STUDY ABOUT PROJECT MANAGEMENT IN OIL AND GAS INDUSTRY

By

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A DISSERTATION REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR MBA IN OIL & GAS MANAGEMENT OF

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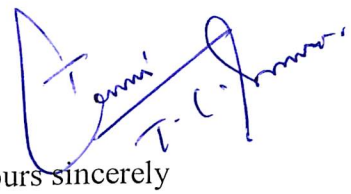
Dear Sir,

Mr. Anupam Maiti is registered for MBA Oil and Gas with the University of Petroleum & Energy studies, Dehradun in 2017.

I hereby give my acceptance to guide the above student through Dissertation work Titled: 'STUDY ABOUT PROJECT MANAGEMENT IN OIL AND GAS INDUSTRY' which is a mandatory requirement for the award of the MBA degree.

Thanking You,



Yours sincerely

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ABSTRACT

With the vast oil reserves, oil extracting countries poised to become one of the world's major oil suppliers. However, extracting this oil economically will require effective management of the oil sands' projects in order to build them on time and within budget. Projects are subject to both internal and external forces such as political, economic, social and technological which can destabilize and create tremors to the execution.

Project management methodology is a set of established guidelines that are followed in executing projects in each and every industry. These methodologies are widely based on initiating, planning, organizing, executing, and monitoring & controlling process group. However, it is carried out through nine project management knowledge areas i.e. integration, scope, time, cost, quality, human resource, communications, risk and procurement management. Projects are always governed by certain factors that have major influence in directing the success or failures. Broadly cost, time & scope have been identified as key important success factors for projects. The project management methodologies provide solutions to the problems encountered during the engineering, procurement and construction phases of oil & gas projects.

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Acronym	Definition
SOS	System of Systems
OPEC	Organization of the Petroleum Exporting Countries
CPM	Critical Path Method
PMBOK	Project Management Body of Knowledge
MAUT	Multi Attribute Utility theory
SOW	Statement of Work
PMIS	Project Management Information System
WBS	Work Breakdown Structure
RFQ	Request for Quantification
EPC	Engineering, Procurement and Construction

CHAPTER 1: INTRODUCTION

In the present society, Energy is vital for the success and development. Regular project management should be an integral part of planning, organizing, scheduling, and controlling projects in the industry. Those who support or oppose oil and gas projects are often uninformed about the merits and demerits of the projects.

The strategies of project management can help mitigate such awareness problems. There is a correlation between the applications of project management and better business performance. For this reason, a framework based on a System of Systems (SoS) modeling is very essential for the oil and gas industry.

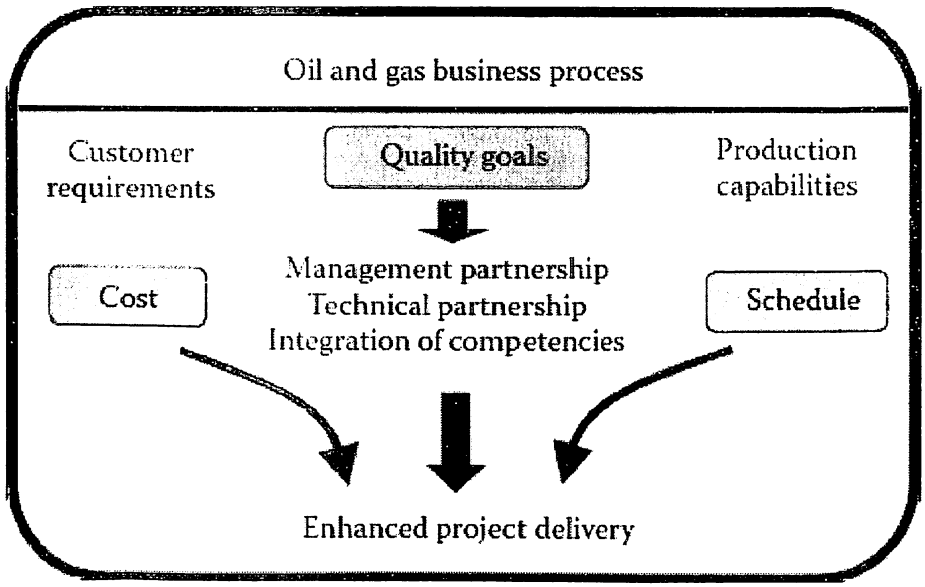

Figure 1.1: Oil and Gas Business Process

The first quarter of 2012 saw a significant rise in global crude oil prices. After closing at high price in 2011, it traded within a relatively narrow range for the remainder of the year. This price increase reflected changes in global oil supplies, as significant unplanned disruptions in production from countries that are not members of the Organization of the Petroleum Exporting Countries (OPEC) countered the recovery in Libyan production. Project management must address these types of developments in day-to-day operations in the oil and gas industry.

1.1 Project Management

Project management is described as the method of dealing with, allocating, and timing sources to gain a positive intention in a green and rapid way.

Project Management Body of Knowledge (PMBOK) defines undertaking management as the utility of understanding, abilities, tools, and techniques to challenge activities to gain project objectives.

Different resources define project management as the collection of competencies, gear, and control strategies which can be considered vital for executing a project efficiently.

Projects in the oil and gas industry are complex in nature and dynamic too, thus makes it necessary to have a consistent approach. The use of project management continues to grow in a rapid manner. As the complexity of new technologies and advancement in processes increases the need to develop effective management tools also increases.

Project management is necessary throughout the design and production stages of the product. And also project management plays a necessary role in developing strategies for marketing, transportation, and delivery for the product. When the product finally gets to the customer, project management will be needed to integrate its use with those of other products within the customer's organization.

CHAPTER 2: LITERATURE REVIEW

For any oil and gas project, there is always a chance that things will not turn out exactly as planned. All oil and gas projects are complex and they involve risks in all the phases of the project starting from the feasibility phase to the operational phase. These risks have a direct impact on the project schedule, cost, and performance. These projects are inherently complex and volatile with many variables.

Project management techniques have steadily improved in the last 40 years. In the 1950s, formal techniques, such as the Critical Path Method (CPM), were developed for managing large complex engineering and construction projects for the petrochemical industry. In the 1960s, computer automation of many project management techniques became possible, with sophisticated tracking models developed for controlling the progress of projects.

In the 1980s, the introduction of personal computers provided even more access to automated project management techniques to allow planning, scheduling, monitoring, and controlling of work in a real-time environment.

The need for a project management approach is established by the fact that a project will always tend to increase in size even if its scope is narrowing. The following four literary laws are applicable to any project environment:

Parkinson's Law: Work expands to fill the available time or space.
Peter's principle: People rise to the level of their incompetence.
Murphy's Law: Whatever can go wrong will.
Badiru's rule: The grass is always greener where you most need it to be dead.

An integrated systems project management approach can help to minimize the impacts of these laws through good project planning, organizing, scheduling, and control. The Project Management Institute, as a way of promoting a common language for the practice of project management, developed the Project Management Body of Knowledge (PMBOK), which has been widely adopted around the world.

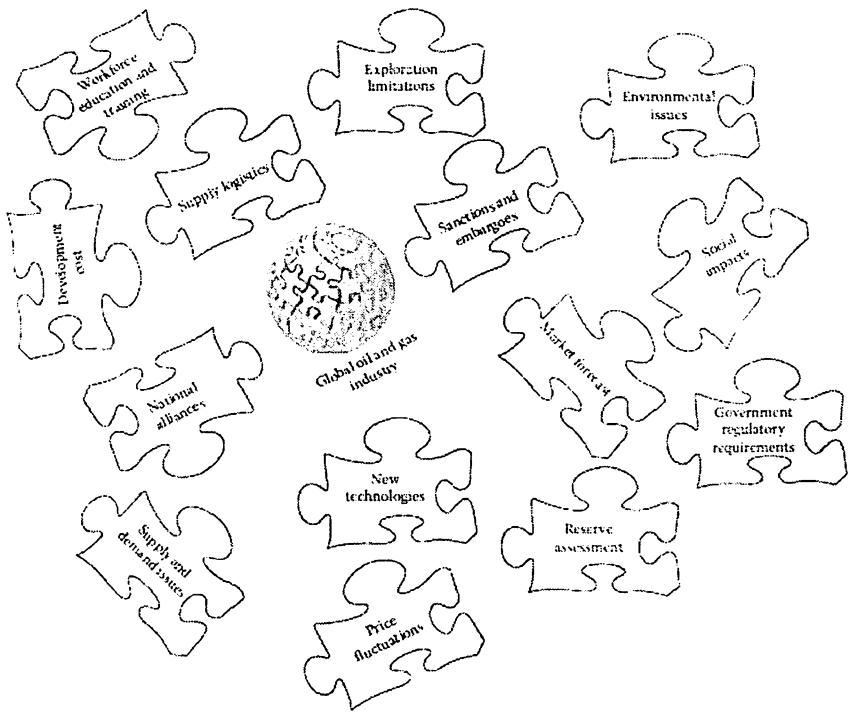

Figure 2.1 View of the oil and gas industry

Possible sources of uncertainty include the following:

- ✓ Poor estimates of time and cost
- ✓ Lack of knowledge about the number of factors and types which influencing the project
- ✓ Unknown events within the project environment
- ✓ Lack of a clear specification of project requirements
- ✓ Lack of knowledge about the interdependencies among activities in the project
- ✓ Ambiguous guidelines about managerial processes
- ✓ Project scope changes
- ✓ Variability in project design and logistics
- ✓ Varying direction of objectives and priorities.

A proper management plan, if developed for identified uncertainty, would ensure better and smoother achievement of project goals within the specified time, cost, and technical requirements.

Project management techniques are framed in a way to make sure time, cost, and quality achievement of a large-scale project, which may be mainly due to changes in scope and design, changes in government policies and regulations, changes in industry agreement, unforeseen inflation, underestimation and improper estimation.

Project-wide application of the management system, including change control processes, accomplishes three major objectives:

- ✓ Establishes evolutionary method to consistently identify and request changes to established baselines and to assess the value and effectiveness of those changes.
- ✓ Provides opportunities to continuously validate and improve the project by considering the impact of each change
- ✓ Provides the mechanism for the project management team to consistently communicate all changes to the stakeholders

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Quantitative vs. Qualitative Research Defined

There are two major paths to conducting research in the Social Sciences, the first one is the Qualitative, and the other is the Quantitative method, which is considered to be the more orthodox of the two. Most scientific theories are based on quantitative methods involving numbers, statistical modelling, and analysis. Concepts such as frequency distribution, measures of central tendency, linear correlation, and prediction, are used as tools to extract and validate the theories emanating from the research experiments.

Qualitative research deals with paradigms such as post-positivism, which focuses data collection on what is seen as well as the cause and effect relationship, critical theory, which focuses on the perspectives or the lens used to view historical outlook and social struggles, and interpretive, which emphasizes the role of the researcher as the interpreter of the data.

3.2 The Five Different Qualitative Methods

3.2.1 Narrative Research

Narrative research is defined by Pinnegar & Daynes (2006) as "an approach to qualitative research that is both a product and a method. It is a study of stories or narratives or descriptions of a series of events that account for human experiences".

Narrative research is used to examine a person's life. It also includes stories and deeds of a living or deceased person, for example, the life of Pierre Elliott Trudeau, who is arguably the finest Canadian Prime Minister in recent history.

The following steps are used for conducting a narrative research study:

i. Evaluate whether the problem deals with the life of a person or place
ii. Identify and choose people who know the person and have stories about the person on whom the study is being done
iii. Keep the context of the stories in perspective
iv. Retell the stories and narratives in a way that has a certain order and makes sense
v. Establish good relations with the story tellers and make them participate in the research.

3.2.2 Phenomenological Research

Phenomenological research is something that people have lived through or experienced such as the dropping of bombs on Hiroshima or a happy event such as the hockey match.

In approaching a phenomenological study, the following high-level steps can be helpful:

i. Establish whether the research falls under the realm of phenomenology by evaluating Peoples' experiences
ii. The researcher should remove his or her experiences in order to have the participants' views spring out more predominantly from the study
iii. Use in-depth data collection procedures such as interviews, poetry, music, art, etc.
iv. Use open ended questions such as the participant's experience of the phenomenon and the influences on the experience such as the background

3.2.3 Grounded Theory Research

The Grounded concept is a qualitative research method wherein the idea is developed from the information, rather than the other way round, therefore, this method is an inductive technique, meaning that it actions from the specific to the more general. The central point of the Grounded Theory is to take the best data and try to fit it in the applicable concept. Moreover, it does not test a hypothesis, but rather, it seeks to determine which theory accounts for the research situation 'as-is'.

This research method is predominantly used inside the fields of psychology, social sciences, health sciences, and enterprise. Grounded Theory research has additionally been used in the field of Project Management on topics such as Construction Productivity, Knowledge Management, and Quality control. Creswell indicates the subsequent factors to help the researcher in a Grounded Theory study:

i. Identify the level of theory that is available; if there is inadequate concept, the research can be done under the realm of Grounded Theory
ii. The researcher's objective is to focus on the process and identify how it unravels
iii. Interviews, observations, and documents are the primary sources of data
iv. Information gathered from numerous sources is coded
v. Identify the emergence of styles from the coding

3.2.4 Ethnography Research

Ethnography, as defined as a qualitative design wherein the researcher describes and translates the shared and discovered patterns of values, behaviors, ideals and language of a tradition-sharing group. An ethnographic study can contain, for example, the study of the Masaai tribe in Tanzania or the study of Polynesians in Hawaii. In thinking about an ethnographic research study, the following steps are important to keep in mind:

i. Define the research study and ensure that it fits the definition of ethnography, which is essentially the study of groups and group behavior.

ii. The ethnographic organization to be studied should be diagnosed.

iii. Identify themes which the researcher would like to study pertaining to the group.

iv. Identify more information about the group and the way it works and lives.

v. Patience in accumulating the information, due to the prolonged nature of this research.

3.2.5 Case Study Research

The last approaches of research are the case study that could have involved the study of a single case or a collection of single cases to create idea out of it. Case study entails the study of an issue explored through one or more cases within a bounded machine.

A case study can be done, for example, on how different engineering companies execute their projects or how the Unions reward the construction trades for achieving good productivity.

Steps to undertake a case study research include:

i. Identify whether there is a single case instance or multiple case instances, the factors to compare the cases, and the limitations of the cases

ii. Identify the case or cases that have the potential of providing good results which are different in terms of problems, process, or event; this is done through purposive or non-probability sampling – targeting a subject or participant to obtain data about a certain population where randomness is neither achievable nor desirable

iii. Multiple data sources should be looked at including observations, documents, processes, and methodologies

iv. Do a holistic analysis of the complete case

v. Interpretation of the analysis from the learning of the case, this can evolve as a lesson learned from the case.

Regardless of the research method selected, there are certain hallmarks or characteristics which distinguish good research from the mediocre. These characteristics are important because they show the approach, rigor, and concern with which the research is undertaken.

3.3 Research Design

This is an important aspect of any research. It includes all the activities from beginning to the end involved in undertaking research; from identifying the research question, collecting the data from the surveys, analyzing it, getting meaning out of the data together with drawing the conclusions from it.

Research design, from this perspective, includes every step that is taken in order to achieve the research's results. The research design, from the researcher's perspective, has to be thought out before starting the process. For a novice researcher, the process or methodology can be one of trial and error. However, one has to be able to think about the next steps in the various stages of research and to visualize the process.

Visualizing enables the researcher to play out the research design in his mind, specifically, the unfolding of the research, which includes the next steps to be implemented and how they should be implemented. This also provides the researcher with an opportunity to take corrective action if things are not going as planned.

3.4 Data Collection & Management

Data collection is the variety of methods and techniques available to the quantitative or qualitative researcher to affirm hypotheses and create new realities through the research process. For the qualitative researcher, these methods and processes begin by identifying the place where the research will be conducted or the individuals who could form part of the sample. This is followed by contacting the people who will participate in the research to provide the information; through purposive sampling, the best candidates for the research are selected.

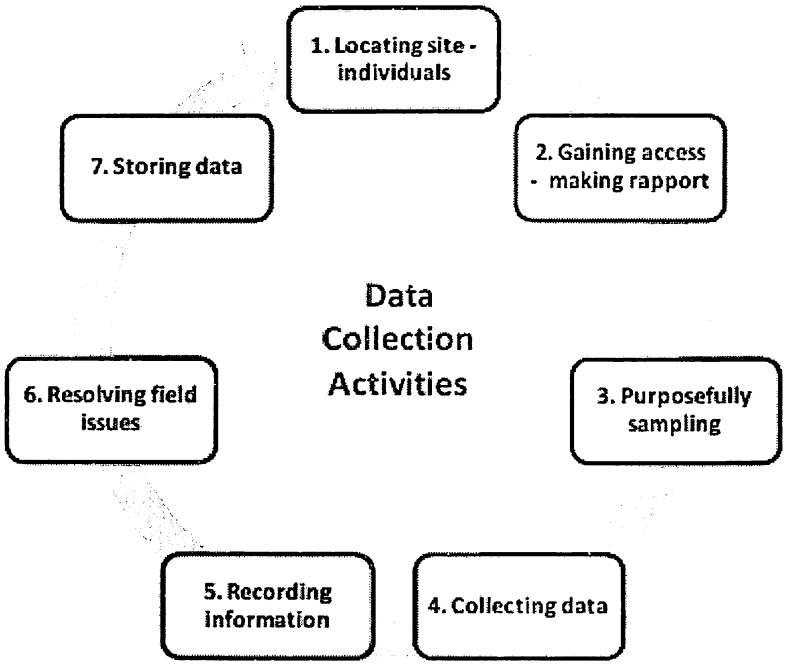

Figure 3.1 Data Collection Process

Through observations, interviews, surveys, awareness organizations, testimonies, and the like, the data is collected using different modes such online, recording devices, or simply note taking.

Field issues, such as missing a step in the research or inadequate data collection, have to be resolved, and finally, appropriate means have to be used, such as computers, in order to organize and store the data. Figure 3.1., representing a circle of activities, summarizes the data collection process from beginning to end.

Data management is an important aspect of data collection. Unlike quantitative research, whose data is predominantly numeric, and therefore, easily managed and stored, qualitative research deals with words from interviews, discussions, and observations. This information has to be sorted, managed, and stored effectively so that it can be retrieved quickly and easily during the research process.

	Data Collection Format	Data Analysis Strategies	Data Representation
Narrative Research	Interviews. documents	Analysis of stories. "restorying" stories. developing themes often using chronology	Developing a narrative about the stories of an individual's life
Phenomenological Research	Interviews with individuals. documents & observations	Analyse significant statements. meaning. description of the "essence"	Describing the essence of the experience
Grounded Theory Research	Primarily interviews with 20 - 60 individuals	Analysis through open. axial and selective coding	Generating a theory illustrated in a figure
Ethnographic Research	Observations. interviews. other sources if research period longer	Analysis of description of culture-sharing and themes about the group	Describing how culture-sharing group works
Case Study Research	Interviews. observations. documents. artefacts	Analysis of description of case. themes of case and cross-case themes	Developing detailed analysis of one or more cases

Table 3.1 Data Collection Processes of Various Qualitative Research Methods

For example, in Grounded Theory, research codes are used to identify anchors around which the main points of data can be gathered. Coding, a process of comparing data from various sources such as interviews, is employed so that a general theory or pattern can emerge. With such an involved process to arrive at a general theory, an effective data management process can be very useful. Table 3.1., illustrates the basic differences between the forms of data collected, strategies for analyzing the data collected, and how the data is represented in its final form for the five research methods.

3.5 Data Analysis and Representation

Unlike quantitative research, where the results of the data are represented by numbers, in qualitative research, data is in multiple forms including videos, poetry, diaries, and journals, among others, all of which have to be analyzed in order to come up with meaningful conclusions. This rich diversity of data makes the task of data analysis and interpretation quite challenging.

Different qualitative research methods have different ways to analyze and interpret data collected during the research.

3.5.1 Coding

Coding is defined as examining the data and breaking it into finer parts and then on the basis of the subject of the study, put the parts together in a logical fashion and to come up with theory out of it. Coding, which is predominantly used in Grounded Theory, is essentially identifying elements that originate from interviews, observations, and other forms of data collection. When these codes are put together, they can assist in the formulation of a theory or a series of chapters of one's life (in the case of narrative research) or elements of case(s). Coding is an imperative tool, which can sometimes require a few iterations before final representative codes from the raw data can be achieved.

3.6 Rigor

Rigor is the subject with which the research design is implemented. This discipline is especially important in documenting the whole process of the research exercise from the objectives of the research to the final data collected from the field. This also includes the data analysis and the number of levels of evaluation finished at the records. The documentation is completed in a methodical step-by-step way that can be summarized, and yet, drilled down for details; this makes the research and the data analysis auditable, and it additionally brings a great deal of organization to the records. Indeed, if during the research process there was a need to back track on one or more of the research steps, it would be possible to do so without losing valuable time.

3.7 Key Approaches to Validity

Validity is the strength of qualitative design, how well it has been put together, and how accurate the findings are. However, these factors can cause apprehension. The concern relates to the trustworthiness or the dependability of the data gathered. Generally, this can be verified by the time spent in the field or the thick and rich description of the data collected. One can be more specific by checking both the internal and external validity of the research results, thereby providing greater trust to the data collected.

3.7.1 Internal Validity

Internal validity is how much of a relationship can be identified formed from the data on the basis of cause and effect. The test here is to find out if the variables are independent or can cause other results. In other words, if some other researcher were to perform the same experiment, can one expect to get the same results as the original researcher.

3.7.2 External Validity

External validity, as Yin suggests, is identifying extent and the areas where the results of the study can applicable. In other words, can the same results be achieved in other settings or environments? Can they be generalized for other areas? Ways to establish external validity include peer reviews, where the reviewer takes a cold eyes review of the data and asks the researcher questions on the means of arriving at certain conclusions and its significance. Member check is another external validation method where the researcher asks the research participants to evaluate the validity and authenticity of the data, analyses, and conclusions. This approach is an important and effective methodology to ensuring the reliability, integrity and standing of the data.

3.7.3 Triangulation

One common approach to increase the reliability, credibility, and validity of the research is triangulation, which is the use of multiple sources of data, methods, and theories to substantiate the findings. Triangulation can also include asking other people or investigators, who have encountered or been in similar situations, to validate the research perspectives. Within history, Alexander the Great never conquered a city or a people without thoroughly researching the people, their culture, the condition of the empire's status as well as any other type of information that would allow him to evaluate the means by which they could just not be conquered but ruled.

3.7.4 Reliability

Willis relates reliability to stability in the sense that if an experiment is repeated, will the scores, results, and data change or will they remain the same. Reliability can be increased by

collecting detailed field notes during or shortly after the interviews or observations. Having rich data provides a good basis for documenting the array of scenarios under which certain events or results can occur. This increase provides a larger range of conditions for the results to be true, and thereby, assisting the reliability. Lincoln & Guba support this concept by maintaining that authenticity is revealed if the researchers can show that a wide collection of realities have been represented, consequently improving the trustworthiness of the results.

3.8 Researcher Involvement

In qualitative research, researcher involvement enables in achieving the objectives of the study, specifically when he or she is knowledgeable about the topic of study. The knowledge base provides the ability to monitor the technical aspects of the research process, and, therefore, fine tune the study as it progresses. Significant changes to the study should be avoided, as this can be a detriment to the process of obtaining consistent results. Although researcher involvement is useful, there are certain disadvantages associated with being too familiar with the topic. For example, complacency can set in, and the researcher may not capture key information because the researcher is not paying attention to the participants. More importantly, if the study participants are aware of the researcher's background of expert knowledge, they may, in the interviews, not elaborate as much as one would expect. Although there are ways to mitigate, the researcher needs to be cognizant of the issue.

3.9 Ethical Considerations

Ethics are a fundamental part of any research. Prime concerns include the privacy and protection of the study participants, who sometimes take tremendous risks by opening up to tell their story for the benefit of society. In doing so, they place a huge amount of trust in the researcher. It, therefore, becomes incumbent on the researcher to protect their privacy and to protect them from any physical, social, or economic harm.

CHAPTER 4: PROJECT MANAGEMENT METHODOLOGIES

A project management methodology defines a process that a project team uses in executing a project, from planning through phase-out.

People, process, and technology assets (science and engineering) form the basis for implementing organizational goals. Human resources constitute crucial capital that must be recruited, developed, and preserved.

The ability of an organization in leveraging science and technology to move up the global value chain requires the softer side of project management along with the technical techniques. One more key benefit of applying integrative project management to oil and gas projects centers around systems safety.

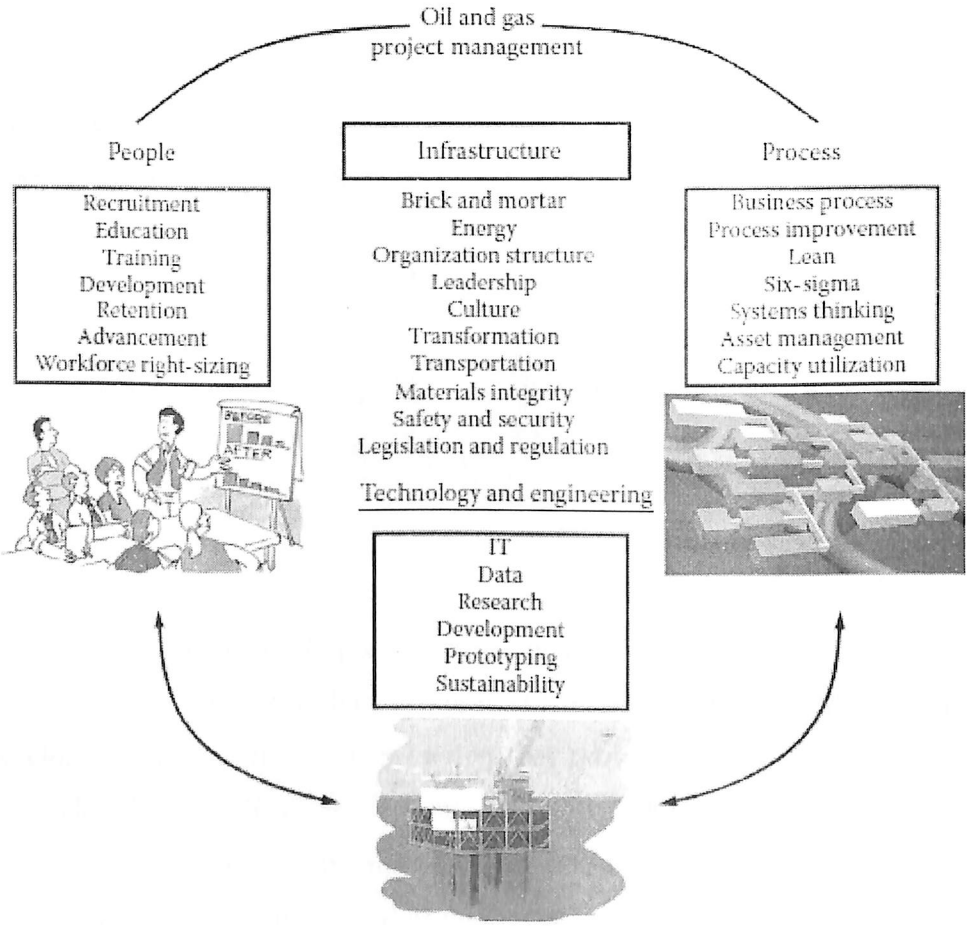

Figure 4.1 Framework for cross-functional application of project management

Science, technology and engineering undertakings can be volatile and subject to safety violations through one of the following actions:

1. Systems or individuals who deliberately, knowingly, willfully, or negligently violate embedded safety requirements in science, technology, and engineering projects

2. Systems or individuals who inadvertently, accidentally, or carelessly compromise safety requirements in science, technology, and engineering projects

The above potential avenues for safety violation make safety training, education, practice, safety monitoring, and ethics very essential. An integrative approach to project management helps to cover all the possible ways for safety compromise.

4.1 Project Management Processes

The Project life cycle defines the following:

1. Resources that will be needed in each phase of the project life cycle
2. Specific work need to be done

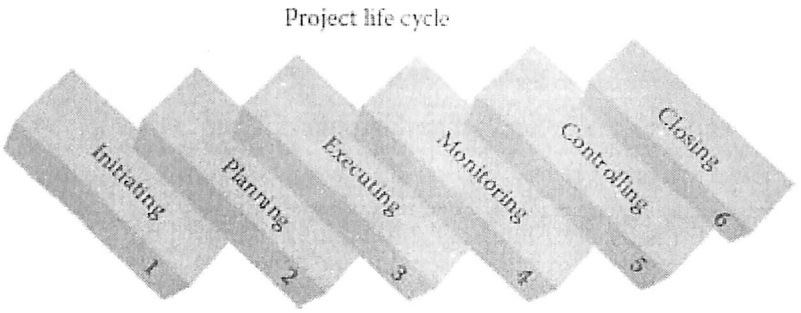

Figure 4.2 Implementation clusters for project life cycle

Figure 4.3 shows the major phases of project life cycle going from the conceptual phase through the close-out phase. It should be noted that project life cycle is distinguished from product life cycle. Project life cycle does not explicitly address operational issues whereas product life cycle is mostly about operational issues starting from the product's delivery to the end of its useful life. Note that for oil and gas projects, the shape of the life cycle curve may be expedited due to the rapid developments that often occur in technology.

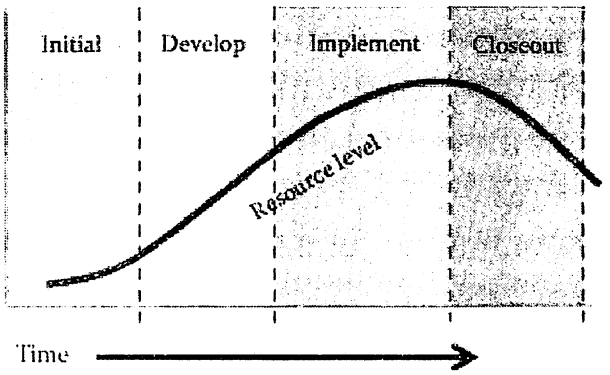

Figure 4.3 Phases of project life cycle

For example, for an exploration technology project, the entire life cycle may be shortened, with a very rapid initial phase, even though the conceptualization stage may be very long.

The characteristics of project life cycle include the following:

1. Cost and staffing requirements are lowest at the starting phase of the project and ramp up at some point of the preliminary and improvement levels.

2. The opportunity of correctly completing the project is lowest at the start and highest at the end. That is due to the fact many unknowns (risks and uncertainties) exist at the starting phase of the project. As the project approaches its end, there are fewer opportunities for risks and uncertainties.

3. The risks to the project organization (project owner) are lowest at the beginning and highest at the end. This is because not much investment has gone into the project at the beginning, whereas much has been committed by the end of the project. There is a higher sunk cost manifested at the end of the project.

4. The ability of the stakeholders to to steer the final undertaking results (cost, quality, and schedule) is highest at the beginning and gets step by step decrease towards the end of the project. This is intuitive because influence is best exerted at the beginning of an endeavor.

5. The cost of scope modifications decreases over the years throughout the project life cycle while the cost of scope changes increases over time. The inspiration is to determine and finalize scope as early as possible. If there are to be scope modifications, do them as early as possible.

4.2 Project Decision Analysis

Decision analysis facilitates a proper consideration of the essential elements of decisions in a project systems environment. These essential elements include the problem statement, information, performance measure, decision model, and an implementation of the decision. The recommended steps are enumerated below:

Step 1: Problem statement: A problem involves choosing between competing, and probably conflicting, alternatives. The components of problem solving in project management include:

- Describing the problem (goals, performance measures)
- Defining a model to represent the problem
- Solving the model
- Testing the solution
- Implementing and maintaining the solution

Problem definition is very crucial. In many cases, *symptoms* of a problem are more readily recognized than its *cause* and *location.* Even after the problem is accurately identified and defined, a benefit/cost analysis may be needed to determine if the cost of solving the problem is justified.

Step 2: Data and information requirements: Information is the driving force for the project decision process. Information clarifies the relative states of past, present, and future events. The collection, storage, retrieval, organization, and processing of raw data are important components for generating information. Without data, there can be no information. Without good information, there cannot be a valid decision. The essential requirements for generating information are:

- Ensuring that an effective data collection procedure is followed
- Determining the type and the appropriate amount of data to collect
- Evaluating the data collected with respect to information potential
- Evaluating the cost of collecting the required data

Step 3: Performance measure: A performance measure for the competing alternatives should be specified. The decision maker assigns a perceived worth or value to the available alternatives. Setting measures of performance is crucial to the process of defining and selecting alternatives. Some performance measures commonly used in project management are project

cost, completion time, resource usage, and stability in the workforce.

Step 4: Decision model: A decision model provides the basis for the analysis and synthesis of information and is the mechanism by which competing alternatives are compared. To be effective, a decision model must be based on a systematic and logical framework for guiding project decisions. A decision model can be a verbal, graphical, or mathematical representation of the ideas in the decision-making process.

A project decision model should have the following characteristics:

- Simplified representation of the actual situation
- Explanation and prediction of the actual situation
- Validity and appropriateness
- Applicability to similar problems

The formulation of a decision model involves three essential components:

Abstraction: Determining the relevant factors

Construction: Combining the factors into a logical model

Validation: Assuring that the model adequately represents the problem

The basic types of decision models for project management are as follows

Descriptive models:

These models are directed at describing a decision scenario and identifying the associated problem. For example, a project analyst might use a CPM network model to identify bottleneck tasks in a project.

Prescriptive models:

These models furnish procedural guidelines for implementing actions. The Triple C approach, for example, is a model that prescribes the procedures for achieving communication, cooperation, and coordination in a project environment.

Predictive models:

These models are used to predict future events in a problem environment. They are typically based on historical data about the problem situation. For example, a regression model

based on past data may be used to predict future productivity gains associated with expected levels of resource allocation. Simulation models can be used when uncertainties exist in the task durations or resource requirements.

4.3 Group Decision Making

Systems decisions are often complex, diffuse, distributed, and poorly understood. No one person has all the information to make all decisions accurately. As a result, crucial decisions are made by a group of people. Some organizations use outside consultants with appropriate expertise to make recommendations for important decisions. Other organizations set up their own internal consulting groups without having to go outside the organization.

Decisions can be made through linear responsibility; in that case one person makes the final decision based on inputs from other people. Decisions can also be made through shared responsibility, in that case a group of people share the responsibility for making joint decisions.

The major advantages of group decision making are listed below:

1. Facilitation of a systems view of the problem environment.
2. Ability to share experience, knowledge, and resources. Many heads are better than one. A group will possess greater collective ability to solve a given decision problem.
3. Increased credibility. Decisions made by a group of people often carry more weight in an organization.
4. Improved morale. Personnel morale can be positively influenced because many people have the opportunity to participate in the decision-making process.
5. Better rationalization. The opportunity to observe other people's views can lead to an improvement in an individual's reasoning process.
6. Ability to accumulate more knowledge and facts from diverse sources.
7. Access to broader perspectives spanning different problem scenarios.
8. Ability to generate and consider alternatives from different perspectives.
9. Possibility for a broader-base involvement, leading to a higher likelihood of support.
10. Possibility for group leverage for networking, communication, and political clout.

4.4 Brainstorming

Brainstorming is a way of generating many new ideas. In brainstorming, the decision group comes together to discuss alternate ways of solving a problem. The members of the brainstorming group may be from different departments, may have different backgrounds and training, and may not even know one another.

The diversity of the participants helps create a stimulating environment for generating different ideas from different viewpoints. The technique encourages free outward expression of new ideas no matter how far-fetched the ideas might appear. No criticism of any new idea is permitted during the brainstorming session.

A major concern in brainstorming is that extroverts may take control of the discussions. For this reason, an experienced and respected individual should manage the brainstorming discussions. The group leader establishes the procedure for proposing ideas, keeps the discussions in line with the group's mission, discourages disruptive statements, and encourages the participation of all members. After the group runs out of ideas, open discussions are held to weed out the unsuitable ones. It is expected that even the rejected ideas may stimulate the generation of other ideas that may eventually lead to other favored ideas.

Guidelines for improving brainstorming sessions are presented as follows:

- Focus on a specific decision problem.
- Keep ideas relevant to the intended decision.
- Be receptive to all new ideas.
- Evaluate the ideas on a relative basis after exhausting new ideas.
- Maintain an atmosphere conducive to cooperative discussions.
- Maintain a record of the ideas generated.

4.5 Delphi Method

The traditional approach to group decision making is to obtain the opinion of experienced participants through open discussions. An attempt is made to reach a consensus among the participants. However, open group discussions are often biased because of the influence of subtle intimidation from dominant individuals. Even when the threat of a dominant individual is not present, opinions may still be swayed by group pressure. This is called the "bandwagon effect" of group decision making. The Delphi method attempts to overcome these

difficulties by requiring individuals to present their opinions anonymously through an intermediary.

The method differs from the other interactive group methods because it eliminates face-to-face confrontations. It was originally developed for forecasting applications, but it has been modified in various ways for application to different types of decision making. The method can be quite useful for project management decisions. It is particularly effective when decisions must be based on a broad set of factors.

The Delphi method is normally implemented as follows:

1. *Problem definition.* A decision problem that is considered significant is identified and clearly described.

2. *Group selection.* An appropriate group of experts or experienced individuals is formed to address the particular decision problem. Both internal and external experts may be involved in the Delphi process. A leading individual is appointed to serve as the administrator of the decision process. The group may operate through the mail or gather together in a room. In either case, all opinions are expressed anonymously on paper. If the group meets in the same room, care should be taken to provide enough room so that each member does not have the feeling that someone may accidentally or deliberately observe their responses.

3. *Initial opinion poll.* The technique is initiated by describing the problem to be addressed in unambiguous terms. The group members are requested to submit a list of major areas of concern in their specialty areas as they relate to the decision problem.

4. *Questionnaire design and distribution.* Questionnaires are prepared to address the areas of concern related to the decision problem. The written responses to the questionnaires are collected and organized by the administrator. The administrator aggregates the responses in a statistical format. For example, the average, mode, and median of the responses may be computed. This analysis is distributed to the decision group. Each member can then see how his or her responses compare with the anonymous views of the other members.

5. *Iterative balloting.* Additional questionnaires based on the previous responses are passed to the members. The members submit their responses again. They may choose to alter or not to alter their previous responses.

6. *Silent discussions and consensus.* The iterative balloting may involve anonymous

written discussions of why some responses are correct or incorrect. The process is continued until a consensus is reached. A consensus may be declared after five or six iterations of the balloting or when a specified percentage (e.g., 80%) of the group agrees on the questionnaires. If a consensus cannot be declared on a particular point, it may be displayed to the whole group with a note that it does not represent a consensus.

In addition to its use in technological forecasting, the Delphi method has been widely used in other general decision making. Its major characteristics of anonymity of responses, statistical summary of responses, and controlled procedure make it a reliable mechanism for obtaining numeric data from subjective opinion.

The major limitations of the Delphi method are:

1. Its effectiveness may be limited in cultures where strict hierarchy, seniority, and age influence decision-making processes.

2. Some experts may not readily accept the contribution of non-experts to the group decision-making process.

3. Since opinions are expressed anonymously, some members may take the liberty of making ludicrous statements. However, if the group composition is carefully reviewed, this problem may be avoided.

4.6 Nominal Group Technique

The nominal group technique is a silent version of brainstorming. It is a method of reaching consensus. Rather than asking people to state their ideas aloud, the team leader asks each member to jot down a minimum number of ideas, for example, five or six. A single list of ideas is then written on a chalkboard for the whole group to see. The group then discusses the ideas and weeds out some iteratively until a final decision is made.

The nominal group technique is easier to control. Unlike brainstorming where members may get into shouting matches, the nominal group technique permits members to silently present their views. In addition, it allows introversive members to contribute to the decision without the pressure of having to speak out too often. In all of the group decision-making techniques, an important aspect that can enhance and expedite the decision-making process is to require that members review all pertinent data before coming to the group meeting. This will ensure that the decision process is not impeded by trivial preliminary discussions.

Some disadvantages of group decision making are:

1. Peer pressure in a group situation may influence a member's opinion or discussions.

2. In a large group, some members may not get to participate effectively in the discussions.

3. A member's relative reputation in the group may influence how well his or her opinion is rated.

4. A member with a dominant personality may overwhelm other members in the discussions.

5. The limited time available to the group may create a time pressure that forces some members to present their opinions without fully evaluating the ramifications of the available data.

6. It is often difficult to get all members of a decision group together at the same time.

Despite the noted disadvantages, group decision making definitely has many advantages that may nullify the shortcomings. The advantages as presented earlier will have varying levels of effect from one organization to another.

Team work can be enhanced in group decision making by adhering to the following guidelines:

1. Get a willing group of people together.

2. Set an achievable goal for the group.

3. Determine the limitations of the group.

4. Develop a set of guiding rules for the group.

5. Create an atmosphere conducive to group synergism.

6. Identify the questions to be addressed in advance.

7. Plan to address only one topic per meeting.

For major decisions and long-term group activities, arrange for team training that allows the group to learn the decision rules and responsibilities together.

The steps for the nominal group technique are

1. Silently generate ideas, in writing.

2. Record ideas without discussion.

3. Conduct group discussion for clarification of meaning, not argument.

4. Vote to establish the priority or rank of each item.

5. Discuss vote.

6. Cast final vote.

4.7 Interviews, Surveys and Questionnaires

Interviews, surveys, and questionnaires are important information gathering techniques. They also foster cooperative working relationships. They encourage direct participation and inputs into project decision-making processes.

They provide an opportunity for employees at the lower levels of an organization to contribute ideas and inputs for decision making. The greater the number of people involved in the interviews, surveys, and questionnaires, the more valid the final decision. The following guidelines are useful for conducting interviews, surveys, and questionnaires to collect data and information for project decisions:

1. Collect and organize background information and supporting documents on the items to be covered by the interview, survey, or questionnaire.

2. Outline the items to be covered and list the major questions to be asked.

3. Use a suitable medium of interaction and communication: telephone, fax, electronic mail, face-to-face, observation, meeting venue, poster, or memo.

4. Tell the respondent the purpose of the interview, survey, or questionnaire, and indicate how long it will take.

5. Use open-ended questions that stimulate ideas from the respondents.

6. Minimize the use of yes or no type of questions.

7. Encourage expressive statements that indicate the respondent's views.

8. Use the who, what, where, when, why, and how approach to elicit specific information.

9. Thank the respondents for their participation.

10. Let the respondents know the outcome of the exercise.

4.8 Multivote

Multivoting is a series of votes used to arrive at a group decision. It can be used to assign priorities to a list of items. It can be used at team meetings after a brainstorming session has generated a long list of items. Multivoting helps reduce such long lists to a few items, usually three to five.

The steps for multivoting are

1. Take a first vote. Each person votes as many times as desired, but only once per item.

2. Circle the items receiving a relatively higher number of votes (i.e., majority vote) than the other items.

3. Take a second vote. Each person votes for a number of items equal to one-half the total number of items circled in step 2. Only one vote per item is permitted.

4. Repeat steps 2 and 3 until the list is reduced to three to five items depending on the needs of the group. It is not recommended to multivote down to only one item.

5. Perform further analysis of the items selected in step 4, if needed.

The tools, techniques, and concepts presented in this chapter provide practical guidance for applying decision tools for oil and gas project management. To improve a project is to improve the project's underlying processes. A process encompasses the steps and decisions involved in the way that work is accomplished.

4.9 Supplier Selection Decision

Supplier selection decision is a frequent problem in oil and gas project management. A technique, such as the PICK chart, can be adapted for selecting suppliers based on qualitative or subjective analysis. For a more rigorous selection approach, quantitative methods may be necessary. The supplier selection problem is very much like an outsourcing problem, and they both can benefit from rigorous analytical selection tools and techniques.

Some of the commonly used techniques for vendor selection include the following:

- Total cost approach:

In this approach, the quoted price from each vendor is taken as the starting point and each constraint under consideration is replaced iteratively by a cost factor. The contract is awarded to the vendor with the lowest unit total cost.

- Multi Attribute Utility theory (MAUT):

In this approach, multiple, and possibly conflicting, attributes are fed into a comprehensive mathematical model. This approach is useful for global contracting applications.

• Multi objective programming:

In this approach, flexibility and vendor inclusiveness are achieved by allowing a varying number of vendors into the solution such that suggested volume of allocation to each vendor is recommended by the mathematical model.

• Total cost of ownership:

In this philosophy-based approach, the selection process looks beyond price of purchase to include other purchase-related costs. This is useful for demonstrating vendor buying and overall involvement in project success.

• Analytic hierarchy process:

In this approach, pair-wise comparison of vendors is conducted in a stage-by-stage decision process. This is useful for cases where qualitative considerations are important for the decision process.

4.10 Project integration

Project integration management specifies how the various parts of a project come together to make up the complete project. This knowledge area recognizes the importance of linking several aspects of a project into an integrated whole. This section emphasizes the importance of "togetherness" in any project environment. Project integration management area includes the processes and activities needed to identify, define, combine, unify, and coordinate the various processes and project activities. The traditional concepts of systems analysis are applicable to project processes.

The definition of a project system and its components refers to the collection of interrelated elements organized for the purpose of achieving a common goal. The elements are organized to work synergistically together to generate a unified output that is greater than the sum of the individual outputs of the components. The harmony of project integration is evident in the characteristic symbol that this book uses to denote this area of project management knowledge.

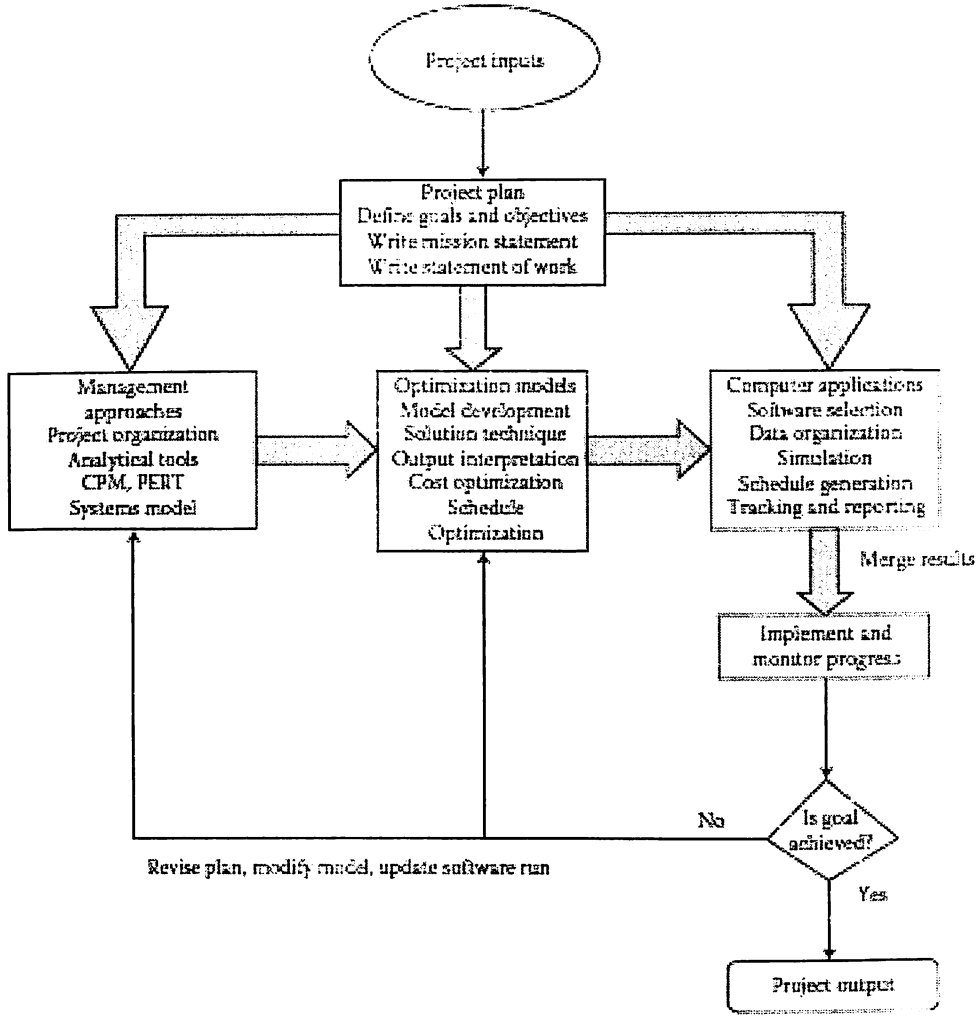

Figure 4.4 Flowchart of integrated project management

While the knowledge areas of project management, as discussed in the preceding sections, overlap and can be implemented in alternate orders, it is still apparent that project integration management is the first step of the project effort. This is particularly based on the fact that the project charter and the project scope statement are developed under the project integration process. In order to achieve a complete and unified execution of a project, both qualitative and quantitative skills must come into play.

4.10.1 Stepwise Project Integration

The integration component of the body of knowledge consists of the elements shown below:

Step 1: Develop project charter

Step 2: Develop preliminary project scope

Step 3: Develop project management plan

Step 4: Direct and manage project execution

Step 5: Monitor and control project work

Step 6: Perform integrated change control

Step 7: Close project

In addition to the standard PMBOK inputs, tools, techniques, and outputs, the project team will add in-house items of interest to the steps presented in this section. Such in-house items are summarized below:

- *Inputs*: Other in-house (custom) factors of relevance and interest
- *Tools and techniques*: Other in-house (custom) tools and techniques
- *Outputs*: Other in-house outputs, reports, and data inferences of interest to the Organization

The seven elements in the block diagram are carried out across the process groups presented earlier. The overlay of the elements and the process groups are shown in the following Table 4.1

Implementation of Project Integration Elements across Process Groups

	Initiating	Planning	Executing	Monitoring and Controlling	Closing
Project Integration	1. Develop project charter 2. Develop preliminary project scope	3. Develop project management plan	4. Direct and manage project execution	5. Monitor and control project work 6. Integrated change control	7. Close project

Table 4.1 Implementation of Project Integration Elements across Process Groups

4.10.1.1 *Step 1: Develop Project Charter*

Project charter formally authorizes a project. It is a document that provides authority to the project manager and it is usually issued by a project initiator or sponsor external to the project organization. The purpose of a charter s to define at a high level what the project is about, what the project will deliver, what resources are needed, what resources are available, and how the project is justified.

Step 1: Develop Project Charter		
Inputs	**Tools and Techniques**	**Outputs**
Project contract (if applicable) Project statement of work Enterprise environmental factors Organizational process assets Other in-house (custom) factors of relevance and interest	Project selection methods Analytic hierarchy process (AHP) Project management methodology Project management information system Expert judgment Balance scorecard Process control charts Other in-house (custom) tools and techniques	Project charter Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.2 Tools and Techniques for Developing Project Charter within Integration Management

The charter also represents an organizational commitment to dedicate the time and resources to the project. The charter should be shared with all stakeholders as a part of the communication requirement for the project. Cooperating stakeholders will not only sign-off on the project, but also make personal pledges to support the project.

Projects are usually chartered by an enterprise, a government agency, a company, a program organization, or a portfolio organization in response to one or more of the following business opportunities or organizational problems:

- Market demand
- Response to regulatory development
- Consumer request
- Commercial enterprise need
- Exploitation of technological enhance

- Legal requirement
- Social want

The driving force for a project charter is the need for an organization to make a decision about which projects to authorize to respond to operational threats or opportunities. It is desired for a charter to be brief.

Depending on the size and complexity of a project, the charter should not be more than two to three pages. Where additional details are warranted, the expatiating details can be provided as addenda to the basic charter document. The longer the basic charter, the less the likelihood that everyone will read and imbibe the contents. So, brevity and conciseness are desired virtues of good project charters. The charter should succinctly establish the purpose of the project, the participants, and general vision for the project.

The project charter is used as the basis for developing project plans. While it is developed at the outset of a project, a charter should always be fluid. It should be reviewed and updated throughout the life of the project.

The components of the project charter are summarized below:

- Project overview
- Assigned project manager and authority level
- Project requirements
- Business needs
- Project purpose, justification, and goals
- Impact statement
- Constraints (time, cost, performance)
- Assumptions

***Definition of Inputs to Step 1*:**

***Contract*:**

A contract is a contractual agreement between the organization performing the project and the organizing requesting the project. It is treated as an input if the project is being done for an external customer.

***Project statement of work (SOW)*:**

This is a narrative description of products or services to be supplied by the project. For internal projects, it is provided by the project initiator or sponsor. For external tasks, it is

provided by the customer as part of the bid record. For instance, request for suggestion, request for facts, request for bid, or agreements statements may contain specific work to be done. The SOW shows the following:

- Business want primarily based on required training, marketplace demand, technological development, legal requirement, government rules & regulations, industry standards, or trade consensus.
- Product scope description, which files project necessities and traits of the product or service that the project will deliver
- Strategic plan, which guarantees that the project supports corporation's strategic desires and business tactical actions.

***Enterprise environmental factors*:**

These are factors that impinge upon the business surroundings of the company. They include organizational shape, business culture, governmental standards, industry needs, quality standards, trade agreements, physical infrastructure, technical assets, proprietary information, existing human resources, personnel administration, internal work authorization system, marketplace profile, competition, stakeholder requirements, stakeholder risk tolerance levels, commercial obligations, access to standardized value estimating data, industry risk, technology variances, product life cycle, and project management information system (PMIS).

Organizational process assets:

These refer to the business processes used within an organization. They include standard processes, guidelines, policies, procedures, operational templates, criteria for customizing standards to specific project requirements, organization communication matrix, responsibility matrix, project closure guidelines (e.g., sunset clause), financial controls procedure, defect management procedures, change control procedures, risk control procedures, process for issuing work authorizations, processes for approving work authorizations, management of corporate knowledge base, and so on.

***Definition of Tools and Techniques for Step 1*:**

***Project selection methods*:**

These methods are used to determine which projects an organization will select for implementation. The methods can range from basic seat-of-the-pants heuristics to highly complex analytical techniques. Some examples are benefit measurement methods, comparative measure of worth analysis, scoring models, benefit contribution, capital rationing approaches, budget allocation methods, and graphical analysis tools. Analytical strategies are mathematical models that use linear programming, nonlinear programming, dynamic programming, integer programming, multi characteristic optimization, and other algorithmic tools.

***Project management methodology*:**

This defines the set of project management process groups, their collateral processes, and related control functions that are combined for implementation for a particular project. The methodology may or may not follow a project management standard. It may be an adaptation of an existing project implementation template. It can also be a formal mature process or informal technique that aids in effectively developing a project charter.

***PMIS*:**

This is a standardized set of automated tools available within the organization and integrated into a system for the purpose of supporting the generation of a project charter, facilitating feedback as the charter is refined, controlling changes to the project charter, or releasing the approved document.

***Expert judgment*:**

This is frequently used to assess the inputs required to develop the project charter. Expert judgment is available from sources such as experiential database of the organization, knowledge repository, knowledge management practices, knowledge transfer protocol, and business units inside the organization, specialists, stakeholders, customers, sponsors, professional organizations, technical associations, and industry groups.

***Definition of Output of Step 1*:**

***Project charter*:**

Project charter is a formal record that authorizes a project. It offers authority to the project manager and it is also issued by a project initiator or sponsor outside to the project organization. It empowers the project team to perform actions needed to accomplish the end goal of the project.

4.10.1.2 *Step 2: Develop Preliminary Project Scope Statement*

Project scope presents a definition of desires to be achieved. It specifies the characteristics and boundaries of the project and its related products and services, in addition the methods of acceptance and scope control. Scope is developed based on information provided by the projected initiator or sponsor. Scope statement includes the following:

- Project and product objectives
- Product characteristics
- Service requirements
- Product acceptance criteria
- Project constraints
- Project assumptions
- Initial project organization
- Initial defined risks
- Schedule milestones
- Initial Work Breakdown Structure (WBS)
- Order-of-magnitude cost estimate
- Project configuration management requirements
- Approval requirements

Step 2: Develop Preliminary Project Scope Statement		
Inputs	Tools and Techniques	Output(s)
Project charter Project statement of work Enterprise environmental factors Organizational process assets Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Expert judgment CMMI (capability maturity model integration) Critical chain Process control charts Other in-house (custom) tools and techniques	Preliminary project scope statement Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.3 Tools and Techniques for Developing Preliminary Project Scope Statement within Integration Management

***Definition of Inputs to Step 2*:**

Inputs for Step 2 are the same as defined for Step 1 covering project charter, SOW, environmental factors, and organizational process assets.

***Definition of Tools and Techniques for Step 2*:**

The tools and techniques for Step 2 are the same as defined for Step 1 and cover project management methodology, PMIS, and expert judgment.

***Definition of Output of Step 2*:**

The output of Step 2 is the preliminary project scope statement, which was defined and described earlier.

4.10.1.3 *Step 3: Develop Project Management Plan*

A project management plan includes all moves necessary to define, combine, and coordinate all subsidiary and complementing plans right into a cohesive project management plan. It defines how the project challenge is executed, monitored and controlled, and closed. The project management plan is up to date and revised via the integrated alternate manage process. In addition, the process of developing project management plan documents the gathering of outputs of planning processes and includes the following:

- Project control processes selected with the aid of the management group
- Degree of implementation of each selected process
- Descriptions of tools and strategies to be used for accomplishing those processes
- How selected techniques could be used to control the particular task
- How work could be accomplished to accomplish the task objectives
- How modifications will be monitored and controlled
- How configuration management will be performed
- How integrity of the overall performance measurement baselines will be maintained and used
- The requirements and techniques for communication amongst stakeholders
- The selected project life cycle and, for multiphase tasks, the associated project phases.
- Key management reviews for content, volume, and timing

Step 3: Develop Project Management Plan		
Inputs	**Tools and Techniques**	**Output(s)**
Preliminary project scope statement Project management processes Enterprise environmental factors Organizational process assets Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Expert judgment	Project management plan

Table 4.4 Tools and Techniques for Developing Project Management Plan within Integration Management

***Definition of Inputs to Step 3*:**

Inputs to Step 3 are the same as described formerly and include preliminary project scope declaration, project management strategies, enterprise environmental elements, and organizational process assets.

***Definition of Tools and Techniques for Step 3*:**

The tools and techniques for Step 3 are project management methodology, project information system, and expert judgment. Project management methodology defines a procedure that aids a project management team in growing and controlling changes to the

project plan. PMIS at this step covers the following segments:

- Automated system, which is utilized by the project team to do the following:
  - ✓ Support generation of the project management plan
  - ✓ Facilitate comments as the document is developed
  - ✓ Manage modifications to the project management plan
  - ✓ Release the accredited file
- Configuration management system, which is a subsystem that includes sub approaches for undertaking the following:
  - ✓ Submitting proposed changes
  - ✓ Monitoring systems for reviewing and authorizing changes
  - ✓ Offering a method to validate approved modifications
  - ✓ Implementing change management system
- Configuration management system, which forms a collection of formal processes used to apply technical and administrative oversight to do the following:
  - ✓ Identify and document functional and physical characteristics of a product or thing.
  - ✓ Control any modifications to such characteristics.
  - ✓ File and document each change and its implementation status.
  - ✓ Support audit of the products or components to verify conformance to requirements.
- Change control system is the segment of PMIS that provides a collection of formal procedures that define how project deliverables and documentation are controlled.

***Definition of Output of Step 3*:**

The output of Step 3 is the project management plan.

4.10.1.4 *Step 4: Direct and Manage Project Execution*

Step 4 requires the project manager and project team to perform multiple actions to execute the project plan successfully. Some of the required activities for project execution are summarized below:

- Perform activities to accomplish project objectives
- Expend effort and spend funds
- Staff, train, and manage project team members
- Obtain quotation, bids, offers, or proposals as appropriate
- Implement planned methods and standards
- Create, control, verify, and validate project deliverables
- Manage risks and implement risk response activities
- Manage sellers
- Adapt approved changes into scope, plans, and environment
- Establish and manage external and internal communication channels
- Collect project data and report cost, schedule, technical and quality progress and status information to facilitate forecasting
- Collect and document lessons learned and implement approved process improvement activities

The process of directing and managing project execution also requires implementation of the following:

- Approved corrective actions that will bring anticipated project performance into compliance with the plan
- Approved preventive actions to reduce the probability of potential negative consequences
- Approved defect repair requests to correct product defects during quality process.

Step 4: Direct and Manage Project Execution		
Inputs	**Tools and Techniques**	**Output(s)**
Project management plan Approved corrective actions Approved preventive actions Approved change requests Approved defect repair Validated defect repair Administrative closure procedure Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Process flow diagram Other in-house (custom) tools and techniques	Project deliverables Requested changes Implemented change requests Implemented corrective actions Implemented preventive actions Implemented defect repair Work performance information Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.5 Tools and Techniques for Managing Project Execution within Integration Management

***Definition of Inputs to Step 4*:**

Inputs to Step 4 are summarized as follows:

• Project management plan.

• ***Approved corrective actions*:** These are documented, authorized guidelines required to bring expected future project overall performance into conformance with the project management plan.

• ***Approved change requests*:** These include documented, legal modifications to increase or decrease project scope. Can also adjust policies, project management plans, strategies, costs, budgets, or revise schedules. Change requests are carried out with the aid of the project team.

• ***Approved defect repair*:** This is documented, authorized request for product correction of defect found during the quality inspection or the audit process.

• ***Validated defect repair*:** This is notification that re-inspected repaired items have either been accepted or rejected.

• ***Administrative closure procedure*:** This documents all the activities, interactions, and related roles and responsibilities needed in executing the administrative closure procedure for the project.

***Definition of Tools and Techniques for Step 4*:**

The tools and techniques for Step 4 are project management methodology and PMIS, and they were previously defined.

***Definition of Outputs of Step 4*:**

- Deliverables
- Requested modifications
- Carried out change requests
- Applied corrective actions
- Applied preventive actions
- Implemented defect repair
- Work performance information

4.10.5 *Step 5: Monitor and Control Project Work*

No organization can be strategic without being quantitative. It is through quantitative measures that a project can be tracked, measured, assessed, and controlled. The need for monitoring and control can be evident in the request for quantification (RFQ) that some project funding agencies use. Some quantifiable performance measures are schedule outcome, cost effectiveness, response time, number of reworks, and lines of computer codes developed. Monitoring and controlling are performed to monitor project processes associated with initiating, planning, executing, and closing and is concerned with the following:

- Comparing actual overall performance against plan
- Assessing performance to decide whether or not whether corrective or preventive actions are required, and then recommending those actions as necessary.
- Analyzing, reading, tracking, and monitoring project dangers to make sure risks are diagnosed, status is reported, and response plans are being done.
- Keeping an accurate well timed information base concerning the project's products and associated documentation
- Providing records to aid status reporting, progress size, and forecasting
- Providing forecasts to update modern price and schedule statistics.
- Monitoring implementation of authorized modifications.

Step 5: Monitor and Control Project Work		
Inputs	**Tools and Techniques**	**Output(s)**
Project management plan Work performance information Rejected change requests Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Earned value management Expert judgment Other in-house (custom) tools and techniques	Recommended corrective actions Recommended preventive actions Forecasts Recommended defect repair Requested changes Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.6 Tools and Techniques for Monitoring and Controlling Project Work within Integration Management

***Definition of Inputs to Step 5*:**

Inputs to Step 5 include the following:

- Project management plan
- Work overall performance plan
- Rejected alternate requests
- Alternate requests
- Helping documentation
- Change review status showing disposition of rejected alternate requests

***Definition of Tools and Techniques for Step 5*:**

- Project management methodology.
- PMIS.
- Earned value technique: This measures performance as project moves from initiation through closure. It provides means to forecast future performance based on past performance.
- Expert judgment.

***Definition of Outputs of Step 5*:**

- ***Recommended corrective actions*:** Documented recommendations required to bring expected future project performance into conformance with the project management plan

• ***Recommended preventive actions***: Documented recommendations that reduce the probability of negative consequences associated with project risks

• ***Forecasts***: Estimates or predictions of conditions and events in the project's future based on information available at the time of the forecast

• ***Recommended defect repair***: Some defects found during quality inspection and audit process recommended for correction

• Requested changes

4.10.1.6 *Step 6: Integrated Change Control*

Integrated change control is accomplished from project inception through completion. It is required due to the fact initiatives rarely run according to plan. Major components of integrated alternate control include the following:

• Identifying when an alternate desires to occur or when a change has occurred

• Amending factors that circumvent change control strategies.

• Reviewing and approving requested modifications.

• Managing and regulating flow of approved modifications.

• Maintaining and approving recommended corrective and preventive actions

• Controlling and updating scope, cost, budget, schedule, and quality necessities based totally upon permitted changes.

• Documenting the whole impact of requested modifications.

• Validating defect restore.

• Controlling project quality to standards based totally on quality reviews.

Combining configuration management system with incorporated change control consists of identifying, documenting, and controlling changes to the baseline. Project-wide application of the configuration management system, including change control processes, accomplishes three essential objectives:

• Establishes evolutionary method to consistently identify and request changes to established baselines and to assess the value and effectiveness of those changes

• Provides opportunities to continuously validate and improve the project by considering the impact of each change

• Provides the mechanism for the project management team to consistently

communicate all changes to the stakeholders

Integrated change control process includes some specific activities of the configuration management as summarized below:

• ***Configuration identification***: This provides the basis from which the configuration of products is defined and verified, products and documents are labelled, changes are managed, and accountability is maintained.

• ***Configuration status accounting***: This includes capturing, storing, and getting access to configuration information needed to manage products and product information effectively.

• ***Configuration verification and auditing***: This involves confirming that performance and functional requirements defined in the configuration documentation have been satisfied.

Step 6: Perform Integrated Change Control		
Inputs	**Tools and Techniques**	**Output(s)**
Project management plan Requested changes Work performance information Recommended preventive actions Recommended corrective actions Deliverables Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Expert judgment Other in-house (custom) tools and techniques	Approved change requests Rejected change requests Update project management plan Update project scope statement Approved corrective actions Approved preventive actions Approved defect repair Validated defect repair Deliverables Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.7 Tools and Techniques for Integrated Change Control within Integration Management

***Definition of Inputs to Step 6*:**

The inputs to Step 6 include the following items, which were all described earlier:

• Project management plan

• Requested changes

• Work performance information

• Recommended preventive actions

• Deliverables

Definition of Tools and Techniques for Step 6:

- ***Project management methodology:*** This defines a process that helps a project management team in implementing integrated change control for the project.
- ***PMIS:*** This is an automated system used by the team as an aid for the implementation of an integrated change control process for the project. It also facilitates feedback for the project and controls changes across the project.
- ***Expert judgment:*** This refers to the process whereby the project team uses stakeholders with professional judgment on the change control board to govern and approve all requested modifications to any issue of the project.

Definition of Outputs of Step 6:

The outputs of Step 6 include the following:

- Accredited change requested
- Rejected alternate requests
- Project management plan (updates)
- Project scope statement (updates)
- Accredited corrective actions
- Accredited preventive actions
- Accredited defect repair
- Confirmed defect repair
- Deliverables

4.10.1.7 Step 7: Close Project

At its completion, a project must be formally closed. This involves performing the project closure portion of the project management plan or closure of a phase of a multiphase project. There are two main procedures developed to establish interactions necessary to perform the closure function:

- ***Administrative closure procedure:*** This provides details of all activities, interactions, and related roles and responsibilities involved in executing the administrative closure of the project. It also covers activities needed to collect project records, analyze project success or failure, gather lessons learned, and archive project information.

• ***Contract closure procedure***: This involves both product verification and administrative closure for any existing contract agreements. Contract closure procedure is an input to the close contract process.

Step 7: Close Project		
Inputs	**Tools and Techniques**	**Output(s)**
Project management plan Contract documentation Enterprise environmental factors Organizational process assets Work performance information Deliverables Other in-house (custom) factors of relevance and interest	Project management methodology Project management information system Expert judgment Other in-house (custom) tools and techniques	Administrative closure procedure Contract closure procedure Final product, service or result Updates on organizational process assets Other in-house outputs, reports, and data inferences of interest to the organization

Table 4.8 Tools and Techniques for Closing Project within Integration Management

***Definition of Inputs to Step 7*:**

The inputs to Step 7 are the following:

• Project management plan.

• Contract documentation: This is an input used to perform the contract closure process and includes the contract itself as well as changes to the contract and other documentation, such as technical approach, product description, or deliverable acceptance criteria and procedures.

• Enterprise environmental factors.

• Organizational process assets.

• Work performance information.

• Deliverables, as previously described, and also as approved by the integrated change control process.

***Definition of Tools and Techniques of Step 7*:**

• Project management methodology

• PMIS

• Expert judgment

***Definition of Outputs of Step 7*:**

• Administrative closure procedure

• Procedures to transfer the project products or services to production and/or operations are developed and established at this stage

• This stage covers a step-by-step methodology for administrative closure that addresses the following:

- ✓ Actions and activities to define the stakeholder approval requirements for changes and all levels of deliverables
- ✓ Actions and activities confirm project has met all sponsor, customer, and other stakeholders' requirements
- ✓ Actions and activities to validate completion and exit criteria for the project

• Contract closure procedure

- ✓ This stage provides a step-by-step methodology that addresses the terms and conditions of the contracts and any required completion or exit criteria for contract closure
- ✓ Actions performed at this stage formally close all contracts associated with the completed project

• Final product, service, or result

- ✓ Formal acceptance and handover of the final product, service, or result that the project was authorized to provide
- ✓ Formal statement confirming that the terms of the contract have been met

• Organizational process assets (updates)

- ✓ Development of the index and location of project documentation using the configuration management system
- ✓ Project closure documents, which consist of a formal documentation indicating the completion of the project and transfer of deliverables
- ✓ Historical information, which is transferred to knowledge base of lessons learned for use by future projects

CHAPTER 5: APPLICATION OF RESEARCH METHODOLOGY

Research methodology is a way to systematically resolve the research issues. It could be understood as a science of studying how research is executed scientifically.

5.1 Research Objectives

The overarching objective of the research study was to identify the major areas of focus in project management in order to build a model for the successful execution of an Engineering, Procurement and Construction (EPC) project. This objective would be achieved by quantifying the lessons learned collected in the survey based on the project methods, the resulting rankings would indicate which lessons are the most important. The high ranking lessons would become the areas of major focus in building a model for projects. These methods of surveying were used because its effectiveness at identifying the areas of focus in an undocumented subject matter.

The specific objectives of the research study were to:

- ✓ Conduct a two to three round survey using the project methodologies
- ✓ Collect lessons learned from industry professionals who had worked or were currently working on EPC projects
- ✓ Establish the context by identifying the reasons why they are lessons learned.
- ✓ Identify solutions and recommendations that would lead to the successful execution.
- ✓ Create a model for the successful execution based on the essential lessons learned collected from the survey.

5.2 Planning the Research Study

The scope of the survey question would have an impact on the range of responses from the participants, such as simple yes or no answer to the more open ended responses. For this survey, the researcher's objective was to tap into the participant's knowledge and experience. Therefore, a broader question was much more desirable since it would allow for the collection of more data.

The survey participants identified for the survey were from different backgrounds in terms of their position in the EPC and owner organizations, their knowledge, experience, education, language, vocation, etc. Thus, it was important to ensure that all the participants derive the same meaning when reading the question.

5.3 Scope of Study

The scope of the study was to interview people who had worked in engineering, procurement, and construction areas of the projects. The goal was to obtain their experiences in the form of lessons learned that could be used to develop a model that would lead to the successful execution of the projects in future. Included in the scope was a review of all engineering phases, such as DBM, EDS, and Detailed Engineering.

5.4 Researcher Involvement

In conducting a research study, the researcher can be involved in a couple of ways - he or she can either be actively or passively engaged in the survey, particularly during the interviewing process. From the researcher's perspective, being passively involved would mean using a medium for surveys, such as the internet or email that has minimal interface with the researcher. On the other hand, being actively involved would require personally conducting the surveys by interviewing the participants. For this researcher, it was a conscious decision to be actively involved in the survey interviews. There were several reasons for this decision, which include:

- The Delphi Method of surveying *requires* the researcher to conduct an initial interview with the participants individually to get their views on the topic being researched and to test the questionnaire. From this researcher's previous experience in conducting surveys, by actively participating in the study, the researcher is able to learn more about the topic. In addition, during the interviews, if the participant is not clear about certain aspects, the interviewer can prod the participant so as to obtain a better explanation with greater detail.

- In addition, by actively participating in the survey, the researcher also gets to understand and appreciate the nuances of the area of research, such as the tools, terminology,

Interconnectedness of the various subject elements, and so on; such understanding would be difficult to experience if the surveys were being done remotely.

• Finally, with one-on-one surveys, the researcher gets the opportunity to confirm certain ideas emanating in the surveys by cross-checking with other participants if they had experienced something similar.

The researcher felt comfortable conducting the interviews and was successful in interacting with specialists in the industry because of his background, which includes having studied project management at the graduate degree level, having substantial experience working in the Project Controls area in the EPC industry, both at the construction site and at the engineering contractors home office, as well as having worked for owner and contractor companies. This work experience has provided the researcher with the knowledge of the various engineering disciplines, procurement, and construction areas, and the researcher was, therefore, able to probe the participants for appropriate detail in their responses during the interviews.

However, as a researcher, one has to be cautious when using this approach of being actively engaged in the interviews. This is because, being so attached to the research topic it is sometimes difficult to always have an open mind. In addition, it is easy for the researcher's preconceived ideas to inadvertently slip into the participant responses.

Therefore, the researcher has to remain an impartial facilitator and ensure that participants are not guided by leading questions or responses.

5.5 Trial Run

This is an essential element of surveying, because it helps to identify and resolve inconsistencies and vagueness in the survey instrument and its subsequent reporting. The trial run is essentially conducting a pilot of the survey; testing out the survey with a few individuals to observe their reactions to the questions, how they perceive and answer them, how easy or difficult is it to do the survey, and the participants' comments about the survey questions. All this information helps in tweaking or adjusting the survey if required and removing the "bugs" in an attempt to get better data. The revised survey instrument usually results in a much better product than the previous versions.

5.6 Survey Methodology and Procedure

One important characteristic of the Delphi Method is that it is not a rigid method, and therefore, it provides great flexibility in designing the survey. This flexibility is important, particularly when the researcher is entering into an uncharted territory, where there is not much information available in the literature and the objective of the survey is to extract as much knowledge and experience from the participants as possible.

This flexibility element of the Delphi Method is particularly helpful in cases where the available knowledge has not been well documented or published in the public realm.

5.7 Participant Selection

By having a broader group of participants, the knowledge base of the study becomes much wider and deeper. There are essentially four qualities that define a participant's expertise:

i. Knowledge and experience with issues under consideration
ii. Capacity and willingness to participate
iii. Sufficient time to participate
iv. Effective communication skills

5.7.1 Purposive Selection

Purposive selection or criterion based sampling was used, with specific emphasis on selecting individuals who had worked on EPC projects. This was achieved by identifying some of the participants who were known to the researcher, having worked previously together on projects, and others through referrals and contacts in the EPC industry. To ensure that the survey provided rich data, effort was made to select individuals who had or were currently working in lead positions or higher in the hierarchy of the project organization. The implication of selecting participants from higher level positions is that the survey participants had a great deal of knowledge and experience of their field, and therefore, offered a better chance of obtaining good quality of data.

5.8 Sample Size

The characteristic of the sample, whether it is heterogeneous or homogenous, was also a determinant of the sample size. With a homogeneous group, a sample between ten to fifteen participants would provide adequate results. In the survey, the sample can be considered homogeneous because all the participants are from the same industry and have worked on EPC projects.

5.9 Data Collection Process

The researcher will contact the survey participants either in person or by telephone to invite them for the survey. The research objectives, topic, methodology, and time requirement were explained to the potential participants before they were asked if they would agree to participate in the survey. If they agreed, a half-hour appointment was setup for a one-on-one interview. In most cases, the surveys were conducted at the participant's places of work in order to not intrude on their schedule and to get their full attention to complete the survey. Due to the close proximity of the researcher to the participants, personal interviews were thought to be the best alternative rather than telephone, on-line, or email.

CHAPTER 6: RISK MANAGEMENT

6.1 Introduction

Risk management is a vital and integral part of project management in the oil and gas industry. For an oil and gas infrastructure project, risk management may be done efficiently by investigating and identifying the sources of risks associated with each activity of the project. These risks can be assessed or measured in terms of likelihood and impact. Because of the exploration basis of the oil and gas industry, a distinctive and diverse set of risk issues will be involved. So, as risks are assessed for managerial processes, technical and exploration risks must also be assessed. Risk and estimation of reserves constitute a major portion of project risk analysis in the oil and gas industry. The major activities in oil and gas risk analysis consist of feasibility studies, design, transportation, utility, survey works, and construction, permanent structure works, mechanical and electrical installations, maintenance, and so on.

6.2 Risk Management Process

Project risks originate from the uncertainty that is present in all projects to one extent or another. A common area of uncertainty is the size of project parameters, such as time, cost, and quality with respect to the expectations of the project. For example, we may not know precisely how much time and effort will be required to complete a particular task. Possible sources of uncertainty include the following:

- ✓ Poor estimates of time and cost
- ✓ Lack of a clear specification of project requirements
- ✓ Ambiguous guidelines about managerial processes
- ✓ Lack of knowledge of the number and types of factors influencing the project
- ✓ Lack of knowledge about the interdependencies among activities in the project
- ✓ Unknown events within the project environment
- ✓ Variability in project design and logistics
- ✓ Project scope changes
- ✓ Varying direction of objectives and priorities

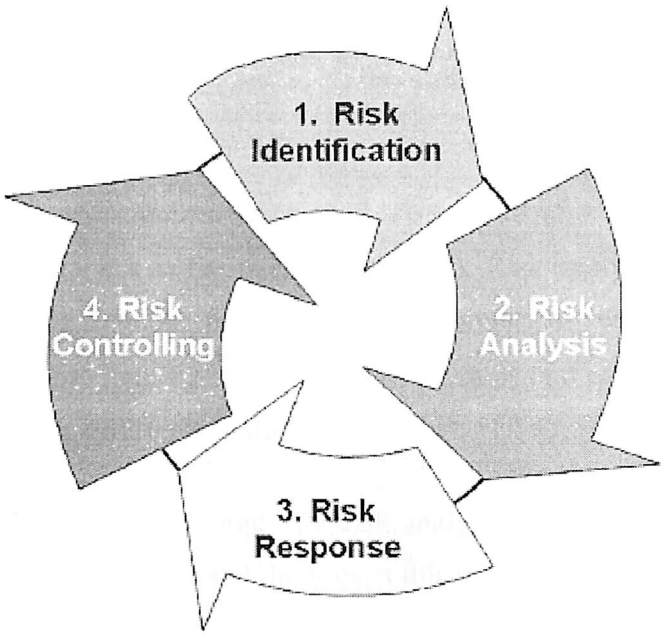

Figure 6.1 Risk Management Process

6.2.1 Risk Identification

Risk Identification is the first and most important step because it builds the basis for all subsequent steps. The risk identification step is very similar to a transformation process.

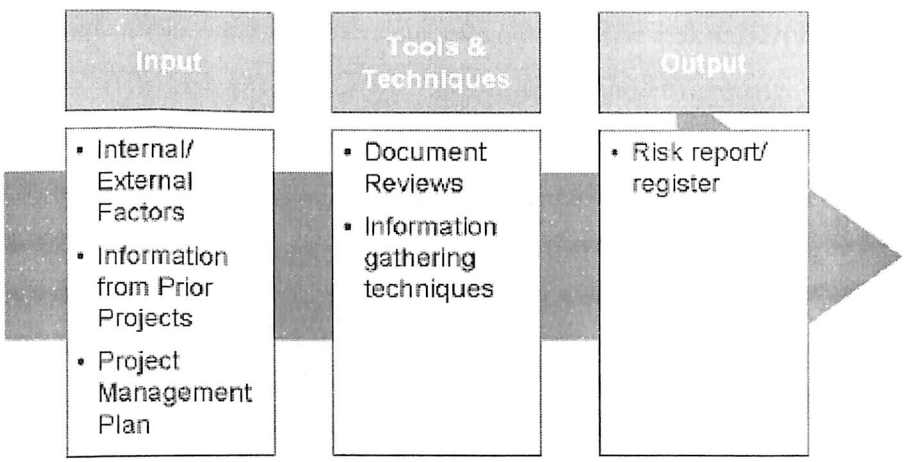

Figure 6.2 Risk Identification

In the beginning you have inputs and in the end you have a result or simply an output. In the middle step there are tools and techniques to fulfil the transformation process as shown in figure 6.2.

6.2.2 Risk Analysis

The basis of risk analysis is the risk identification. Risk analysis covers a complete and continuous evaluation which should be realized quantitatively as well as qualitatively for all identified risks. The goal is to detect possible interrelationships and enable the project manager to identify a kind of importance order, also called prioritizing.

The most commonly used technique for risk analyzing is scenario analysis. This simply consists of the probability of the event and the impact this would have on the project. The scenario analysis is part of many more approaches to the analysis of risks.

6.2.3 Risk Response

After having collected all data for the risk control, a risk might occur once. As a result, the project manager has to decide how to react to it. The literature defines five main alternatives between which one can choose: mitigate, avoid, transfer, share or retain the risk.

6.2.4 Risk Control

The very last step in the whole risk management process is risk control. Included in this step are executing the risk response strategy, monitoring and triggering events, initiating contingency plans and continuously watching new risks. In the risk control portion the change in management systems is also an essential part. During the project there might be changes in scope, budget and schedule which the project manager has to deal with.

CHAPTER 7: CONCLUSION

This study illustrated the necessity of different aspects of preparing and executing parts of the project management process in Oil and Gas projects.

Many economists and business leaders have argued that the primary purpose of involving project management in business is to yield profit and integrating it within its business practices defeats that very purpose. This is a very strong and realistic argument for 99% of companies but there are a small number of extraordinarily large corporations throughout the globe who have exceptional turnovers and most of whom accrue massive profits.

In Initial Chapters, we have seen about the Research methodologies in Project management and the various types of methods which can be followed in a research and the kind of approach to a project. Later we have studied about the risk management and the phases of risks management and a brief about those methodologies.

We are concluding that we have studied about the Role of Project management in the Oil and Gas industry in detail.

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