CHAPTER 7

FINDINGS, LIMITATIONS & CONCLUSION

7.0 Introduction

The core of this research is all about the project governance and risk management of power projects in UAE been impacted adversely by cost and schedule overruns, converging into a business problem. Upon unfolding of objective of this research, duly applying the research methodology envisaged, sequentially, enlightened the researcher by providing a resounding solution to the problem under this study.

Consequently, this chapter summarizes the thesis and provides the details of Major Finding, Limitations of the study and lists the scope for future work. This chapter provides the researchers remark enabling other researchers to carry forward with further research on Contingency estimation of substation construction projects in UAE.

7.1 Findings

The following are the major findings of the study:

- Initial identification of Risk Variables were carried out with reference to the Literature Review output resulting into 229 Risk Variables, and thereafter incorporating the suggestions provided by the substation project experts in UAE to reach at a total number of 185 Risk Variables duly grouped on the Stakeholder wise - Work Breakdown Structures basis including the Technical & Non-Technical sectors across 20 categories.

- 108 Numbers of Risk Variables were identified to be significant Risk Variables which are impacting the contingency applicable to construction of substations in UAE; based on the survey response, resulting with a factor loading of more than 0.700 by factor analysis, , as tabulated in Table 7.1.

- Hypothesis testing was done using chi-square analysis on the response received for the 108 risk variables confirming the ALTERNATE HYPOTHESIS, which states that "There is significant relationship between the perception of the stakeholder pertaining to contingency on project performance".

- Based on the concurrence to the Alternate hypothesis, Multivariate analysis was carried out on the Cost Performance and Time performance from the already collected responses, resulting in further condensed list of Risk Variable of 35 Nos. for cost performance and 34 Nos. for the time performance data, based on the significance level from the multivariate analysis output.

- Model for the Contingency estimation was prepared taking into account the % allocation of the project value against the major categories (Technical) such as Civil, Electrical & MEP and thereafter obtaining the estimated cost distribution of support categories (Non-Technical), duly working out the overall distribution for all the Risk Variables. Thereafter, the "B" value obtained from the Multivariate analysis is considered for the each Risk Variable having significance in the Multivariate analysis and thereafter utilizing the "Factor Loading" obtained from the Factor Analysis for these significant risk variables, applying the Regression formula; thereby resulting in a value of 1.862 corresponding to 4.65% of project value for consideration as Project Contingency.

Table 7.1 – List of Significant Risk Variables obtained as Objective 1 output

CAT.	RISK VARIABLES
FINANCE	Invoicing by Contractor to Client
	Cash In Flow [i.e. Liquidity]
	Inflation / Price Fluctuation
	High Interest Rate
	Exchange Rate Fluctuation
	Periodic Audits
HR / ADMIN	Requirement for No Objection (NOC) / Approvals from Statutory Bodies
	Cultural Impact / Personality Impact / Language Impact
	Resources Deployment
	Utilization of Resources
	Natural Calamity
HSEQ	Natural Calamity
	Laws and Regulations and the changes during the tenure of the contract
	HSE Plan at site, Induction of Site team, Awaraness Program, Training & Safety Signs.
	Inspection & Audits, Housekeeping & Control, Risk Assessment & Method Statements
	Shutdown for carrying out Modification / Tie-in
	Warranty requirements
	Periodic Medical Checks / Physical Exercise / Fitness
	Quality of Material
	Quality of Workmanship
CONTRACTS	Variation to the Contract
	Suspension of Work by Client
	Acceptance of Work by Client / Consultant
	Default of the Vendor
	Accidents & Injuries
DSGN	Laws and Regulations and the changes during the tenure of the contract
	Geo-Technical conditions
	Input from Client / Consultant / Other Contractors
	Provision of Interfaces details by Client / Consultant for Tie-ins
	Approval of Design Documents
	Decision making by Client
	Employee Turnover & Availability of Skilled Personnel
	Dependence on external sources
CIVIL - Gen	Default of the Vendor
	Claims / Variation / Litigation by Supplier / Subcontractor (Vendors)
	Dependence on external sources
	Laws and Regulations and the changes during the tenure of the contract
	Requirement for No Objection (NOC) / Approvals from Statutory Bodies
CIVIL - Soil Inv	Input from Client / Consultant / Other Contractors
	Site Level & Access road confirmation
CIVIL - Piling	Requirement for Building Permits / Civil Defence Approvals
	Site Level & Access road confirmation
	Geo-Technical conditions
	Duration is short / Un realistic
	Dependence on external sources
	Quality of Workmanship
	Accidents & Injuries
	Inflation / Price Fluctuation
Civil - Superstru	Availability of Raw Materials / Construction Materials
	Duration is short / Un realistic
	Accidents & Injuries
	Inflation / Price Fluctuation
Civil - Finishing	Availability of Raw Materials / Construction Materials
	Inflation / Price Fluctuation
	Quality of Material
	Quality of Workmanship
	Accidents & Injuries

CAT.	RISK VARIABLES
Civil - External	Competency Approval / Work Permits from Competent Authorities
	Dependence on external sources
	Accidents & Injuries
	Inflation / Price Fluctuation
MEP - General	Vendor Selection
	Vendor Performance and Relationship
	Claims / Variation / Litigation by Supplier / Subcontractor (Vendors)
	Dependence on external sources
	Requirement for No Objection (NOC) / Approvals from Statutory Bodies
MEP - Proc / Mfg	Delivery of Materials / Equipment / Execution of Work
	Material Handling / Storing
	Sub Vendor Performance and Relationship
	Default of the Sub-Vendor
MEP - Fab / Inst	Duration is short / Un realistic
	Quality of Material
	Quality of Workmanship
	Accidents & Injuries
	Natural Calamity
MEP - Testing	Decision making by Client
	Witness Engineer by Client for Factory Tests / Type Tests / Site Tests
	Failure of Equipment
	Dependence on external sources
	Air Quality / Noise Level / Waste around the work place
	Operation & Maintenance during Warranty Period including Training to Client representatives
ELEC - General	Vendor Selection
	Vendor Performance and Relationship
	Default of the Vendor
	Claims / Variation / Litigation by Supplier / Subcontractor (Vendors)
	Dependence on external sources
ELEC - Proc / Mfg	Exchange Rate Fluctuation
	Material Handling / Storing
	Delivery of Materials / Equipment
	Vendor Performance and Relationship
	Default of the Vendor
ELEC - Inst	Duration is short / Un realistic
	Material Handling / Storing
	Accidents & Injuries
	Natural Calamity
ELEC - Testing	Decision making by Client
	rovision of Interfaces details by Client / Consultant for Tie-ins
	Witness Engineer by Client for Factory Tests / Type Tests / Site Tests
	Testing Equipment Availability
	Dependence on external sources
	Quality of Material
	Quality of Workmanship
	Accidents & Injuries
PROJ MGMT	Project Charter / Project Management Plan
	Duration is short / Un realistic
	Testing Equipment / Commissioning Spares Availability
	Failure of Equipment
	Reporting on LESSONS LEARNED & Action Taken

- This model was used for validation of an existing project where the cost performance data was taken and distributed against each Category, resulting in a cost overrun of 4.46% of Sales value while the estimated contingency value equivalent of 4.65% of project value, which has resulted in a saving of 0.19%.

- Thus the contingency estimation model for cost as obtained from the Multivariate analysis shall be considered to be within the acceptable limits of not impacting the project performance (by means of mitigating the cost overrun) upon validation.

- This model can be utilized for the estimation of the cost contingency for construction of substation project in UAE with limitations.

7.2 Limitations of Study

- Applying relationship to multiple variables is a complex process due to many difficult combinations of variables under analysis. However, these are based on limited number of responses received, which can cause restraint to the results of this study.

- The model was output of 35 risk variables after elimination of many variables from the initial list, based on the statistical analysis on the responses received. However, this may constrain the actual result of the model output considering the effect of the eliminated risk variables during the actual project implementation.

- This study is reflection of responses received from various respondents who are / were involved in the construction of substation projects in UAE, which includes substations of various levels such as Generation Substation, Transmission Substations and Distribution Substations, varying in the level of requirements and project constraints. Hence, specific precaution has to be considered while considering the model

during implementation of different levels of Substations, even though a vast range of Substation projects were considered while formulating the Contingency Estimation Model for Cost performance.

7.3 Future Scope of Work

- The model developed is based on set of risk variables after carrying out statistical analysis on the responses. This can be extended or redefined by following:
  - ✓ Adding or reducing or revising the Risk Variables in the existing model of this study.
  - ✓ Extending this study by breaking up the area of study into Generation Substations, Transmission Substations and Distribution Substations.
- A detailed study on the Time Performance and formulation of model for Time Contingency estimation is recommended, to mitigate the Time overrun of the projects.
- Other statistical analysis tools such as Range Estimating, Artificial Neural Networks, Fuzzy Sets, Analytical Hierarchy Process, etc., shall be considered for model formulation in future studies.

7.4 Suggestions

- Even though many Project Risk Management theories are available and most of the Project professionals are aware of the basic details, lagging in utilizing them while implementing a project will result in undesired performance. Hence, proper implementation of Project Risk Management, is required, in order to achieve a better result at all times.
- To avoid huge cost overrun in the project, proper contingency estimation shall be made during the project budget preparation and allocation,

utilizing some validated form of available models rather than allocating contingency based on Rule of Thumb.

7.5 Contribution to Literature

Several studies were made on Stakeholder Theory (Freeman, 1984) specific to the "Maximization of Firms Value" (Jenson 2002), Cash flow (Fama 1970; Graves and Waddock 1994), effective risk management (Wang, Barney, and Reuer 2003), and effectively managing the stakeholders Paul Littau, et al (2015); G.Locatellia, et al (2014); Harold Kertzner (2012).

However, implementation of the Stakeholder theory for 'value maximization of the firm' by proper contingency estimation and proper Risk Management is very limited in Construction of Substation projects in UAE. Generally a rule of thumb is utilized for contingency estimation at both the Governance level of the organization as well as the Management level of the project; while list of project risks variables were identified & listed out in the Risk Registers as a common practice without analyzing and implementing the mitigation plan to control them. Furthermore, proper contingency estimation based on Quantitative analysis of past projects / performance and proper implementation of the Project Risk Management in terms of risk mitigation, is missing.

The result of current study to the problem as stated above had provided an insight and to ponder further, that, 'the flow of information related to project decisions, i.e. contingency estimation fixing up the project budget, from the Stakeholder Perception towards the Organization Governance' improves the 'Firms value' rather than following only the traditional flow from Organization Governance, as shown in the Figure 7.1.

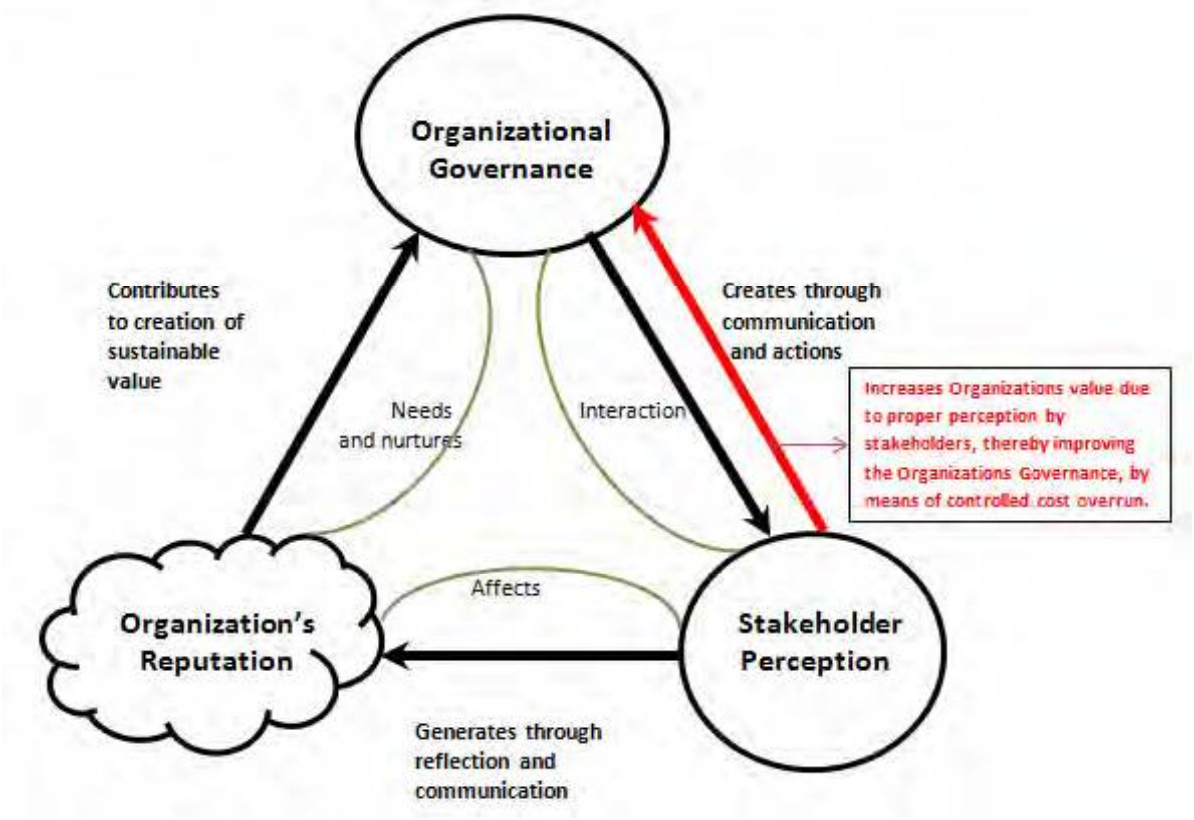

Figure 7.1 – Enhanced Flow of Decision between Stakeholder and Organizational Governance

7.6 Conclusion

A detailed literature review unlocks the gaps prevailing in the system causing the business problem, resulting into a requirement of a detailed research on 'How the perception of the stakeholders in contingency estimation while establishing the Project Risk Management plays a role towards firm value maximization' being the problem statement that revolves around this core theme. This problem statement was further broken down into meaningful and attainable research objectives to answer the questions raised.

This research initially aimed at identifying the significant risk variables impacting the contingency estimation, which was accomplished as part of the objective 1 by means of factor analysis. Thereafter upon identification of the significant risk

variables, their impact on the project performance was established by hypothesis testing under objective 2 by studying the contingency perception of the different stakeholders involved in the project for these identified significant risk variables and their impact on the project performance in terms of cost and time.

Consequent to the identification and establishment of their relevance in contingency perception impacting the project performance; a model named "contingency estimation model" was formulation using Regression analysis utilizing the primary data and secondary data collected so far, for the estimation of the cost contingency, applicable in construction of substation projects in UAE. The model as formulated has been tested based on the actual project data of a historical project, which confirms validity of the formulated model.

On the contribution to the theory, this study had provided a way forward for consideration for the initial problem. By considering the stakeholder perception, the firm value can be maximized by means of better project performance which was validated by the contingency estimation model. While considering the stakeholder perception, there is also a need to look back into the flow of the decisions from the traditional Top to bottom (i.e. Organizational Governance to the Stakeholders Perception) but also to bring into practice the reverse flow also from bottom to top (i.e. Stakeholders Perception to Organizational Governance), thereby resulting into a better Reputation of the Organization in the society as a whole.

The current research provides a platform for construction of Substation projects in the UAE by providing a contingency estimation model, by considering the perception of stakeholders in formulating the model for contingency estimation. This model shall be utilized for building the project budget, after taking into account the project risks; for implementation to mitigate the cost overrun, with all the assumptions and limitations stated therein be considered appropriately by the organizations and the Project Managers.