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Experimental Study on: "Risk Management in Residential Building Project"

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ABSTRACT
Risk can be described as the absence of information when a decision is to be made at any time throughout a process. The construction industry is often considered as complex and defragmented due to working in a project based format; with a unique product and a process where there are times when decisions need to be made with insufficient information. Therefore, proper risk management processes can be vital to minimizing risks, maximizing opportunities and securing a successful project process This master thesis has been conducted at a large Swedish construction company that houses both a constructing unit and a residential development unit. Consequently, the focus of this thesis has been on analysing the risk management process when a residential project is both developed and constructed by the same company. The purpose of this master thesis is to describe and analyse risk management in a project based organization within the construction industry. The thesis aims to provide a better understanding of how risk management is used in practice but also what underlying factors that can affect risk management processes. The study will include both the perspective of the developer and the constructor; as well as their separate and joint processes facilitating risk management. In regards to the purpose of this thesis, a general risk management model has been used to provide a framework for analysis. This model consists of four steps: risk identification, risk assessment, risk mitigation and risk monitoring.

Keywords: *Risk Management, Risk Factor, Risk Management Action*

1. INTRODUCTION

1.0. Introduction

This chapter offers a brief introduction to the scenario of construction Diligence in Our Country as on date. It also offers a fairly good idea of the role of organization in the Construction Diligence. It introduces to the various hazards and uncertainty that are tormenting the Building Industry. The studied focuses on the hazards encountered by the makers of residential complexes and townships.

1.1. Today's Scenario For The Construction Industry

Risk is an integral part of every activity undertaken by mankind. The constantly changing factors like environmental, economical political, socialsand technical and their increasing complexity have been the prime explanations for generating new risks. It is only the magnitude which varies for each one. Risks and doubts natural in the constructions industry are more than in other industries. The preparation, executing and maintaining all arrangement activities is multifarious and time-consuming. Hazards can be defined as an event that negatively affects the project objectives, which are:

1. Time and Schedule
2. Cost
3. Quality of work

A risk is nothing but a situation. Hazards are neglected by formation contractors and consultants while considering bids and tenders. Projects risk monitoring is widely recognized as one of the most critical procedures and capability areas in the field of Projects Controlling.

1.1.1. The Components of the Building Trade

Undoubtedly building is a vital activity in any economy, it encouragements and is swayed by the GDP of any nation (Cox & Townsend, 1998). Building industry is defined as a unsafe industry with uncertainties that organization has to contract with. he real estate sector to India's GDP has been estimated at 6.3 per cent in 2013, and the segment is expected to generate 7.6 million jobs in the same period, according to a report.

1.1.2. Characteristic Hazards In Building

There are many types of risk in the building contracts; they are:

- Corporal mechanisms
- Postponement and clashes
- Route and command
- Loss and damage to folks and stuff
- Peripheral issues
- Payment
- Law and arbitration

1.1.3. Hazard And Improbability

Hazard is clear as the coverage to loss/gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Events are said to be certain if the probability of their occurrence is 100% or they are termed as totally uncertain if the probability of occurrence is 0%. In between these two extremes the uncertainty varies quite widely (Jaafari, 2001). Risk also can be defined as a characteristic of a situation, action, or event in which a number of outcomes are possible, the particular one that will occur is uncertain, and at least one of the possibilities is undesirable (Yoe, 2000). Greene (2001) stated that there is no all encompassing definition of risk and provided his interpretation of what risk constituents:

$$\text{Risk} = \text{Hazard} \times \text{Exposure} \quad [1]$$

Greene defined hazard as the way in which an event can cause harm and exposure as the extent to which likely recipient of harm can be influenced by the hazard.

A stage where there is lack of information, but by looking at past experience, it is easier to predict the future events where the outcome is known and expected.

Smith et al (2006) said "Risks occur where there is some knowledge about the event. While in uncertainty there may be not enough information about the occurrence of an event, but we know that it might occur."

1.1.4. Research Importance

The management of risks is a central issue in the planning and management of any ventures. Small and medium construction industry is suffering from the misunderstanding of risk management including risk identification, analysis and assessment, and that is why this research is important, where it will discover the risk factors in the construction industry for these small and medium industry undertaking huge projects for townships and multistoried building complexes and determine the importance of each factors in terms of its severity and allocation.

2. LITERATURE REVIEW

2.1. Introduction

The construction industry has made rapid strides in the last decade or so. In the process they have also increased the Risk and Uncertainty in equal proportion. Now companies are faced with more risk and uncertainty than ever before. Expectations of clients have gone up. They are not willing to accept any surprises and if and when things go wrong they seek redress in the form of litigation. Hazard Administration has become an important part of the administration process for any project. In circumstance of the formation trade, as it is linked with segment and charge plunders, they become an purpose of consideration. Here an attempt has been made to review literature concerning some of the Risks faced in the Construction Industry.

2.2. Outlining Hazard And Vagueness

A risk has a cause and, if it occurs, a consequence (Office of Project Management process improvement, 2003). Jaffari (2001) defined risk as the exposure to loss/gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Events are said to be certain if the probability of their occurrence is 100% and totally uncertain if the probability of its occurrence is 0%. In between these two extremes the uncertainty varies quite widely. The unpredictable and even undesirable events that would change the prospects for the profitability on a given investment (Kartam, 2001). Scared and Posner (cited in Greene, 2001) provide their interpretation of what a peril constitutes:

Risks = Hazard x Exposure

It can be defined as a trinity of risk event (A), risks probabilitys(P) and functionsof risk losses (u).

$$R= (A, P, u).$$

The risk event (A) is a random event which is connected with any project decision (Titarenko, 1997).

Improbability is a situation in which a number of possibilities exist and which of them has occurred, or will occur, is unknown. Considering all threats are uncertain but not all improbability is risky (Yoe, 2000).

Flanagan & Norman (1993) differentiated between risk and uncertainty.

- Risk has a place in calculus of probability, and lends itself to quantitative expression.
- Uncertainty, by contrast, might be defined a situation in which there are no historic data or previous history related to the situation being considered by the decision maker.

2.3. Causes of Risk As Threats

There exists no comprehensive study explaining the causes of risks among construction companies, moreover research covering the subject matter has tended to identify the symptoms rather than causes, a number of authors have attempted in their studies to ascertain the causes of threats in the construction industry, Kangari (cited in Rwelamila & Lobelo, 1997).

2.4. Foundations Of Risks

Checklist of riskadrivers (Estate Management Manual, 2001):

- Commercial risk.
- Pecuniary risk.
- Legalarisks.
- Political risks.
- Social risks.
- Environmental risks.
- Communications risks.
- Geographical risks.
- Geotechnical risks.
- Construction risks.
- Technological risks.
- Operational risks.
- Demand/product risks.
- Management risks.

While the list of potential risks in every category is neither complete nor exhaustive, it does represent the majority of typical project risks and demonstrates the advantage of a logically developed classification scheme (Enshasi and Mayer, 2001).

2.5. Risk Management Process

A number of variations of risk management process have been proposed. Boehm (cited in Raz & Michael, 2001) suggested a process consisting of two main phases: risk assessment, which includes identification, analysis and prioritization, and risk control which includes Risk Management Planning, Risk Resolution and Risk Monitoring, planning, tracking and corrective action. Chapman and Ward (cited in Tummala & Burchett, 1999) identified risk management approach as a multiphase `risk analysis' which covers identification, evaluation, control and management of risks.

Hazard analysis involves evaluating risks and interactions to assess the range of possible venture outcomes. It is complicated by a number of factors including, but not limited to (PMI, 1996):

2.6. Risk Response Practices

PMI (1996) suggested three ways of responding to risk in projects, they are as follows:

- ✓ **Avoidance:** eliminating a specific threat, usually by eliminating the cause. The project management team can never eliminate all risks, but specific risk events can often be eliminated.
- ✓ **Mitigation:** reducing the expected monetary value at risk events by reducing the probability of occurrence (e.g., using new technology), reducing the risk event value (e.g., buying insurance), or both.

2.7. Types of Risks

Risks can be associated to technical, operational or business aspects of projects.

Finally, the risks can be characterized as internal or external. Whereas, an external hazard has origin in bases external to the assignment scope, such as cost cuts by senior administration few other types of hazard in major assignments are:

Completion Hazard: This is the danger that the project may not be completed on time, or at all, due to various reasons such as cost overruns, technology failure, force majeure etc.

Price Risks: This is the risk that the price of the project's output might be volatile due to supply-demand factors. If new capacities are coming up or if there is likelihood of fall in demand of the project output, the price risk is high.

Resource Risks: This risk includes the non-availability of raw materials for the project operation. It also includes the risk that the raw material prices might move adversely.

Technology Risks: This is the risk that the technology used in the project is not sufficiently proven.

Operating Risks: This is a risk that the project operational and preservation costs would escalate. It includes that the project will have operational problems in its execution phase.

Political Risk: This risk relates to matters such as increased taxes, revocations or changes to the concession, exchange controls on proceeds, forced government participation in shares and refusal of import licenses for essential equipment.

Casualty Risk: This is the risk of physical damage to the project equipment. It also includes liabilities to third parties on account of accidents at the project site.

Environmental Risk: This risk refers to increased project costs for complying with new environmental standards. There could also be environmental protests from the local populace against the project.

Permission Risk: This is the risk that official clearances for the project may not be forthcoming or subject to expensive conditions.

Exchange Rate Risk: This is the risk that the procurement of sophisticated equipment for the Project may have a likely impact on the overall cost of the project due to the fluctuations in the exchange rate and that it could have a telling effect on the project cost.

Interest Rate Risk: This is the risk that the floating interest rate of the project loans would increase beyond the levels assumed for preparing projected cash flows.

Insolvency Risk: This is the risk of insolvency of contractors, project sponsors, suppliers and purchasers of project output, insurers or a syndicate bank.

Project Development Risk: This is the risk that the project development might not take place in an orderly manner.

Site Hazard: This is the hazard that the undertaking site might have permissible encumbrances. It also includes the hazard that the site has methodological problems.

Financial Closure Risk: This is the risk that the project might or might not reach financial closure.

3. RESEARCH METHODOLOGY

3.1. Introduction

The preceding chapter described in some detail the concepts and the practices of Risk Management in construction projects for full understanding of risk management concepts and practices. In this stage, a description of data collection procedure adopted for this research is described. This stage also provides the information about examination strategy, researchsdesign, target population and sample size. It also discusses some of the practical problems encountered.

A detailed methodology and tools used are described.

3.1.1. Investigation Strategy

Chambers English Dictionary defines research as (Fellows & Liu, 1997): a careful search

- ➢ Investigation
- ➢ Systematic investigation towards increasing the sum of knowledge.

Investigation does not occur in a vacuum, research projects take place in context– of researcher's interests, expertise and experiences; of human contacts; of the physical environment, etc (Fellows & Liu, 1997).

The world" whether as individuals or groups (Fellows & Liu, 1997). Qualitative research is "subjective" in nature, emphasizing meanings, experiences and so on (Naoum, 1997).

In this research, a quantitative approach is selected to determine the variables and factors that affect the risk management practices in building projects in Mumbai-Karjat-Kasara region and to find out if there is a systematic risk management practices through the contracting companies.

3.1.2. Research Design

The term "research design" refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Polit & Hungler, 1999). Burns & Grove (1997) defined the term design as "some consider research design to be the entire strategy for the study, from identifying the problem to find the plans for data collection.

Other limit strategy to clearly define structural structure within which the study is implemented". The structure that the researcher creates is the strategy (Wood & Haber, 1998).

Much investigation in the societal disciplines and management spheres involves asking and obtaining answers to questions through steering surveys of folks by questionnaires, interviews and case studies (Fellows & Liu, 1997).

In this study a closed-ended survey with dialogue is used to collect data from respondents. In structured interview, questions are presented in the same order and with the same wording to all interviewees. The interviewers have full control on the questionnaire throughout the entire process of the interview (Naoum, 1998).

In structured interview, the interviewer administers a questionnaire, perhaps by asking the questions and recording the responses, with little scope for probing those responses by asking supplementary questions to obtain more details and to pursue new and interesting aspects (Fellows & Liu, 1997). Naoum (1998) summarizes as follows:

1. The answer can be more perfect.
2. The rejoinder frequency is moderately high (approximately 60-70 percent), especially if interviewees are contacted directly.
3. The answers can be explored with finding out "Why" the particular answers are given

3.1.3. Research Population

A population consists of the totality of the observation with which we are concerned (Walpole & Myers, 1998). In this research, the population is the total number of contractors (32 first class contracting companies) who have valid registration with the government agencies or authorities connected with the development work in the region.

3.1.4. Sample Size

Sampling defines the process of making the selections; sample defines the selected items (Burns & Grove, 1987). Wood and Haber (1997) defined the sampling as the process of selecting representative units of a population for the study in a research investigation.

Unfortunately, without a survey of the population, the representativeness of any sample is uncertain, but statistical theory can be used to indicate representativeness (Fellows & Liu, 1997). One of the most frequent questions asked "what sample should I use?" historically, the responses to this question is at least 30 subjects.

A statistical calculation was used in order to calculate the sample size. The formula below was used to determine the sample size of unlimited population (Creative Research Systems, 2001)

$$ss = \frac{Z^2 \times P \times (1-P)}{C^2}$$

Where SS is Sample Size

Z = Z value for Confidence level (e.g. 1.96 for 95% confidence level)

P =% picking a choice, expressed as decimal, (0.50 used for sample size needed)

C = Confidence level (0.05)

$$\text{Thus SS} = \frac{1.96^2 \times 0.50 \times (1-0.50)}{0.050^2} = 384$$

Apply Correction factor for Finite Population.

$$SS = \frac{SS}{1+\frac{SS-1}{pop}}$$

Where *pop* is the population size i.e 32

$$SS = \frac{384}{1+\frac{384-1}{32}} = 29.609 \text{ Say } 30$$

Thus sample size to be adopted is 30

4. RESULTS AND DISCUSSIONS

4.1. Introduction

The aim of this study is to determine the risk factors in construction of residential complex and townships and allocation of these factors, including the various methods used to deal with risks and the techniques adopted in analyzing those risks. The results of the study are illustrated in this chapter with self explanatory graphs, the severity of risk factors, allocation of each, methods of dealing with risks and techniques of analysis. Also, in this chapter the results and findings of this research are discussed in detail, especially emphasizing on the unique factors more relevant to housing complex construction or developing townships. The contractors and the owner's perspectives are also discussed as regards to the severity and allocation.

4.2. Risk Factors

As mentioned in Chapter 3, the questionnaire included thirty risk factors, which have been categorized in nine main groups, these groups were, Construction Group , Design Group, Financial Group, Management Group, Logistics Group, Physical Group, Environmental Group, Legal Group and Political group The factors of each group will be demonstrated in terms of their severity and allocation according to the participants answers.

4.3. Risk Management Actions - Remedial Methods

According to the survey results, contractors usually depend on producing a proper schedule by getting updated information constantly. This is so because they can adjust to the changing environment and situations and adapt to suitable changes based on the information received. Subjective judgment to produce a proper program as the most effective risk preventive actions was placed second. Judgments probability uses the experience increased from similar projects undertaken in the past by the decision maker to decide on the likelihood of danger exposure and the outcomes. Judgment and experience gained from previous agreements may become the most valuable info source for the usage when there is limited time for preparing the assignment program. Creation, however, is subjected to a dynamic environment, that is why threat leaders must constantly strive to improve their guesses. Even with near perfect assessments, decision making about danger is a difficult undertaking. Consequently, contractors considered getting updated project information and add risk premiums to time estimation at the project planning stage to be effective risk preventive method.

Most of the contractors were averse to the use of computers as it was found to be costly and in the absence of skilled personnel's it could lead to disastrous results. They found the conventional methods more reliable and trustworthy. Quantitative risk analyses techniques packages were not considered to be an effective preventive method for reducing

the effects of risk. This tends to support Kartam (2001) that the approach of risk analysis is largely based on the use of checklists by managers, who try to think of all possible risks. Insufficient knowledge and inexperience of using and interpreting analysis techniques in practice could be the main two reasons for such result. Referring to similar projects for accurate program was recommended by the practitioners to be an effective preventive method. The percentage above the column is effectiveness proportion for each method.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This study was carried out to identify the risk factors, their importance, their effects, the mitigation methods and remedies as encountered in construction of residential complexes and township development. The study included risk management actions, risk analysis techniques, their effectiveness and usage. The study was carried out considering the contractors view as well as reflecting the owners' opinion vis-à-vis the allocations. The study revealed the reluctance in using Risk Management Practices and rely more on judgment and past experience. It also brought out the fact that there is a tendency to do certain things by the traditional ways rather than apply RMP. It is recommended that some implementation of RMP will certainly go a long way for a better success rate.

5.2. Conclusions

Sr. No	Risk Factors	Cat	Severity	No Of Respondents
1	Undocumented Design changes	H	8.4	33 (96%)
2	Inexperienced designers involved in Design	H	7.23	32 (92%)
3	Defective design (incorrect)	H	8.09	31 (89%)
4	Delayed payments on contract	H	8.89	30 (87%)
5	Undefined scope of working	H	8.17	29 (84%)
6	Getting Permits	M	6.91	20 (57%)
7	No coordination in design (struct, mech, elect, etc.)	H	7.09	18 (52%)

The construction industry has characteristics that distinguish it from other sectors of the economy. It is extremely sensitive to economic cycles. This business is highly competitive because of the large number of firms present and the relative ease of entry into this business. This makes it an all the more risky business.

In this study, identifying the risk factors faced by developers of residential complexes and township projects is based on collecting information about construction risks, their consequences and corrective actions that may be done to prevent or mitigate the risk effects. Determination of severity and allocation of these risk factors was the main result of this research. The main emphasis of this research was to explore and identify the key risk factors faced in the rapidly growing sector of the construction industry. Analysis dealt with measuring the effects and assigning each risk factor to the one who is in the best position to handle it. Table 3.1 shows the risk factors identified. These factors were investigated to measure the severity of each. The most sever risk factors allocated to contractors is illustrated in Table 5.1, that of Owners in Table 5.2 and the shared risk in Table 5.3 respectively.

S. No.	RISK FACTORS	CAT	SEVERITY	No of Respondents
11	Unmanaged cash flow problems	H	8.1	30 (100%)
13	Resource management	H	7.3	30 (100%)
01	Gaps between the Implementation and the specifications due to misunderstanding of drawings and specifications	H	7.1	30 (100%)
12	Project Complexity causing planning Confusion	M	5.7	30 (100%)
02	Lower the work quality in presence of time constraints	M	4.4	29 (97%)
20	Varied labor and equipment productivity	M	6.5	28 (94%)
17	Poor communications between the Head Offices & field offices	M	5.4	28 (94%)
09	Inflationary Effects	M	5.2	19 (63%)
18	Occurrence of accidents because of poor safety procedures.	H	7.8	16 (53%)
15	Unavailable labor, materials and equipment	M	5.7	16 (53%)

Table 5.1 Risk Allocated to **Contractors** (which more than 50% respondents agreed)

S. No.	RISK FACTORS	CAT	SEVERITY	No of Respondents
03	Undocumented Design changes	H	8.2	29 (96%)
08	Inexperienced designers involved in Design	H	7.3	28 (93%)
05	Defective design (incorrect)	H	8.1	27 (90%)
10	Delayed payments on contract	H	8.9	26 (87%)
16	Undefined scope of working	H	8.2	25 (83%)
24	Getting Permits	M	6.8	17 (57%)
06	No coordination in design (struct, mech, elect, etc.)	H	7.1	15 (50%)

Table 5.2 Risk Allocated to **Owners** (which more than 50% respondents agreed)

SR. NO	RISK FACTORS	CAT	SEVERITY	No of Respondents
14	Poor communication between involved parties	M	6.0	24 (80%)
25	Legal disputes during construction among the parties of the contract	M	4.97	23 (77%)
23	Adverse weather conditions	M	3.6	22 (73%)
26	Delayed disputes resolutions	M	5.2	22 (73%)
04	Actual quantities differ from the contract quantities	M	5.3	20 (67%)
27	No specialized arbitrators to help settle fast	M	3.9	19 (63%)
19	Supplies of defective materials	M	5.2	18 (60%)
29	Fear of political Interference	M	4.4	18(60%)

Table 5.3 Risk Allocation **Shared** (which more than 50% respondents agreed)

From the above tables it is evident that of the top ten risk factors, contractors considered (40%) of the risk factors as highly important risks and (60%) of them as medium risks. However, owners agreed that (86%) of the risk allocated to them were highly important risks while (14%) were of medium importance. That reflects the high concern of contractors regarding the cooperation from owners about such issues.

Contractors were more specific in allocating risks and were more likely to share these risks with owners. All risks agreed to be shared were of medium importance. Of the 30 risks identified the contractors and owners agree that (27%) of the risks can be shared. It is to be noted that though there were five categories almost all the risks were allocated to the three categories (contractor, owner and shared). There was a reluctance to agree the transfer of risk to insurance due to the complexity involved. It was found that only (46%) were in favour of transferring the risk to Insurance companies. Risk like Acts of god , Insecurity in the region and availability of legal arbitrator was considered insignificant and were categorized as Ignore.

Contractors and owners still depend on traditional approaches to manage risk factors and their consequences; the use of direct judgment to control risk factors was the most applied method used to control risk events (sections 4.7 and 4.8). These results assure the need to develop the used methods for managing risk factors. Uses of quantitative methods, computer systems or sensitivity analysis are not practiced by respondents due to the exorbitant cost and the requirement of highly skilled personnel's. Preference was loaded in favor of direct judgment and comparing analysis to analyze risk consequences (section 4.9).

5.3. Recommendations

5.3.1. Recommendations To Contractors

- Contracting companies should calculate and consider risks by adding a risk premium to quotation and time estimation.
- This trend has to be supported by Contractors Union, Government bodies like municipalities , HUDCO, CIDCO and other organizations concerned about the housing and township development agencies.
- Contractors should strive hard to prevent financial failure, by practicing a strict cash flow management and minimizing the dependence on bank loans. It is strongly recommended that the loans from non conventional sources should be avoided as they could be the beginning towards the end of financial stability.
- Contractors should learn how to share and shift different risks by hiring specialized staff or specialized sub-contractors.
- Contracting firms should utilize computerized approaches used for risk analysis and evaluation. It is strongly recommended to use package which integrates with widely used programs like Microsoft Project and Microsoft Excel. Manual approach even though not recommended can be resorted to for small and medium projects.
- Contractors should work on training their personnel to properly apply management principles.
- Employing highly skilled personnel's, pays in the long run, when the benefits of RMP start pouring in.

5.3.2. Recommendations To Owners

- Tenders should be awarded to accurate estimated cost and not necessarily to the lowest bidder.
- The contract clauses should be modified and improved to meet the genuine requirement of both parties and should not be one sided or ambiguous.
- Conduct continuous training programs to equip the personnel's for managerial and financial best practices and to identify, analyze and mitigate both the internal and external risk factors affecting the industry and to initiate the proper ways to deal with such factors.
- The design process is the most important phase in the construction process. Design products should be at the highest level of quality, because of that it should have more focus by owners.

5.3.3. Shared Recommendations

- Allocate risks contractually and clearly to each party by defining the potential risk factors and allocate them on the party which is in the best place to manage these risks.
- They both should have equal concern of providing and implementing of safety measures.
- Necessary information along with supportive documentation should be exchanged between parties to maintain a fairly good amount of communication level.
- Arbitrators with sound knowledge of construction activities will be of immense help in settling conflicts or disputes.
- Documentation works should be applied widely in the industry especially with the present ISO needs.
- Contractors and owners must keep computerized historical data of finished projects, which will be helpful in rights reservation and also as a ready reference for similar future project comparison.
- It is recommended to have standardization in contract clauses, which address issues of clarity, fairness, roles and responsibilities, allocation of risks, dispute resolution and payment. This will reduce a great deal of uncertainty.

5.3.4. Proposed Future Studies

This study was conducted during the period when construction of housing complexes was at its peak due to the shortage of residential accommodation to the continuous

flow of migrants heading towards the city for a better living. Banks and financial institutions were also liberal in disbursing funds both to the contractors as well as to the end users making it more attractive. Every contractor builder, developer entered into this business because of the enormous amount of work involved and the easy profits that followed. Later on their will be saturation and the risk factors could change, their severity levels may change and an entirely new picture would come up.

A similar study could help identify the risk factors, their severity and the mitigative methods adopted during the lean period. This will help in creating awareness of the use of RMP. This will help generate awareness amongst the contractors and the owners about the advantages of Risk Management Practices.

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