

ABSTRACT

In the construction industry, changing legal environment and higher complexity of projects are exposing organizations and projects to higher risks. Simultaneously, there has been significant growth of literature on risk assessment tools and risk management frameworks. However, the industry shows low adoption of these tools and frameworks. A major reason for this low adoption is that the knowledge on risk management is largely founded on opinions of practitioners, without adequate attention to actual industry practices and factual project details. Such paradigm has created a gap between research and practice on risk management. This gap also has significant implications such as inability of risk models to provide cost implications of risks, and inability to provide prescriptive risk mitigation measures at project-level. Therefore, this thesis is set in the premise that existing knowledge on risk management needs to be augmented with research aligned to the actualities of construction projects to make research more useful. ‘Actualities of construction’ signifies observations grounded in industry practices and factual details instead of exclusive reliance on subjective opinions of practitioners.

The goal of the research is to develop a Project-level Risk Management Framework (PRMF) that identifies, evaluates, and suggests mitigation measures for risks in construction projects. To achieve this goal, four project objectives of ‘risk identification’, ‘risk assessment’, ‘investigation of risk interdependence’, and ‘development of PRMF’ were defined.

To align the goal of the research with the actualities of construction projects, the research has undertaken inductive inquiries. In inductive inquiry, research methods are gradually guided by the observations from data. Various sources of factual project data and actual industry practices that could be used for risk management research were explored. Then, three research approaches were adopted— content analysis of claim documents to analyze risks from past projects, case study of ongoing projects to analyze risks in present projects, and opinion-survey among experts to analyze risks in anticipated future projects. Together, these three approaches provided a unique coverage on risks from past, present, and future projects as well as methodological diversity. For the first two objectives, viz. risk identification and risk assessment, in all three research approaches were used in parallel. Subsequently, their findings were consolidated for analysis in the third and fourth objectives.

In the opinion survey approach, a questionnaire survey was done with 32 internal and 22 external risks to identify critical risks. The questionnaire measured ‘likelihood of occurrence’, and ‘degree of impact’ on four project objectives of Time, Cost, Scope, and Quality. Critical risks were shortlisted corresponding to ‘moderate likelihood and moderate impact’ resulting in 22 internal risks and 12 external risks. Relative priorities assigned by different stakeholders to four project objectives and trends of risk assessment under these project objectives were also analyzed revealing valuable insights.

The case study research covered in-depth investigation of risk management in nine ongoing projects located across India. For each project, a case study report was prepared by analyzing data from four sources; viz. project documents as primary source, interviews of site executives for undocumented information, site photographs as direct observations, and archival records. These nine case studies provided valuable observations and insights about risk management practices for formulating PRMF. A unique opportunity of two very similar case projects with different contractors helped in exploring the role of contractors in risk management at the project-level.

The content analysis research was conceptualized on the integration of literature on risk management and claim management, which revealed a causal relationship between risks and claims. Potential of this relationship was demonstrated by developing a Claim-based Risk Assessment Model (C-RAM) using techniques of content analysis over 28 settled arbitration case awards. Research findings revealed new parameters to quantify patterns of occurrences of risks, and their cost implications as fractions of contract sums.

Subsequently, the critical risks from the three research approaches were compared which revealed that critical risks from past, present, and anticipated future projects converge and exhibit perpetual nature. Further, interdependence among risks was analyzed using a second-round questionnaire on 21 consolidated critical risks using techniques of Cross Impact Matrix-Matrix Multiplication, and Interpretive Structural Modelling. These analyses provided a better understanding of driving, dependent, and hierarchical structure of risks in a project. These observations were triangulated with the findings of case study and content analysis research to develop a ‘strategic plan for risk management in projects’.

Finally, the findings from all three approaches and existing literature were integrated to develop the PRMF and its three core components, viz. Risk Information Database, Risk register, and Risk Treatment Plan. Two additional components; viz. Vulnerability assessment

and Heuristic model for scenario analysis of cash flow were developed to make PRMF comprehensive and more useful for the industry.

Apart from the PRMF, the research contributes three significant theories to the body of knowledge. *First*, an elevated understanding of the role of contractors in risk management highlights that contractors are decisive factors differentiating the success or failure of a project. Risks both to a project and its contractors, should be considered in risk management. *Second*, risk and claims have a causal relationship, and claims can be visualized as cost implications of unmitigated risks in a project. This relationship will encourage an integration of risk management and claim management. *Third*, critical risks in construction projects are perpetual in nature. Hence alongside criticality, interdependence among risks should also be considered for developing a risk management framework.

Overall, the thesis initiates a new paradigm in risk management research by demonstrating research methods aligning to the actualities of construction. It can be a milestone in bridging the gap between risk management research and practice.

Keywords: Case study, claim management, content analysis, contractor capability, cost implications of risks, risk assessment, risk interdependence, risk management, risk management framework, risk treatment plan.