RISKS OF INADEQUACIES OF INPUTS OF PRECONSTRUCTION ACTIVITIES TO DESIGN PHASE ON COST AND TIME OVERRUNS IN CONSTRUCTION PROJECTS

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Degree of Doctor of Philosophy

Department of Civil Engineering

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Dissertation submitted in partial fulfilment of the requirement for the Degree of Doctor of Philosophy

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DECLARATION

"I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Name of the supervisor: Professor Malik Ranasinghe

Signature of the supervisor: Date : 23-03-2021

ABSTRACT

Cost and Time overruns are common occurrences in construction projects completed in Sri Lanka. This research study was carried out to find the possible reasons for these overruns. The objectives of the study were to review, identify and analyze risks created by the inadequacies, correlations, coherence and accuracy of the input data of pre-construction activities to the design phase of construction projects and to develop and validate an industry best practice framework/model/guideline to minimize/eliminate cost and time overruns of construction projects due to risks of inadequacies, correlations, coherence and accuracy of the inputs of pre-construction activities to the design phase of the projects.

Initially, contributory factors for Cost and Time overruns of construction projects were identified. 'Design effects' was found to be the critical contributory factor. A study on 'Design effects' identified the pre-construction activities that are input to the design phase of construction projects. These pre-construction activities were used to examine 'Relevance of the activity' and 'Adequacy of the input of the activity' to the design phase in a construction project. Accordingly, a model, "$z = 100 - 2.6916e^{0.024x}$" where 'Inadequacy of the input to the design phase (z)' and 'Relevance of a pre-construction activity (x)' was derived for the input of a pre-construction activity to design phase of a construction project.

Pre-construction activities were expanded and analysed to assess the risks created by inadequate inputs from the pre-construction activities to the design phase of construction projects as follows. Scientifically developed questionnaires based on the mixed type of research method and where internal consistency was rated as 'excellent' were used for data collection. The probabilistic random sampling method confirmed that the sample of respondents selected for the study was adequate. One questionnaire was used to collect data from 32 projects to examine 'Relevance' and 'Adequacy' of input from pre-construction activities to the design phase of construction projects. The other questionnaire was used to collect data from 100 projects to examine the possibility of eliminating/minimising the Risk of Cost overruns and Risk of Time overruns by retaining services of a third-party independent designer to verify the adequacies of input from preconstruction activities to the design phase of construction projects. All respondents to the questionnaires were substantive experts actively involved in construction projects.

A structure to collect data was developed to identify and analyze risks from the input of respective pre-construction activities to the design phase of construction projects. The developed framework analysed risks using Risk Matrix, Relative Importance Index (RII), Severity Index (SI), Descriptive Statistics, Sampling Adequacy, Reliability, Validity, Correlation and Accuracy of data, Biases, Coherence of responses and Calibration of respondents.

Guideline for industry best practice was derived by using scientific techniques of data analysis for risks created by the inadequacies of input from respective pre-construction activities to the design phase of construction projects. Results from the analysis satisfied the limits set by each scientific technique used for the analysis. The analysis highlighted the ranks of preconstruction activities which with inadequate input to the design phase of construction projects increased the Risk of exceeding Cost, Risk of exceeding Time and minimising the Risk of exceeding Cost and Time. Risk interpretation revealed that top ranks of preconstruction activities were 'Likely' to induce Risk of exceeding Cost and Risk of exceeding Time of construction projects.

Guideline for industry best practice was validated through statistical methods and Case studies from the construction industry. The main conclusions of the study were that: i) Inadequacies of input from preconstruction activities to the design phase contributed towards Cost overruns and Time overruns in construction projects; ii) Risks created by the inadequacies, correlations, coherence and accuracy of the input data of pre-construction activities to the design phase of construction projects contributed towards Cost overruns and Time overruns in construction projects and iii) Verification of the input from preconstruction activities to the design phase of construction projects by a third party independent designer would minimise the Risk of exceeding Cost and the Risk of exceeding Time of Construction projects. In addition to the 3 main conclusions described above, there were 19 conclusions and 3 recommendations.

Key words: Cost overrun, Time overrun, Preconstruction activities, Risk, Independent designer

This dissertation is dedicated with warmest gratefulness to

my School

Ananda College, Colombo, Sri Lanka

and

my University

University of Moratuwa, Sri Lanka.

These two institutions paved the way for me to be what I am today.

ACKNOWLEDGEMENT

I express my heartfelt gratitude to Professor Malik Ranasinghe, my supervisor, who made the study stimulating and enjoyable. I greatly appreciate his availability for the study, almost at any time, prompt responses, guidance, advice, feedback and support from the inception of the study. I am blessed to have him as my supervisor.

I also thank Professor Asoka Perera and Dr S B Wijekoon, members of the review panel and Professor Saman Bandara for the valuable inputs given during the study. In addition, input to the study from Professor Kamal Premaratne, Dr. Asitha Seneviratne and Dr. Vasantha Abeysekara is deeply appreciated.

Further, noteworthy support to the study given by Mr. Namal Peiris, Mr. Sisira Weerabahu, Ms. Dinusha de Silva, Mr. Isuru Herath, Ms. Sashenka Kumarage, Ms. Dinusha Dissanayake, Mr. Thushara Perera, Mr. Darshana Weerabahu and Mr. Barnes Abeywardena is highly appreciated. Also, my appreciation goes to the experts who positively reacted to the requests for responses related to the study. In addition, I appreciate the relavant staff of the University of Moratuwa, specially from the Faculty of Graduate Studies for giving the best possible support to the study.

The encouragement given in either way to the study by my son, Randesh Daluwatte, was probably one of the highlights of the process of the study and I really appreciate his sincere efforts. Finally, I like to thank my family for standing by me.

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