CHAPTER 2

LITERATURE REVIEW

2.0. Introduction

The business problem as identified being 'Improper Governance and improper risk management is leading to project delays and cost inflation in power projects in UAE', relates to the Project Management and its subsects which lead to project delays and cost inflation; while being country and sector specific with power projects in UAE. In order to take up this business problem and to find out a way forward to come out with recommendations for attempting to solve the same, a two part literature review is required. The first part being a review of the key terms used in the project management; while the second part will be by funneling down of the Project Governance and Risk Management related literature being the two themes as noted from the business problem and find out a commonality between them & their associated gap areas; utilizing various suggestions collected from this secondary research, to formalize a conclusion.

2.1 Theoretical Significance of Key Terms

A detailed review was carried out on various literatures such as books, journals, research articles and other online articles; to understand the theoretical significance of the key terms, i.e. "Projects", "Construction", "Project Management", "Risk", "Contingency", "Stakeholders" and "Perception"; being relevant to the subject under study.

2.1.1 Project -

As per PMBoK® Guide (2013), a project is a temporary endeavor that is undertaken to create a unique product or service or result. The temporary nature of the projects indicates that a project has a definite start and end. The project end is reached when its objectives are achieved in most of the cases or when the project is terminated that is, if it is not feasible to execute or in the event the need for the project undertaken no longer exists. Temporary does not mean that the duration of the project is short. This term Temporary means the project's engagement and its longevity. Temporary does not apply to a project, service or result that is created by the project. The projects are usually undertaken to create a long lasting outcome. Business dictionary describes it as "Planned set of interrelated tasks to be executed over a fixed period and within certain cost and other limitations"

Every project creates a unique product, service or result, while its outcome may be tangible or intangible. Due to the unique nature of projects, most of them will be having uncertainties or differences in the products of services or results created by the project. A project may have repetitive elements in some of its deliverables or activities; however, this repetition does not change its fundamental unique characteristics.

A project is unique, in that it is not a routine operation, but a specific set of operations designed to accomplish a singular goal. So a project team often includes people who don't usually work together – sometimes from different organizations and across multiple geographies. Project management, then, is the application of knowledge, skills and techniques to execute projects effectively and efficiently. A project can involve a single individual resource or multiple resources, of a single organizational unit or multiple organizational units from multiple organizations.

Hughes (2001) shows that, every project passes through a number of phases and each phase has a unique purpose, duration and scope. Hence it is important to break down the entire project into various phases. Project must start from some kind of definition of need followed by design, contracting, construction and project completion. For a project to be successful, it needs to overcome some of the major constrains and challenges lying in the project management. Risk and uncertainty are inherent in all the phases through which the construction project passes.

2.1.2 Construction -

Construction is a process that consists of the building or assembling of infrastructure. Far from being a single activity, large scale construction is a feat of human multitasking. Construction is an industry that involves complex and dynamic processes. It consists of successful coordination of multiple discrete business entities such as professionals, tradesmen, manufacturers, trade unions, investors, local authorities, specialist trade contractors and others [Keane, P. J. & Caletka, A. F, 2008].

Construction differs from that of manufacturing, where, manufacturing typically involves mass production of similar items without a designated purchaser, while construction typically takes place on location for a client by the contractor. Construction starts with planning, design and financing and continues until the project is built and ready for use. Construction requires collaboration across multiple disciplines. [Online source - http://en.wikipedia.org/wiki/Construction]

Construction Projects are classified into three sectors of construction: buildings, infrastructure and industrial. Building construction is usually further divided into residential and non-residential (commercial / institutional). Infrastructure construction is often called heavy civil or heavy engineering that includes large public works, dams, bridges, highways, railways, water or wastewater and utility distribution. Industrial construction includes refineries, process chemical, power

generation, mills and manufacturing plants. There are also other ways to break the industry into sectors or markets based on individual requirements.

Construction Projects can be also classified based on various methodologies such as Rule-of-Thumb classification, Classification by Complexity, Function-Based Classification, Project Classification for Supply Chain Management, Project Parameters-Based Classification for Machine Scheduling, A Posteriori Project Classification using Linear Discriminate Analysis, Project Classification for Strategic Portfolio Management, Reference Class Forecasting. However, each methodology has its optimum domain of applicability, ranging from a general guide for rapid project classification to detailed project characterization schemes. [Safa M. et.al., 2015]. Each type of construction project requires a unique team to plan, design, construct and maintain the project which leads to numerous risk exposures. Latham (1994) states that, no construction project, is free of risk. This can be managed by proper application of Project Management principles.

2.1.3 Project Management -

As per PMBoK® Guide (2013), Project Management is the application of knowledge, skills, tools and techniques to project activities to meet the project activities. Project Management is accomplished through the appropriate application and integration of the 47 logically grouped project management processes, which are categorized into five Process Groups. These five Process Groups are Initiating, Planning, Executing, Monitoring & Controlling and Closing.

Moreover, these 47 logically grouped project management processes are further grouped into ten separate Knowledge Areas, where each Knowledge area represents a complete set of concepts, terms and activities that make up a professional field, project management field or area of specialization. These Knowledge Areas are utilized by project team members most of the time, as appropriate. These ten Knowledge areas are as shown in Fig. 2.1.

1	Project Integration Management	6	Project Human Resource Management
2	Project Scope Management	7	Project Communication Management
3	Project Time Management	8	Project Risk Management
4	Project Cost Management	9	Project Procurement Management
5	Project quality Management	10	Project Stakeholder Management

Fig. 2.1 - 10 Knowledge areas (Source: PMBoK® Guide, 2013)

These 10 Knowledge areas represent the key constraint areas of Scope, Time, Cost, Quality, Human Resource and Risk areas, while they include the Communication management which is critical for a project success along with Procurement management which is a key area for better bottom-line of an organization. The Stakeholder management which is often misinterpreted and is missed out has a huge impact on the project which is in recent times becomes more relevant due to historical data analysis and availability of such results. Integration management is to integrate all the aspects together to deliver a successful project. The Mapping of the 47 Project Management Processes categorized into 5 Process Groups and grouped into 10 Knowledge Areas is shown in Fig. 2.2.

Managing a project typically includes, though not limited only to the following:

- Identifying the project requirements
- Addressing various needs, concerns and expectation of stakeholders
- Setting up, maintaining and carrying out communications among stakeholders
- Managing stakeholders towards meeting project requirements and creating project deliverables
- Balancing the competing project constraints such as Scope, Quality, Schedule (Time), Budget (Cost), Resources and Risk.

Each project has its specific characteristics and circumstances which can influence the constraints on which the project management team needs to focus.

Knowledge Areas	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring & Controlling	Closing
Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
Project Time Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

Fig. 2.2 – Mapping of Project Management Process Group / Knowledge Area / Processes (Source: PMBoK® Guide, 2013)

2.1.4 Risk -

Risk as explained in dictionary is "the possibility of bringing about misfortune or loss" which also bears the same meaning as "danger, hazard, pitfall, peril and uncertainty" [Collins Concise Dictionary, 2006]. Risk is the potential of gaining or losing something of value. Values (such as physical health, social status, emotional well-being, or financial wealth) can be gained or lost when taking risk resulting from a given action or inaction, foreseen or unforeseen. Risk can also be defined as the intentional interaction with uncertainty. Uncertainty is a potential, unpredictable, and uncontrollable outcome; risk is a consequence of action taken in spite of uncertainty.

As per PMBoK® Guide (2013), Project Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality. A risk may have one or more causes and if it occurs may have one or more impacts. A cause may be given or potential requirement, assumption, constraint or condition that creates the possibility of negative or positive outcomes. Risk conditions may include aspects of the project under execution or the organization's environment that contribute to project risk, such as immature project management practices, lack of integrated management systems, concurrent multiple projects or dependency on external participants who are outside the project's direct control. Project risk has its origins in the uncertainty present in all projects.

As per Tom Kendrick (2015), the three categories of project risk are controllable known risk, uncontrollable known risk and unknown risk. Many other literatures have categorized as controllable known risk and uncontrollable known risk (P Kodukula, 2014; E M Farahani & M H Nakhaei, 2009; S.M. Renuka, C. Umarani, S. Kamal, 2014; Sedat Han, 2005).

Known risks (controllable known risks) are those that have been identified and analyzed, making it possible to plan responses for those risks. Known risks that

cannot be managed proactively (uncontrollable known risks), should be assigned a contingency reserve.

Unknown risks cannot be managed proactively and therefore may be assigned a management reserve. [Tom Kendrick, 2015] A negative project risk that has occurred is considered an issue. Individual project risks are different from overall project risk. Overall project risk represents the effect of uncertainty on the project as a whole. It is more than the sum of individual risks within a project, since it includes all sources of project uncertainty. It represents the exposure of stakeholders to the implications of variations in project outcome, both positive and negative. "Risk" in literature as summarized by Rasool Mehdizadehn (2012) is listed in below Table 2.1.

Table 2.1 - Two different definitions of "Risk" in literature Rasool Mehdizadehn (2012)

Risk : the measure of consequences	**Risk: the source event**
ISO guide draft 73 (2009) Effect of uncertainty on project objectives. An effect is a deviation from the expected positive and/or negative objectives.	Chapman (2001) an event, which should it occur, would have a positive or negative effect on the achievement of a project's objectives
WSDOT (2010) The combination of the probability of an uncertain event and its consequences. A positive consequence presents an opportunity; a negative consequence poses a threat.	PMI (2008) (PMBOK) project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives.
ITIG (2006) Risk is a function of the consequence/severity of a hazard and the likelihood of occurrence of the hazard.	Del Cano and Cruz (2002) an uncertain event that, if it occurs, has a positive (opportunities) or negative (threats) on a project objective.
Bourdeau et al. (2003) Expectancy of undesirable results (but the occurrence of positive results can be integrated).	Baloi and Price (2003) The likelihood of a detrimental event occurring to the project.
Raftery (1999) Exposure to the possibility of economic and financial loss or gain, physical damage or injury, or delay as a consequence of the uncertainty associated with pursuing a particular course of action.	Al-bahar and Crandall (1990) The exposure to the chance of occurrences of events adversely or favorably affecting project objectives as a consequence of uncertainty.

2.1.5 Contingency -

AACE International, the Association for the Advancement of Cost Engineering, has defined contingency as "Contingency is an amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience" [https://en.wikipedia.org/wiki/Cost_contingency]. Oxford dictionary states that, "Contingency is a future event or circumstances, which is possible but cannot be predicted with certainty".

As per PMBoK® Guide (2013), cost estimates may include contingency reserves which are sometimes called as contingency allowances to account for cost uncertainty. Contingency reserves are the budget within the cost baseline that is allocated for identified risks, which are accepted and for which contingency or mitigating responses are developed. Contingency reserves are often viewed as the part of the budget intended to address the "known-unknowns" that can affect a project. Contingency reserves can be provided for a specific activity, for the whole project or both. The contingency reserve may be a percentage of the estimated cost, a fixed number or may be developed by using quantitative analysis methods. In the course of the project, as more precise information about the project becomes available, the contingency reserve may be used, reduced or eliminated. Contingency should be clearly identified in cost documentation. Contingency reserves are part of the cost baseline and the overall funding requirements for the project. The Fig. 2.3 below illustrates the various components of a project budget including the contingency reserve.

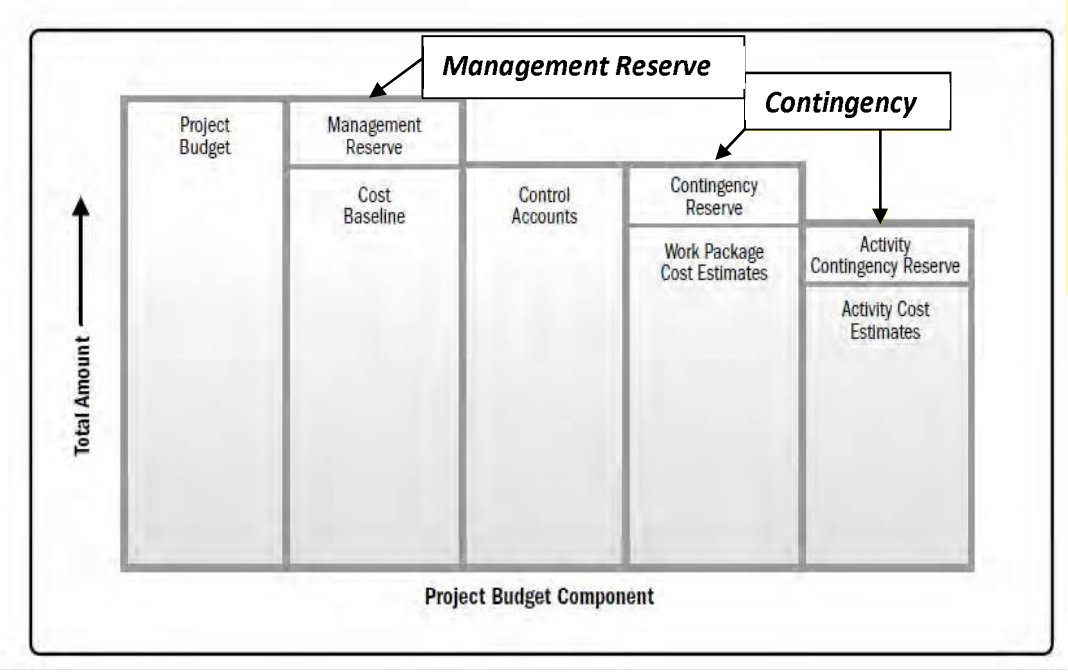

Fig. 2.3 Various Components of Project Budget

2.1.6 Stakeholders -

As per PMBoK® Guide (2013), A stakeholder is an individual, group or organization who may affect, be affected by or perceive itself to be affected by a decision, activity or outcome of a project. Stakeholders may be actively involved in the project or have interests that may be positively or negatively affected by the performance or completion of the project. Different stakeholders may have competing expectations that might create conflicts within the project. Stakeholders may also exert influence over the project, its deliverables and the project team in order to achieve a set of outcomes that satisfy strategic business objectives or other needs.

Project stakeholders include all members of the project team as well as all interested entities that are internal or external to the organization. The project manager should manage the influence of various stakeholders as shown in Fig. 2.4 in relation to the project requirements to ensure successful outcome.

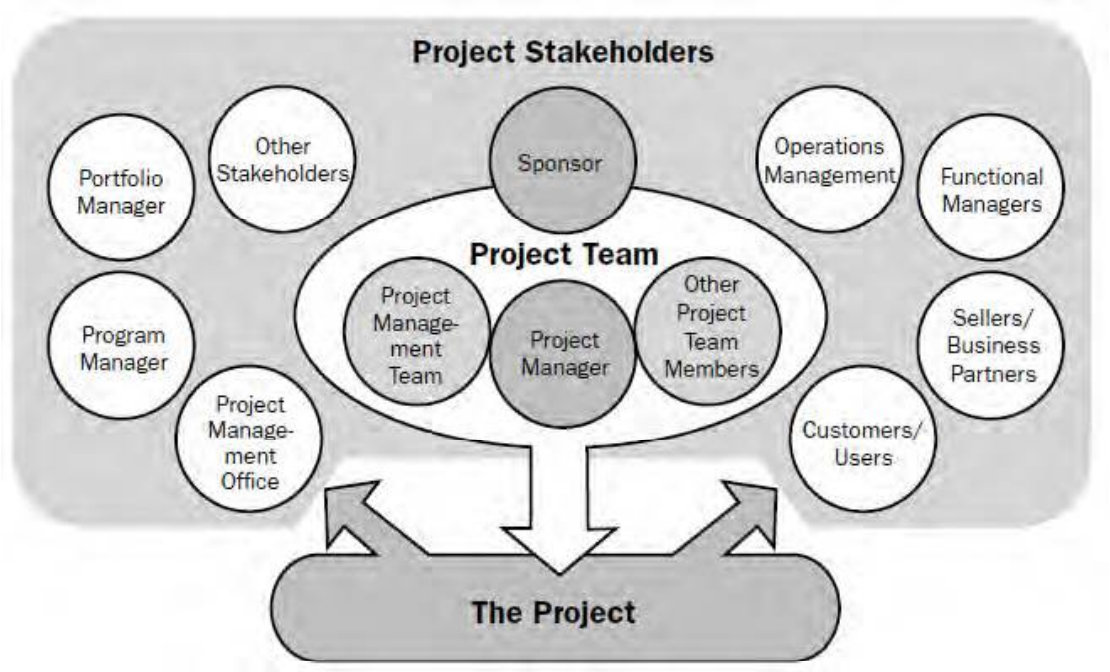

Fig. 2.4 The relationship between Stakeholders and the Project

The above illustrates the interactive relationship between the project, the project team and various project stakeholders in general who are impacted by the project.

2.1.7 Perception -

Perception is defined as "the process by which an organism detects and interprets information from the external world by means of the sensory receptors" (collinsdictionary.com) and also as "the act or faculty of perceiving, or apprehending by means of the senses or of the mind; cognition; understanding" (dictionary.com). Perception is also defined as a "process by which individuals shape and interpret their sensory impressions in order to give meaning to a situation. The situation may be the same, but the interpretation of that situation by any two individuals may differ, sometimes widely" (Walker, 2012).

2.2 Detailed Literature Review

The Business problem refers to two criteria for a detailed literature review, which are Project Governance and Project Risk Management.

As per PMBoK® Guide (2013), Project Governance is described as 'the alignment of the project with stakeholders' needs or objectives'. Project governance enables organizations to consistently manage projects and maximize the value of project outcome and align the project with business strategy, for which Project Management to be applied by way of application of knowledge, skills, tools and techniques to project activities to meet the project objectives.

Managing a project typically includes, but not limited to 'Balancing the competing project constraints such as Scope, Quality, Schedule (Time), Budget (Cost), Resources and Risk' PMBoK® Guide (2013), which is depicted in a pictorial form in Fig. 2.5.

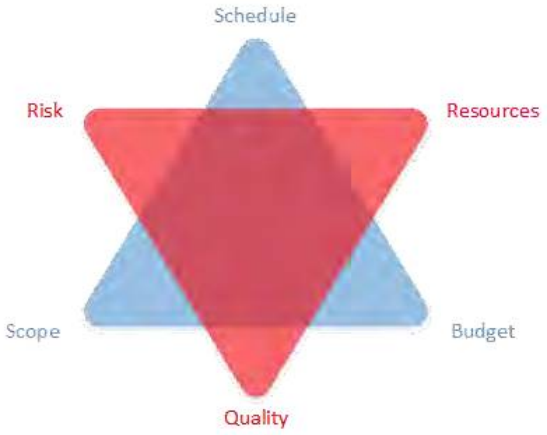

Fig. 2.5 – Six Project Constraints (Source: PMBoK® Guide (2013))

The relationship among these factors is such that if any one factor changes, at least one other factor is likely to be affected. For example, if the schedule is shortened, often the budget needs to be increased to add addition resources to complete the same amount of work in less time. If a budget increase is not possible, the scope or quality may be reduced to deliver a product in less time for

the same budget. Project stakeholders may have differing ideas as to which factors are the most important, creating an even greater challenge. Changing the project requirements may create additional risks. The project team must be able to assess the situation and balance the demands in order to deliver a successful project (Rahschulte, T. J. & Milhauser, K. (2010)).

As depicted in the Fig. 2.5, the six project constraints include three constraints of Scope, Schedule & Budget, which are and were considered from the time of project management inception. Tsuda (2006) noted that "Scope, Schedule, Cost—they are classic". The other three constraints, i.e. Quality, Resource and Risk, which are subsequently included as part of the constraints. However, acceptability of them as a separate constraint while evaluating a project and its performance is being a topic of discussion by various project management experts; while various suggestions of grouping the constraints are also been talked for a quite long time.

The following were also been commented by Tsuda (2006) as detailed below, on the six constrains as stated in PMBoK® Guide (2013) which provides a glimpse of the project management world.

"I've heard many practitioners call the Triple Constraints (TC) obsolete or, at least, inadequate. Many PMs point out that we need to factor in quality. I don't have a problem with this one. On the other hand, I didn't know that Scope didn't include quality. For me, Scope never meant just a list of things or features. Without a set of acceptance/quality criteria, Scope would be too fuzzy. So, with that proviso, I think Scope is still a good one.

What about Cost? I've had a lot of PMs tell me with an honest expression that they don't think about costs because "they have to do it with what they have so it's all fixed cost and so it doesn't matter anyway". Maybe some of us forget that cost is really a measure of resources. For a lot of my projects, we were more focused on the hours/days of resources needed than on the $$. Even in a "fixed

cost" environment, we will compete for resources – especially critical (in the sense of scarce) resources. If you don't usually deal with the $ costs, let's use Resources as the constraint. So, I think Resources is OK.

No one seems to question the importance of Schedule – except to say that the Schedule is always too short. Of course, if it is always too short, what does that say about either our estimation skills, or our assumptions about reality… but that's for another time.

Another question is "Where're the risks?" Clearly, risks are a critical consideration.

So, I'm still a fan of the Triple Constraints. Except now it's the Quadruple Tetrahedron? I think Triple Constraints + Risk might be better."

Rahschulte, T. J. & Milhauser, K. (2010) stated that 'Most people engaged with the Project Management Institute are familiar with the triple "constraints" and their relationship to one another. These efficiency-based measures are often touted as success measures and incorrectly so. Experienced project managers know that there are a variety of constraints that must be taken into consideration if long-term organizational viability is to be supported by "successful" projects. While there is much that has been written about the triple constraints little research has been conducted to determine trends associated with the change project managers must make to address the (larger) needs of organizations today. Success, as measured by the triple constraints, of a single project does not ensure success for the organization at large. Effective project managers must work to deliver their projects within the parameters of scope, schedule, and cost, but importantly do so by success measures of organizational effectiveness and increasing its adaptability to change'.

However, Nahod, M.M. (2012) stated and affirms again that 'Scope management is one of the angles of the project management triangle, which means that together

with time and cost it represents one of the most significant constraints and focuses on the project'.

Consequent to the above discussions and comments, the triple constraint of Scope, Time and Cost are taken up as first step of detailed literature review while the Risk Management is taken up upon formalizing the triple constraints; considering that the Quality is part of the Scope constraint and the Resource is included as part of the Cost constraint.

2.2.1 Scope as a Project Constraint

As per PMBoK® Guide (2013), Project Scope Management includes the processes required to ensure that the project includes all the work required and only the work required, to complete the project successfully. Managing the project scope is primarily concerned with defining and controlling what is and is not included in the project. Defining project scope using input from all stakeholders is a vital task that needs to be adequately carried out at the early stage. The purpose of project definition is to provide adequate information that is needed to identify the work to be performed in order to avoid major changes that may negatively affect project performance (Gibson *et al.*, 2006).

Project success in terms of project performance cannot be achieved without a systematically and professionally appointed system for managing the scope (Nahod, M.M. (2012)), which can be achieved by identifying the variance to the scope while taking control of them. Osama Hussain (2012) defines the project scope control, as it is not unusual for construction projects to witness a major scope changes, however, scope change and scope creep are completely different. "Scope Change is an official decision made by the project manager and the client to change a feature 'X' to expand or reduce its functionality. Generally, scope change involves making adjustments to the cost, budget, other features, or the timeline. On the other hand "Scope Creep is generally referred to as the phenomenon where the original project scope to build a product with feature 'X',

'Y', and 'Z' slowly grows outside of the scope originally defined in the statement of work. Scope creep refers to scope change which happens slowly and unofficially, without changing due dates or otherwise making adjustments to the budget." Another definition for scope creep is that "the tendency for a project to extend beyond its initial boundaries"; while some project manager accept the fact that scope creep is a must and try to live with it and reduce its direct effects, most project manager are struggling to fight scope creep". This is reflected in PMBoK® Guide (2013) as 'Controlling the project scope ensures all requested changes and recommended corrective or preventive actions are processed through the Perform Integrated Change Control process. Control scope is also used to manage the actual changes when they occur and is integrated with other control processes. The uncontrolled expansion to product or project scope without adjustment to time, cost and resources is referred to as scope creep. Change is inevitable; therefore some type of change control process is mandatory for every project'.

Furthermore, from the stakeholders' perspective, differences in perception of what was meant when the client specified the project deliverables can lead to vastly different understandings of what exactly is required. Not only must the scope be agreed up front, it needs to be constantly monitored throughout the project to avoid it changing in a way that will break the budget or timescale, or will contravene stakeholder's expectations of the final deliverables. This is usually referred to as scope creep. (Paul Newton, 2015) (Virginia A. Greiman, 2013).

Since most engineering and construction projects are complex project efforts which are performed on a fast-tracked design and implementation schedule, poor project scope definition, change control, and management performance leads projects into budget overruns and late finishes. The analysis result of survey data by Neslihan Alp, Banning Stack (2012) stated that '78% of the population responded that unauthorized scope creep results in project cost overruns'. Henry

Alinaitwe1, Ruth Apolot and Dan Tindiwensi (2013) had stated that 'Eighty-four per cent of the cost overruns were caused by change in work scopes' based on the case study carried out and also suggested that 'Stakeholders in the construction industry are advised to minimise changes in work scopes, as this has the greatest impact on cost and time overruns'.

Modification to the agreed upon scope are considered as inherent in the nature of projects because of their complexity and the inevitable appearance of unforeseen problems (Ertel, 2000). The evidence shows that scope changes have a significant impact on the cost of projects leading to cost overrun. Chick (1999) showed that the a change that occurs later in a project will have more effect on the project's cost, and also mentioned a possible effect on project schedule. Kauffmann et al. (2002) used the earned value method in quantifying scope change 'magnitude' for cost adjustments. Barry et al. (2002) showed a correlation between software project duration and effort. However, a thorough investigation of the effect of scope changes on project duration has not yet been conducted (Moshe Ayal, 2005)

While adequate front-end project planning, with clear project scope definition, can alleviate the potential for cost overrun; inadequate project planning and poor scope definition can lead to expensive changes, delays, rework, cost overruns, schedule overruns, and project failure. Changes often reflect the uncertainties that occur during the early stages of the project (Assaf & Al-Hejji, 2006). However, it is irrational to get stakeholders' opinions about the project outcome after the completion, when their involvement is limited. Incomplete project definition can also occur, when the input of one or more stakeholder is intentionally or unintentionally omitted (Sharma & Lutchman, 2006). Hence any failure to consider and clarify stakeholders' expectations and concerns at early stage in the project can result in extraordinary risks being ignored and may lead to difficulties in running the project, and hence poor performance (Atkinson et al., 2006), at the end. This match with the well-known saying that 'Projects don't fail at the end,

they fail at the beginning. Therefore, project scope definition is critical for enhancing satisfaction of stakeholders as well as successful implementation of construction project (Heywood & Smith, 2006; Dr. Dan Patterson, 2006).

Changes in project activities provoke the changes in project cost, time and quality of the project, be it a scope change or scope creep. One of the he most common causes of change orders is 'change of project scope by owner (additional-enhancement)', and few of the most common effects of change order are increasing the project's cost, increasing the duration of individual activities & delaying in completion schedule (Alia Alaryan, Emadelbeltagi, Ashraf Elshahat and Mahmoud Dawood (2014)), this being a positive impact to the project by means of variation to the contract, there is no impact to the contractor's budget or schedule. When activities are changed without changing project cost or time, being a scope creep increases the risk of not completing the project on time as well risk. However, when the project cost and time are increased considering them as a scope change, it gives the opportunity to provide a quality output. (Fabiola Nibyiza, 2015).

This summaries that , if the scope creep happens it results in unacceptable risk (Paul Newton, 2015), be it known or unknown, to the project by means of cost overrun and schedule delays; the same shall be treated by means of Project Risk Management, to cope with such events and bring the project under control.

2.2.2 Cost as a Project Constraint

Cost is among the major considerations throughout the project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success (Azhar et al., 2008; A.S. Ali, S.N. Kamaruzzaman 2010). Despite its proven importance, it is not uncommon to see a construction project failing to achieve its objectives within the specified cost (Dinesh Bhatia, M. R. Apte, 2016).

As per PMBoK® Guide (2013), Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing and controlling cost so that the project can be completed within the approved budget. The sequence of the cost management process starts with Plan, then estimating, budgeting and finally controlling. Estimate cost is the process of developing an approximation of the monetary resource needed to complete project activities & Determine Budget is the process of aggregating the estimated cost of individual activities or work packages to establish an authorized cost baseline.

As the literature review of the Cost in the earlier section and the details as stated above, it has been noted that the activity and / or Work package cost estimated are approximation only, above which a 'Contingency reserve' which is to take care of the known risks, is added upon to finalize the Cost Baseline which is used for the project. However, apart from this Contingency reserve, 'Management reserves' which is to take care of unknown risks are further added on to the cost baseline to reach at the project Budget.

While on specific review of the improper cost estimation, it has been confirmed by Ahiaga-Dagbui, D, Smith, S D, Love, P E D and Ackermann, F (2015) who state that 'It is no surprise that the same factors seem to come top of the list most of the time in these surveys - poor estimation (A.S. Ali, S.N. Kamaruzzaman 2010), poor project management, inadequate risk management, unexpected ground conditions, scope changes or material price changes. These are the usual suspects and they come to mind very readily for respondents. It will take more thoughtful research design, perhaps research conducted within the context of a particular project, to be able to partly circumvent these default responses that have yet to help mitigate or contain cost overrun in construction'.

While considering that the cost estimation is only an approximation, needful allowance has to be included to arrive at a cost baseline. This is achieved by reserve analysis (PMBoK® Guide, 2013) Contingency reserves as detailed in 2.1.5, is 'the budget within the cost baseline that is allocated for identified risks

also known as "known-unknowns", which are accepted and for which contingent or mitigating responses are developed' & Management reserves which is 'an amount of the project budget withheld for management control purpose and are reserved for unforeseen work that is within scope of the project and are intended to address the "unknown-unknowns" that can affect the project'.

Considering that there are blemishes in the cost estimates, being an approximation, while including a contingency reserve based on an unknown factor of risk, the details are being discussed separately in the risk management process, which duly impact the cost baselines and leads to cost overrun. Meanwhile, the second part of the reserve analysis, i.e. management reserve is purely based on the perception of the management team to conclude on the overall project budget.

As seen from the above, Cost overrun has been attributed to several sources including scope creep and rework (Love et al. 2005), various risk events, etc. It further validates that the triple constraints as considered in this paper is interlinked with each other and have an impact on one another in the event of any change in one parameter of the project constraint.

2.2.3 Time as a Project Constraint

As per PMBoK® Guide (2013), Project Time Management includes the processes involved in planning, developing, managing, estimating and controlling project schedule. The aim of the project time management or schedule management is to achieve the project completion as per the contract milestone dates and or client requirements specified and documented. There are various methods to estimate the project time based on the scope, while considering other project constraints while arriving at a schedule baseline.

As per Chidambaram Ramanathan, SP Narayanan and Arazi B Idrus (2012), the construction process can be divided into three important phases, i.e. project conception, project design and project construction. Usually, the vast majority of

project delays occur during the 'construction' phase, where many unforeseen factors are always involved (Chan and Kumaraswamy, 1997). In construction, delay could be defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for the delivery of a project. It is a project slipping over its planned schedule, and this is a common problem in construction projects.

Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it rarely happens that a project is completed within the specified time and within budget. Delay is defined as the time overrun either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project (Sadi A. Assaf & Sadiq Al-Hejji, 2006)); while it is also defined as an act or event which extends required time to perform or complete work of the contract manifests itself as additional days of work (Zack, 2003). To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. As stated by Keane and Caletka (2008) the most significant unanticipated costs on many construction projects are the financial impacts associated with delay and disruption to the works.

Delays are usually accompanied by cost overruns. These have a debilitating effect on contractors and consultants in terms of growth in adversarial relationships, mistrust, litigation, arbitration, cash-flow problems, and a general feeling of trepidation towards other stakeholders (Ahmed et al., 2002). When projects are delayed, they are either extended or accelerated and therefore, incur additional cost. The normal practices usually allow a percentage of the project cost as a

contingency allowance in the contract price and this allowance is usually based on judgment (Akinsola, 1996). Therefore, delays in construction projects cause dissatisfaction to all parties involved and the main role of the project manager is to make sure that projects are completed within the budgeted time and cost. Several studies have been undertaken on factors causing delays and cost overruns, and affecting quality, safety and productivity, etc. and specific problems in special types of projects. These studies usually focus on specific aspects of project performance.

Delays have an adverse impact on project success in terms of time, cost, quality and safety (Association of Project Managers 2006, Arditi and Pattanakitchamroon 2006). Construction stakeholders have to think about the nature of these problems by more analysis and studies (Theodore et al. 2009). The effects of construction delays, however, are not confined to construction companies, but can influence the overall economy of a country like the UAE, where construction plays a major role in its development and contributes 14% to the GDP (Motaleb and Kishk, 2010).

2.2.4 Project Risk Management

While on overview, many literatures shows that, the risk management process in construction projects is full of deficiencies, affect its effectiveness being part of project management function, cumulatively on the project performance. Since the Industrial Revolution time, risk management in construction projects has generally been approached using a cutback approach that produces poor results and limits the value of project management. Risk is handled through the application of contingencies (cost) and schedule floats (time) that are not determined based on a comprehensive analysis of the risks that can affect a particular project, and that in many cases are clearly insufficient to cover the consequences of risks that do occur during the project execution, in most of the cases resulting in the costs overrun and late completion of the project (A F Serpella, X Ferrada, R Howard and L Rubio, 2014).

To make an effective and efficient risk management it is necessary to have a proper and systematic methodology and more significantly the theoretical knowledge and practical experience of various types. Usually, it requires expertise to identify the unforeseen events that may occur during the execution of a project, on the actions that work well for its mitigation when such events occurs, even though one may not be an expert in complete list of events, however shall be able to cover most of them, based on inputs. The absence of an effective project risk management function has several negative consequences for participants in a project due to lack of preventive action against the risks and uncertainty that any project presents. Risk analysis and management in construction depend mainly on intuition, judgement and experience and that formal risk analysis and management techniques are rarely used due to a lack of knowledge and to doubts on the suitability of these techniques for construction industry activities (A S Akintoye and M J MacLeod, 1997). This may lead to delays, significant increases in costs and contractual disputes, among others.

Construction projects are characterized as very complex, always unique projects, where risks raise from a number of different sources. Construction Project management involves numerous stakeholders: end users; promoters; construction companies; consultants; government bodies, subcontractors, suppliers, and other entities (Perez et al., 2010, Rasool Mehdizadeh, 2012). These projects require continuous decision making due to numerous sources of risk, many of which are not under the direct control of project participants. Intensive research and development has been done in the area of project risk management, which is widely recognized as a critical area in the field of project management (Anna Klemetti, 2006).

In order to understand the problems stated above, a detailed theoretical review was done on project risk management and the outcome of the review is given in subsequent section.

As per Rita M (2010) A Project Risk Management process is a systematic and proactive approach of taking control of the project undertaken by understanding or reducing the uncertainties (unknowns). Many tailored risk management components can be applied to projects of various durations and budgets. However, Risk Management primarily involves minimizing the consequences of adverse events as well as minimizing the results of positive events and hence Risk can be good or bad events which results into opportunities or threats respectively. Various Project Risk Management processes classification is available in literatures perceived based on the understanding, requirement and expertise of the authors.

The Risk Management can be defined as a process to identify, analyze and respond to project risks (Ana, Alvaro and Rafaela (2014)) in order to enhance opportunities and reduce threats affecting the objectives of the project ((Azadeh Sohrabiejad and Mehdi Rahimi (2015)) while it is stated as structured approach which includes identification of risks, their classification, analysis, deciding upon risk response strategies and monitoring as well as controlling of the implemented risk response strategies (Walke et al., 2011).

Fig. 2.6 below provides the overview of Project Risk Management comprising of six process, viz. Plan Risk Management, Identify Risks, Perform Qualitative Risk Analysis, Perform Quantitative Risk Analysis, Plan Risk Responses and Control Risks, as detailed in PMBOK® Guide, (2013).

Risk identification is common in all the processes. The potential risks associated with a project are identified during this step. Various checklists and risk breakdown structures were suggested in many literatures to identify potential risks which have probability of having adverse effect on project objectives.

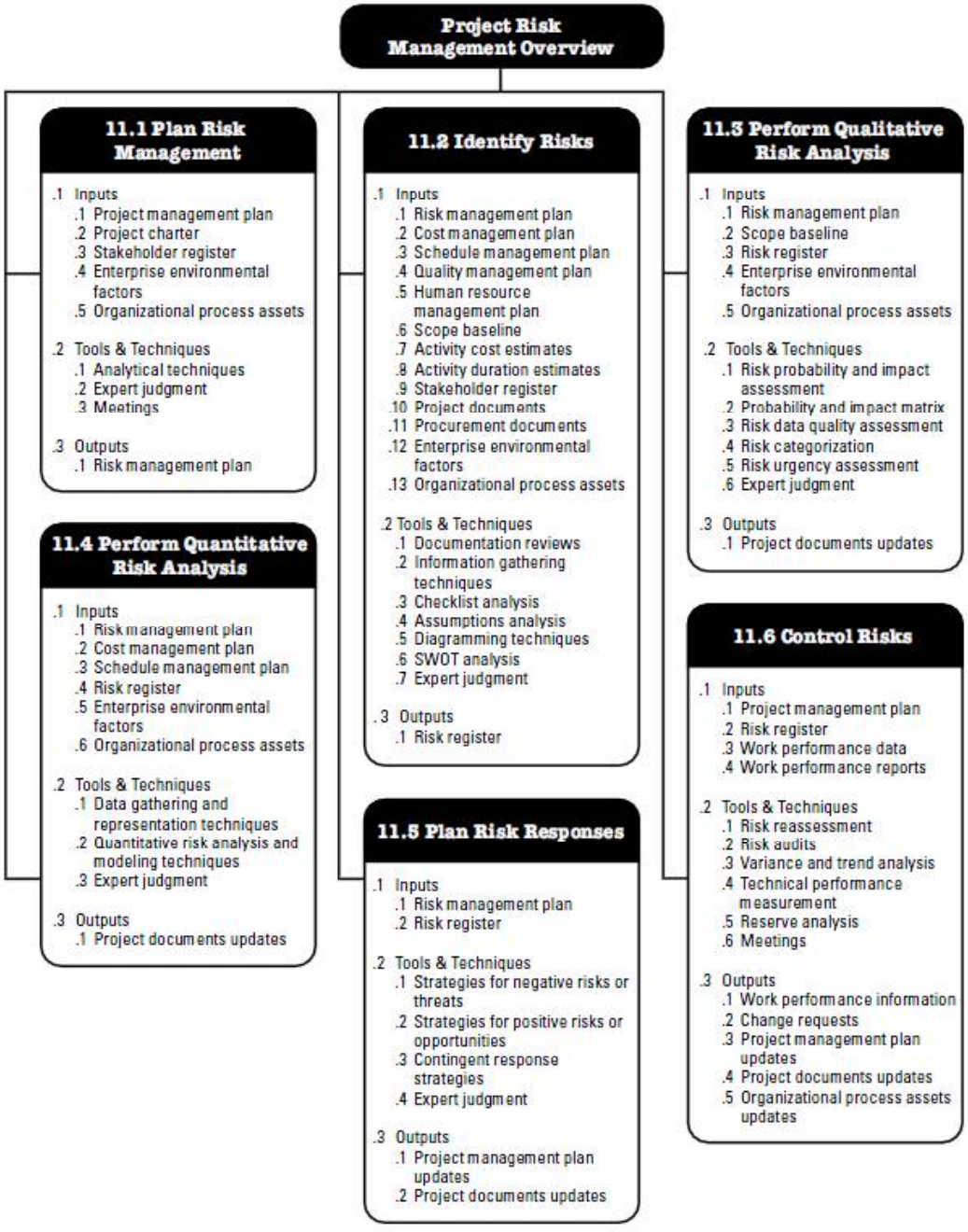

Fig. 2.6 – Project Risk Management Overview (Source: PMBoK® Guide (2013))

Project Management Institute's PMBOK® Guide, (2013) details the general process including the Tools and Techniques for risk identification. As per Rita M (2010), Risk identification starts in project initiating stage itself. Furthermore it is addressed in detail during the project planning stage and continues during project

executing, monitoring and controlling stages since changes are made and issues are discovered throughout. Risk Variables identified during the above process are listed out and are classified on broader basis for grouping and further analysis.

There are many risks events that adversely affect the timely completion, cost, quality and scope of construction projects. Hence it is important to have understanding about risks that occur during planning, execution and maintenance of construction projects, their probability of occurrence as well as consequences of their occurrence and probability of consequences (Walke et al., 2011). Accordingly, a detailed review of literature has been carried out for identifying various Risks and their categorization as identified by the author of the literature, related to the construction projects.

Categorization of the risks was done by various researchers based on their experience and their study requirements, such as Assaf & Hejji (2005) had nine major categories (i.e. Project, Owner, Contractor, Consultant, Design, Materials, Equipment, Labour and External) which are related with the risk causing delay in large construction projects in Saudi Arabia; while Mustafa & Bahair (1991) had categorized their construction project risk under six groups (i.e. Acts of God, Pysical, Financial & Economic, Political & Environmental, Design and Job Site-Related) and Motaleb & Kishk (2010) had categorized their risk related to construction delays in UAE under 5 sets (i.e. Contractor, Consultant, Project Managers, Clients, Financial and other unforeseen factors). A simplified grouping of risk was done by Faridi & El-Sayegh (2006) as Contractor and Client related risk causing delay in the UAE construction industry and it is almost seconded by Ren, Atout & Jones (2008) as Client, Contractor and Consultant related, for their root cause of construction project delays in Dubai.

However, a critical review of the construction delays causing risk on Time and Cost was done by Ramanathan et al (2012) where a total of 18 categories were identified and grouped based on various research articles across the globe related to the construction projects, whereas, Sohrabinejad & Rahimi (2015) had

classified as 12 categories. Based on the above and the references and categorization made by various researchers, a re-categorization was made resulting into 16 categories which are listed below in Table 2.2:

Table 2.2 - List of Categories for grouping various risk identified from research articles

1	POLITICAL
2	LEGAL
3	SOCIAL
4	NATURAL
5	DESIGN
6	PROJECT / CONST.
7	FINANCIAL / ECONOMIC
8	MANAGEMENT

9	QUALITY
10	SAFETY
11	CONSULTANT
12	CONTRACTOR
13	CLIENT
14	LABOUR / EQUIPMENT
15	MATERIALS
16	EXTERNAL

The Risk variables as identified by various research articles and the researchers were grouped against these 16 categories with their reference to the respective article are shown in Appendix A1.

The primary goal of tracking scope, cost, and time throughout the construction process is to facilitate the early detection of problem activities (i.e. risk) that are running over-budget or falling behind scheduled progress. Current practice tracks this information using separate processes, which leads to inconsistencies between the information and inaccuracies when determining the cost and schedule status (S. Staub and M. Fischer, 1999).

While the literature review of the triple constraint + risk has concluded without providing a firm solution on how to proceed with, utilizing the suggestions or findings to solve the problem under study, a group of sub-themes are emerging out of the review of main themes of Scope, Cost, Time and Risk. The scope creep which negatively impacts the project; cost overrun beyond the cost baseline, and schedule delays, are due to lack of proper management of these constraints, which

are due to either 'known risks' or 'unknown risks' occurred during the course of the construction project. The generic lists of risks are identified from various literatures during the risk management review, which are also related to the triple constraints. This augment a requirement for a detailed literature review on how to plan a response to treat these risks.

2.2.5 Plan Risk Response

Plan Risk Response is the process of developing options and actions to enhance opportunities and to reduce threats to the project objective. The key benefit of this process is that it addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed (PMBoK® Guide, 2013).

Risk treatment involves developing a range of options for mitigating the risk, assessing those options, and then preparing and implementing action plans. The highest rated risks should be addressed as a matter of urgency. Risk treatment plans may involve the redesign of existing controls, introduction of new controls or monitoring of existing controls. Low impact risks may require periodic monitoring while major risks are likely to require more intense management focus. Selecting the most appropriate risk treatment means balancing the costs of implementing each activity against the benefits derived. In general, the cost of managing the risks needs to be commensurate with the benefits obtained. When making cost versus benefit judgements the wider context should also be taken into account.

However, a kind of situation has arisen from the literature review, that the risks that impact the project constraints are either due to known risk or unknown risk. The treatment of the known risk (also called as known-unknowns) is by utilizing the contingency reserve in the cost baseline, based on the strategy being utilized for the risk. However, the treatment of the unknown risk (also called as unknown-unknowns) is possible only by utilizing the Management reserve which

is available in the Budget, without any strategy for treatment of such event. Hence further literature review is done towards the known risks.

There are four strategies for responding to negative risks: Avoid, Transfer, Mitigate and Accept (PMBoK® Guide, 2013; Rita Mulcahy, 2010). The details of each strategy are listed below:

Avoid – Risk avoidance is a risk response strategy whereby the project team acts to eliminate the threat or protect the project from its impact. It usually involves changing the project management plan to eliminate the threat entirely.

Transfer – Risk transference is a risk response strategy, whereby the project team shifts the impact of a threat to a third party, together with ownership of the response. Transferring the risk simply gives another party responsibility for its management – it does not eliminate it.

Mitigate – Risk mitigation is a risk response strategy whereby the project team acts to reduce the probability of occurrence or impact of a risk. It implies a reduction in the probability and / or impact or an adverse risk to be within acceptable threshold limits. Taking early action to reduce the probability and / or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred.

Accept – Risk acceptance is a risk response strategy where the project team decides to acknowledge the risk and not take any action unless the risk occurs. This strategy is adopted where it is not possible or cost-effective to address a specific risk in any other way. This strategy indicates that the project team has decided not to change the project management plan to deal with a risk, or is unable to identify any other suitable response strategy.

Selection of the most appropriate risk treatment approach should be developed in consultation with relevant stakeholders and process owners.

Avoiding risk will not eliminate them; it is better to face it, analyze it, and have proper action ready in case it takes place (Mohamed K. Khedr – 2006). As noted risk has impact on all project outcomes. The major impacts as noted are the Project Cost and Schedule. Schedule delay can, to the extent be mitigated by means of acceleration, fast tracking and crashing. However, cost overrun containment needs a continuous control from the commencement of the project until its closure. Project cost is one of the most important criteria with regards to project success but is by far the hardest to control. Cost uncertainty in rates, availability and usage can all contribute to cost overruns. (Dr. Dan Patterson, 2006). Cost area of risk management of the construction projects are identified for further research in many of the literatures (Qaqish Tamer Ayoub, 2011; Ekaterina Osipova, 2008; Dan BENȚA, 2011, Anna Klemetti, 2006; David James Bryde and Jurgen Marc Volm, 2009; Hans Thamhain, 2013).

Accordingly, it shall be the focus to identify the risk pertaining to the area of study in order to take proper action if it takes place, while analyzing the appropriate strategy that suits the risk, while further review of the cost area of risk management, i.e. contingency reserve for the identified risk has to be taken up.

2.2.6 Literature Review on Contingency

Contingency is probably the most misunderstood; misinterpreted and misapplied word in project execution. Cost contingency has been broadly defined as "The amount of funds, budget or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization. (Patrascu, 1988). The literature review of the concept of project cost contingency identified four key attributes; it is (i) a reserve of money that (ii) caters for risk within projects, (iii) indicating the organization's final total financial commitment, and (iv) affecting stakeholders' behavior within projects (Baccarini D, 2006).

As per Dr. Dan Patterson (2006), successfully controlling project cost is a science unto itself and a highly sought after project management skill. Add to this the

complexity of risk and uncertainty and the situation only becomes even more involved. Miscalculate cost estimates at the bidding phase will result into the risk of entering into a loss-making venture. Mismanage cost overruns due to uncertainty during the execution of the project will cause "the best laid plans fall to the wayside". The risk related to cost is taken care by proper contingency allocation for the project. However, objectively determining how much to set aside in the form of contingency within a project is not easy, but can be done by proper Risk Analysis.

Afetornu, C and Edum-Fotwe, F T (2005) states that, "Project contingency estimation is based on percent allocation of the total project budget and is often established by rule of thumb" which is acknowledged by Paul Terna Gbahabo and Oluseye Samuel Ajuwon (2017) that "Contingency plans are not based on any estimation technique but rather on a "rule of thumb" calculation. They are usually an additional cost allowance on the project by a certain percentage above the base cost estimate based on the experience of the project cost engineer (European Commission DG XVI, 1998). The industry average for contingency risk allowance in many jurisdictions is a 10% figure over the gross costs. However, it is not always suitable to allocate fixed contingency allowance estimate for the entire duration of a project but rather allocated in phases as each stage comes with its specific risks and can be eliminated has they manifest". The use of contingency in the construction industry provides a tacit acknowledgement of the perennial problem of cost overruns in the delivery of projects. The effects of cost overruns are adverse consequences such as projects becoming non- viable, or in extreme cases being abandoned. The economic impact of cost overrun includes delays in payback for investment by the client and occupancy of the facility or development by the end-user. A critical review of the cost determining factors in infrastructure procurement would help to ascertain which of the costs is most likely to overrun. This in turn would enable cost engineers and project sponsors to arrive at a more correct contingency estimate.

Taylor (2005) found some gaps between theory and practice in risk monitoring and contingency handling in the implementation stage and posited that this may be caused by a lack of understanding of the theory on the part of the managers; while David James Bryde And Jurgen Marc Volm (2009) stated that further research could focus on other project participants to identify their perceptions of project risk and the extent to which practice aligns with theory and Hans Thamhain (2013) recommend for testing of impact of contingencies on project performance and organizational conditions, that are most conducive for risk management.

Very few literatures are found to detail the Contingency Calculation, Modelling or Methods. Dr. Khaled Nassar (2002) provided details on Probabilistic concepts for Cost Contingency Analysis for Construction Projects using Spreadsheets; while Gabriel A. Barraza (2011) states the details on Probabilistic Estimation and Allocation of Project Time Contingency and Alfred E. Thal Jr.; Jason J. Cook; and Edward D. White III (2010) had utilized the Multiple linear regression to predict the contingency amount for significant variables that may influence or serve as indicators of potential cost overruns.

Determining the actual contingency amount can be accomplished by either expert opinion or statistical methods. Statistical methods are very useful especially when previous cost history has been collected and good record keeping is being followed. Statistical techniques used to analyze contingency can range from Monte Carlo simulations to regression and variance analysis. Expert opinion is usually a prudent choice even when considering statistical methods, to augment the quantitative approach and check for logicality and consistency. Dr. Khaled Nassar (2002). Baccarini D (2006) had made a detailed review of various literatures and listed out various estimating techniques for calculating project cost contingency, as given in Table 2.3:

Table 2.3 - Various Estimating Techniquest for Calculating Project Cost Contingency (Source : Baccarini D, 2006)

Sl No	Estimating techniques for calculating project Cost Contingency	Author Reference
1	Traditional percentage	Ahmad 1992, Moselhi 1997
2	Method of Moments	Diekmann 1983; Moselhi, 1997, Yeo 1990
3	Monte Carlo Simulation	Lorance & Wendling 1999, Clark 2001
4	Factor Rating	Hackney 1985, Oberlander & Trost 2001
5	Individual risks – expected value	Mak, Wong & Picken 1998; 2000
6	Range Estimating	Range Estimating (Curran 1989)
7	Regression Analysis	Merrow & Yarossi 1990; Aibinu & Jagboro 2002
8	Artificial Neural Networks	Chen & Hartman 2000; Williams 2003
9	Fuzzy Sets	Paek, Lee, & Ock, 1993
10	Influence Diagrams	Diekmann & Featherman 1998
11	Theory of Constraints	Leach 2003
12	Analytical Hierarchy Process	Dey, Tabucanon & Ogunlana 1994

Few of the above listed techniques are discussed below:

Traditional Percentage: Traditionally cost estimates are deterministic i.e. point estimates for each cost element based on their most likely value (Mak et al 1998). Contingencies are often calculated as an across-the-board percentage addition on the base estimate, typically derived from intuition, past experience and historical data. Research indicates that this is the most common approach for estimating project cost contingency (Baccarini, 2005). This estimating method is arbitrary and difficult to justify or defend (Thompson and Perry 1992). It is an unscientific approach and a reason why so many projects are over budget (Hartman 2000). A percentage addition results in a single-figure prediction of estimated cost which implies a degree of certainty that is not justified (Mak et al 1998). The weaknesses of the traditional percentage addition approach for calculating contingencies has led for a search for a more robust approach as evidenced by the range of estimating methods set out in above Table.

Monte Carlo Simulation (MCS): MCS is a quantitative technique for analysing risk and provides a structured way of setting the contingency value in a project cost estimate (Clark, 2001). The output of MCS when applied to estimating project cost is a probability distribution for the total final cost of the project.

Artificial Neural Networks (ANNs): ANNs are an information processing technique that simulates the biological brain and its interconnected neurons (Chen & Hartman, 2000). The structure of ANNs mimics the nervous system by allowing signals to travel through a network of simple processing elements (akin to neurons) by means of interconnections among these elements. ANNs employ a mechanism to learn and acquire problem-solving capabilities from 'training' examples by detecting hidden relationships among data and generalising solutions to new problems. ANNs are suitable for non-linear modelling of data, which contrasts with the linear approaches using regression. Over the past decade the use of ANNs for cost estimating has grown. ANN can be used to predict project cost overruns and thereby assist management in developing an appropriate contingency. For example, Chen & Hartman (2000) used ANN to predict the final cost of completed oil and gas projects from one organisation using 19 risk factors as the input data. It was found that 75% of the predicted final cost aligned with the actual variance i.e. where the ANN model predicted an overrun/underrun, an overrun/underrun actually occurred. The prediction accuracy of ANN outperformed multiple linear regressions.

Regression: Regression models have been used since the 1970s for estimating cost and are a powerful statistical tool for analytical and predictive purposes in examining the contribution of variables to overall estimate reliability (Kim et al 2004). An extensive review of cost modelling techniques by Skitmore & Patchell (1990) found the use of regression analysis for cost modelling has primarily focused upon the search for the best predictors of tender price. This indicates a need for regression cost modelling of the client's final cost of project. The application of regression analysis for cost modelling follows the principle of

parsimony. That is, models should be sophisticatedly simple and fit the data adequately without using any unnecessary parameters, and generally produce better forecasts (Sonmez 2004). The development and selection of early stage cost forecasting models will have limited data available so the use of a complicated forecasting model will add unnecessary assumptions and thereby work against the principle of parsimony. Regression techniques can be applied to achieve the principle of parsimony (Cheung 2005). Furthermore regression models allow explicit relationships between dependent and independent variables to be analysed. It is surprising that there has been very little research conducted into the application of regression for predicting the final cost of projects (Baccarini D, 2006).

Pursuant to the above, Dr. Dan Patterson (2006) suggest for implementing a formal Cost Risk Management approach (where contingency plays a major role), and incorporating this very closely into the estimating and planning process further ensures that the project will be a success and not fall foul to irreversible cost overruns. However, due to various limitations applied in the above models, specific variables considered for the contingency calculation therein, result in mismatch for a general usage in all construction projects, which kindle the requirement to review on literature related to power projects.

Accordingly, further review of contingency in power projects were made; which resulted in very few literature on risk in power projects carried out towards the cost overrun and contingency in order to avoid such a mismatch.

Shaun Frazerhurst, Neil Watson, (2013), detailed the commercial cost risks encountered in a power project and the action taken to mitigation the same to achieve project goals; while Francis, Adam J. and Skitmore, Martin (2005) identified key risk areas in a Substation project and found low level of awareness of the project participants in formal risk management.

V M Rao Tummala, John F Burchett, (1999) stated that adopting a risk management strategy, such as risk prevention or risk transfer in a power project, enabled the contingency to be reduced, all remaining risks still need to be properly managed to avoid any likely cost overruns, conversely in the Otahuhu Substation Diversity Project report of Transpower New Zealand Limited (2012), various cost risk were identified and mitigation plans were implemented but with limited success ultimately leading to cost overrun, due to simple cost estimation and underestimation of contingencies.

2.3 Findings

The literature review as detailed above pave way to the roadmap to reach the research question fostered in the chapter 1; while emphasizing the gap that was identified out of their in-depth examination. The project management process followed in the construction projects; specifically to the power projects and the projects in UAE are not fully capable of providing project performance outcome; most of the times; resulting in delayed completion and cost exceeding the budget. One of the major reason causing this impact is the Contingency; be its estimation or its utilization or both; due to misunderstanding of the provision available; be it the project team member or the project manager or the stakeholders directly involved in the project execution.

Considering the above; this literature review had identified gap in several areas of project management relating to the Project Contingency which were not identified and assessed in substation construction projects in UAE. It shall be also noted that the perception of the contingency; its estimation method are inappropriate for the construction projects, and without a standard practice being charted; with various methods being utilized inadequately impacting to the project performance; be the time or the cost. The summary of Theme based Findings is listed below:

❖ Construction Project:

- Most of the construction projects do have a Risk Management Plan but are not implemented as per the plan leading to time and cost overrun.
- The Risk management measures are devised keeping in mind either a set of similar activities or from the point of view of the purview of responsibility center, which is resulting into inadequate risk management.

❖ Project Risk Management:

- Detailed Risk Analysis is required.
- Strategies to be formulated for Managing Risk.
- Risk Mitigation measures to be developed.
- There is a need to study Contingency handling / planning / perception.

❖ Contingency:

- Perception of Contingency Project Risk and the extent to which practice aligns with theory by project participants need to be studied.
- There is a need to study the Impact of Contingencies on Project Performance and organizational conditions that are most conductive for risk management.

❖ Contingency in Construction of Substations:

- There is often a lack of contingency allowance to cover project risk and lack of use of any risk management methods in electrical distribution projects.
- There is a need to properly manage the Contingencies to avoid any likely Contingency in Construction of Substations cost overruns.
- Underestimation of Contingencies during construction due to over simplified "rule of thumb" many a times leads to cost overrun.

It has been noted from the literature that that project stakeholders low level of awareness of contingency leads to its underestimation, which in turn impact on the project performance; thereby stakeholder behavior. Hence, further review on the theoretical premises related to stakeholder theory has been taken up.

2.4 Literature Review on Theoretical Premise (Stakeholder Theory):

The stakeholder approach in project management within various industrial sectors, especially construction, is an internationally recognized professional discipline, which enjoys support from a growing community of researchers, scholars, and enquiring practitioners. In project management, it is accepted as one of the most important success factors (Littau, 2010). Stakeholder theory is a useful framework for analyzing the behavioral aspects of the project management process, this being particularly a very complicated process. Projects can be beset by the agenda of various stakeholders within an organizational structure. When this occurs, the implementation of a strong project stakeholder management strategy is necessary to increase the likelihood of success of the project (Sutterfield, 2006).

Littau (2010) had stated that 'looking at Project Management literatures, a considerable number of articles dealing with project success, strategic frameworks, project environment and the social aspects of project management can be identified. Within these areas of project management research, project stakeholders are often mentioned as essential players in projects (Cleland, 1986; Miller & Olleros, 2001; Olander & Landin, 2005). Cleland (1986) introduced stakeholders and stakeholder management processes to the project management canon by highlighting the importance of stakeholder identification, classification, analysis, and management approach formulation. During the last few years, many authors stated clearly the extraordinary importance of stakeholders in projects (Burgoyne, 1999; Jergeas, Williamson, Skulmoski, & Thomas, 2000; Freeman, 2002; Dervitsiotis, 2003). Stakeholder management has become an important soft skill in projects (Crawford, 2005; Morris, Jamieson, & Shepherd, 2006; Winter,

Smith, Morris, & Cicmil, 2006). Stakeholder theory has its origins in the year 1984. Although this term had been used before, Freeman was the starting point of the stakeholder theory (Achterkamp & Vos, 2008)'; the origin, definition and usage are detailed in subsequent section.

Origins, Definitions and Usage:

Tim Ambler (1995) states that 'According to stakeholder theory, a person who holds a stake in the activities of an organization, a "stakeholder", is entitled to consideration in some ways similar to shareholders. Stakeholders may thus include employees, customers, shareholders, suppliers, the state, the local community, society, bankers, special interest groups, the environment and technological progress (Argenti, 1993). Freeman (1984) defined a stakeholder as any individual or group who can affect, or is affected by, the achievement of the organisation's objectives. The word "stakeholder" first appeared, in this usage, in 1963 in an internal memorandum at Stanford Research Institute (Wang and Dewhirst 1992) and has since become a prominent concept in the corporate and academic communities. Ansoff (1965) may have been the first to use the term "stakeholder theory" in defining the firm's objectives. Palgrave (1992) defines stakeholder as anyone whose welfare is tied with a company. The word may link with US colonial usage where the act of knocking a stake into the ground established a claim requiring subsequent clarification. Today stakeholder theory provides a well-known and widely accepted code of corporate ethics (Argenti, 1993)'.

The definition of stakeholder as given by Roland K. Mitchell (1997) in a chorological order from 1963 to 1995 and by Littau (2010) from 1984 to 2009 are as given in Table 2.4 and Table 2.5 respectively.

Table 2.4 - Who Is a Stakeholder? A Chronology (Source: Ronald K. Mitchell, 1997)

Source	Stake
Stanford memo, 1963	"those groups without whose support the organization would cease to exist" (cited in Freeman & Reed, 1983, and Freeman, 1984)
Rhenman, 1964	"are depending on the firm in order to achieve their personal goals and on whom the firm is depending for its existence" (cited in Nasi, 1995)
Ahlstedt & Jahnukainen, 1971	"driven by their own interests and goals are participants in a firm, and thus depending on it and whom for its sake the firm is depending" (cited in Nasi, 1995)
Freeman & Reed, 1983: 91	Wide: "can affect the achievement of an organization's objectives or who is affected by the achievement of an organization's objectives" Narrow: "on which the organization is dependent for its continued survival"
Freeman, 1984: 46	"can affect or is affected by the achievement of the organization's objectives"
Freeman & Gilbert, 1987: 397	"can affect or is affected by a business"
Cornell & Shapiro, 1987:5	"claimants" who have "contracts"
Evan & Freeman, 1988: 75-76	"have a stake in or claim on the firm"
Evan & Freeman, 1988: 79	"benefit from or are harmed by, and whose rights are violated or respected by, corporate actions"
Bowie, 1988: 112, n. 2	"without whose support the organization would cease to exist"
Alkhafaji, 1989: 36	"groups to whom the corporation is responsible"
Carroll, 1989: 57	"asserts to have one or more of these kinds of stakes"-"ranging from an interest to a right (legal or moral) to ownership or legal title to the company's assets or property"
Freeman & Evan, 1990	contract holders
Thompson et al., 1991: 209	in "relationship with an organization"
Savage et al., 1991: 61	"have an interest in the actions of an organization and ... the ability to influence it"
Hill & Jones, 1992: 133	"constituents who have a legitimate claim on the firm ... established through the existence of an exchange relationship" who supply "the firm with critical resources (contributions) and in exchange each expects its interests to be satisfied (by inducements)"
Brenner, 1993: 205	"having some legitimate, non-trivial relationship with an organization [such as] exchange transactions, action impacts, and moral responsibilities"
Carroll, 1993: 60	"asserts to have one or more of the kinds of stakes in business"-may be affected or affect ...
Freeman, 1994: 415	participants in "the human process of joint value creation"
Wicks et al., 1994: 483	"interact with and give meaning and definition to the corporation"
Langtry, 1994: 433	the firm is significantly responsible for their well-being, or they hold a moral or legal claim on the firm
Starik, 1994: 90	can and are making their actual stakes known"-"are or might be influenced by, or are or potentially are influencers of, some organization"
Clarkson, 1994: 5	"bear some form of risk as a result of having invested some form of capital, human or financial, something of value, in a firm" or "are placed at risk as a result of a firm's activities"
Clarkson, 1995: 106	"have, or claim, ownership, rights, or interests in a corporation and its activities"
Nasi, 1995: 19	"interact with the firm and thus make its operation possible"
Brenner, 1995: 76, n. 1	"are or which could impact or be impacted by the firm/organization"
Donaldson & Preston, 1995: 85	"persons or groups with legitimate interests in procedural and/or substantive aspects of corporate activity"

Table 2.5 - A list of all definitions of "stakeholders" (Source - Littau, 2010)

Author	Definition
Freeman (1984, p. 46)	"...a stakeholder in an organisation is any group or individual who can affect or is affected by the achievement of the organisation's objectives..."
Cleland (1985)	"...who have a vested interest in the outcome of the project"
Cleland (1986)	"....individuals and institutions who share a stake or an interest in the project."
Cleland (1989)	"Stakeholders are those persons or organisations that have, or claim to have an interest or share in the project undertaking."
Dinsmore (1990)	"Who has a stake in project outcome."
PMBOK® Guide (1996)	"Stakeholders are individuals and/or organizations that are involved in or may be affected by the project activities."
Wright (1997)	"Stakeholders are any individuals who have an interest in the outcome of the project."
McElroy & Mills (2000)	"A project stakeholder is a person or group of people who have a vested interest in the success of a project and the environment within which the project operates."
APM London (2000)	"...people or organisations who have a vested interest in the environment, performance and/or outcome of the project."
PMI (2001)	"...individuals and organizations that are directly involved with the project and who have a vested interest in the resulting deliverables of the project."
Freeman (2002)	"...groups or individuals who can affect or are affected by the accomplishment of an organisation's mission."
PMBOK® Guide (2004)	"...individuals and organizations that are actively involved in the project or whose interest may be affected as a result of project execution or project completion."
Boddy & Paton (2004)	"Stakeholders are individuals, groups or institutions with an interest in the project, and who can affect the outcome."
Andersen (2005, p. 84)	"...a person or a group of persons, who are influenced by or able to influence the project."
Bourne & Walker (2006)	"Stakeholders are individuals or groups who have an interest or some aspect of rights or ownership in the project, and can contribute to, or be impacted by, the outcomes of the project."
El-Gohary et al. (2006)	"...stakeholders are individuals or organisations that are either affected by or affect the development of the project."
Sutterfield et al. (2006)	"...any individual or group of individuals that are directly or indirectly impacted by an entity or a task."
Javed et al. (2006)	"Stakeholders are the people who have some kind of interest in the project."
Olander (2007, p. 278)	"A person or group of people who has a vested interest in the success of a project and the environment within which the project operates."
Walker et al. (2008, p. 73)	"Stakeholders are individuals or groups who have an interest or some aspect of rights or ownership in the project, and can contribute to, or be impacted by, either the work or the outcomes of the project."
Edum-Fotwe & Price (2009)	"....individuals or groups who are directly and/or indirectly involved in the selected scales and beyond and whose lives, environment or business are affected by the three spatial scales and beyond the adopted constructs."
Couillard et al.(2009)	"...Entities or persons who are or will be influenced by or exert an influence directly or indirectly on the project."

The various definitions given are evolved or revolving around with minor modifications of the two main different types of definition as given by:

"…a stakeholder in an organisation is any group or individual who can affect or is affected by the achievement of the organisation's objectives…," (Freeman, 1984 p. 46)

"…who have a vested interest in the outcome of the project" (Cleland, 1985)

Although there are various perspectives of stakeholder theory (e.g., social science stakeholder theory, instrumental stakeholder theory, and convergent stakeholder theory), one common denominator of all the perspectives is that stakeholders perceive that they have stake in the entity or task. As a result of their perceived stake in the entity or task, they have certain expectations, and consequently, engage in certain types of behavior, sometimes constructive and sometimes destructive (Sutterfield, 2006).

Within the project management process, various stakeholders perceive that they have various stakes in the project. Based on their perceived stakes in the project, stakeholders behave in ways in which they feel will help them accomplish their project objectives, which may be congruent on incongruent with the project objectives. Therefore, it is required to clearly understand the objectives of each project stakeholder in order to effectively manage his or her needs and desires. In order to achieve a successful project outcome, the interests of multiple stakeholders throughout the entire project management process must be managed proficiently.

Various aspects of Stakeholder Theory:

Stakeholder theory looks at the relationships between an organization and others in its internal & external environments. It looks at how these connections influence how the business conducts its activities. Stakeholders can come from inside or outside of the business. Examples include customers, employees,

stockholders, suppliers, non-profit groups, government, and the local community, among many others. One of the most important contributors to stakeholder theory is R. Edward Freeman and his book Strategic Management: A Stakeholder Approach (1984). The core idea of stakeholder theory is that, organizations that manage their stakeholder relationships effectively, will survive longer and perform better than organizations that don't. Freeman suggests that organizations should develop certain stakeholder competencies, which include:

- Making a commitment to monitor stakeholder interests
- Developing strategies to effectively deal with stakeholders and their concerns
- Dividing and categorizing interests into manageable segments
- Ensuring that organizational functions address the needs of stakeholders

The stakeholder theory has been advanced and justified in the management literature on the basis of its descriptive accuracy, instrumental power, and normative validity. These three aspects of the theory, although interrelated, are quite distinct; they involve different types of evidence and argument and have different implications. These three aspects of stakeholder theory, as shown in Figure 2.7 are mutually supportive and that the normative base of the theory which includes the modern theory of property rights-is fundamental (Donaldson, 1995).

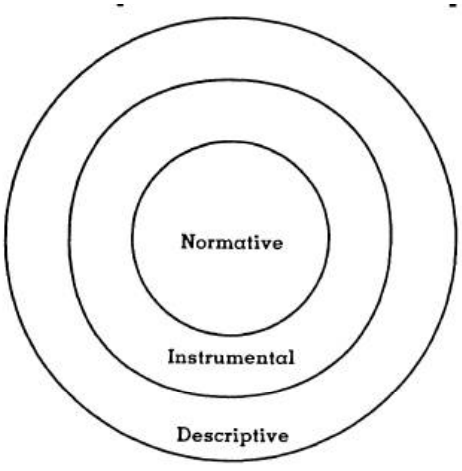

Figure 2.7 – Three Aspects of Stakeholder Theory (Source – Donaldson, 1995)

Descriptive/Empirical: The theory is used to describe, and sometimes to explain, specific corporate characteristics and behaviors. For example, stakeholder theory has been used to describe (a) the nature of the firm (Brenner & Cochran, 1991), (b) the way managers think about managing (Brenner & Molander, 1977), (c) how board members think about the interests of corporate con- stituencies (Wang & Dewhirst, 1992), and (d) how some corporations are actually managed (Clarkson, 1991; Halal, 1990; Kreiner & Bhambri, 1991).

Instrumental: The theory, in conjunction with descriptive/empirical data, where available, is used to identify the connections, or lack of connections, between stakeholder management and the achievement of traditional corporate objectives (e.g., profitability, growth). Many recent instrumental studies of corporate social responsibility, all of which make explicit or implicit reference to stakeholder perspectives, use conventional statistical methodologies (Aupperle, Carroll, & Hatfield, 1985; Barton, Hill, & Sundaram, 1989; Cochran & Wood, 1984; Cornell & Shapiro, 1987; McGuire, Sundgren, & Schneeweis, 1988; Preston & Sapienza, 1990; Pre- ston, Sapienza, & Miller, 1991).

Normative: The theory is used to interpret the function of the corporation, including the identification of moral or philosophical guidelines for the operation and management of corporations. Normative concerns dominated the classic stakeholder theory statements from the beginning (Dodd, 1932), and this tradition has been continued in the most recent versions (Carroll, 1989; Kuhn & Shriver, 1991; Marcus, 1993). Even Friedman's (1970) famous attack on the concept of corporate social responsibility was cast in normative terms.

Libertarian: In another form of Stakeholder theory view by Freeman and Phillips (2002), they argue that stakeholder theory has organic roots in libertarian political theory. They demonstrate that, when read in light of the core libertarian principles of personal freedom, voluntary association, and individual responsibility, stakeholder

theory has a particularly robust underpinning. Of special importance is the notion that this libertarian reading helps to emphasize that stakeholder theory is fundamentally about how we understand value creation and trade – the foundations of capitalism – rather than offering an ethical revision of the "standard account" of business as shareholder profit maximization.

Much of the stakeholder-based work found in management journals is either central to the stakeholder discussion or pertains to the intersection of stakeholder theory and strategic management. However, management also includes behavioral areas such as organizational behavior, organizational theory, and human resource management. Traditionally, management has also included management science, manufacturing, and operations management. Some literature on the management specific to the project management and governance are detailed in subsequent sections.

Specific Literature Review of Stakeholder Theory on Performance and Project Management:

As per Freeman et al. (2010), Jones (1990) provided a relatively early application of the stakeholder concept in the project management literature. He examined the political context of project management from the perspective of chief executive officers of aerospace companies. He discovered that factors such as the degree of stakeholder representation in the structure of goals and the level of participation in decision making significantly influenced the level of internal politics. More recently a stakeholder approach to project management has become more common in the project management literature. For instance, Oral, Kettani, and Cinar (2001) used a stakeholder approach to evaluate and select projects in an international context. In another example, McManus (2002) discussed the influence of multiple stakeholder values on project management. Along these same lines Karlsen (2002) developed a formal and systematic project stakeholder management process based, in part, on a survey of project managers in Norway. Also, Cleland and Ireland (2002) used a stakeholder conception of project management to tie different organizational stakeholders together. Olander (2007)

applied stakeholder impact analysis to construction project management. Finally, Aaltonen, Kujala, and Oijala (2008) extended the concept of stakeholder management to global project management. Achterkamp and Vos (2008), after conducting a meta-analysis of the project management research, recognized that the importance of effective stakeholder management to project management success is commonly accepted in the field.

Human resource management, one of the major arms of the project management, has also been influenced by stakeholder theory. This influence is at least partly a result of the perspective that firms that practice effective and trustworthy stakeholder management are better able to attract a high-quality workforce (e.g. McNerney 1994; Albinger and Freeman 2000; Greening and Turban 2000). In a relatively early application of stakeholder theory to human resources research, Jansen and Von Glinow (1985) examined conflicts between the behaviors, attitudes, and norms that result from the organization's reward system and the behaviors, attitudes, and norms of organizational stakeholders. For example, they found that although stakeholders need honest and open reporting, the organizational reward system can encourage information falsification and nondisclosure. Olian and Rynes (1991) evaluated the efficacy of traditional organizational systems in implementing a total quality perspective within the firm. They concluded that these systems were inadequate and recommended several changes to organizational processes and measurement systems, along with changes in the values and behaviors of key organizational stakeholders.

G.Locatellia, et. al. (2014) states that, 'There are several specific areas (like stakeholder management and project governance), deserving specific investigation', considering the stakeholders might have high influence on time-related issues in megaprojects while there is a need to identify the mechanisms and reasons for this influence. Similarly, Kerzner, H. (2011) states that 'The near term future seems pretty clear; stakeholders are becoming more knowledgeable in project management and want to make informed decisions. For this to happen, we

must learn better ways of providing real time information to stakeholders, such as through dashboards, and we must provide them with meaningful metrics', which is by means of 'Percent of work packages adhering to the budget' which is including the contingency, being a critical metric for performance of a project.

Jesnson (2002) believes that, in the contest for a better project performance, managers (being the primary stakeholder of a project) are forced to choose between the two goals and that value maximization offers them an objective principle for making the tradeoff; while the firm can resolve this ambiguity by specifying the tradeoffs among various dimensions, and thereby specifying the an overall objective function, affecting the firm in the way of cash flow, risk and so on.

Freeman (2010) had noted that 'to the extent that firms are able to manage risk effectively, stakeholders may be more inclined to invest in the organization, whether these investments involve the efforts expended by employees, purchases by customers, sales from suppliers, or capital provided by market participants'. He also state that 'avoiding negative outcomes reduces expenses as well as reducing the risks associated with variations in returns. Risk reduction enhances the value of a firm's securities because investors consider both future cash flows and risk simultaneously when assessing the value of a security', thereby improving the project performance and outcome.

Specific Literature Review of Stakeholder Theory from the Perspective of Corporate Governance:

Interest in the topic of corporate governance has blossomed in recent years (Chatterjee and Harrison 2001), possibly due to the increasing number of large corporate scandals that have been plaguing the business community. Because of the vastness of the strategy literature on corporate governance, only few points by focusing specifically on the intersection between governance and stakeholder theory are detailed below (Freeman, 2010).

From a strategic management perspective, corporate governance deals with the forces that influence how firms and their managers behave in the execution of their responsibilities. Some of these forces are completely external to the firm. For example, the market for corporate control, as manifested in attempted or completed takeovers, is considered a governance mechanism. From this perspective, incumbent managers of poorly performing public corporations are motivated by a potential takeover to improve the performance of their firms, because they fear that after the acquisition they will lose their jobs (Chatterjee, Harrison, and Bergh 2003; Denis, Denis, and Sarin 1997).

Governance gains much of its importance through the separation of ownership from control in modern corporations, where individual shareholders typically have little influence over the decisions of managers (Berle and Means 1932). Governance may also be internally derived, as in a board of directors.

Although board members also provide resources and advice, most scholars believe that the most important function of board members is to monitor top managers to make sure that they are acting responsibly with respect to the interests of the stockholders who elected them. Managers are perceived as agents for the shareholders, and agency problems exist to the extent that they act in their own interests rather than the interests of the shareholders (Jensen and Meckling 1976; Williamson 1984a; Fama and Jensen 1983; Vilanova 2007). When these situations become extreme, the governance system is examined to determine why the inappropriate behavior was not corrected.

Kerzner, H. (2011) also states that 'as the complexities of projects have grown, so has the need for more accurate and timely information. Executives are discovering that time is no longer a luxury but a serious constraint. We are being pressured to provide executives and members of governance groups with reliable information such that they can make informed decisions in a timely manner', which specifies the flow of information and interaction between the stakeholders and the Organization Governance.

Organizational interest in the principles of stakeholder management has prompted the consulting industry to provide guidance in how to develop, monitor, and manage relationships with a broad group of stakeholders.

The finding of the review on the theoretical premise is as given below:

- ❖ Stakeholder Theory:
  - Proper utilization of the stakeholder management with reference to the perceptions by stakeholders increases the Firm Value and improves Organizations Governance, by means of controlled project metrics thus the project performance.

2.5 Major Gaps

The major research gaps that are identified are listed below:

- There is a need to identify the project risks that are required to be considered while estimating contingency allowance of a construction project.
- There is a need to study the Impact of Contingency perception of the stakeholders on Project Performance in terms of time and cost for construction projects.
- No study could be found which suggests a model for estimating the contingency applicable for construction of substation project in UAE.

2.6 Chapter Summary

In the quest to find the elements influencing the project performance in construction of substation in UAE, the literature review had surveyed the intellectual literatures on the construction projects, project management process and in specific towards the risk and risk management process and then into the contingency perception. The result of the literature review has provided an insight into the details as required in the business problem proposed in chapter 1, by means of findings and the research gaps.

These Findings and research gaps have given the possibility to utilize various tools and techniques for the data analysis and model development which are detailed in next chapter along with its viability of practical implementation.

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