOGY

STAGE 1

- Synopsis
- Risk management process
- Risk variables that impact on project
- Journals study

STAGE 2

- Literature case study
- Literature review

STAGE 3

- Live case study

STAGE 4

- Conclusion

CHAPTER 2

LITERATURE STUDY

2.1 RISK MANAGEMENT PROCESS:

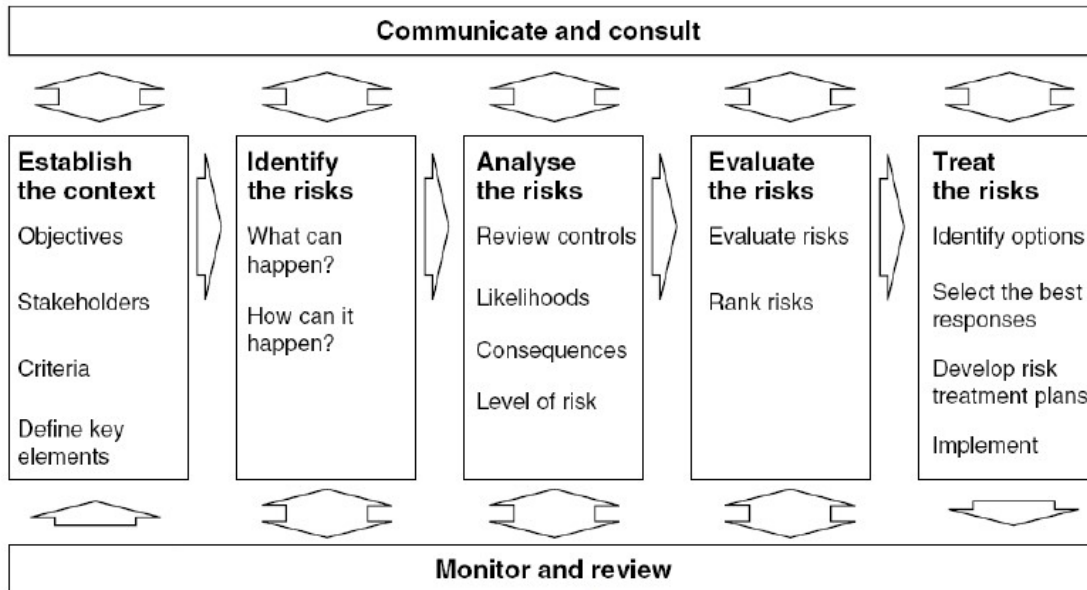


FIG 2.1 RISK MANAGEMENT METHOD

2.2 RISK VARIABLES THAT PROJECT IMPACT

- Design modifications
- Building strategies difficulty
- Low productivity
- Payment and lack of cash
- Poor communication between project teams
- Low productivity
- Delays in payments Injury and accidents
- Contractual modification
- State and governance change in native legislation
- Effect of surrounds e.g. conditions of website conditions

- Low organisation contentment
- Local larceny and hooliganism Shortage of materials
- Fluctuation in inflation value

2.3 JOURNAL STUDY

2.3.1 RISK MANAGEMENT IN CONSTRUCTION INDUSTRY

International Journal of Engineering analysis, ISSN: 2319-6890(online), 2347-5013(print) Volume No.5, Issue Special one pp: 153-155, eight & nine Jan 2016

ABSTRACT:

With sophisticated and changing project settings that provide an environment of high insecurity and risk, construction sector is very vulnerable to risks. The business is subject to many technological, socio-political and corporate hazards. In the housing business, the capacity to deal with these risks was not excellent. Thus, persons functioning in the industry suffer many failures, such as permanent failures due to the quality and functioning needs, price overruns and unsafe delays in the completion of the project. Risk management may be a process consisting of risk identification, quality and quantitative evaluation, answers with an appropriate risk-handling methodology so that the risks may be controlled by observation. This article addresses notions of risk management and several risk analysis approaches that may be applied to answer all types of threats through the whole life cycle of a building project.

KEYWORDS: Building industry, risk analysis, risk management,

INTRODUCTION:

Building is an inevitably identifiable square measure, with the dangers arising from many sources. Risk is defined as any action or impact that may have an influence on project goals. Inherent risks and uncertainties assess the other businesses in the building industry. Risk is an inherent aspect of every project associated with the undertaking. Risk is donation irrespective of its size or industry. There is no entirely risk-free project. If risk is not evaluated correctly and ways to control them are not trained, the project will probably lead to failures.

Concept of risk analysis and management:

Risk management may be a process for identifying, analysing and confirming projects' risks to prevent dangers. In order to execute the project approach, all phases of the risk management technique should be included in the risk management procedure. Risk

management might be a key strategy because of the character of the building. Housing risk is generally roughly categorised into:

- Financial risks
- Physical hazards
- The operational risk
- Social and policy hazards
- Technical hazards
- Entrepreneurship risks and the environment.

RISK MANAGEMENT PROCESS:

Risk management consists of identifying, evaluating, responding and reviewing the methodology.

Identifying the risk: the risks are generally identified in the following manner

a. Brainstorming:

One of the most important strategies in style. Used in general for the formulation of plans; it is also quite useful for identifying danger. Everyone involved in the project is gathering in one location. One assist is provided by the UN agency to enlighten participants about various issues, and therefore after the elements have been identified. The assistance review eliminates extraneous components before shutting it.

b. Delphi Approach:

This technique is comparable to the group action, but it does not seem that the participants understand each other and are not in an equivalent position throughout this process. They will determine the factors without consulting other participants. The assistance in groups summarises the factors known.

c. Interview/expert opinion:

Experts or staff with adequate competence in a very highly qualified project are typically helpful in avoiding/solving similar problems repeatedly. In order to identify moving items, all participants or the relevant people within the project are typically questioned.

d. Past experience:

The comparison has been developed to identify variables in the past expertise from an analogous project. Once the features of the test are examined, they might provide insight into the common variables.

e. Checklists:

These squares evaluate easy but very useful lists of predefined items measuring the project potential. The checklist that includes a list of the known dangers is used in the past and the replies to them are also a start in identifying the hazards.

Evaluation of risk:

Quantitative methods:

A. Analysis of Sensitivity:

This is intended to identify the uncertain components of the project that can most affect the project outcomes. When creating a risk model, a sensitivity analysis is performed to assess the sensitivity of different models to the result of the projects. In order to attempt to achieve this, the 1 variable values are adjusted at a time, and the project's influence is also visible.

b. Scenario Analysis: Scenario analyses provide effect to different project status or impacts of different risks when they occur at the same time. After this examination, a good decision is usually formed which provides {the choice} with less loss or risks, which is typically chosen.

c. Monte Carlo simulation (probabilistic analysis):

A simulation of the project is done using a model to highlight the possible influence on project objectives of varying levels of uncertainty. For this investigation, city simulation is generally employed. The impact of uncertainties and risks on the budget and the schedule of projects is quantified.

It mimics the full system time and again when a price is selected from the chance distribution by random means for each issue. For every activity in time management, it uses three purpose estimations such as the worst case and best case period possible.

d. decision tree method:

The analyse is per call tree performed. To formulate the subject and evaluate the options, call trees square measure tremendously beneficial. The square measurements used to describe a project constitute a graphical representation and may plainly reflect the consequences of each call made within the project.

Qualitative methods:

Qualitative risk evaluation methods Square measurement of the risk probability- and effect descriptive scales and square measurements. These procedures are quite simple, when quick assessment in small and medium sizes is required. In addition, this practise is generally used as confined resources of your time and cash in the event of poor, restricted or inaccurate numerical information. The following are listed:

a. Risk probability and effect assessment:

- A risk opportunity and an effect evaluation must be used to analyse the probabilities of the specified risk.
- In addition, risk implications for a project's objectives are analysed with regard to the positive influence it has on opportunities and negative threat effects.
- For the purposes of this evaluation, chance and impact should be specified and tailored to a specific project.
- Clear scale definitions should be established and their scope should be based on the project's kind, criteria and goals.
- PMI identifies examples that vary from 'very unlikely' to 'almost sure' yet an adequate numerical assessment is permitted.
- The level of influence varies from 'extremely low' to 'extremely high.'

b. Risk rating matrix likelihood/impact:

- The probability and effect that were evaluated as a foundation for measurement in the previous step square measure.
- This is why the evaluation square measure results, with priority given to victimisation, have identified various methods of computation discovered in the literature.
- The priority score is calculated by Westland as the average chance and impact.
- Variation of priority score, rating and colour measurement assigned to indicate the importance of each danger.
- High impact threats, known as dangerous and will require rapid reaction, and low-priority score threats are typically monitored through action or when necessary.

c. Evaluation of urgent risk categorisation and risk:

- A system of project dangers might be classified in risk

Based on their sources, square project measurements are most vulnerable to these problems. Tools that may be used in this square measurement approach will break down structure (WBS) or risk disorder (RBS) and have an effective function in developing risk response. The WBS splits enormous operations into small, handling units and forms a joint hierarchy of self-employment. RBS classifies and reveals its reliability. The objective of the second approach, Risk Urgency Evaluation, is to adapt hazards to their rapid reaction, however:

- This Third Step of the RMP shows how the recognised risks and hazards should be addressed.
- The method and technique used depends on the kind of hazards in question.

a. Evasion of risk:

- Risks are typically avoided by withdrawing in an extremely opposite direction the risk of death penalty from the project, but project objectives are still being fulfilled.
- Change project management to remove a danger, isolate project objectives from the effects of a risk or to relieve the project objective exposed to losses, such as extending or lowering the scope of the project. Project management

b. Transfer of risk:

- Risk transfer means that the UN agency is ready to take over responsibility for its governance and the UN agency may bear accountability for the hazard should it arise.
- It does not eliminate the transfer of a risk; there remains a hazard, but another party owns it and runs it.
- Risk transfers are typically successful because of the exposure to money risk.
- The purpose is to ensure that the risk is best handled and managed by the party.

C. Risk Reduction:

- Risk mitigation decreases to the appropriate threshold the associated chance/or effect of an unfavourable risk occurrence.

- Early steps are often more convenient to reduce the risk possibility and/or effect than trying to remedy the hazard after the hazard is over.

d. Risk exploitation:

- This method is designed to remove ambiguity associated with a chosen top-side risk, without doubt by causing chance.
- Eliminate the uncertainty associated with the high risk selection. An opportunity to have a good influence on project goals might be described as a risk event.

e. Risk share:

- Allocate an opportunity to a different party UN agency to maximise its possibility of predominance, and, if that happens, boost possible benefits.
- The transfer of threats and sharing possibilities is comparable in square measures when a 3rd party is hired, who is responsible and to whom the threats square measures transmitted should be able to share the possible benefits.

f. Risk improvement:

- The objective of the reaction is to modify the positive risk's 'magnitude.'
- The opportunity is increased by increasing its likelihood and/or effect, which increases the benefits of the endeavour.
- Seeking to enable or strengthen the opportunity and to target and strengthen their triggering factors proactively.

g. Risk Acceptance:

- Eventually all hazards or cash in all possibilities cannot be eliminated.
- We shall document these and provide a basic level of awareness of their existence and knowledge.
- This approach is employed when it is impossible to answer the threat by the opposite means, or even when the greatness of the risk is not the reaction.
- When the project manager and the project team also try to solve a risk, if and when this happens they agree to address the hazard.

h. Contingency plan:

- The contingencies may also be in the form of one unbroken reserves one day, so that they can handle unknown risks or in the form of pricing, in order to manage unknown risks.

Risk assessment:

- That is the final phase in this process.
- We prefer to monitor and document their efficacy and any changes in the risk profile of the project after implementing the response activities.

CONCLUSION:

- The strategies of victimisation within the literature about the RM measure square professionals in construction companies, but they do not appear to be aware of it.
- Risk measurement is handled everyday in the business, but not in such an organised way as the literature defines it.
- The information on RM and RMP is almost nonexistent, despite the fact that the thinking on risk management is changing to a great deal in the construction industry, as other studies revealed.
- Risk management could be a strategy which associate companies should use to fulfil the company's objectives at intervals.
- Consequently, awareness needs to be developed and people should take an interest in using risk management strategies in industry.

2.3.2 JOURNAL 2

The MANAGE RISK comes with the –HOW to do A in OUTCOME

History Risks include....

- Quality and safety
- Cost management
- Timeline management
- Scope and amendment management
- Procurement & contracts
- Management of personnel
- Information management
- external influences. External risk management

If it is ignored, what happens?

- Prices increased
- Loss or decline in profit
- Completeness and reputation damage; and worse
- business and economic status disposal
- Risk management project

How is the risk managed?

- Assessment and quantification
- Implementation
- Monitoring
- Reduction

Controls of project

- Method of daily project management
- Missing project lagging information
- Failure to recognise and develop risk and chance responses
- The lack of prompt settlement of many stakeholders' issues
- Requests
- Management of contracts
- Failure to meet project requirements
- Legal liabilities or loss of rights not required.

Control monitoring

- Compliance with stipulated policies and procedures
- Regular conferences on projects standing, revised action lists and jointly responsible obligations
- Formal updated project management tools combining current data
- project risk management for your business is of great importance
- Project controls establish the management foundation for the project
- Project controls covers with a broad spectrum

Procedures for controlling

- Risk and casualty registries
- Register of issues
- Clear and similar contractual documentation Proceedings
- To ponder about major dangers at Regular documented conferences

2.4 LITERATURE CASE STUDY

Case studies in Lesotho

Risk management in public sector projects:

Abstract

- Building has problems which hinder their desired results.
- The restrictions on times, costs, quality and competition are in force.
- Incisive risk management (RM) strategies are essential for these difficulties.
- This paper gives the results of a case-by-case analysis which nonetheless determines why the field of public building is deficient in recent RM techniques in Lesotho building and why.
- This research explores perceptions of stakeholders about the probability and effect of hazards (P-Is) on 3 public sector buildings.
- The measuring scale for Likert was not intended to gather P-I grids for knowledge.
- Scatter plots are analysed and sent to the knowledge area unit.
- However, the results achieved by means of a cross-case survey show that the people surveyed perceive the number of risk P-Is in the structure under examination to be high.

INTRODUCTION

- Project management (PM), which involves risk management (RM) in combination with the important information categories, has been adopted by the housing sector.
- The findings of this study show that the project stakeholders understand the effects of building risks and that information areas in Lesotho cope with RM shortcomings.
- Semi-structured interviews in the Lesotho example were supplemented with a mini-form in 3 cases, but the project actors grasp the probabilities and implications of the risks.
- However, in the context of the project life cycle (PLC) for a public construction project in Lesotho, the study jointly analyses modification to building hazards.
- Unit of the technical competence area crucial to RM project, as a result of risk, the uniqueness and expertise of the project may be operated.
- RM is crucial in order to prevent overruns costs/time and attracts potential investors into public infrastructure in general.
- Investigating RM follow-up in native public works might help stakeholders reassess approaches of reducing project losses and failing.

DEVELOPMENT TRADES CHANGES

- Table 1 shows the problems which distinguish the area unit in Lesotho.
- These issues highlight the implications on time and value.
- The primary project risks are recognised as delays in public construction.
- Area delays common in poor nations in building.

Table 2.1 Risk impact on selected major public construction comes in African nation

Project	Risk type	Causes of delays	Effect on project performance
The road upgrade of Mpharane - Belabela	Internal market project, engineering & assumption	• Inadequate cost recovery for road users (about 36.5 percent) • No succinct project goals • Brief design and feasibility studies have been insufficient • High precipitation	• 9-month delays • Exceed the cost • (55.3 percent
External & Internal Metolong Dam Project	External & internal	• Logistic difficulties • Labor conflicts • High precipitation	• Temporaries – 1 year • Exceed cost
Delayed funding for Tikoe Industrial Estate Project	External	Inclement weather for delayed funds	• Late for a year • Exceed cost

Risk likelihood and effect

- Risk has a direct time impact which mostly leads to the overshoot of value.
- The project parameters are known as 'quadruple constraint' for risk consequences of your time, cost, quality and scope.
- PM literature shows that at different phases of a project, several risks occurred with very different implications.
- Common hazards relate, in addition to environmental, technical, scheduling, written agreements, financial, and management questions, to quality, staff, costs, expenses, time limit, and strategic decisions.
- These risks are internally measured by a project.
- The risk identification is the start in RMP, as described in Figure one.
- If a risk is known, the next step is to investigate it for its incidence and effect likelihood.
- The second stage is thus necessary to examine the price of the hazard.
- Analysis can take place using qualitative or quantitative systems.
- Qualitative risk analysis incorporates an impact-probability matrix (P-I), an effect-rating risk (RCR) and an analysis of Monte-Carlo.

Process of risk management:

- Project managers must consider the consequences of risks on the opposing data fields of project management (PMKAs).
- The Institute of Project Management (PMI) has advised ten data areas on their work, including integration management, scope management, time management, and quality management, management of human resources, communication management, proxy, neutral management, value management, and risk management.
- This research, however, employs RM to look at the many PMKAs pertinent to the project managers.
- Of the ten PMMAs alone, neutral management was not evaluated in this study because of the anticipated small spectrum of stakeholders concerned in the functions of PM in an African nation.
- The deletion of Hindu deity from neutral management helps to avoid superficial PM perceptions.

MATRIX THE PROBABILITY QUALITATIVE (P-I)

- Every qualitative and quantitative information integrates a risk analysis P-I model.
- Table a pair shows a simple quality 5x5 risk strategy, whereby $P \times I = \text{Priority Risk Problem} \cdot (\text{RPF})$.
- The unexperienced class is not very attractive anywhere $PI=0.1$ to 0.6 is concerned, the dangers are not very attentive, the Yellow class is somewhat more attractive anywhere $PI=0.4$ to 1.0 , the risk needs a modest bit of attention ($2.5-4.5$ RPFs).

Table 2.2: P-I qualitative matrix of risk analysis

Impact	0.9	0.9	1.8	2.7	3.6	4.5	Very high
	0.5	0.7	1.4	2.1	2.8	3.5	High
	0.5	0.5	1.0	1.5	2.0	2.5	Medium
	0.3	0.3	0.6	0.9	1.2	1.5	Low
	0.1	0.1	0.2	0.3	0.4	0.5	Very low
		1	2	3	4	5	
		Very low	Low	Medium	High	Very high	
		Probability					

- Table three shows risks of influence on quality, value and time during a project, going from zero.1 (low) to zero.9 (high).
- Numerical measurements between zero (low/niggable), 0.3 (minor), 0.5 (moderate), 0.7 (significant), 0.9 (high) and 1.0 (catastrophic) may also be expressed as subjective judgments (Nicholas & Steyn, 2011: 373).

Table 2.3: Project risk levels related to project parameters shown

Impact Value	Impact		
	Quality performance	Cost overruns (percentage)	Time delays (months)
0.1 (low)	Minimal	Within budget	Negligible
0.3 (minor)	Small	1-10%	Minor slip (<1)
0.5 (moderate)	Moderate	10-25%	Moderate slip (1-3)
0.7 (significant)	Significant	25-50%	Significant (> 3)
0.9 (high)	Goals not achievable	>50%	Large slip

METHODOLOGY Research

Data analysis and results interpretation

- To record information for qualitative P-I grids and scatter diagrams a 5-point measuring equipment was utilised to provide numerical knowledge as a case study.
- Through a 5-point likert measurement of 1=very low, 2=lower, 2=medium, 4=high and 5=excellent, respondents have been allowed, to indicate their impressions. •
- Literature supports this technique where qualitative risk analysis methods such as P-I networks include numerical (quantitative) values that match ratings (qualitative).

Collection of information

In short, three big building works in the public sector have been deliberately selected with unusual contractual values of the R100 million.

- Most contractors' registration status was reduced to the levels A to B.
- The RM exposure was supported by the professionals participating in each project.
- The observation level of the RM supplied the main criterion for the sample method; consequently, in all cases, construction project managers, building managers, quantity inspectors, architects, contract managers, engineers and their numerous subordinates were selected as interviews. Semistructured interviews were done face to face with the use of a five-point Likert scale to study and evaluate the probabilities and effects of risks on the project and measuring square data throughout the PLC.

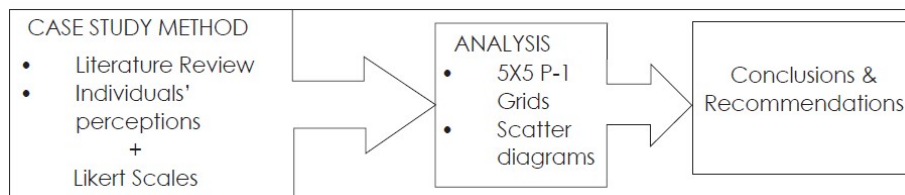


Figure 2.2: Process of research

- The examined literature supported by the analytic approach throughout this multiple case study is presented in Figure 2.
- Interviews with project managers, assistant project managers, architects, main engineers, mechanical and electrical engineers, consultants, quantity surveyors and construction managers were done in order to record information using a Likert measuring tool.
- Qualitative 5x5P-I risk analysis grids and dispersion diagrams resulting from the 5-point scale were assessed for the knowledge acquired.
- Table 4 provides an analytical sample, with 13 interviews in particular in the 3 instance.

Limitation

- Square measurement restrictions • as with the bulk of research. • For example, just eight PMI data locations have been often picked from the whole.
- An RM that is key to the study was tested on all various PMKAs and neutral management was eliminated, thus preventing superficial impressions owing to the expected small size of stakeholders within the PM offices involved.
- Furthermore, the second case was not completed in the whole of the data gathering procedure.
- There were therefore limited knowledge since the reduced sales portion could not be examined.
- However, the observations of the following sections nevertheless show aspects of RM in construction which were not analysed in the past by trial and error in African nation. In addition, some participants had not wanted to be recorded when they had interviewed, whereas subcontractors did not meet the sample requirements.

Results and discharges

Profile of the answer

- The first section of the form featured inquiries concerning the demographic profile of the respondents, but the people who were in the best position to report the risk and effect on the project are perceived as well as data square measurements.

The professions of responders covering design, project management, quantity measurement, management of contracts and engineering are shown in Table 4.

Table 2.4: analysis sample

Case Interviewee	PM	Assis. PM	Architect	Principal Eng.	M&E Eng.	Consultant	QS	Contracts Mgr.	TOTAL
Case 1	√		√	√	√		√		5
Case 2		√√				√		√	4
Case 3	√	√						√√	4
TOTAL	2	3	1	1	1	1	1	3	13

Risk and effect throughout the PLC

As regards the potentially recognised hazards (environmental, financial, technological, and political) occurring and their impact, question 3 of the form has tested the view of the respondents.

- The inquiry raised answers from one (extremely low) to five on a 5-point Likert scale (very high).

- The results of each instance measurements of the square of the project in Tables 5 to 7.
- The results demonstrate that the beliefs of participants about the probability of dangers at the initial stage are radically different.
- The outcomes, however, are mainly medium to horribly high in the design, style, execution and sales event phases.
- The repercussions were in turn apparent across the PLC as parallel to their probabilities.
- These show that the likelihood and consequences of hazards increased proportionally, as the project advanced.

Table 2.5: Project risk perceptions P-I throughout the PLC in case study 1

Phase / Interviewee	Architect	Quantity Surveyor	Structural Engineer	M&E Engineer	Contractor's PM
Likelihood:					
Initiation	Medium	Very low	Very high	Very high	Very low
Planning & Design	Medium	Medium	Very high	Very high	Very low
Execution	Low	High	Very high	High	High
Closeout	High	Medium	Very high	High	Very high

Phase / Interviewee	Architect	Quantity Surveyor	Structural Engineer	M&E Engineer	Contractor's PM
Impact:					
Initiation	Medium	Very low	Very high	Very high	Very low
Planning & Design	Medium	Medium	Very high	Very high	Very low
Execution	Low	High	Very high	High	High
Closeout	High	Medium	Very high	High	Very high

Table 2.6: Project risk perceptions P-I in the PLC in case study two

Phase / Interviewee	Contracts Manager	Project Engineer	Assistant PM	Consultant
Likelihood:				
Initiation	Very low	Very low	High	High
Planning & Design	Medium	Very low	High	High
Execution	High	High	Low	Very high
Closeout	-	-		-
Impact:				
Initiation	Very low	Very low	High	High
Planning & Design	Medium	Very low	Very low	High
Execution	High	High	High	Very high
Closeout	-	-	-	-

Similar to case 1, participants generally saw a corresponding increase in the chance and effect of hazards since the project evolved.

Phase / Interviewee	Contracts Manager	Project Engineer	Contractor's Contracts Manager	Construction manager
Likelihood:				
Initiation	Very low	Very low	Very low	Very low
Planning & Design	Medium	Very low	Medium	Medium
Execution	High	High	Very high	Very high
Closeout	Medium	Very high	High	Medium
Impact:				
Initiation	Very low	Very low	Very low	Very low
Planning & Design	Medium	Very low	Medium	Medium
Execution	High	High	Very high	Very high
Closeout	Medium	Very high	High	Medium

Risk in the opposing fields of information (KAs)

Question four of the form tested the opinion of the respondents as to how well the known risks, (environmental, financial, technical and political), are impacted by using a 5-point Likert scale ranging from 1 (very low) to 5 (Integration, scope, time, cost, quality and communication resources, to procurement management) (very high). Table 8 through 10 display the outcomes.

Table 2.7: Perceptions of risks in Case 1 on the reverse information areas of PMI

KAs / Interviewee	Architect	Quantity Surveyor	Structural Engineer	M&E Engineer	Contractor's PM
Impact:					
Integration	Medium	Very high	Very high	Very high	Very high
Scope	Very high	High	Very high	Very high	High
Time	Very high	Very high	Very high	Very high	Very high
Cost	Very high	Very high	Very high	Very high	Very high
Quality	Medium	Very high	Very high	Very high	Low
Human resources	Low	Very high	Very high	High	Low
Communications	Low	Very high	Very high	Medium	Medium
Procurement	Very high	Very high	Very high	Very high	Very high

- Results demonstrate that Structural Engineer, and also M&E Engineer following, were most likely to be exposed by these identified areas to dangers compared to other WHO's mixed perspectives.
- In general, due to their perceived critical role, time, costs and procurement management looked most significantly affected.

Table 2.8: Perceptions of the risk effect on opposing PMI fields in Case 2

KAs / Interviewee	Contracts Manager	Project Engineer	Assistant PM	Consultant
Impact:				
Integration	High	Very high	Very low	Low
Scope	Medium	Medium	Very low	Very high
Time	Very high	Very high	Very low	High
Cost	Very high	Very high	Unsure	High
Quality	High	Medium	Very low	High
Human resources	Medium	Very high	Medium	Unsure
Communications	High	Very high	Very low	Unsure
Procurement	Medium	Very low	Very low	Unsure

In this instance, participants had comparable judgments about the influence of these hazards on the PMKAs. The consultant was generally unaware of the impact on several sections of these hazards.

Table 2.9: Risk perception of the impact of Case 3 on opposite PMI fields

KAs / Interviewee	Contracts Manager	Project Engineer	Contractor's Contracts Manager	Construction Manager
Impact:				
Integration	High	Very high	Very high	Very high
Scope	Medium	Medium	Medium	Medium
Time	Very high	Very high	Very high	Very high
Cost	Very high	Very high	Very high	Very high
Quality	High	Medium	Very high	Very high
Human resources	Medium	Very high	Very high	Medium
Communications	High	Very high	Very high	Low
Procurement	Medium	Very low	Very high	Medium

The results show that point and pricing were heavily influenced, followed by integration management. The panellists generally saw hazards as widespread across the PLC.

CASE ANALYSIS AND IMPLICATIONS

Risk opportunity and effect in the PLC Case 1

Table 2.10: outline of risk P-I across the PLC just in case one

Impact					7 (4.5)	Very high
				5 (2.8)		High
			4 (1.5)			Medium
		1 (0.6)				Low
	3 (0.1)					Very low
Very low Low Medium High Very high Probability						

- RM perceptions were collected in Table 11 from 5 respondents.
- 2 respondents rated P-I 'extremely low' and 'extremely high' with a 'mid' score for the initiation phase.
- The design and style stage was ranked by 2 people interviewed as 'mid' and 'extremely high,' while the stage was ranked 'extremely poor.'
- The execution stage was rated "high" by three respondents, while others assessed it as being "very high" and "low."
- During the sales event stage, the "high" and "very high" rating of two respondents were measured, while one rated it as the "middle."
- The examination of scores reveals that the range of RM monitoring in Table 11 was very low and therefore undesirable results.

Case 2

- Table 12 shows the assessed risk P-I perceptions of our interviewees on the 5-point Likert scale developed to capture individual perspectives
- 2 interviewees assessed the stage of performance as high, one as high, and the other as poor.
- 3 respondents considered that the P-I was 'high' during the implementation stage, while one considered the P-I to be 'extremely high.'
- Two interviewees considered that the initiating phase had "extremely low" risks, while another two disagreed, indicating that this segment had "high" P-Is.
- The shut-down phase was not hierarchical, since the project had still been carried out

Table 2.11: outline of risk P-I across the PLC just in case two

Impact					1 (4.5)	Very high
				6 (2.8)		High
			1 (1.5)			Medium
						Low
	4/3(0.1)	1 (2.0)				Very low
	Very low	Low	Medium	High	Very high	Probability

Case 3

- The interviewee perceptions in case three as summarised in the P-I grid (Table13).
- Interviewees realise the P-Is would be the same danger.
- Two informants said that "extremely high" P-I was observed at the execution stage, but the PLC had comparable problems with shutouts.
- Another two respondents considered 'high' P-I during the implementation stage, whenever additional 'high' scores were hierarchically achieved by an interviewee on the shut-out stage.
- The four respondents look at the beginning since the stage is the least troublesome. The design and style of the project were rated 'average' by three respondents, while one person rated it 'extremely poor.'
- In the meantime, 2 interviewers rated the phase "high" and on the contrary "very high" 2, there differentiating it from the worst part.

Table 2.12: a P-I risk overview across the PLC in instance 3

Impact					3 (4.5)	Very high
				3 (2.8)		High
			5 (1.5)			Medium
						Low
	5(0.1)					Very low
	Very low	Low	Medium	High	Very high	Probability

Risk in different domains of information Case 1 Influence

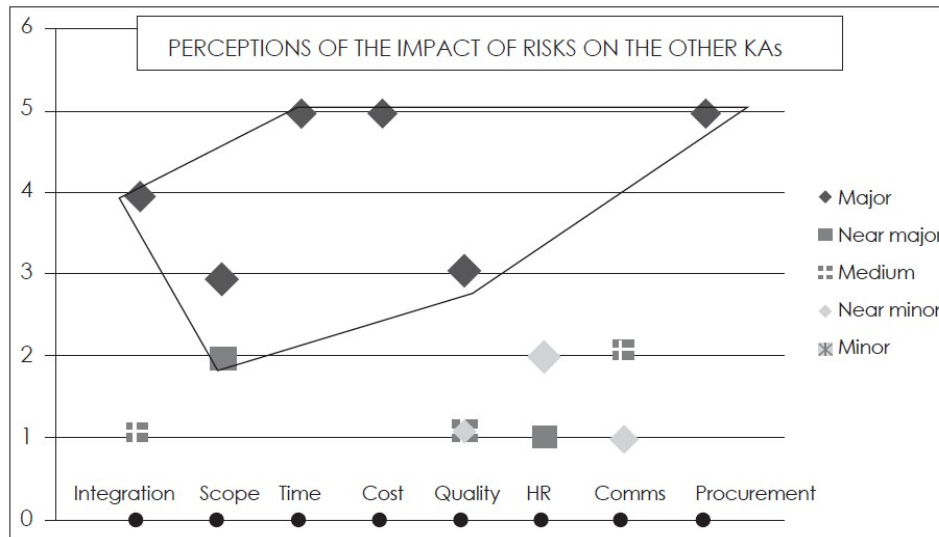


Figure 2.3: Case one –summarized perceptions of the impact of risks on the opposite KAs throughout the PLC

- However, Figure 2.3 shows that respondents feel that risk has an influence on the contrary
- However, Figure 2.3 shows that participants have recognised the impact of the risk on the project's opposing regions.
- Some red dots seem to be prevalent in the main graphic, which indicate that the project is competing with problems in accordance with the perspectives of those interviewed.
- The regions considered very impaired were integrated by 4 respondents, with one being rated 'too high' by one, 4 being rated 'too high' by one reporter, while 3 were rated 'too high' by quality and all were rated 'too high' by all.
- Time, value and proxy.
- The Project Management Information Body (PMBOK) agrees that the activities should be mapped to the nine areas of knowledge for project management to be successful (PMKAs).
- The views showed that the stakeholders of the project did not follow the current thinking. As a consequence of ignoring risks, the project succeeded in resolving problems.

Case 2

- Two interviewees in Case a couple believed that the project has significant time and expense effects, while one participant realised that several areas have been significantly affected, as shown in Figure 4. (Extracted from Table 9).

Hence, the respondents suggested that a number of specific areas were addressed by themselves; thus, this research is generally seen as managing the media risk level of the material in keeping with the equal distribution of red dots in Figure 4. Figure 4 (scatter diagram).

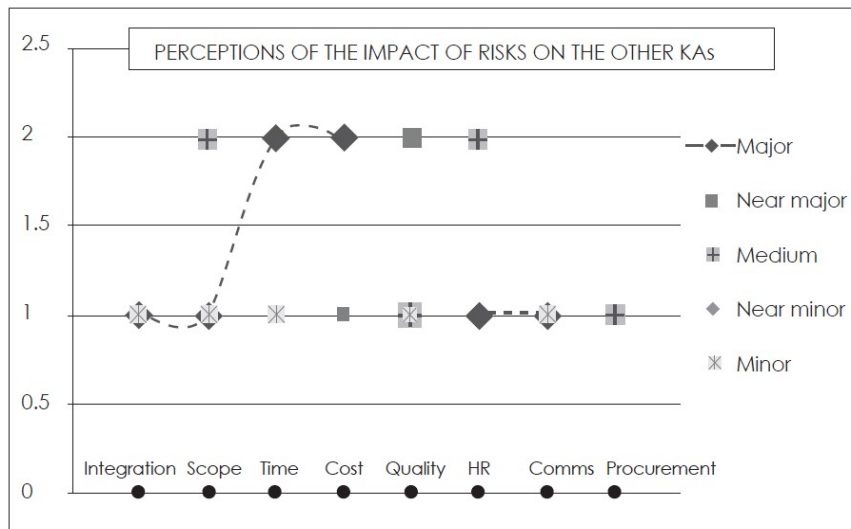


Figure 2.4: Case a pair of –summed assessments of the effect of hazards across the PLC on opposite KAs

Case 3

- In Case 3 all respondents were classified as "medium," although the time and value of all participants were rated "very high," as demonstrated by red dots dispersed by the highest level inclined in Figure a pair of.5.
- The results demonstrate a perceived speculative influence on the project because of a tiny gap between those who have been acknowledged by the World Health Organisation, and others remain enthusiastic about the obstacles.
- Two project areas: time and value were also mentioned.
- Then integration ensued.
- Thus, the impression reveals that the project has a highly detrimental impact with bad RM.

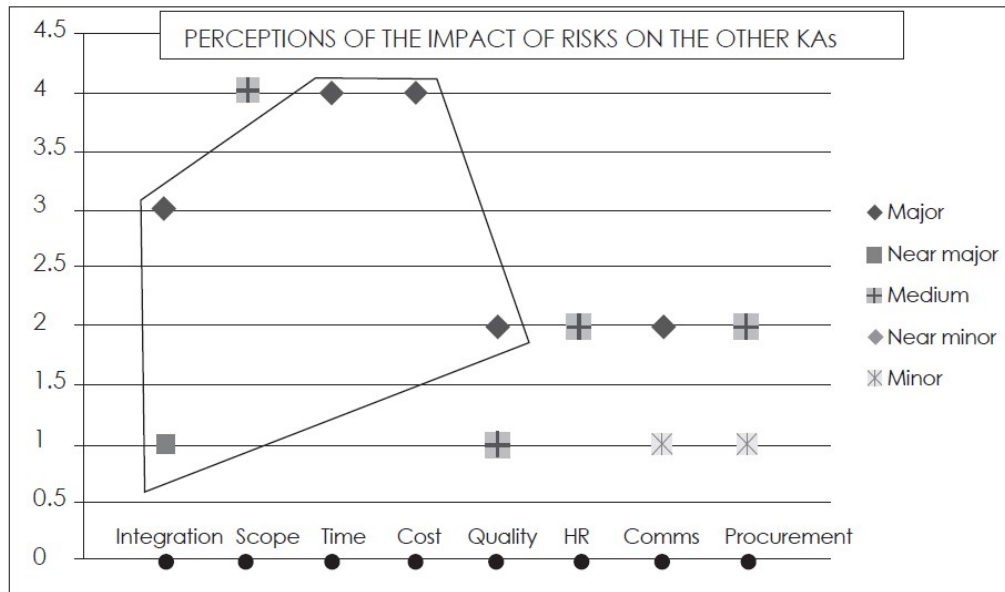


Figure 2.5: case 3 summarised the risk effect views in the PLC on opposite KAs

- Publicly coming RM perceptions
- The analysed answers show that interviewed persons in case 1 were convinced that there was a very low level for RM, whereas in cases one and three, the Pi-I perceptions on the subject were determined to be moderate and near to the medium, seriously (Table 14).
- The initiation stage achieved the highest "very poor" result, on average, whereas design and style achieved the highest and the highest, as seen in Table 14.
- It is worth noting that the shut-out stage was not sufficiently self-addressed, as the result of the Case a couple didn't provide P-I ratings for this stage, as the project was still dead. Finally, at the point of implementation the people surveyed felt that 'P-Is' are 'high' and 'extremely high.'
- The majority of respondents viewed the start-up phase as risk-free.

Table 2.13: The average P-I of the project interviewers across PLC

Project stage	Very low	Low	Medium	High	Very high
Initiation	63%	0%	7%	17%	13%
Planning & design	32%	0%	47%	8%	13%
Execution	0%	15%	0%	53%	32%
Closeout	0%	0%	23%	22%	22%

DISCUSSION

- Almost everyone in the 3 instance considered reasonable considerations of risks, their probabilities and their consequences were inadequate.
- Further stress was placed on the achievement of the goals of projects while taking no account of risk concerns.

- The interviewer said that the interviewees were outweighed at the completion stage of the project, whereas eight said that technical data failures (e.g. elaborated data) were sometimes overlooked during the planning stage.
- This might end in random changes.
- Employers in eight people interviewed tend to be reluctant to promote the culture of RM.
- But Table 15 shows the interviewers the degree of RM in each instance with regard to suppressing P-Is. They perceive the average RM level sometimes in the 3 situations.

Table 2.14: Findings in

<i>Research element</i>	<i>Case 1</i>	<i>Case 2</i>	<i>Case 3</i>	<i>Summary</i>
<i>RM perceptions</i>	<i>Very low</i>	<i>High</i>	<i>Low</i>	<i>Low level</i>

CONCLUSIONS and suggestions

- The outcomes of this study report are related to the building risks dynamic in Lesotho with the underlying public sector challenges.
 - This study gave insights into the implications of risks on the building stage and strengthened its opportunities and effects.
 - The results confirm that the stated lack of current information has been applied due to the considered risks that remain high in the near future. •
- Based on the results in the 3 scenarios, time, cost, integration, quality and procurement management were the most affected aspects of the project.
- The outcomes mirror the absence of the necessary RM capabilities.
 - Recommendations should thus be directed towards improving RM training and training, which might have an impact.
 - This may be achieved through sufficient coaching of construction management execs at the business and operational levels.
 - The utilisation of commissioned facilities in Lesotho may be an on-site technique to increase the application of RM. The company should have courageously held regular RM workshops.

Mini FORM INTERVIEW

1. Tick the appropriate box here to indicate the organisation and title of your employment.

RD	☐	BDS	☐	Main Contractor	☐	Subcontractor	☐	Consultant	☐
PM	☐	Asst. PM	☐	Contract. Man	☐	Architect	☐	Asst. Arch.	☐
Engineer	☐	Asst. Eng.	☐	CM	☐	QS.	☐	Asst. QS.	☐

2. Information about the general project: (IF PM/QS/Hauptagent)

Start date:

Tender amount:

 R

Anticipated finish date:

Anticipated final cost:

 R

3. On each level of the PLC,

A. It is undoubtedly due, however, to these hazards, and b. – Scale your perceptions from one (extremely low) to five points in Likert (very high)

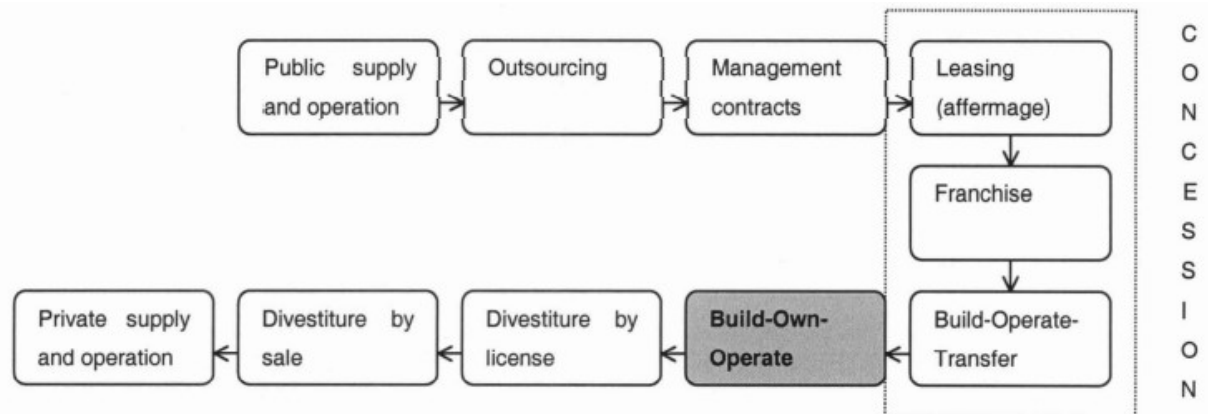
		Probability						Impact				
Project phase	Unsure	Low.....High					Unsure	Low.....High				
		1	2	3	4	5		1	2	3	4	5
Initiation (I)	U	1	2	3	4	5	U	1	2	3	4	5
Planning & design (P)	U	1	2	3	4	5	U	1	2	3	4	5
Execution (E)	U	1	2	3	4	5	U	1	2	3	4	5
Closeout (C)	U	1	2	3	4	5	U	1	2	3	4	5

4. What is the impact (identified) of the eight data categories on each project section? – Scale your perceptions from one (extremely low) to five Likert scale (very high).

PMI knowledge area	Unsure	Impact				
		Low.....High				
		1	2	3	4	5
Integration	U	1	2	3	4	5
Scope	U	1	2	3	4	5
Time	U	1	2	3	4	5
Cost	U	1	2	3	4	5
Quality	U	1	2	3	4	5
HR	U	1	2	3	4	5
Communications	U	1	2	3	4	5
Procurement	U	1	2	3	4	5

2.5 LITERATURE REVIEW

2.5.1 GENERAL CONCESSIONS



SPECTRUM OF POTICITY AND INFRASTRUCTURE OPERATION

- Personnel are placed on the market by entirely various methods: outsourcing, administration contracts, leases, franchises, concessions, licencing and selling desserts and individuals.
- Dual carriage general overview providing and operating concessions. Chart depicts the range of options for infrastructure ownership and operation starting with public provision and operations to the complete provision and operation of personnel.
- Concessions include lease, franchise and Build-Operate-Transfer (BOT) arrangements, according to the current categorization approved by the Globe Bank. However, our definition of construction-operation-transference concessions is limited within the scope of this study, which is the most often utilised delivery mechanism on toll roads. The graphic shows the most common organisation of larva.

2.5.2 Controlling social risk management applications

- Our government tailored prior risk management techniques to highlight the most important features of dual transport, once consideration is given to the strengths and weaknesses of the various, in Europe, us, the area and Asia.

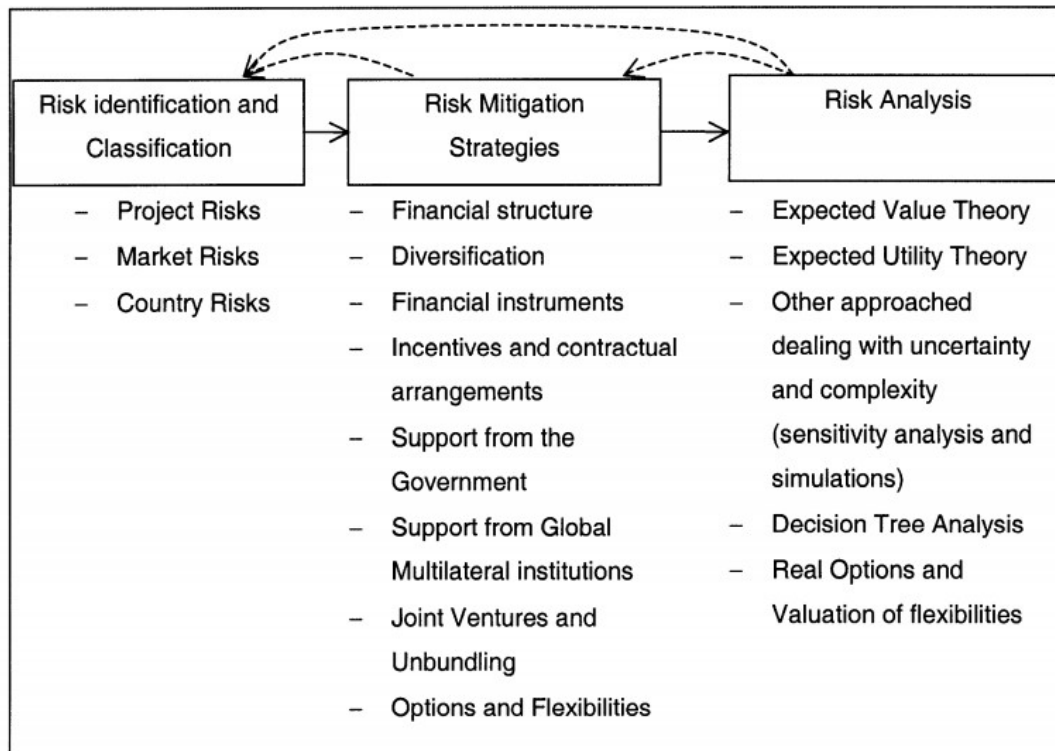
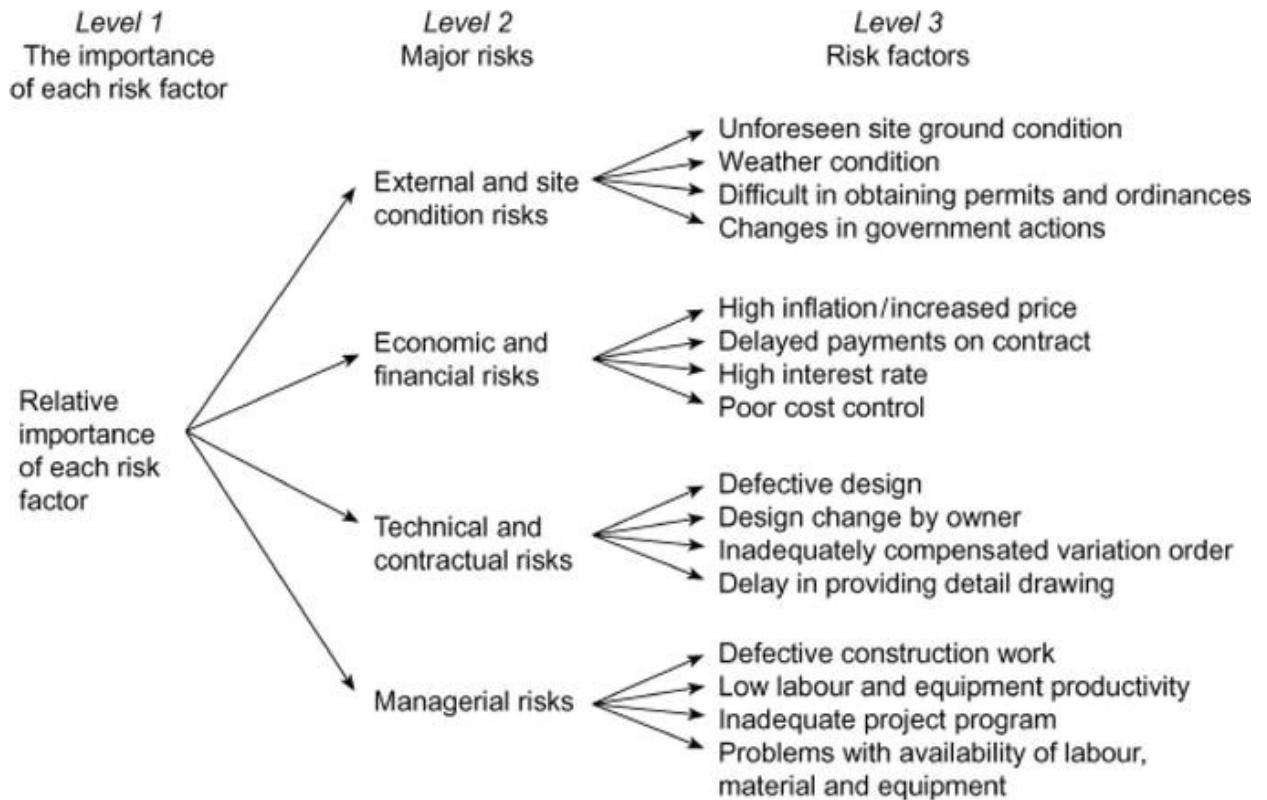


FIG 2.6 RISK FRAMEWORK FOR TOLL ROADS

2.5.3 RISK management at construction project

- The project risks are frequently identified as the associated grading of adverse effects, the funding of each of the projects and the structure of the projects, the outcome of decisions taken or the environmental conditions at the site of the project. Building risks are the subjects not eliminable but their influence is frequently reduced.
- An unique, particular and dynamic building project has entirely distinct degrees and combinations of hazards such that the answers made to reducing such risks and their various implications have an impact on project performance {altogether different}. Risk classes are external risks, economic risks, risks of money, risks of technical and written agreements and risks of social control. This risk identification is commonly found in the following diagram

RISK AT BUILDING PROJECT



HIERARCHY OF RISK AT BUILDING PROJECT

- The many hazards associated with international construction must be managed extremely importantly, in particular in underdeveloped nations, but not just in order to jointly secure work in order to make profit. In order to manage building risks efficiently, it is important that the key risks be correctly identified and adequately integrated in the written agreement parties. The views of stakeholders of risk vary due to totally diverse project interests.
- The diagram depicts risk class and risk identification for a building project. In each risk class, risks are known. The hazard classes within the project cover economic risks, time risks, physical risk, personal risk, style and technical risks, written agreements risk, policy and regulatory risks and safety risks. Building hazard classes have supported several issues as well as the construction job categories, the stakeholders, development strategies, project resources, difficulties of development and others.

2.5.4 TOLL ROAD Projects GENERAL Risk Management

In essence, highway risk management takes place at various phases such as risk detection, risk assessment, and risk response. The distinguishing feature of the motorway is that the acknowledged hazards. Risks may vary by wagering on the project views of the stakeholders.

The recognised danger of road building is:

Major danger • Traffic risk: all development traffic. Disadvantages for travelling passengers.

- Risk of duty: less toll collection due to the lower traffic density. The danger of duty causes a failure in building value recovery. Inflating the total building value.
- Building risk: The project is to be finished at certain prices and time, and so, there is a chance of increasing fabric value.
- Operating and maintenance risk: due to the project delays, the operating and maintenance value inflated to disguise the calculable maintenance expense, affecting the start of the operation.
- Land procurement: project-level delay resulting in an increase in the calculable value of the building due to land acquisition.

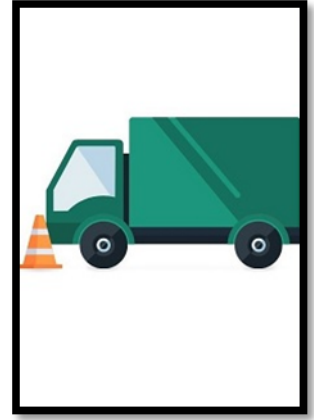
Lower risk

- Utilities: no gasoline, power or utilities are available that have not been solved in time to impose delays on some projects
- Noise: repeated, loud noise induces abortion and can be a serious distraction for long term listeners.
- Material and handling: materials and tools which are raised and effected on the building website on an ongoing basis, either by hand or by using lifting tools. Fully distinct businesses may have greater demands, but all may entail certain dangers.

In the Republic of India the risk of motorways derives from the view of households classified in seven classes as following::

1. Political risks, such as concessions, tax increases, incorrect implementing of tariffs, tariff increases, societal control of new government policies etc.
2. The risk of building, such as improper landscape, project delay, the state of the website, failure of the contractor... 2. 2.
3. Risks in operation and maintenance, such as the network state, inadequacy of the operator, building quality, etc.
4. Legal and written contract risks, such as guarantee for concession time, faulty / inconsistent contract document etc.
5. Financial gain hazards, such as an imprecise volume of traffic, imprecise toll rate estimates, building of a different competitive route, etc.
6. Cash risks, such as inflation, devaluation, unit charge, policy changes, limited capital, etc.
7. Major force, such as atmosphere, natural calamities, etc.

8. Motorway hazards emerge, when evaluated from various impartial angles, {totally entirely different} The main danger in highway is supposed to be land buying, for the capitalist goal of reading. Alternative significant public policy hazards.



CHAPTER 3

3.1 CASE STUDY - 1

FOUR TOLL PLAZAS

3.1.1 PROJECT DETAILS:

PROJECT: FOUR TOLL PLAZAS

LOCATION: Chennai

CONSTRUCTION : TNRDC

ROAD EXTENTION : 60.5 KM

BUDGET : 2,156 CRORE

3.1.2 INTRODUCTION

At one time, the Tamil Nadu Road Development Company (TNRDC) began the construction of 4 toll plazas on the outer path from Minjur to Vandalur, the once drivers area unit smoken by the lack of transparency in the range of toll systems and poor maintenance of the urban bypassway and Rajiv Gandhi incense tree.

- The length of 60.5 km may connect the NH-45 with Minjur on Via Nazaratpeti (NH-4), Nemilichery (NH-205) and Padiyanallur on the Thiruvottriyur Ponneri Pancheti (TPP) route (NH-5).
- TNRDC erected 4 toll gateways each at Varatharajapuram (6 kms), near Mudichur, Kolapancheri (21,8 kms) at Nemilichery, Palavedu (30,85 kms) near Red Hills and Chinnamullaivoyal (56,70 kms) four kms from Minjur, as stated in official documentation.
- TNDRC authorisation for the establishment of toll gates under the National Highway Fees (Determination of Rates and Collection) Rules 2008 has been sanctioned by the authorities.
- Whereas the 6-lane access road controlled by motor vehicles in central urban suburbs in the Northern part of towns, motorists have to pay toll for every 15 kms. • In 1998, an external route had been planned with AN aiming to decompose cities and to ensure a free flow of traffic on blood vessel roads.
- The remaining 30,5 km of Orr project works between Nemilichery and Minjur have been hampered for some years by land acquisition concerns between Nallur and Avadi, but the twenty-nine,65 km road between Vandalur and Nemilichery was complete and opened for public views in 2014.
- While executives of TNRDC state that over 98% of phase II works have been finished, starting March 2019 the route is fully available to the public. The project was worth two,156 crore Rs dead.

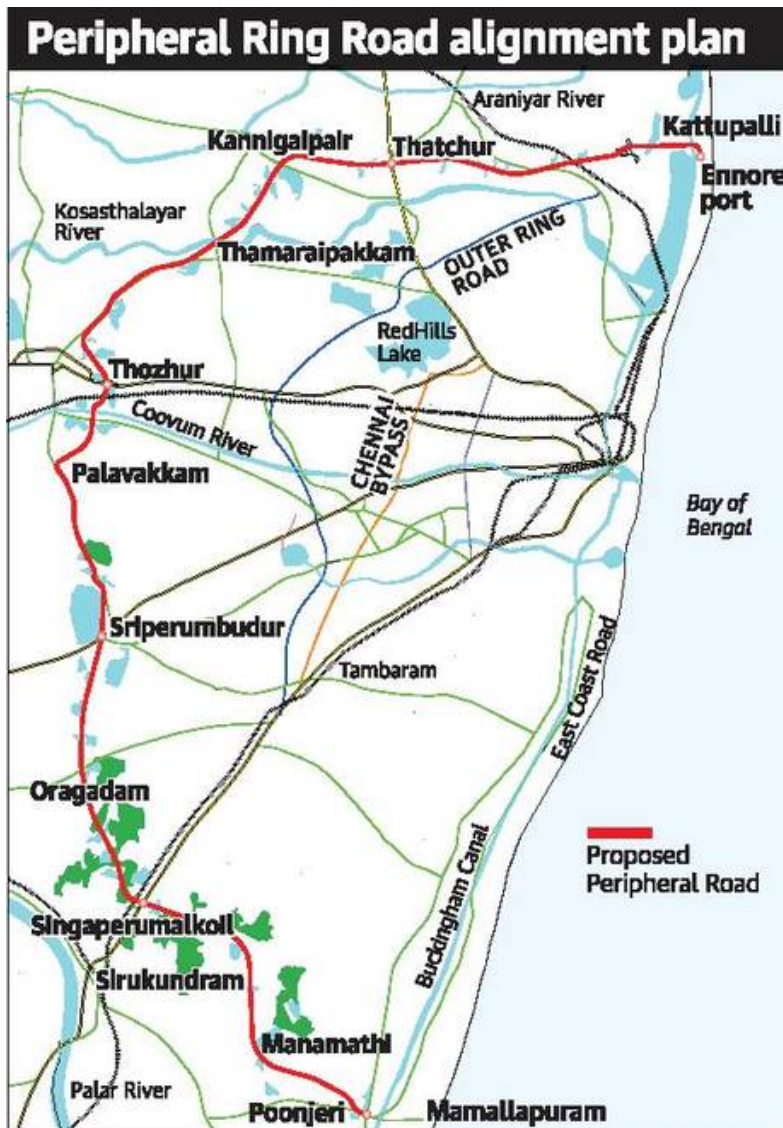


PHASE I:

- A contract for the development of the phase I of the Orr urban centre was granted in August 2009 to the GMR Cluster and NAPC Association.
- Phase I began construction in August 2010. It was completed by the Gregorian calendar month of 2013 and finally postponed.
- Phase I consisted of 5 main bridges, 8 transport passes, 3 interchanges, 18 pedestrian subways, 3 flyways, 2 small bridges and a hundred box culverts.

PHASE II:

- A contract was awarded to do the Phase II clinical study in 2013 for a company made of GVR below.
- Segment I – Granite State 205 to Granite State Five Ch.
- Segment II - Granite State 5 TPP Road Ch. Km. 18+420 km.
- Segment I and II, (approx. 30.500 km long) connection NH-205 at the Nemilichery village and the TPP near the Minjur district unit, is expected to concern the implementation of the project during this second part. The project route is planned as a 6-lane motorway split by service highways.
- The construction is based on the DBFOT system. • The construction is based on a DBFOT system.



Dimensions of road

- Segment No 4 length 62.00 km
- 122 m (400') wide with a fifty m wide transportation crossing for the formation of two means of transmission with VI lanes, a pair of service lanes and fifty m (22 m) broad to provide necessary public facilities and future transportation development;
- 551.93.5 hectares in extent

Segment segment Seg I – GST road (Vandalur) to GWT Road,(Nazarathpet) • Length - nineteen.7 kilometres • Seg dos – Google Ways road(Nazarathpet) to Google Housing Road,(Nemilichererry) • Length - nine.5 kilometres.

• Seg 4 – Nallur GNT Road to TPP Road,(Minjur) • Length – 14 km.

Cost - Rs.1081.40 crores section I



Table 1 granite State 205 to granite state five Table one calculable Total traffic

Year	LC V	2A Trucks	3A Trucks	MA V	Car	Bus	Two Wheeler	Load Auto	Aut o	Agricultural Tractors	Total Traffic (in Veh)	Total Traffic (in PCUs)	Tollabl e Traffic (in Veh)	Tollabl e Traffic (in PCUs)
2015	788	520	526	137	3147	566	1416	78	157	78	7413	11113	5683	9780
2020	1390	430	930	232	6201	857	2219	102	218	88	12667	17858	10040	15982
2025	1908	373	1251	315	7795	1036	3337	131	291	97	16534	22649	12678	20055
2030	2863	401	1787	444	10544	1438	4725	161	373	106	22843	31174	17478	27717
2035	3903	413	2342	581	13412	1858	6263	191	457	115	29534	40112	22509	35722
2040	4979	431	2896	712	16339	2289	7730	217	532	121	36247	49129	27647	43862

Table 2 Total calculable Section 2 traffic: Granite State 5 to the route TPP

Year	LCV	2A Truck	3A Truck	MA V	Car	Bus	Two Wheeler	Load Auto	Aut o	Agricultural Tractors	Total Traffic (in Veh)	Total Traffic (in PCUs)	Tollabl e Traffic (in Veh)	Tollabl e Traffic (in PCUs)
2015	617	403	284	126	2404	570	1082	121	240	121	5967	9171	4403	7665
2020	1191	380	625	248	4865	840	1695	159	332	136	10472	15333	8150	13303
2025	1785	347	890	372	6410	1071	2549	203	445	151	14221	20386	10874	17683
2030	2823	386	1334	550	8875	1519	3608	250	570	165	20081	28795	15487	25303
2035	3981	406	1803	739	11480	1987	4783	295	697	178	26351	37701	20397	33368
2040	5214	431	2286	927	14181	2466	5904	336	812	188	32745	46835	25505	41722

Details of the buildings and installations envisaged

- Major Bridges No — One
- Railway No. Over Bridges/Road below Bridge — Zip
- Grade Specification No. - 2
- Minor Bridges No. - 2
- Transport No. Underpasses - 8
- No.of Underpasses Pedestrian - 17
- Ninety-eight of Culverts No.

Facilities of the project:

- toll plaza(s);
- mountainous furniture;
- roadside Amenities;
- countryside and treetops;
- lay-off trucks;
- bus-bays and bus shelters;

- pedestrian premises;
- a baseline camp, operation and maintenance; I a TNRDC workplace website;
- postal therapy;
- Restoration stations for vehicles
- the laboratory of the project; and,
- Others
- route Patrol vehicles and systems;
- Facilities for emergency help, ambulance, crane, tow trucks
- Advanced Traffic Management Systems (ATMS)



3.1.3 RISK MANAGEMENT



RESEARCH METHOD USED

Risk Breakdown Structure (RBS) Risk breakdown structure is very useful to identify and classify any possible risk on a certain project. This method will list the categories and sub-categories within which risks may arise. One benefit of the use of this method is to remind one in a risk identification exercise of the many sources from which project risk may arise.



- Risk identification on toll road projects is divided into categories according to stakeholder interests in the project.
- Risk perceptions of each stakeholder will differ due to the different interests within the project. Next table presents the results of interviews in the identification of risks from different stakeholders in this project.
- The identification of risk from the perception of contractor, owner, community surrounding the project, design consultant, and supervisory consultant are:



Risk identification on toll road projects is divided into categories according to stakeholder interests in the project.

- Risk perceptions of each stakeholder will differ due to the different interests within the project. Next table presents the results of interviews in the identification of risks from different stakeholders in this project.
- The identification of risk from the perception of contractor, owner, community surrounding the project, design consultant, and supervisory consultant are divided into eight risk categories.
- The risk categories are economic risk, contract and legal risks, construction risk, risk of income, risk of operation and maintenance, political risk, social risk, and force majeure risk. Risk identification was carried out for each risk category. Each stakeholder carries different categories of risk, depending on the interests of stakeholders in the project.

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Economic risk	• Loss of costs due to job repairs left by subcontractors • Increase in the price of iron units of concrete		• Payment of land acquisition stagnating • The presence of brokers on land acquisition process • The price of compensation for land acquisition is not suitable • Livelihoods change/disappear • Decrease in value/price of land/house investment due to adjacent to toll road	• Late payment • Changes in interest rates • Monetary policy changes	• Contractor completes the job before the contract expires

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Contract and legal risks	• Abandonment of funds due to no date of maintenance guarantee returns, maintenance period of 3 years		• The process of socialization of land acquisition is not according to the regulation • No feasibility study of EIA (Environmental Impact Analysis) • Violation of environmental laws and regulations • Violation of legislation on land acquisition	• Inconsistency of contract documents • Late of completion of planning	

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Construction risk	• Work is late • Work path collapsed • Theft may occur at the location of the box culvert and overpass • Over material class B2 on ready-mix	• Land acquisition is late • Increase in land procurement costs • Late of procurement of review design consultants • Inaccuracy and lack of existing utility data • The results of the initial study (engineering, environment) is less accurate • Procurement of supervisory contractors/consultants is late	• Road becomes dirty • Pavement in this area becomes damaged • Some walls of the house become cracked • Accidents due to project vehicles and project activities • Air pollution caused by construction dust (influence on health) • Disruption of activity/accessibility due to project (road closure, route transfer)	• Primary data and secondary data are inadequate • The quality of personnel does not meet the standards • Difficult access to location planning • Error of price estimates for bidding • The results of planning are considered less compatible with conditions in the project • The planning completion time is too short	• Improper design from design consultant • Project delays • Conditions in the project do not support • Construction failure • Contractor works not in correct procedures • Unavailability of PPE (Personal Protective Equipment) • Uncooperative owner

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Construction risk		• Quality of material does not conform to specifications • Contractor claims for additional fees beyond the contract • Design not in accordance with the conditions and or incomplete • Flooding and environmental disturbance due to lack of handling of temporary drainage and construction • methods during construction • Unavailability of construction material • Not achieving the volume of traffic • Delay of tariff increase		• Inaccurate quantity estimates	

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Risk of income		• Inaccurate quantity estimates • increase in construction costs • The flatness and hardness of the pavement surface does not meet the SPM • The quality of the winning supervising contractor/consultant is not as expected			

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Risk of operation and maintenance		• Increased operating and maintenance costs are not appropriate to business plan			

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Political risk		Decrease in performance due to changes in government policy		- Changes in wisdom - Changes in government structure - Increase in taxes (related to project cost estimates)	- Changes in policies/regulations - Changes in government structure - Changes in position/organizational structure of owner

Risk categories	Risk from contractor's perception	Risk from owner's perception	Risk from society's perception	Risk from design consultant's perception	Risk from supervisory consultant's perception
Social risk			- Residence changed/moved - Separate/disconnected access road residents due to toll road projects - Noise/disruption of life due to vehicles on toll roads during the operation of toll roads		

STAGE 3 **RISK ANALYSIS**

- Risk analysis was done using risk breakdown structure method Risk level was obtained by multiplication between the risk probability and risk impacts. The results of the risk analysis suggest that the rank of risks from each stakeholder varies.

Rank of risk	Risk from contractors perception		Risk from owner's perception		Risk from society's perception		Risk from design consultant's perception		Risk from supervisory consultant's perception	
	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level
1.	Work is late	15	Land acquisition is late	20	Pavement in this area becomes damaged	15	Error of price estimates for bidding	8	Improper design from design consultant	18
2.	Liquidated damages of 1 per km per day, no maximum limit	15	Increase in land procurement costs	20	Air pollution caused by construction dust (influence on health)	14	Changes in interest rates	8	Project delays	15
3.	Increase in the price of iron units of concrete	15	Increase in construction costs	16	Road becomes dirty	12	Late of completion of planning	5	Weather conditions during construction	11
4.	Bored Pile meets the bolder layer and instructs the consultant to proceed	9	Contractor claims for additional fees beyond the contract	12	Noise/disruption of life due to vehicles on toll roads during the operation of toll roads	11.25	Late payment	5	Conditions in the project do not support	8
5.	Work path collapsed	6	Not achieving the volume of traffic	12	No feasibility study of EIA (Environmental Impact Analysis)	11.25	Weather conditions during the survey	5	Contractor works not in correct procedures	6

Rank of risk	Risk from contractors perception		Risk from owner's perception		Risk from society's perception		Risk from design consultant's perception		Risk from supervisory consultant's perception	
	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level
6.	Loss of costs due to job repairs left by subcontractors	6	The results of the initial study (engineering, environment) is less accurate	12	Residence changed/moved	9	Changes in wisdom	4	Construction failure	5
7.	Theft may occur at the location of the box culvert and overpass	5	Delay of tariff increase	9	Disruption of activity/accessibility due to project (road closure, route transfer)	7.5	Changes in government structure	4	Changes in policies/regulations	4
8.	Over material class B2 on ready-mix concrete	2	The quality of the winning supervising contractor/consultant is not as expected	9	Some walls of the house become cracked	7.5	Monetary policy changes	4	Changes in position/organizational structure of owner	3
9.	Abandonment of funds due to no date of maintenance guarantee returns, maintenance period of 3 years	1	Design not in accordance with the conditions and or incomplete	9	Livelihoods change/disappear	7.5	The planning completion time is too short	3	Contractor completes the job before the contract expires	3

Rank of risk	Risk from contractors perception		Risk from owner's perception		Risk from society's perception		Risk from design consultant's perception		Risk from supervisory consultant's perception	
	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level
10	Extended Performance Guarantee	1	The flatness and hardness of the pavement surface does not meet the SPM	9	Separate/disconnected access road residents due to toll road projects	6.9	Increase in taxes (related to project cost estimates)	3	Uncooperative owner	2.5
11.			Increased operating and maintenance costs are not appropriate to business plans	9	Violation of environmental laws and regulations	6.9	Primary data and secondary data are inadequate	2	Unavailability of PPE (Personal Protective Equipment)	2
12.			Inaccurate quantity estimates	9	The process of socialization of land acquisition is not according to the regulation	5	Inconsistency of contract documents	5	Changes in government structure	1.5
13.			Decrease in performance due to changes in government policy	8	The price of compensation for land acquisition is not suitable	4.4	The quality of personnel does not meet the standards	1		
Rank of risk	Risk from contractors perception		Risk from owner's perception		Risk from society's perception		Risk from design consultant's perception		Risk from supervisory consultant's perception	
	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level
14.			Inaccuracy and lack of existing utility and data	6	Accidents due to project vehicles and project activities	4	Difficult access to location planning	1		
15.			Procurement of supervisory contractors/consultants is late	6	Payment of land acquisition stagnating	4	The results of planning are considered less compatible with conditions in the project	1		
16.			Quality of material does not conform to specifications	6	The presence of brokers on land acquisition process	4				
17.			Late of procurement of review design consultants	4	Violation of legislation on land acquisition	4				

Rank of risk	Risk from contractors perception		Risk from owner's perception		Risk from society's perception		Risk from design consultant's perception		Risk from supervisory consultant's perception	
	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level	Risk	Risk level
18.			Flooding and environmental disturbance due to lack of handling of temporary drainage and construction methods during construction	4	Decrease in value/price of land/house investment due to adjacent to toll road	4				
19.			Unavailability of construction material	4						

The table shows the risk priority of each stakeholder. It can be seen that for all stakeholders, the highest rank of risks is within the construction risk. For the contractor, the most significant risk is the job delay. For owner, the most risk is the delay of land acquisition. For local community surrounding the project, the most significant risk is the risk of having pavement in that area damaged by construction activities. For design consultant, the highest risk is the error of price estimates for bidding. For supervisory consultant, the top risk is the improper design from design consultant.

Risk responses are divided into three according to the level of risks, as follows:

- Low risk → risk acceptance
- Moderate risk → risk mitigation
- High risk → risk avoidance

Based on the results of analysis and interviews with stakeholders, the risk response obtained.

Risk response	Risk percentage (%)				
	Contractor	Owner	Society	Design consultant	Supervisory consultant
Risk acceptance	30	15.79	5.55	62.5	38.46
Risk mitigation	40	57.89	77.78	37.5	30.77
Risk avoidance	30	26.32	16.67	—	30.77

Inference and solutions

- For this toll road project, risks as perceived by stakeholders are categorized as: construction risk, economic and political risks, legal and contractual risks. These three risk categories are presented in each stakeholder risk analysis with several assumptions and conditions.
- For the owner, the economic risk is the risk of income.

- The economic risks refer to macroeconomic risks, related to economic policies such as inflation and devaluation, as well as the micro-economic risks associated with financial stakeholders.
- The categories of political, legal, and contractual risks are made into one category, because these three risks are considered to be related.

No	Risk category	The top risk level				
		Contractor	Owner	Society	Design consultant	Supervisory consultant
1	Construction risks	15	20	15	8	18
2	Economic risks	15	12	7.5	8	3
3	Political, legal, and contractual risks	15	8	11.25	4	4

THE TOP RISK LEVEL OF EACH STAKEHOLDERS WITH RISK BREAKDOWN STRUCTURE METHOD.

CONCLUSION

- A strong base about risk management would help a great deal in tackling the risks.
- Risks necessarily need not be negative and it can be viewed as an opportunity to develop our projects in a better way.

3.2 CASE STUDY - 2

3.2.1 PROJECT DETAILS:

PROJECT - PROPOSED IT PARK
LOCATION - CHENNAI

AREA STATEMENT

PLOT AREA		12.31 acres, 5,36,224 sqft		
		Built Up area (in sqft)	Parking area (in sqft)	Leasable area (in sqft)
PHASE-I	BLOCK-2	9,71,977	3,08,118	6,67,748
	BLOCK-3	9,82,647	3,07,727	6,61,583
PHASE-II	BLOCK-1	15,61,676	4,46,651	11,32,180
	Total	35,16,300	10,62,496	24,61,511

PHASING PLAN & TIMELINE

PROJECT PHASES		TIMELINE	PROJECT START	PROJECT FINISH
PHASE-I	BLOCK-2	24 months	17-Jun-19	16-Jun-21
	BLOCK-3	24 months	24-Sep-19	23-Sep-21
PHASE-II	BLOCK-1	24 months	To commence 6-18 months from Phase-I	

3.2.2 SITE PICS





3.2.3 RESEARCH METHOD

RESEARCH METHOD USED IN THIS CASE STUDY



3.2.4 RISK MANAGEMENT

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SI. NO	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY IMPACTED	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
01	Pre-construction	Mine approval for excavation and carting out	Excavation progress and carting away of soil apart from internal storage	Statutory	5	5	25	Closed	Mines approval submitted by contractor after 2days	Valid for 6 months
02	Pre-construction	Labour licence for the project	Mobilisation of labours for site and infra works	Statutory	4	3	12	Closed	Labour licence obtained	
03	Pre-construction	PCB approval for batching plant operation	Operation of batching plant	Statutory	4	3	12	Closed	CTE shared by client after a week. PCB applied and approvals in process	Submission of PCB within 1 month
04	Construction	Clearance for excavation – from Thasildhar collect orate	Progress of excavation	Schedule	4	3	12	closed	Clearance from client to commence excavation by 20 days	
05	Planning & design	Issue of WO for block-3	Placement of the tank in the site to be clarified	scope + cost + schedule	4	4	16	Closed	Contractor clarified that water will be brought from outside and stored	
06	Construction	Mass excavation completion	Progress of isolated footing excavation	Schedule	4	3	12	Closed	Mass excavation of 95% completed by 6months	
07	Construction	Soil dumping – mixing of good and bad earth in block-1 area	Suitability of filling in future due to mixing of soil	Quality	4	3	12	Closed	Discussed with contractor to dump the clay and good earth separately	Follow up for a segregated dumping

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SL NO	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY IMPACTED	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
08	Construction	Soil testing for suitability of filling	Soil dumped in block-1 area is to be used for block-2 filling. Soil mixed up during filling and needs to be tested	Quality	4	3	12	Closed	Soil sample taken for testing. Results awaited	Follow up with contractor on status of test results
09	Construction	Rock anchoring sample submission	Sample finalisation and procurement	Schedule + quality	4	3	12	Closed	Sample board submitted by contractor	
10	Construction	Rock anchoring methodology submission	Progress of rock anchoring and type of anchoring finalisation	Schedule	3	3	9	Closed	Contractor shared the methodology and comments from DT received on the same	Follow up for closure of the comments from approval
11	Construction	3 rd party plant – trial cube test results failure	Risk to progress with the concerned vendor for regular supply	Quality	4	4	16	Closed	Supply of concrete from vendor not accepted for the project	
12	Construction	Machinery idle for excavation work	Progress of mass excavation	Schedule	3	3	9	Closed	Operator shortage was posted. Advised contractor to use the dry periods to do maximum excavation	
13	Planning & design	Compound wall mix design – cement content	Finalisation of cement content in design mix	Scope + quality	4	3	12	Closed	Contractor agreed to go ahead with 400kg cement for pile design mix	

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SL NO	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY IMPACTED	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
14	Construction	Basic cement testing apparatus (vicat) not available at site	Lapse in periodic testing of cement as per quality plan	Scope + quality	4	3	12	Closed	Apparatus brought to site and closed	
15	Construction	Water proofing material 3 rd party testing	Quality of the material as differences were observed between material supplied to other projects	Quality + reputation	4	4	16	Closed	Testing done in Chennai on the next day and in Mumbai on after a week	
16	Planning & design	Stilt & 1 st floor changes from KRC	- Introduction of retail space - Increase in MEP load calculations - Structural impact - Elevation changes	Scope + cost + schedule	4	4	16	Closed	Architectural intent discussed after 4 days and revised drawings shared after 5 days	
17	Construction	Space for dumping balance soil of block-2	Further progress of mass excavation in block-2 and foundation progress	Schedule	5	5	25	Closed	Clearance for temporary storage in block-3 area was given by contractor	
18	Construction	Ingress of water before laying PCC and after water proofing	Laying of Water proofing in Water Concreting with Water above PCC Purpose and effectiveness of Laid waterproofing	Quality + reputation	5	4	20	Closed	Held meeting with Water proofing vendor. Contractor also committed that localised Dewatering will be done to maintain the water table low.	Contractors consultant suggested to maintain water table below 1m level below PCC during concreting

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SLN O	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
19	Strategic planning	Preventive measure for soil sliding due to heavy rains	Damage to footings and worker safety in the slide prone areas	Quality + reputation	5	4	20	Closed	Soil consultant visited the site to examine the vulnerable areas. Temporary measures like placing sandbags taken	Continuous monitoring of vulnerable areas for possible slide. Risk is likely to occur till retaining wall is constructed
20	Construction	Foundation progress & raft slab progress	Delay in upper slab completion	Schedule	4	4	16	Closed	Raft completed after 2 months	
21	Construction	Mixing of soil while dumping in block-3 area	Suitability of Filling in future Outside carting will likely have even the good soil dumped out warranting purchase of soil for filling	Scope + Cost + Schedule	5	4	20	Closed	Reminded contractor to dump the soil separately. Contractor has commented that they will separate the soil while dumping outside.	Outside carting to be ensured only clay is taken out
22	Construction	Water proofing material peeled off due to block work collapse	Workability of the water proofing material	Scope + Cost + Schedule	5	4	20	Closed	Recertification completed at site	Recertification works to commence at site shortly. Parallel checking of random footings for the condition of Water proofing's workability proposed.
23	Construction	Footing F3A concrete stopped in between due to rains	Soundness of the concrete and further action to complete the concrete	Scope + Cost + Schedule	5	4	20	Closed	NDT testing conducted and closed	Implementation of accepted rectification method and completion of the concrete

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SLN O	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY IMPACTED	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
24	Construction	Replacement of Texture paint with ACP	Cost implication delay in elevation finalization	Scope + Cost + Schedule	4	3	12	Closed	Cost implication break up shared by contractor	Costing under review and negotiation
25	Construction	Threat of pandemic-covid-19 on its spread	Stoppage of site works. Impact on progress	Cost + Schedule + Reputation	5	5	25	Closed	Site works commenced	
26	Construction	Nation wide lockdown	Stoppage of works at site & impact of progress.	Cost + Schedule + Reputation	5	5	25	Closed	Insitu site works can progress. Works started from site after 2months	Fore Majeure condition. Until permitted by Govt to work
27	Occupancy coordination	Managing 717 workmen inside the site amidst the pandemic and lockdown.	Workmen welfare during the lockdown and monitoring their health	Statutory	5	5	25	Closed	Workmen were sent o their home town in buses	
28	Planning & design	New elevation option from client for facade	- Changes in Façade design - Vendor Finalization delay - Impact in MEP due to the revised option - Delay in material delivery and hence installation	Scope + Cost + Schedule	5	4	20	Open	Reminded contractor for submission of revised costing impact and costing for NT items	Follow up for costing and rate analysis for block-2
29	Construction	Extension of lockdown due to pandemic	Resumption of works	Cost + Schedule + Reputation	5	5	25	closed	Lockdown extended	

1. RISK IDENTIFICATION			2. RISK ASSESSMENT					3. RISK MITIGATION		
SI. NO	PROJECT PHASE AT IDENTIFICATION	RISK DESCRIPTION	IMPACT DESCRIPTION	RISK CATEGORY IMPACTED	IMPACT SEVERITY	IMPACT PROBABILITY	RISK RATING	RISK STATUS	COMPLETED ACTIONS	PLANNED FUTURE ACTIONS
30	Construction	Reduced progress of works for next 6 months	Impact overall completion of project	Schedule	5	5	25	Closed	Tracking of Schedule and cash flow for 6 months plan	
31	Construction	Soil slide due to monsoon	Progress of works Adjacent structures of block-3	Schedule + reputation	5	5	25	Open	Action plan for the slides received from contractor	Plum concrete planned and sand bags placement as a solution. Raising the ret walls and filling is planned as mitigation action
32	Construction	Impact of block-3 works due to heavy rains	Area Requires continuous dewatering to work further	Schedule	5	3	15	Closed	Dewatered and works commenced slowly after a week	
33	Strategic planning	Increase in price of raw materials like cement, steel, PT strands post lockdown	Material Demand in market Site material shortage and irregular supply Basic price difference for steel and cement	Scope + cost + schedule	5	4	20	Open	Material delivered to site but was irregular. Material tracking done in regular basis	
34	Strategic planning	Demand for cement at site and supply during pongal festival	Due to shortage at site 2 slabs, 1 footing (CF3) in Block-3 and verticals will be delayed despite being ready	Cost + schedule + reputation	4	4	16	Closed	Cement supply came after pongal holidays	

TIMELINE TO IMPACT

TIMELINE TO IMPACT		
< 30 days	30 – 90 days	>90 days
Labor License for the project	Soil Testing for suitability of filling	Mine approval for excavation and carting out
PCB approval for Batching plant operation	Rock anchoring methodology submission	Mass Excavation completion
Clearance for Excavation- From Thasildar/ Collectorate	Compound Wall Mix Design - cement content	Soil dumping - Mixing of Good and bad earth in Block-1 area
Issue of WO for Block-3	Preventive Measure for Soil Sliding due to heavy rains	Basic Cement Testing apparatus (Vicat) not available at site
Rock anchoring Sample submission	Foundation progress and Raft slab progress	New elevation option from Client for Façade
3rd Party plant-M/s. Nuvoco Trial Cube Test Results failure	Mixing of Soil while dumping in Block-3 area	Extension of Lockdown due to pandemic
Machinery idle for Excavation work	Water proofing material peeled off due to block work collapse	Reduced progress of works for next 6 months
Water proofing Material 3rd Party Testing	Footing F3A concrete stopped in between due to rains	Soil slide due to monsoon
Stilt & 1st Floor Changes from KRC	Replacement of Tecture paint with ACP	Impact of Block-3 works due to heavy rains.
Space for dumping balance soil of Block-2	Threat of Pandemic -COVID-19 on its spread	Increase in price of Raw materials like Cement, Steel, PT strands post lock down
Ingress of Water before laying PCC and after Water proofing	Nation wide lockdown	Demand for cement at site and supply during pongal festival
	Managing 717 workmen inside the site amidst the Pandemic and lock down	

TIMELINE TO IMPACT



- The risks occurred in this project was impacted in 3 timelines such as: <30 days, 30-90 days, and >90 days.
- 32% risks will impact for <30 days.
- 35% of risks will impact around 30-90 days.
- 33% of risks will impact for >90 days.

MILESTONE SCHEDULE

ID	Task Name	Duration	Start	Finish	H2	2019 H1	H2	2020 H1	H2	2021 H1	H2	2022 H1	H2	2023 H1
1	COMMERZONE PALLIKARANAI	1293 days	Mon 17-06-19	Fri 30-12-22										
2	SPCPL Works	1293 days	Mon 17-06-19	Fri 30-12-22										
3	Construction (SPCPL)	1293 days	Mon 17-06-19	Fri 30-12-22										
4	BLOCK-2	1293 days	Mon 17-06-19	Fri 30-12-22										
5	Excavation	208 days	Mon 17-06-19	Fri 10-01-20										
6	Structure works	926 days	Thu 05-09-19	Fri 18-03-22										
7	Masonry and Plastering works	347 days	Mon 24-05-21	Thu 05-05-22										
8	Façade works	472 days	Tue 13-07-21	Thu 27-10-22										
9	Finishes and MEP works- Warmshell	542 days	Wed 09-06-21	Fri 02-12-22										
10	Terrace	232 days	Mon 18-04-22	Mon 05-12-22										
11	Water proofing	60 days	Mon 18-04-22	Thu 16-06-22										
12	Chiller	150 days	Thu 23-06-22	Sat 19-11-22										
13	Common works and commissioning	24 days	Sat 12-11-22	Mon 05-12-22										
14	Elevators	250 days	Sat 19-03-22	Wed 23-11-22										
15	DG works	195 days	Sun 08-05-22	Fri 18-11-22										
16	Shaft works	256 days	Mon 14-02-22	Thu 27-10-22										
17	Main entrance lobby & Lift Lobby	180 days	Mon 04-07-22	Fri 30-12-22										
18	Lift Lobby	180 days	Mon 04-07-22	Fri 30-12-22										
19	Entrance Lobby	150 days	Mon 18-07-22	Wed 14-12-22										

RISK ANALYSIS

RISK ASSESSMENT TABLE:

Risk Assessment			Probability of Impact				
	Guidance	Rating	<10%	~25%	~50%	~75%	>90%
			1	2	3	4	5
S e l e c t i v e i m p a c t i v i t y	Very Low	1	1	2	3	4	5
	Low	2	2	4	6	8	10
	Moderate	3	3	6	9	12	15
	High	4	4	8	12	16	20
	Very High	5	5	10	15	20	25

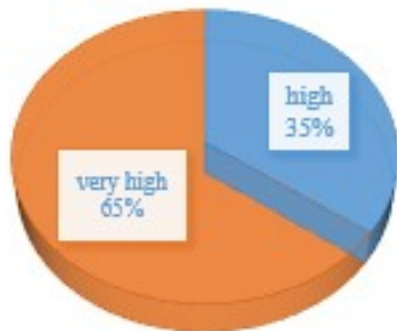
This table represents the color coding of the Impact Severity x Probability of Impact risk assessment product.

High risk, red items, require a detailed action plan; Moderate risk or yellow items need monitoring; and Low risk items score in the green zone. Project Managers and the project team assess the degree of impact and degree of probability for each risk item logged.

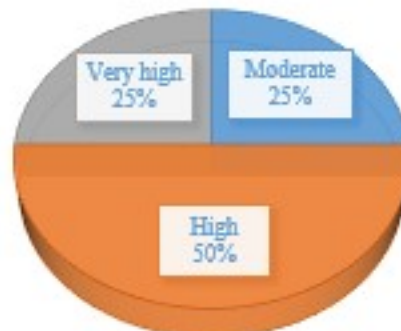
AVERAGE SCORE OF P-I

Project stage	Very low	low	moderate	High	Very high
Strategic planning	0%	0%	0%	35%	65%
Planning & design	0%	0%	25%	50%	25%
Pre-construction	0%	0%	65%	0%	35%
Construction	0%	0%	40%	20%	40%
Occupancy coordination	0%	0%	0%	0%	100%

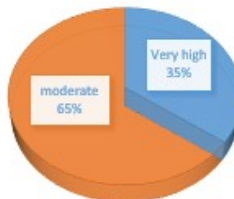
STRATEGIC PLANNING



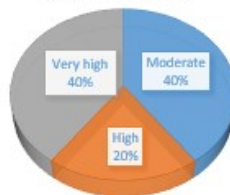
PLANNING & DESIGN



PRE-CONSTRUCTION



CONSTRUCTION



RESULTS & CONCLUSIONS

CURRENT OVERALL PROJECT ASSESSMENT	
Scope risk	G
Budget risk	G
Schedule risk	Y
Quality risk	G
Statutory risk	G

RESULTS:

- In this case study, the various categories of risks occurred were, scope risk, budget risk, schedule risk, quality risk and statutory risk.
- As the project managers and the project teams recorded the risks occurred and give a proper mitigation actions and regularly tracked and monitored the occurred risks was closed and still 1 or 2 risks were in open and it was regularly tracking and monitoring by the team.
- In this case study, mostly all categories of risks were closed by the actions taken by the project team and it come to green zone. The schedule risk was in yellow zone that is considered as moderate risk.

CONCLUSION & RECCOMENDATIONS:

- To manage the risks we need to establish a strong bond between the client and the project team members.
- A strong base about risk management would help a great deal in tackling the risks.
- Software metrics and tools can be developed to manage the risks.
- Risk necessarily need not be negative and it can be viewed as an opportunity to develop the projects in a better way.

CHAPTER 4

CONCLUSION

4.1 CONCLUSION

A good risk management foundation would contribute a lot to tackling the threats. To manage the risks we need to establish a strong bond between the client and the project team members. A strong base about risk management would help a great deal in tackling the risks. Software metrics and tools can be developed to manage the risks. Risk necessarily need not be negative and it can be viewed as an opportunity to develop the projects in a better way.