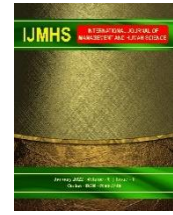




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Implementation Level of Effective Risk Management Systems by Indian Infra Structure Projects - An Assessment

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Abstract

Study reports from various sources indicate that India is likely to see increased failures of infrastructure projects in the coming days. These reports are based on the historical trends of increasing cost overruns and schedule delays. The inability of project organisations to cope up with the uncertainties and risks that haunt the projects stand out as the most major reason for such failures. Even though the concept of risk management has made strong inroads into the project arena in many countries, to manage and mitigate project risks. India is seemingly lagging in integrating risk management into project management.

This paper was an attempt at mapping the level of implementation of any structured risk management in the infrastructure Project segment of India in order to identify the gaps that need to be filled for attaining a satisfactory level of effectiveness in combating project risks. The suggestion of corrective solutions based on the shortcomings thus unearthed was also another objective of the study. The study was made by means of a questionnaire survey across a cross-section sampled out of the Indian infra project spectrum. The survey was conducted only after a thorough literature survey was done to gather the know-how about implanting any effective risk management system to identify the deviations of the risk management practice at project sites from the ideal one. Instrumentation was done with the knowledge thus gathered from the published works, appropriate to point out the vital deviations from index aspects corresponding to maximum effectiveness.

The findings obtained after the analysis of survey results indicated that the project organisation that reported the best in risk management implementation itself had only effectiveness of 76%. 30% of the projects reported a poor level of implementation and exposed the lack of interest in risk management of the top management in low and medium-scale project organisations. Sector-wise analyses brought out the fact that the presence of a nationwide uniformity in governing guidelines could produce a good impact on risk performance. The study concluded that centrally administered policy guidelines aimed at maximising risk management

effectiveness were necessary to bring forth breakthrough progress in the level of implementation of risk management throughout the infra sector.

Keywords: *Risk, Project Risk Management, Risk Management System, Level of Implementation*

Introduction

Mr. Makhtar Diop, the World Bank's Vice President for Infrastructure, had gone public that, "Since February 2020, 256 private infrastructure projects in developing countries have been reported cancelled or delayed. This figure is of high significance as the total number of cancelled projects over the last 3 decades, since 1990 was only 292 and hence indicates that an increased number of cancellations can be expected in the near future. So, it can be doubtlessly inferred that India, with the second-highest number of PPP projects and associated investments in the developing world, is also likely to see increased project failures in the coming days. COVID a force majeure situation may be one prime reason. But Government had taken remedial measures like an extension of concessions till the impact of Covid prevails as well as addressing liquidity problems like RBI moratoriums on debts etc. Blaming Covid alone for the current situation shall be an understatement. A lot of other traditional factors also are in the play.

The May 2015 edition of "Manage South Asia" published by PMI had carried an article "Project Failure: A look at Organisational Factors" which had observed that "year after year, rate of project failure remains the same or are deteriorating further."

So, the phenomenon is not new. It added, "Projects fail when they fail to fulfil their mandates. They fail whenever they fail to have a good grip on the constraints, scope, quality, schedule, resources, and cost." Failure to take any project forward according to the schedule or within the available budget, are the most common causes that impede project progress or result in failures.

Cost-saving and timely performance is of utmost importance to all stakeholders who are involved in any construction project like the owner, contractors, consultants, subcontractors, and others. The prime causes of risks in construction projects involve delay and failure to complete the work at a specified cost and within the agreed time frame. The cost overrun and schedule overrun not only influence the prospects of project completion but can also adversely affect the national economy. Such overruns are often caused by uncertainties unfolding in a hostile manner, and attacks by those unmanaged risks which were on the prowl. By 2000 itself the realisation that unmanaged or unmitigated risks are one of the main reasons for the failure of many projects had dawned upon the project professionals the world over thanks to the publications by the Organisational theorist John Rodney Turner, and the Project management expert Paul S Royer of PMI. In order to successfully complete a project and achieve the project goals, risk management requires to be centrally focused upon by project managers (Kothari, 2021).

In India, the concept of risk management was propounded by Kautilya in his 150 AD work the Arthashastra, wherein a whole chapter 'Calamities of the population' deals exclusively with risk management. Even though the context and content of risks and risk management as detailed in the ancient text are no longer relevant today, the need for appropriate risk management remains evergreen. In the wake of the newfound understanding, since 2010, risk management practices have penetrated the Indian project arena also, though still it is now widely practiced nor effectively implemented wherever it is practiced.

In order to assess the maturity attained by risk management as a discipline in the project sphere of India, this paper intends to study the level of implementation of structured risk management in the infrastructure project segment of India and to establish the gaps which need to be filled so as to attain effectiveness in risk management to the level of containing the various overruns within tolerable limits (Bhaumik *et al.*, 2021).

Research Methodology

The study was planned to be done within the infrastructure project industry of India which is predominantly owned by public bodies. The said segment comprises several key sectors like highways, bridges, railways, water systems, steel / power plants, institutional and residential buildings, etc encompassing projects with varying budget outlays and completion periods.

At first, a literature survey was conducted to understand how any effective risk management system should be framed by the project management teams, which included the identification of such obvious traits and characteristics which together define an effective model. Such a listing only could help in the lookout of their presence in actual project sites in order to determine the necessary features are prevalent or absent, thus enabling the grading of the effectiveness of the risk management in the subject project. An elaborate literature survey could bring out exhaustively the distinguishing features which are inevitable for any effective risk management system in project environments. With that understanding a questionnaire was prepared to be distributed to the project managers of 60 different ongoing projects, belonging to the small, medium, big and large categories by project values, spread out in different sectors and different geographical areas of India.

As each PM was contacted either personally or indirectly through such persons who were influential over the PMs, a response of 91.6 % could be obtained in a time period of 1 month. The survey responses were tabulated and analysed to (1) determine the extent of adoption of structured risk management components by different projects which were under various sectors and of various sizes, as well as to (2) understand the basic tenets, similarities, and contrasting features among them. From the results thus obtained, a good picture of the scenario could be built up, leading to the draw up of gaps and opportunities for improvement, as well as recommendations that would help the policymakers to take appropriate actions for the betterment of the situation. This study would also help to identify areas where further researches are to be made.

Literature Review

Foerster & Arnold (2019) argued that any project organisation should implement a risk management framework by following an eight-step process. First and foremost, among them is the adoption of a 'Risk Policy' in which the risk appetite is defined clearly, and as a corollary, the risk tolerance levels also are specified. As the second step, the 'Context' is to be well established. This is to be done after an exhaustive identification of the external and internal stakeholders, as well as the internal and external environments, followed by attempts at clearly understanding the specifics like the services offered, HR issues, resource management, regulatory obligations, own goals, and objectives. Such an exercise should be done against the backdrop of the adopted risk policy. The organisation should venture into the third step of 'Risk identification' only after fulfilling this step (Younis *et al.*, 2020). The 'Risk Identification' process should start with a thorough search to identify the existing and potential risks exhaustively as well as clearly understand the existing controls. The areas of services performed, sub-contracting, performance and all other possible facets of the operation are to be covered during this search. The fourth step 'Analysis and Evaluation of Risks' should be made on a continuous basis by comparing the exposure levels against, the predetermined tolerance level, the degree of control, and the potential losses presented by each risk. The cost of the controls and their adequacy should be assessed based on the likelihood of occurrence of an event and the severity levels of consequences associated with that event (Alhassani & Bhaumik, 2019).

Once it is done the fifth step of 'Risk Treatment and Management' shall commence. In this step, strategies are to be developed for managing all the significant risks identified. Usually, the various options available are accepting, avoiding, transferring fully or partially, Reducing the likelihood or consequence or both, and retaining the risk. Action plans are to be developed based on the current levels of risk exposure, expected benefits from control actions, the time required for implementation as well as the financial resources in hand. Once the action plans are approved, it is time for implementation and the prerequisite for implementation comes as the sixth step, 'Communication and Consultation'. This should aim at keeping all external and internal stakeholder groups informed in detail, and in real-time. Timely consultation with all affected parties is key to a successful implementation. Communicated action plans speak on who to do what, how, and when (Execution), as well as who and how to monitor and control. Appropriate compliance to them by the addressed parties shall see the plans getting translated into actions envisaged by the said plans. 'Monitoring and Review', though described as the seventh step, shall immediately follow the communication step. Monitoring and review of the risk management strategies should continue on an ongoing basis. As time passes, new risks take birth, the strength of the existing risks change or vanish altogether, the priority of risk may change or the risk treatment strategies may become ineffective. The monitoring Process should not only monitor the existing risks but also aim at identifying new risks or trouble spots. Continuous evaluation of the effectiveness of current risk treatment strategies should also be a part of monitoring. The eighth and the last step brought forth by the book is 'Documentation'. A well-implemented risk management system should document all policies and procedures, assessment processes, risks identified, and the measures planned for mitigation. Documented policies help avoid breaches in performance caused by misunderstanding or misinterpretation.

Documented procedures provide a constant reference, an action guide, and a framework for checking that the operations are done in the right manner.

A study report by National Research Council (2005), which had elaborated on the importance of planning stated that “Risk management includes front-end planning of how major risks will be mitigated and managed once identified. Therefore, risk mitigation strategies and specific action plans should be incorporated in the project execution plan, or risk analyses are just so much wallpaper”. Said report also elaborated on the importance of planning as “for a good implementation the risk management planning is to be done much before the start of projects.” From this, it can be inferred that in any risk management program, the first action should be ‘Risk identification’.

Odimabo, Oduoza & Suresh (2018) argued, “Risk identification techniques are to be used to thoroughly capture significant risks factors affecting construction projects. Brainstorming by bringing together all relevant parties in the construction project to identify the possible risk that might affect the construction project is the commonly used technique. In order to make the brainstorming session to be effective, the process must include individuals who have vast knowledge, experience, and expertise in risk management, especially within the construction project environment. involving obtaining information through past experiences in the construction industry”. Another point stressed by the said author was the need to have a ‘Risk Register’, which contains a standard format used to document risk information, and actions to manage the risk and logs in several information for individual risk factors, including a description, potential causes, ownership, probability, impacts, mitigation, and fall-back plans and status”.

About the next step to be followed, the ‘risk assessment’ above work showed that “qualitative risk assessment is regarded as the most useful part of the process as it allows for risk comparison and prioritisation. It helps focus attention on the most significant risks in order to reduce their negative impact on the objectives of the construction project. Based on the two considerations that are made on the risk the anticipated impact on the project and the likelihood if it occurs. A common set of criteria allows for the comparison and prioritisation of risks when sufficient information is available regarding the construction project. Application of Quantitative Techniques benefits in the determination of (1) the probability of accomplishing a construction project objective, (2) risks that require the most attention by quantifying their comparative influence on construction project risk, (3) realistic and viable costs, schedule, or scope targets. Subsequently, risk responses can be implemented. This process is made easier with the creation of a model. When creating the model, it is modified to quantify the impacts of risk on the construction project using qualitative techniques”. Thus, it surmised that a good risk management implementation should use both quantitative and qualitative methods.

A study report by PricewaterhouseCoopers & Committee of Sponsoring Organizations of the Treadway Commission (2014) dealt with the role of the company board in the successful implementation of risk management. “The company board has a key role in overseeing the risk management process, by knowing the extent to which management has established effective enterprise risk management in the organization, being aware of and concurring with the entity’s risk appetite, reviewing the entity’s portfolio view of risk and considering it against the entity’s

risk appetite, being apprised of the most significant risks and whether management is responding appropriately. The additional dimension that has emerged over the years relates to the need to isolate and understand risk. Strategy is a high-level concept that eventually gets filtered through to front-line operations. These operations need to address the risk to the more detailed objectives that form the basis for the work of most middle managers and the actual workforce. Operational risk affects the day-to-day operational objectives, and each entity must deal with the important task of aligning operations across the entity. The board of directors should be aware of the major aspects of the operational risks as a distinct risk category that should be managed, and it should approve and periodically review the operational risk management framework. The importance of corporate culture can have a wide-ranging effect on the way risk is perceived and dealt with.”

A book on risk management process audit (Pickett, 2005) threw light on the importance of audit in implementation as “In most organizations, management makes the most impact on whether the corporate objectives will be achieved or not. If senior management does not adopt the risk management concept wholeheartedly, there is little chance that a systematic analysis of risk will be undertaken. Communicating information on risks consistently at all levels in the organization and centrally monitoring and coordinating the risk management processes and the outcomes and providing assurance on the effectiveness with which risks are managed, are also important activities of good risk management. risk management must be set within a learning environment for it to be of any use.

A good risk management process incorporates a good system of internal control and a mechanism to update controls as and when risks alter in type, impact, or likelihood”. The book continued to add that, “Risk activities need to be done in such a way that they can be validated, if necessary. This means there should be good documentation in place. Validation enables the board to set a mandate that designates that an effective risk management process will be put in place and turn make several firm statements about their risk management policy. The risk management process should be subject to constant evaluation to ensure it works and makes sense. In addition to built-in mechanisms for managers reporting upward about the way they are managing risk; the auditor has the most to offer in performing this review role. Internal auditors play a key role in evaluating the effectiveness of risk management and recommending improvements. Though Management remains responsible for the risk management process by first training all employees in the importance of risk management to the future of the company and then ensuring that structures are in place to allow employees to participate in the ongoing management of risks, a raised threshold of risk awareness is engendered and maintained.”

The literature search above could throw light on the characteristic features, ought to be possessed by any risk management framework to become effective. This helped to identify those attributes which are to be searched for their presence in the risk management system deployed in any project theatre, to determine its potential to go effective. Thus, a list of 45 features could be listed out and grouped under 7 different attributes. These features were formatted as a questionnaire to undertake a site survey. The 7 main attributes are (1) Establishment of Context and framework, (2) Risk Identification, Evaluation and Management Action Planning, (3) Use of Techniques and Methods, (4) Communication, (5) Monitoring and

Review, (6) Documentation, and (7) Commitment of Top Management. The questionnaire is at Annex-1. The respondents were asked to respond by rating their perception against each question in a Likert Scale, 1 to 5, 1 - being Highly disagree, 2 - Disagree, 3 - neither agree nor disagree, 4 - Agree and 5 - Highly agree.

Questionnaire Survey

A list of 60 ongoing projects from all over India was shortlisted from a master list of ongoing projects, which was compiled with the help of data taken from various web sources and public offices. This master list contained more than 500 entries. The shortlisting was done with the primary purpose of having a bunch of 12 projects belonging to each of the 5 principal geographical regions of India, namely North, East, West, South, and Central. Again, each of those 5 bunches had to be of similar composition with regard to their sizes as small (0.13 to 1.3 million USD), medium (1.3 to 3.25 million USD), big (3.25 to 6.5 million USD), and large (6.5 to 13 million USD). Projects above 13 million dollars being less in numbers and not representative of generic projects of India were not considered. The projects figuring within each bunch were selected from the 5 major Sectors like Railways, highways and bridges, buildings (institutional or residential), water systems (irrigation, or potable), and process plants (steel, oil, power or chemical) keeping such distribution is also more or less similar across all 5 bunches. One collaborator each from all the 60 project sites was identified through the acquaintance network of the researcher, to help conduct the survey. Questionnaire sets were sent to such helpers for handing over to the respondent, and to collect back the filled-up questionnaire. the chief or second in charge of the project management function of each project was the respondent. After a lead period of 30 days after dispatching the questionnaires, 51 filled-up responses were returned, thus achieving a success rate of 85%. The composition of responses received was as below, and more or less the region-wise clustering of responses was found reasonably homogenous as far as sector and sizes are concerned.

L	LARGE				EAST				CENTRAL				WEST				SOUTH				
B	BIG				9				10				11				10				
M	MEDIUM																				
S	SMALL																				
SIZE	L	B	M	S	L	B	M	S	L	B	M	S	L	B	M	S	L	B	M	S	
	3	3	3	2	2	1	3	3	2	3	3	2	3	2	3	3	3	2	3	2	
PLANTS	1	1	1				1			1	1		1		1		1	1	1		11
WATER		1	1	1				2		1		1			1					1	9
HIGHWAYS	1				1		1		1	1	1		1			1	1	1	1		11
RAILWAYS	1	1		1		1	1	1	1		1	1		1		1	1				12
BUILDINGS			1		1								1	1	1	1			1	1	8

The obtained results were tabulated in an excel sheet with the help of the office subordinates of the researcher and subsequently were subjected to various analyses under different groupings of interest. As only score averaging and computation of standard deviations were necessary, high end statistical techniques were not called for in this study.

Results and Discussion

The maximum average score obtained by any project was 3.8 which indicated that the maximum effectiveness of risk management attained by any project organisation was only 76%. Out of the 51 varied projects studied, only 33.3% were found as having scores above 3.5. Whereas around 29% of the projects studied are having a score of less than 3, indicating that they had not taken any deliberate step at all towards making their risk management actions effective. All projects put together, portray an overall average of 3.1 which is just at the 60% mark. The standard deviation of scores among the 51 samples studied was 0.57, i.e., a coefficient of variance of over 18% which is fairly high.

A size-wise analysis made, displayed a picture in which the Large (Score 3.49), and Big (Score 3.35) sized projects were found taking risk management seriously, in comparison to the Medium (Score 2.92) and Small (score 2.63) sized projects, in general. So generally speaking, it could be construed that the Medium and Small-sized Project organisations were averse to taking risk management seriously. A close observation of the pattern of scoring revealed the following: The Large, Big and Medium-sized projects were having maximum scoring for the parameter “involvement of Top Management” followed by “Techniques used for Risk Analysis” and then by “Risk Planning”, though the respective scoring for each parameter was seen progressively decreasing along with Large-Big-Medium sizes, all such scores were above 3. Among the small-sized projects, the ‘Involvement of Top management’ had scored 2.53 indicating the lack of interest displayed by top management in risk management actions. The higher the size of the projects, the owners and project managers might be more worried about the risks the impact would pose and hence they displayed more drive towards attaining risk management effectiveness. The scoring pattern also evidenced the top-driven mechanism prevalent among such projects where the involvement of Top management was very much evident in field actions. This was in line with the findings of (Zwikael, 2008; Anasica & Batra, 2020) that Top Management commitment is the most important driver for any risk management system. That “Techniques and Risk Planning are the next most important attributes to make any risk management movement effective “was highlighted in the treatises (Hopkin, 2018; Chapman & Stephen, 2003), and the same was carried by the findings of this study. ‘Monitoring & review’ and ‘continuous understanding of the real-time context’ were the next major areas that were seen receiving focus in large and big projects followed by ‘documentation’ and ‘communication’ in order. ‘Communication’ which was the least scorer parameter in the series itself had a score of 3 and indicated that the large and big project organisations did shower importance over communication also. Individually, each one of those parameters held good margins for improvement. This pattern helped us to determine how priority was distributed among the 7 major parameters by the leaders among Indian Project organisations. Observation of this priority scaling followed by the bigger companies was seen in agreement with the theory postulated by various literature. Also, this could give us an insight into how the risk management frameworks of Small-sized projects should be restructured.

Another analysis made across the sector spectrum revealed that projects from the railway sector had scored 3.7 which was the highest score among any sector. This was followed

by 'Highways & Bridges' sector and 'Plant' sector which scored 3.2 & 3.16 respectively. The 'Building' sector scored 2.9, and the 'Water system' sector could score only 2.5. A close examination of the sector-wise nature of the project environments revealed that the Railway sector displayed a cross-country uniformity, as all the project participants like contractors, inspectors, managers, and vendors were almost of permanent nature, who possessed long-term association with such projects. The Railway sector projects all over the country were seen as following the same characteristics in deployment, governed by the same controls, sharing the same drive to learn from the past, and possessing an expressed desire to excel in combating risks. Irrespective of the size of the project, almost all railway projects had scored above 3.5 indicating the advancement achieved in bringing effectiveness in risk management. Even small players of the sector could score decently. So, Railway sector could be seen as the leader among Indian project sectors in risk management effectiveness.

The Highways and Bridges sector, in which only one out of the 11 studied fell under the small size, scored an average of 3.2 which again showed that risk management had evolved much towards maturity, though not up to the level of Railways. The project management deployed in the various projects falling under this sector is either following or copying the PM philosophy of CPWD. This could bring forth a thread of uniformity across the country. The project participants also are well experienced and almost exclusive to this sector. So, the risk management is naturally evolving towards increased effectiveness. Almost the same was the case of 'Process plant' sector (Score 3.16) also, where the consultants carrying out such projects are limited in number, the participants are exclusive to each plant group and not shifting much in composition over the years.

The Building sector which scored 2.9 as a whole represented ineffective risk management. The domain of this sector predominantly encompasses the urban and metro areas. The mix of project participants, the nature of project delivery, and project management differ from project to project the local influences are more in command. Under these conditions, the development of an effective risk management system can be coordinated only through policy-driven mechanisms. Policy adoption and enforcement can be emanated from the government side, or the guilds of such project organisations.

The Water Sector which scored just 2.5 operates in a wider domain which includes rural areas also to a significant extent. Also, there is not much uniformity in the way projects are conceived or owned, let alone delivered and managed. The diversity in quality and composition of the project participants in the absence of a common guideline applicable to all, overall effectiveness of risk management also suffers along with many other goodies.

The lesson learned from here is that, irrespective of the sectors, infra projects as a whole are to be governed by new policy guidelines related to risk management. Presence of some uniform governing or guidance had resulted in better scores of Railways, Process Plants and Highway & Bridges sectors. These sectors together contained all those projects that scored above 3.5 individually. This fact highlighted the necessity of such uniformity in guidelines.

Region-wise analysis displayed an interesting result that, when the projects were grouped region-wise, they did not show any significant difference between regions in average

scoring. Northern region scored 3.2, Central, South, and West scored 3.1 each, and East scored 3, with an insignificant variation between them.

Conclusion

The level of implementation of risk management among the most majority of Infrastructure projects in India emerged much below the national average of 76%, whereas the national average itself was not up to the mark. If we consider the national best score of 3.84 as a benchmark even, more than 70% of the projects were well below 90% of the benchmark. This highlighted the need for urgent improvement.

Policymakers have to formulate governing guidelines in the risk management area, to be followed by all those infrastructure projects involving public money, whichever sector they belong to. The guidelines should aim at installing a risk management framework specific to that project, considering the context in full and also the changes occurring in the contextual content over the project period. The guidelines should aim at harnessing the top management's concern, priority, attention, and focus on the risk management actions within such projects, adoption, and application of the latest techniques for qualitative and quantitative analyses including the use of IT. Monitoring and review should be institutionalised by the said guidelines to make risk actions dynamic in response to the changing conditions during the project life cycle. Update of the risk knowledge base by each project delivered, and build-up of a body of knowledge in the public domain for compulsory use in all future projects should also be aimed at. Projects should maintain real-time communication channels connecting all stakeholders of the project to disseminate risk information in real-time. Assigning of risk management responsibility of each project to a particular individual, either full-time or part-time basis, coupled with the need for a regular relay of risk information to top management for appraisals, can make the systems more effective. Policymakers should aim at developing and improving a risk culture conducive to effective risk management across the project sphere that can complete the process. Each project organisation has to adapt its risk policy and tolerability levels commensurate with the specifics of the project in hand, bringing up uniformity in the philosophy of all risk actions, covering all steps from risk identification to Mitigation, including monitoring and reviews, is possible only by training the concerned professionals intensively through a nationwide drive and enlisting the cooperation of subject experts and project veterans. This necessitates the formulation of a professional body with authority and resources. This will also help in the improvement of the body of knowledge perpetually.

Researchers have to explore the correlation between each one of the factors grouped under the 7 major heads and their impact on risk combating results so that the factors can be effectively prioritised for implementation in risk management frameworks. Such inputs can help the policymakers to draft the governing guidelines more efficiently. Uniformity in risk management actions can minimise the variations of effectiveness in risk management across the spectrums of project sizes, sectors, and other variables. Such uniformity can be brought forth only by forming a body central to the nation and having a sway of authority over all projects throughout the national the public sphere, as far as the formulation of a risk management framework and framework administration are concerned.

Conflict of Interest

The authors declare that they have no conflict of interest.

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