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A Comparison of Project Management Models in Chinese and in International Oil Service Companies



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Haixi Yang

Abstract

This master thesis is composed of five main parts.

Chapter one state the background of research regarding project management and the necessity of project management models comparison between in China and international corporations. Besides, the origin and the development of the project management method is stated in Chapter one.

The definition and the characteristics of project management is discussed in chapter two, further, the process including project initiation, project planning, project monitoring and the closure of the project as well as the nine knowledge areas which are covering cost, time, human resource, quality control and procurement are stated here also.

In chapter three, the project management comparison is conducted between international and Chinese engineering corporations in these aspects which are covering salary, training, law related to project management, organizations etc. Also, the common and new project management models are discussed also.

A case of project management in Chinese oil service limited corporations is presented in Chapter four, after the comparison, the conclusion which is stated in chapter five, integrating with the reality we should apply PMC and portfolio model PMC + Partnering model.

Abstract in Chinese

本论文主要由五部分组成

在当前国际大环境“走出去”战略的引导下，国际化新型管理模式的出现，有必要对国外国内的管理模式加以对比，以便我们能更好的与世界接轨。

第一章主要描述研究背景及其项目管理的起源与发展，以及最早的项目管理的案例，和后期相关项目管理组织的建立。

第二章主要描述项目，项目管理的概念及其特点，以及项目管理的五个步骤，包括：项目的发起，项目的计划和设计，项目的监控，项目的结束等。九大知识领域包括：一体化管理，项目范围，时间，成本，质量，人力资源，交流沟通，风险，采办管理等。

第三章主要是在五个方面对比了中外工程公司的项目管理模式，以及常用的普通管理模式，一些新兴的管理模式。最后一节从国际管理模式得出一些启示。

本文的第四章主要讨论了国内外油田服务公司管理模式的特点,进而以实例为证，进行对比，最后得出第五章的不同之处，也就是第五章的结论和建议,建议大力推广 PMC 模式，和应用组合模式 PMC + Partnering 模式

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1. Introduction

1.1 Background

A large number of Chinese corporations have been going abroad to conduct business related to project management after China became a member of WTO since 2001. On the other hand, it is a common phenomenon that Chinese are gradually accepting some foreign companies to cooperate to develop resources, such as oil and gas, mining, and other sources. Confronting with complications and diversification of project management, the traditional model of project management for the Chinese corporations are out of style and can't meet the need of the fierce market competition. We have to conduct analysis on current project management and study the advanced project management model so that we can avoid negative impacts due to the advanced project management on the Chinese companies.

Confronting with fierce market competition, the Chinese oil service corporations have to expand their market and attain the target set by the top leaders, especially for COSL (China Oilfield service limited), under the leadership of its holding corporations CNOOC which established the twelfth "five-year-plan" that is to double oil and gas production in 2020. The Chinese oil service corporations have made a huge progress in service quality, service model and service technique in the past several years, however, we have to acknowledge that there is still a big gap between Chinese service corporations and international oil giant. How can we minimize the gap between the Chinese service corporations and international oil service corporations? We are always developing the market and receiving some contracts for service companies. As a contract, is a project, how to conduct the project smoothly and successfully? Which kind of project management model do you implement in your project? That is why the author made this research and compared the project management models between Chinese and international companies.

1.2 The developing process of project management methods

1.2.1 1945~1960

The "over-the-fence" management method was used by project managers in 1940s, which means each line manager would throw the "ball" over the fence hoping that some other one would catch it when the project was finished. Once the ball was thrown over the

fence, the project manager would not have any more responsibility for this project. The blames were placed on the line manager who had the ball at that time if the project failed.

The “over-the-fence” management has some problems, that is, the customer can’t get questions answered, for example; if the customer wants to know the information, he has to search out where is the project manager “who possesses the ball”. In other words, finding information means wasting of time for this project management model.

Following World War II , it is clear that the traditional over-the-fence management model was not suitable for projects due to “arms race”. The governments only wanted one point of contact, which means one project manager who has the ability to clear and control each phases of the project.

By the late 1950s, project management was growing rapidly in aerospace and defense industries but at relatively low rate in others. The governments had to create a standard to manage the whole process of a project due to involvement by many contractors. However, the private industries did not attach importance to these standards.

1.2.2 1960~1985

Between the late 1960s and mid-eighties, an increasing number of executives began to search for new and advanced project management models which could meet the need of the new project situation.

By 1970s, the situation had changed rapidly, the companies in aerospace, defense and constructions were pioneers to implement the new project management models, soon, other companies were following, but some were forced to accept the project management model required by NASA and the Department of Defense.

1.2.3 1985~2009

By 1990s, companies realized it was really necessary to implement project management technique in the process of managing a project. Table 1-1 shows the life cycle phase that an organization goes through during implementing project management models.

Table 1-1 Life Cycle Phases for Project Management Maturity (Kerzner, 2009)

Embryonic	Executive Management Acceptance Phase	Line Management Acceptance Phase	Growth Phase	Maturity Phase
Recognize need	Visible executive support	Line management support	Use of life-cycle phases	Development of management cost/schedule control system
Recognize benefits	Executive understanding of project management	Line management commitment	Development of a project management methodology Commitment to planning	Integrating cost and schedule control
Recognize applications	Project sponsorship	Line management education	Minimization of creeping scope	Developing an educational program to enhance project management skills
Recognize what must be done	Willingness to change way of doing business	Willingness to release employees for project management training	Selection of a project tracking system	

Line management acceptance is the third life cycle phase in the whole process of project management moving to maturity. We can't, however, make sure that all the line management will actively support the implementation of project management models without visible executive support.

The Growth Phase is the fourth phase during which project management methodology is developed, including planning, scheduling, controlling, as well as selection of a project tracking system.

The last life cycle phase is the Maturity phase in which the project management model is decided, hence, the organization should develop an educational program to enhance project management skills so that the project could move on successfully.

According to (Kerzner, 2009), there are the following five driving forces that make the executives recognize the importance of project management

- Capital projects
- Customer expectations
- Competitiveness
- New project development
- Efficiency and effectiveness

Manufacturing companies has to implement a project management model due to large capital projects, the contractor which is selling products or services should have good experiences in project management. What the contractor is selling to their client is not only the product, but also the solutions. So we can say it is impossible to provide suitable solutions to the client without project management experiences.

Executive understanding is another driving force for some organizations which have a traditional structure that performs routine and repetitive activities. These organizations are not willing to change unless they get the order from the executives.

Because of the relationship between the above five driving forces, the only true driving force is survival. This is illustrated in Figure 1-1

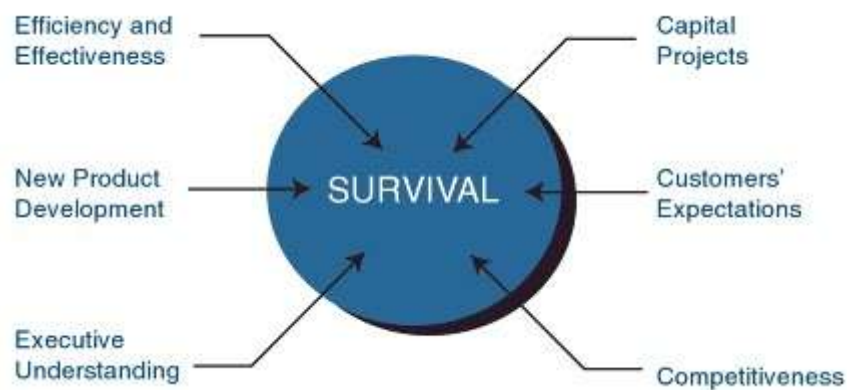


Figure 1-1 Components of Survival .Source: reprinted from H.Kerzner, In Search of Excellence in project management. New York: Wiley, 1998, p.51.

It is a necessity for a company to implement project management if the company wants to survive. The speed by which companies reach some degree of maturity in project management is most often based upon how important they perceive the driving forces to be. This is illustrated generically in Figure 1-2.

- Non-project-driven and hybrid organizations move quickly to maturity if increased internal efficiencies and effectiveness are needed. Competitiveness is the slowest path because these types of organizations do not recognize that project management affects their competitive position directly.
- For project-driven organizations, the path is reversed. Competitiveness is the name of the game and the vehicle used is project management (Kerzner, 2009).

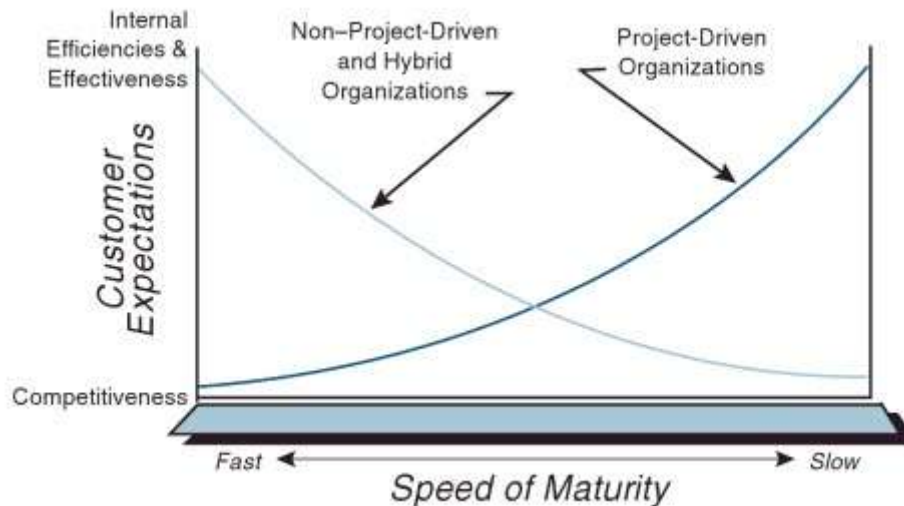


Figure1-2 The Speed of Maturity (Kerzner, 2009)

1.2.4 Some cases related to the development of project management

1.2.4.1 Manhattan Project in US

There are some enormous developments in project management over the past sixty years. The earliest project in which the project management ideal and method was applied is called the Manhattan Project in America from 1942 to 1945, which was a research and development program by the United States and United Kingdom and Canada that produced the first atomic bomb during World War II, in which roughly US\$2 billion was spent, and 200,000 people were involved. The project was under the direction of Major General Leslie Groves of the US Army Corps of Engineers to make a success with a shorter project period and less cost.

1.2.4.2 Apollo Project

The Apollo Project was launched by US from 1961 to 1972, in which 25.5 billion were consumed, 0.4 million people and 20,000 companies were involved. The cost and time period spent in the project were shortened rapidly due to the application of project management. The success of the Apollo Project not only laid the foundation for the subsequent space program, but also made project management spread around the world. Besides, companies in aerospace, defense and construction pioneered in implementing project management in the 1970's.

1.2.4.3 Project experience in other area

The DUPont Company was the first one to apply project management knowledge (CPM) into equipment maintenance in 1957 and then the down time for the failure of the

equipment was shortened from 12hours to 7hours due to the application of project management, which attracted many eyes in this area.

In the design of the Polaris missile submarine for Americans, the project period was shortened by two years due to the application of (PERT) Project Evaluation and Review Technique. In1958, the CPM and PERT were both based on the network mode, thus, they are both called project management based on network.

1.2.5 Organizations related to project management

With the development of the project management all over the world, some organizations were established which indicated that project management was recognized and emphasized during this period. Such as, IPMA (International project management association) was established in Europe in 1965, PMI (project management institute) was established in America in 1969.

1.3 The development and status of project management in China

According to some historic documents and the our research, we know that project management can be traced back to ancient times in China, some well-known construction projects could be the evidence, such as the Great wall and, the Forbidden city. The modern project management techniques such as Critical Path Method (CPM), Program Evaluation and Review Techniques (PERT), Graphical Evaluation and Review Techniques (GERT) were introduced into China in the 60s when China launched its nuclear weapon and missile programs. The project management techniques were firstly applied in aerospace, science, construction and then in other areas.

In 1960s, under the introduction of Professor Loo-Keng Hua in Tsinghua University, the project management which is based on the network, integrated with Chinese philosophy in what is called “take all factors into consideration”, then, the critical path method (CPM) appeared which is based on the network in early period. We have the original definition of project management based on the critical path method created by Chinese Professor Loo-Keng Hua.

According to the above statements, the credit should be given to Professor Loo-Keng Hua, who was the one to first realize that successful application of project management will lead to better growth of economic and social development. Besides, the credits should also go to Professor Xue-Sen QIAN at California Institute of Technology who was the one to promote the project management theory in China and who developed it as a new field. For instance, applying it into missile and aerospace programmes.

Following that, many project management software based on CPM/PERT were developed by Chinese engineers and applied into construction. For example, in 1982, the effective application of the project management method by a Japanese construction company in building Brugger Hydropower Station in China, which enabled the people in the construction field to become aware that the application of project management methods possess the advantage of saving cost and shortening the project period.

Based on the experience from building the Brugger Hydropower Station, in 1987, The Chinese government were trying to employ the project management theory on some special projects, what is more, the Project manager certification system was established at this time. In 1991, the project management theory was applied in most of the project in China. The Chinese government put more emphasis on the project, especially, in some famous huge projects, such as in the construction of The Three Gorges Project.

The main project management models in China could be summarized as followings:

- The clients have employed professional project management organization to take charge of this project.
- The contractors have invited professional project management organization to conduct project management.
- The contractors have invited professional project management organization to win a bid for them, then conduct project management and maximize the benefits of the project.
- With respect to small projects, the clients will manage the project themselves due to lacking of funds.
- Some of the projects, which are supported by the government, still are managed by the government.
- Until the 1990s, the government realized the importance of project management due to frequent accidents in the projects, there are already five million project managers who are trained by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD).
- Project Management Institute (PMI) already has accredited more than 8000 project management professionals (PMP), more PMP will be accredited afterwards due to the importance of the project management.

1.4 The method of conducting this research

Confronting with fierce market competition, the Chinese contractors should be “walking out” to win bids from international corporations; the first condition is that we should know which kind of project management model they employ. The author carrying out the research according to following sequence:

-
- The author firstly presents the definition, characteristics and processes of the common project management models
 - Conducting the comparison between the project management models in China and in overseas.
 - Presenting some cases to prove the conclusion
 - Integrating with personal experience to analyze the difference between the project management models in China and in overseas.

1.5 The content of this thesis

1.5.1 Definition and development process of project management

This thesis is composed of five chapters; the author discusses the background and presents the development process of this research in the first chapter. Following that, the definition and the characteristics of project management are stated, so that the readers could understand what project management is, and be aware of the whole process of project management which started since 1950s. Then, the basic nine knowledge area and five stages of the project management are discussed, which is the base for the afterwards project management comparison between China and international service corporations.

1.5.2 The specific discussion of project management in China and international

After the description of the development of project management, some common and new project management models, such as CM, BOT, EPC, PMC are stated. Specifics about the definition, the characteristics, advantages and disadvantages of project management models are described after the comparison. Some detailed suggestions related to the present project management are coming up after the comparison.

1.5.3 Project management in Oil service corporations in China and internationally

The author is discussing some common project management methods which are employed in oil service companies in China and in international companies firstly. Following that, a comparison is conducted on some aspects such as cost, time, risk etc. After the comparison, the author puts more attention on the current project management model of COSL in which the author is working. Some relevant project management cases are presented here to prove the conclusions.

1.6 Objective of the research

We can easily understand there are still some differences between the Chinese model and the international model, but the author has to declare that the main objective of this research is not to criticize the Chinese model but to compare and make recommendations.

2. Overview

2.1 Project

2.1.1 Defining project

For better understanding of project management, we should be aware of the definition and the characteristics of the project. There are so many different definition with respect to a project and when we are being asked, it may seems like an easy question for us when being required to recognize the project when we see one, however, the definition of a project is fairly more broad than we think.

A project is defined as a temporary endeavor undertaken to create a unique product or service by the Project Management Institute (Gardiner, 2010); however, another definition is given by the British Standards Institution: a project is a unique set of coordinated activities, with a definite starting and finishing point, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters (Gardiner, 2010), From the description above, we can summarize the definition of a project as followings:

- It has a specific objective to be completed within certain specifications
- It has defined start and end dates
- It has funding limits
- It consumes human and nonhuman resources(i.e., money, people, equipment)
- It is multifunctional (i.e., cut across several functional lines) (Kerzner, 2009)

We could encounter many kinds of projects which have different size, but the project management principle is the same, for example, finishing the homework when we were at school, this task is composed of simple technique and basic material, but the project of launching Shenzhou VII spacecraft was vastly different, which including thousands of complex task and involved hundreds of people in the project of designing, planning, organization and executing.

2.1.2 Characteristics of projects

In order to differentiate the project from other activities (like a program), we should be clear of the characteristics of the project. Normally, there are three basic characteristics for the project: temporary, unique and require progressive elaboration.

The first characteristic is that the project should be a temporary one, but it doesn't imply that the project has a short duration. For example, the Great Wall construction project in China was established in year BC 221, and it takes almost 1000 years to finish the building project due to its poor mechanic condition in ancient times.

Project duration is different due to how the project is defined, for example, the I phone company in US may wish to include design, development, operation and future upgrades in a project, which result in a longer duration for the project, conversely, if the company only wish to include design and development, then the duration for the project is shorter. (See the Figure 2.1 below)

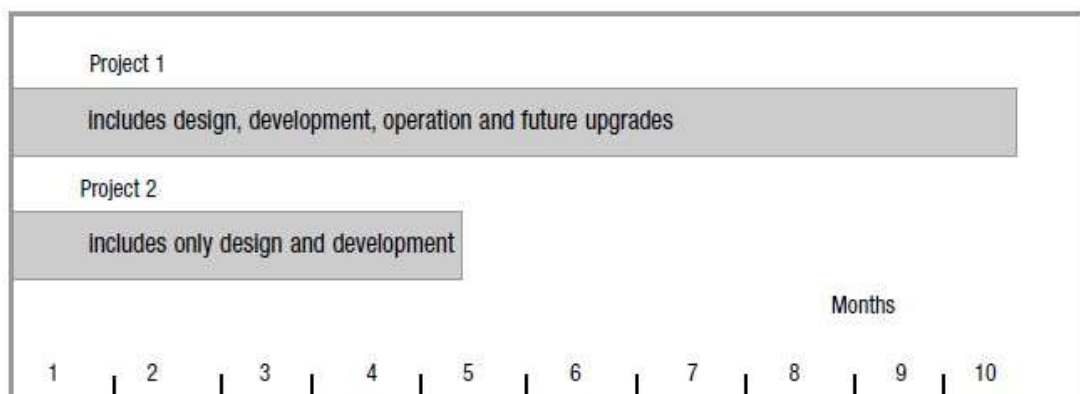


Figure 2.1 Project duration varies according to how a project is defined (Gardiner, 2010)

The second characteristic for a project is that it is unique, we can take the KFC for an example, regardless of how many restaurants KFC have all over the world, but the taste of the KFC is still the same.

The third characteristic is that the project needs progressive elaboration during its execution. For example, a house construction project; the number and size of the house will be determined at the early stage, however, the color can be determined in the end according to the buyers' desire, the style can be determined after the construction has started.

In addition to the above basic characteristics of the project, there are several other features for the project as followings:

- Should carry risk and uncertainty analysis

- Be organizationally complex, requiring the interaction of many people, departments and other organizations.
- Be managed against time, budget and human resource plans
- Suffer conflict due to competition for resources required by other projects and non-project work
- Have single point responsibility provided by the project manager
- Require teamwork and the ability of participants to use effective leadership skills.(Gardiner, 2010)

2.2 Project management

2.2.1 Definition of project management

We know the definition of the project management according to British Standards Institution which is stated as: project management is the planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objects on time and to the specified cost, quality and performance(Gardiner, 2010), In my opinion, project management is about managing the process which is including managing personnel, equipment, material, and operation service to create a product or technology, We are able to understand the process of the project management completely through Figure2.2 below:

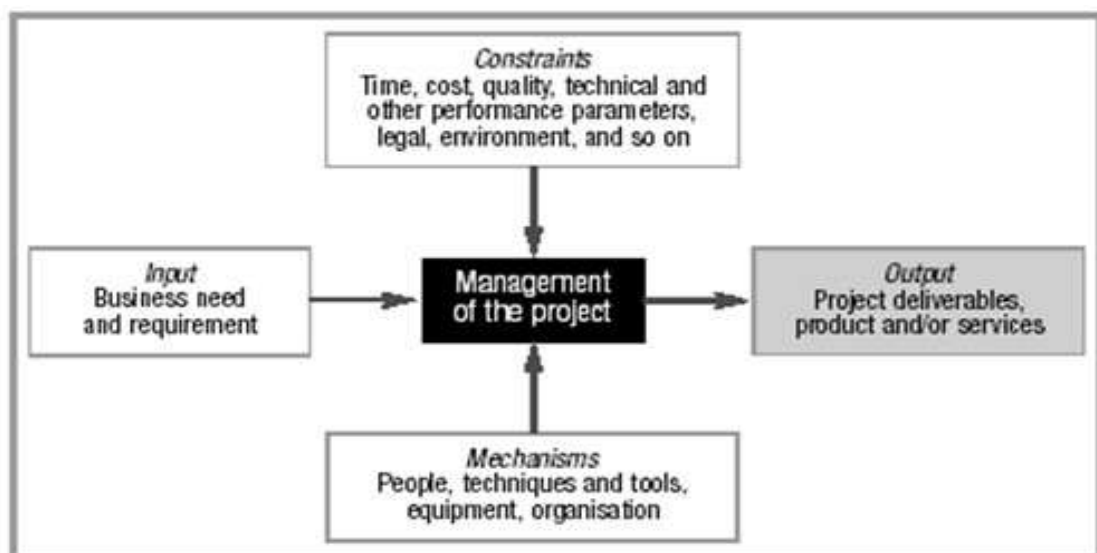


Figure 2.2 Project System Showing Constraints and Mechanisms (Gardiner, 2010)

2.2.2 Characteristics of project management

Project management is having the following characteristics:

➤ Complexity

Project management is a complicated task, which needs several contractors with multidisciplinary knowledge to make a good effort to achieve the target with lower cost and higher profit, meanwhile, applying risk management methods to control the risk and to meet the requirements from clients.

➤ Creature

Project management is the process to create a new product or supply a kind of service which has never been provided. For example, in a chemical plant, the major task for the plant is to produce this new batch of product which, of course, has never been produced before.

➤ Life cycle

As we mentioned earlier, the definition of a project being a unique set of coordinated activities, with a definite starting and finishing point, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters (Gardiner, 2010), in other words, the project management has a certain life cycle, the project will be terminated after the targets have been achieved.

➤ Professional organization

A professional organization should have been established before the starting of the project, so that the project members are aware of their roles and responsibility during the execution of the project, they could know whom they should report to and the relationship with other members.

2.3 Project management process

According to the description (Kerzner, 2009), the management process comprises six activities in particular which are including:

- Project planning
- Project initiation,
- Project execution,
- Project monitoring and control
- Leading and motivating
- Project closure.

Project planning

We have to make a plan which is explaining the goal of the project, how the project is going to proceed and scheduling the activities before the project is started in one part, in another, the plan should specify who will join the project and the number of the participants, also the participants should be aware of the steps to achieve the target for the project. Besides, the project manager should consider the standard of the successful work and

evaluate the risk during conducting the work. Generally speaking, we have three kinds of plans which are:

- Activity plan --- we could know the time distribution of the activity in each phase for the project
- Resource plan --- showing what kinds of technique and material will be required in the project
- Budget plan --- showing the costs for all the equipment, personnel, techniques, tools and material

Project initiation

We should ask ourselves some questions before we initiate a project such as the followings:

- What need to be achieved and why?
- When and how it can be achieved?
- What is the cost and profit?

In other words, we have to recognize the best project within the limited resources and costs, consider the benefits of the project and prepare documents to permit the project, assign project manager and establish the project organization to execute the project.

Project execution

The project execution is the process to conduct the project with the project members under the leadership of the project manager. Figure 2.3 below shows a simple organization structure that illustrates the relationship between the top level and the lower levels. This organization is mainly about arranging the material, people, equipment and support resource in a project to meet the project communication and decision-making to achieve the target of the project on time.

The project manager has to negotiate with the project members to achieve project target successfully, simultaneously, the project members could benefit from the negotiation to improve themselves.

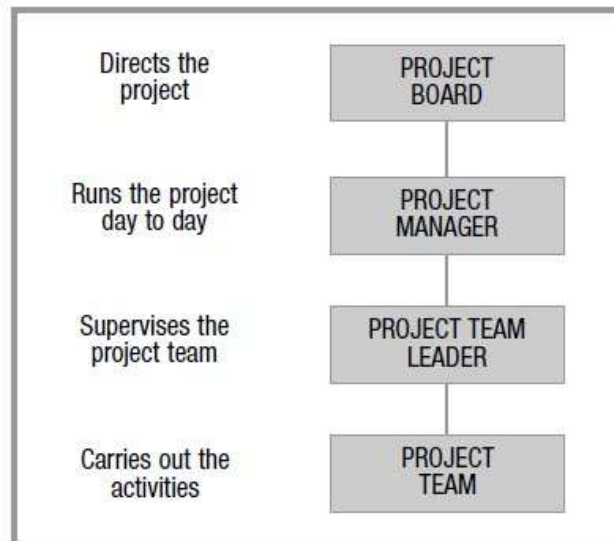


Figure 2.3 Simple Project Organization Structure (Gardiner, 2010)

Besides, the organization should be set up at the start of the project, so that the members are clear about project structure:

A proper structure could make sure the participants:

- Clear their common goal
- Be aware of their role and working scope in the project
- Know their responsibilities
- Know which stage we are in now in the project
- Communicates effectively with team members or team leaders
- Know who to ask for help or advice when in difficulties
- Know whom to report to and how to report

The responsibilities of the board are to direct the project and make sure everything is proceeding according to the plan. The project manager is the one to run the project within the limited period and budget in a safer way.

Project Monitoring and Controlling

Periodic meeting are essential so that the project manager could know whether the project is running regularly on the plan, can compare the actual outcome with the predicted outcome and, then sort out the problems meanwhile. It is easier to correct the problems in the early stage. There are some assessments during the process of conducting the project, which can determine whether there are the possibilities to continue the project in the original way or change the direction. These assessments are used to re-examine the project against the three criteria by asking the following three questions:

- Are we still going about the project in the right way? Are we within schedule?

- Is the project still cost-effective? Are we within budget?
- Are we still going to get what we want? Is the scope still the same?(Gardiner, 2010)

We can do the followings if one of the criteria is not satisfied

- Continue with project
- Stop the project
- Delay the project and rethink it

In the controlling process of the project, a fast tracking system is normally employed to short the project life cycle by overlapping project phase, see Figure 2.4 below. The fast tracking will, however, make project management even more challenging.

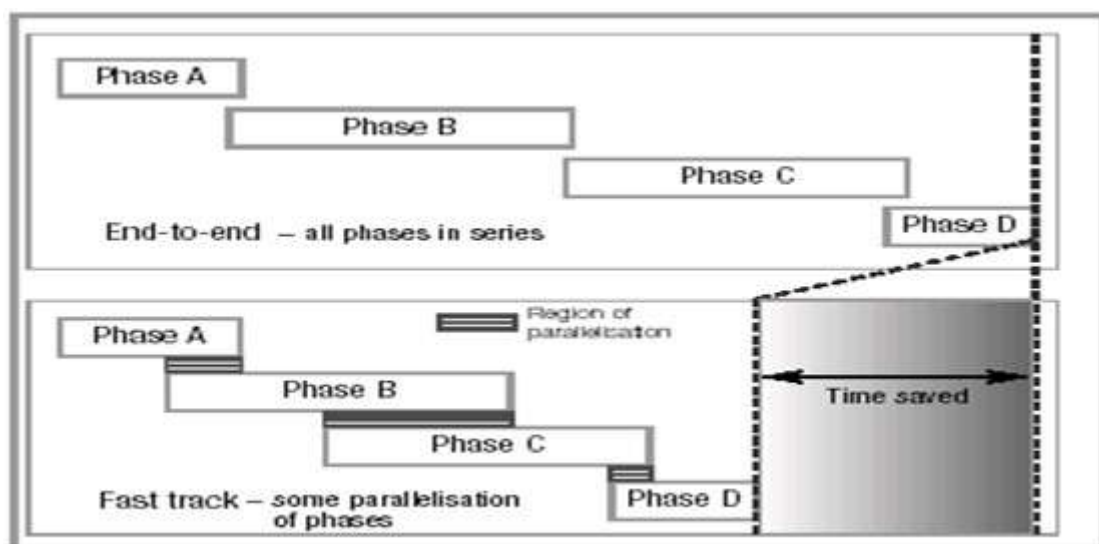


Figure 2.4 Fast Tracking Aims To Shorten Project Duration (Gardiner, 2010)

Leading and motivating

Leadership guru Warren Bennis said: “Anybody can do things right, but it takes leadership to get people motivated to do the right things.” Leadership and team-building skill are crucial in managing a project, project leadership involves “shaping goals, obtaining resources, building roles and structures, establishing good communications, seeing the whole picture and moving things forward to a successful conclusion.”(Gardiner, 2010)

Project managers should have the possibilities to use the skills of communication, negotiation, and team building to make the project going in the right way.

Project closure

This is the last step in the whole process of project management which shall verify all the works are completed within the planning schedule and budget. In the project closure stage, the contract closure and administrative of closure paperwork should be contained.

2.4 Define nine knowledge areas

Before the introduction of nine knowledge areas, I will present a definition of project management's life cycle (PMLC) which is a sequence of processes including project initiation, planning, launching, monitoring and controlling, project closure.

The project management has nine knowledge areas, which include integration, scope, time, cost, quality, human resource, communication, risk and procurement.

Integration management

The integration management which is used to control the project from the project starts to the closure of the project; is including planning, controlling, leading and closure, meanwhile, integrating all the changes during conducting the project and processes against the original plan of the project.

Scope management

What the scope management firstly emphasizing is recognizing the requests from the client or companies, then developing a project management method and work breakdown structure, see following Figure2.5, so that all the members are familiar which part of the work contribute to the highest percentage for the top task. The breakdown structure also could provide some information for the project manager or the client to estimate the project cost, time and resource.

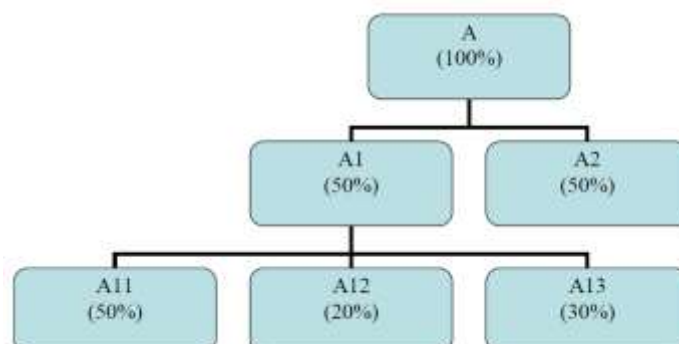


Figure2.5 A Work Breakdown System

Time management

Time management is basically the project duration which the project manager could adjust to meet the requirements from the clients on one hand. On other hand, time management is indicating the time the work should be completed within, which is used to estimate the whole work duration. The labor time is used to estimate the labor cost for the project. Normally, we are requested to complete the project within the time duration on condition that the project quality could be ensured.

Cost management

Cost management covers the planning and controlling phase in conducting the processes of the project. During the planning phase in the project, we estimated the budget and matched it to all the project processes, which is a way to control the cost during the project execution. As the project is moving on, the cost of elements (such as labor cost, material costs) should be adjusted so that the project could be completed within the original cost.

Quality management

As we know, quality management is the most essential for all the projects or the companies, which is the first factor the client cares about when they evaluate performance of the contractor. So we can say: "the project can't go without quality management." Basically speaking, a good quality management comprises three process, they are the quality planning process, quality assurance and the quality control process.

Meaning the product quality and technique service are delivered with quality,

Meet the client requirements,

Delivering on time and within budget

A project is a balanced system, the following Figure 2.6 illustrates the relationship between resource, cost and time.

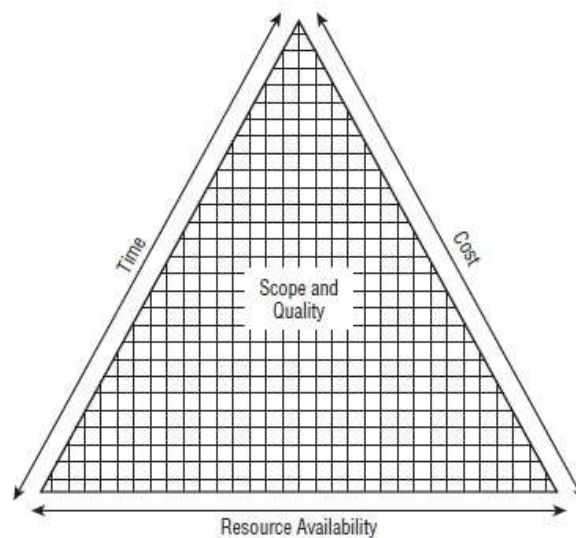


Figure 2.6 The Scope Triangle (Kerzner, 2009)

We can see from the figure above, that inside the triangle it represents the scope and quality in the project, the line represents the cost and time and the resource availability. Time line indicates that the project should be completed within the time plan. Cost line indicated the project should be completed within the cost budget. Resource is personnel, equipment, technique and material which can be used to conduct the project.

Human resource management

In a project, we have the following resources: personnel, material, equipment, technique etc. The responsibility of the project manager is not only to manage the work, but also the personnel in a project. Besides, the project manager is responsible for assigning the personnel to the projects according to his skill and competence as well as his career development plan.

Motivating the project members is another essential responsibility and work for the manager so that all the members could put all their efforts on the work.

Communications management

Communication is a software skill of the project management compared with hardware such as equipment, technique, materials etc. Poor communication is one of the reasons why a project could be a failure if you are conducting an analysis on the failure of the projects. Communication is belonging to interpersonal skill which can't be imitated in my opinion.

Risk management

For better understanding risk management, we should know firstly what is risk? Risk is related to future events (A) and their consequences (outcomes) (C). Today, we do not know

if these events will occur or not, and if they occur, what the consequences will be (Aven, 2008). Risk management is about all the measures and activities which are used to manage risk. We have the following risk analysis method basically: such as Coarse risk analysis, Job safety analysis, Failure modes and effects analysis, Faulty tree analysis, bow-tie program, qualitative analysis, quantitative analysis, and event tree analysis. The following Figure 2.7 presents a bow-tie program which relates to “John contracts a specific disease”, we have the causes to the left of the bow-tie program, and the consequences to the right of the bow-tie program; the initiating event is located in the center of the bow-tie program. So we can conduct an analysis through the program to identify the probability of the causes and consequences.

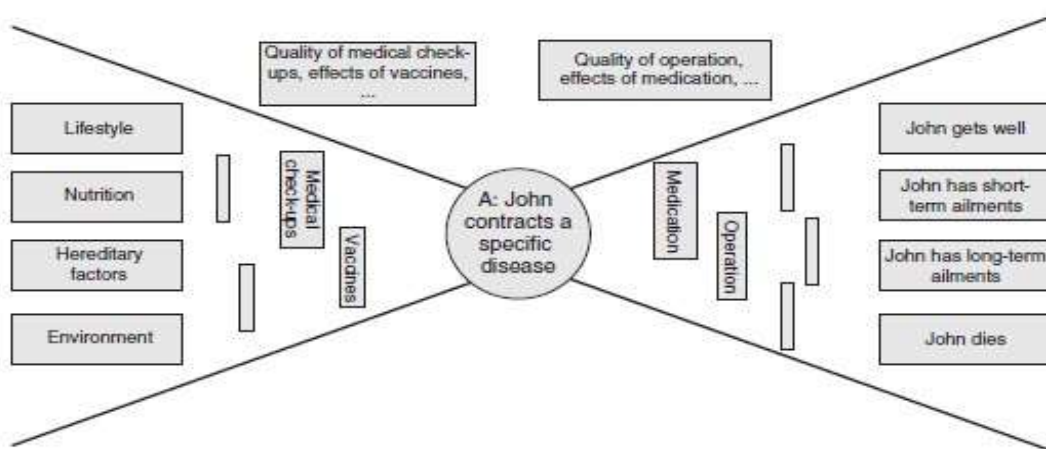


Figure 2.7 A Bow-Tie Example (Aven, 2008)

Risk management is a process about identifying the risk, then conducting risk analysis, risk evaluation, and finally find the solution for reducing the risk. The figure 2-8 below illustrates the risk management process.

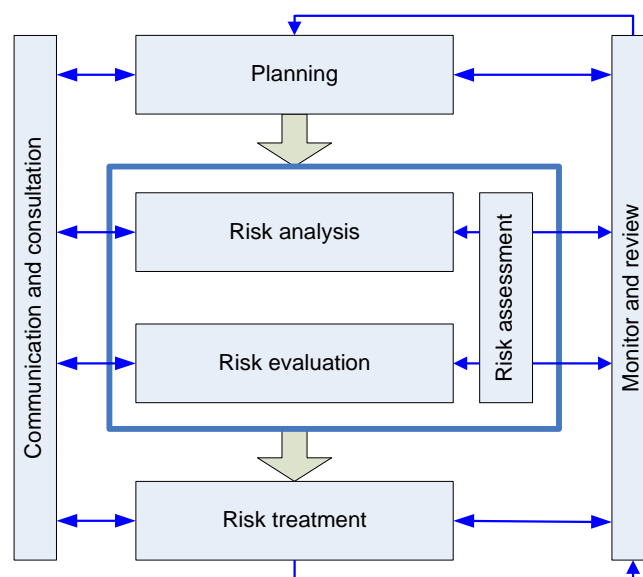


Figure 2.8 Risk Management Process (Aven, 2008)

It is clear from the Figure 2.8 above, that the risk management process has four parts: risk planning, risk analysis, risk evaluation and risk treatment. The project team members should be brought together to discuss and identify all the risks which could occur during the whole project, which also enable the project personnel to understand the importance of the risk management. According to (Aven, 2008), risk can be classified into four categories:

- Technical risks
- Project management risks
- Organization risks
- External risks

The next step is to monitoring and controlling the risk of the project, we can assign a responsible person to each task so that the team members can be aware of his or her duty with respect to risk according to the probability of risk occurrence.

Procurement management

The procurement management is the process that the manager obtains the technique, software, hardware and material in order to complete the project. An excellent project manager should be the one who has a good commander of knowledge on how to acquire the material or service at a low cost. Normally, there are five phases for the procurement management: they are vendor solicitation, vendor evaluation, vendor selection, vendor contracting and vendor management according to (Aven, 2008)

2.5 Define successful project management

A successful project management could be defined as a project which is completed within the constraints of time schedule and cost, meanwhile, the output such as product or technology delivered to the customer should be accepted by them. This description was the definition of the successful project management twenty years go. However, nowadays, the definition of the successful project management should possess the following items:

- Within the allocated time period
- Within the budget cost
- At the proper performance and or specification level
- With acceptance by the customer/user
- With minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organization
- Without changing the corporate culture(Kerzner,2009)

2.6 Define project manager's role

The project manager is the one to coordinate with the leader above and the project members to integrate the personnel, material, and equipment into the product, service or profits.

The integrative process is shown in Figure 2.9, which means the project manager should convert all the input elements into output elements, such as products services and profits. So the project manager should have the strong ability to communicate with others, also he/she should be familiar with each section of the operation and possess knowledge about excellent technology. For example, a cementing project manager in the offshore oilfield should possess the following abilities:

- Should know how the project contract is launched
- Should have strong communicative and interpersonal skill to lead the team members
- Should know the content of the project (working load needed to be done)
- Be clear about each project team member's ability, then he can decide who will be assigned to do the job
- He should have the ability to communicate with team members, arranging personnel, equipment, materials to conduct the cementing job successfully
- He should have excellent knowledge about cementing technique to support the offshore cementing operation
- He should know the regulations for the cementing operation

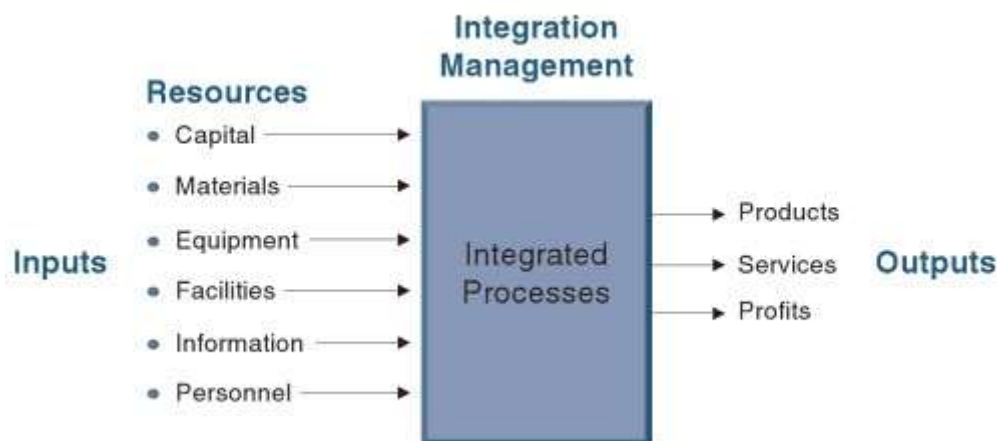


Figure 2.9 Integration Management (Kerzner, 2009)

2.7 Define project employee role

The project employees should accomplish the deliverable task once the project manager delivered the detailed task to them. All the project team members should work with each

other under the leadership of the project manager to accomplish the objective of the project. According to (Kerzner, 2009), the employees should complete the following items:

- Have the responsibility to complete the assigned jobs within the project's time and cost.
- Periodically report to the line manager and project manager of the project.
- Search for the resolution of problem efficiently and effectively.
- Share information and experience with the rest of the project team so that they know what the situation is for the project, and how they can do the job efficiently.

2.8 Program

2.8.1 Definition of program management

Definition of program: a program is a collection of many projects which should be completed within a specified cost and time in which each project should be finished at the same time. Just as the statement, a program is a collection of multiple-projects, so we can say in scope, the program is larger than single project.

Program management: Program management is the coordinated management of a portfolio of projects that change the organizations to achieve benefits that are of strategic importance. (Gardiner, 2010)

Reiss (Gardiner, 2010) identifies four different types of programs:

- The multi-project (multi-client) program, where an organization, for example, a software house, contracts for work to many organizations
- The multi-project (single client) program, in which an organization has many projects for the same customer
- The megaproject program, involving numerous highly interdependent projects aimed at delivering a superordinate goal, for example landing a man on the moon.
- A program management organization, consisting of a portfolio of projects, carefully prioritized and selected to implement the organization's strategic plan.

2.9 Difference between program and project management

Some people think that the project management and program management is the same when being asked, however, there still will be some differences. The two are both about achieving change in a controlled manner, the difference lies in the level at which the change is controlled.

3. Comparison of project management models in Chinese and in international companies

3.1 Comparison of project management in the following aspects

3.1.1 Significance of project management

The mature experience of project management could date back to 1940s, during which a typical example is the Manhattan Project which happened in US from 1942 to 1945. However, the applications of project management only existed in aerospace, defense and constructions. During 1990s, the global economic competition, the increasing number of complexity of organizations and the pressure to lower the cost of projects, all of which forced the governments to give more responsibility and authority to the project managers and team members. Hence, what the project managers should do was carrying out the plan, managing the contracts, trying to understand the corporation finance and to cooperate with the clients to attain the target of the project.

However, in China, it is construction project management first we mention project management. Actually, the project management of construction projects applied project management principles. The project management is, however, not for certain fields, but can be applied in other fields. The responsibility and authority of the project manager in China can't adapt to the international environment due to the investment system in China. But with the policy of reforming and opening up of China, project management will be highlighted more just like in the developed countries.

3.1.2 Organizations of project management

The research and applications of project management in China started in 1991, in which the Project Management Research Institute is formed. Following that, China's Ministry of Finance applied funds in training project managers in 1994, meanwhile, establishing a training organization which was composed of five universities including Tsinghua University, and more than five hundred project management employees graduated from this organization in the 1990s. Some project management courses are commenced in Tianjin University and Fudan University between the end of 1980s and 1990s. But, compared with the other countries, project management aren't regarded so essential yet in China. In the

developed countries, especially in America, project management is becoming one popular and important career path due to the driving force by the American Project Management Association. There are only forty years since the foundation of the American Project Management Association in 1965, when all the professional management people in the world reached an agreement on the definition and importance of the project management. At present, project management has developed towards the direction of globalization, diversity and specialization into more advanced models.

3.1.3 Law related to project management

There is a complete set of law in America, which in one hand is used to protect the project, in another, can be used to monitor and standardize the project during the process of execution. On the contrary, there are only a few laws related to project management in China, which still need to be developed and strengthened.

3.1.4 Training the professional management group

The developed countries put more emphasis on training the professional project management people and on qualification verification. For instance, (PMP) Project management professional examination and qualification certificate launched by Project Management Institute has got the recognition from the society. The people with PMP will have more chance to gain a job from the international companies or in the government departments. What is more, the (PMBOK) Project Management Body of Knowledge has been regarded as an international standard.

3.1.5 Salary in project management

The salary in project management in America could be summarized as followings: salary of the junior management group: 45~50 thousand US Dollars; salary of senior management group: 100~300 thousand US Dollars. In China, especially in some foreign-capital enterprises, project management are gradually becoming more vital and popular, the salary is also growing faster in China.

3.1.6 Difference in culture

We can't say a certain project management approach is good or bad, but we can only say it is fit in the special environment or not. For instance, the Western PM approach, which is a factual advanced and feasible approach in the Western countries, but on the contrary, it is not suitable in China due to the cultural difference and the basic situation. There are four Cultural barriers to use the Western PM in Chinese enterprises which is discussed in followings:

a) Integration Management versus Doctrine of the Mean

It is essential for the manager to integrate all the processes of the project, different organizations, and even the small units in the project in an attempt to attain the project goals within the cost and time. He or she needs to be balance the competing demands for quality, scope, time, and cost, and also needs to adapt the specifications, plans and approach to the different concerns and expectations of various project stakeholders. PM encourages all the different opinions to be surfaced for discussion and recognizes that a meaningful conflict can push the project team to pursue more in depth, insightful analysis of project situations. (Gobeli, Koenig & Bechiner, 1998); conflict is inevitable, but most importantly, we are concerning about how to deal with the conflict. The members are required to be open and direct to speak out their disagreements. As we know, risks are also inevitable, but most of them can be predictable and manageable. Some studies quote a 90% decrease in project problems through the use of risk management. (Mulcahy, 2002)

b) Horizontal Management versus Strong Hierarchy

PM is horizontal management, basically different from the vertical management emphasizing a strong superior-subordinate relationship (Kerzner, 2003). Generally speaking, the project is composed of different people who are from different functional departments, thus, the project manager is not really the boss over other members. The project manager has to coordinate the team members without direct authority. The proper social order in the traditional Chinese culture is a hierarchy, and each person's duty is to render proper support to those who occupy superior positions (Jenner, 1998).

c) Team consciousness versus Family consciousness

The term "teamwork" is the most popular topic when we mention project management. Team work is concerned with four basic aspects; they are cooperation, the actual joint work (the teamwork), trust and effectiveness. Each unit of the project is a significant part in achieving the project goals.

On the contrary, the Chinese culture stresses the family and kinship relationships in doing the project (Li, 2000). The basic family-member relationships are the father-son, husband-wife, older brother-young brother etc. You will have a bright future in the company if you have this kind of relationship, on the contrary, the talented professionals may find it difficult to work in this traditional Chinese firm if they don't have any family or kinship with the owner of the firm (Li, 2000). However, this kind of family consciousness has some negative effects when using PM:

- A long-term family relationships orientation will result in low quality or failure of the project. The family relationships members will get promotion without working hard on the operation due to their relationships in the firm, consequently, they think there are

no needs for them to improve their technique and ability, which could result in bad quality for the project.

- The family or kinships relationships are a circle in the firm, an increasing number of family relationships members will appear in the firm, which will reduce the enthusiasm of the talented professional ones.
- The family or kinships relationships stresses that the family members are homogeneous, while project team members are of high diversity.
- The family or kinships relationships stresses the central position of the “jiazhangzhi” (the leader of a family), while PM encourages everyone to play important roles in a project team.(Wang, 2007)

d) Task orientation versus Boss orientation

People in PM are task-oriented rather than boss-oriented. They focus on completing a give job with the cooperative efforts, and nothing is permitted to distract them from accomplishing the task (Andersen, 2003). The Chinese have the traditional values/beliefs of strong hierarchy and large power distance. In the traditional Chinese cultural system, people are likely to “make the boss happy” instead of “completing the task” as their ultimate pursuit in doing jobs. The boss orientation of Chinese is typically represented by the so-called “guanbenwei” and “jiazhangzhi”. The central theme of “guanbenwei” is to use a person’s hierarchical position as the most important criterion for evaluating and respecting him or her (Wang, 2007). “Jiazhangzhi” means there is a leader in an organization to whom all the members has to obey.

In the below Table3.1, is presented a comparison between PM and Chinese culture

Table 3.1 Comparison between PM and Chinese culture (Wang, 2007)

PM Values/Beliefs	Chinese Values/Beliefs
<p>Integration Management</p> <ul style="list-style-type: none"> ● Encouraging disagreement to be surfaced ● Requiring people being direct and open ● Regarding confrontation strategy as the best way of solving conflict ● Weak uncertainty avoidance 	<p>Doctrine of the Mean</p> <ul style="list-style-type: none"> ● Encouraging disagreement to be buried ● Requiring people being less confrontation and direct ● Using compromising and smoothing strategies to solve conflicts ● Strong uncertainty avoidance
<p>Horizontal Management</p> <ul style="list-style-type: none"> ● Small power distance ● Cross-functional cooperation and communication ● Influencing and coordinating ability important 	<p>Strong Hierarchy</p> <ul style="list-style-type: none"> ● Large power distance ● Superior-subordinator vertical work relationships ● Line authority and control important

<p>Team Consciousness</p> <ul style="list-style-type: none"> ● Short term orientation of relationships ● Work contributions oriented evaluation of people ● Project team of high diversity ● Everyone plays important roles 	<p>Family Consciousness</p> <ul style="list-style-type: none"> ● Long term orientation of relationships ● Guanxi-oriented evaluation of people ● Family members are homogeneous ● Only elite play important roles
<p>Task Orientation</p> <ul style="list-style-type: none"> ● Completing the task ● Viewing people by their work performance 	<p>Boss Orientation</p> <ul style="list-style-type: none"> ● Making the boss happy ● Viewing people by their hierarchical position

According to the research by (Wang, 2007), some empirical evidence can be provided as followings:

- Generally speaking, the major cultural barriers for Chinese enterprises to use the PM approach are from the family consciousness, strong hierarchy, and boss orientation.
- State-owned enterprises have the most significant cultural barriers in all four sets of values/beliefs. Joint-stock enterprises have less significant cultural barriers than state-owned ones, but still have cultural barriers in the values/beliefs of family consciousness, strong hierarchy, and boss orientation.
- Private enterprises and joint ventures don't have significant culture barriers. They can learn and internalize the PM –relevant values/beliefs more easily than state-owned or joint-stock enterprises (Wang, 2007).
- The PM training has significant impact on the culture of Chinese enterprises. That is why the traditional companies always invited the PM trainer to present the PM values. The PM training can well reshape organizational culture towards the PM values/beliefs in state-owned and joint-stock (Wang, 2007)

3.1.7 Risk control

We will have a risk analysis and an evaluation before each project or an operation in COSL, regarding the worksite operation; they will conduct a checking according to the checklist which is a summarization from the worksite experience and analysis. There are some exact emergency operation procedures in the checklist.

There is a special risk control department in the international organization or in a project. There is specific and strict inspection by this department before each operation in the project. The usually method which are employed in this inspection are including: job safety analysis (JSA) , checklist, fault tree analysis, event tree analysis and so on (Aven, 2008)

3.1.8 Safety control

The safety supervisor in international organization or service companies is from the professional safety control company, who is only responsible to the government. The safety supervisor has the authority to suspend the project anytime if some unsafe situation appeared.

On the contrary, in Chinese project or companies, the safety supervisor is assigned by the service contractor itself or from some other contractor which represents the client at worksite. Thus, the safety regulations are conducted ineffectively in this organization due to the common goal.

3.1.9 Environmental management

Environmental management is an essential part of the project management. Each human activity or a project will have an impact on the environment in different forms, especially in the petroleum industry. The emission and discharges during the oilfield development are illustrated in Figure 3.1,

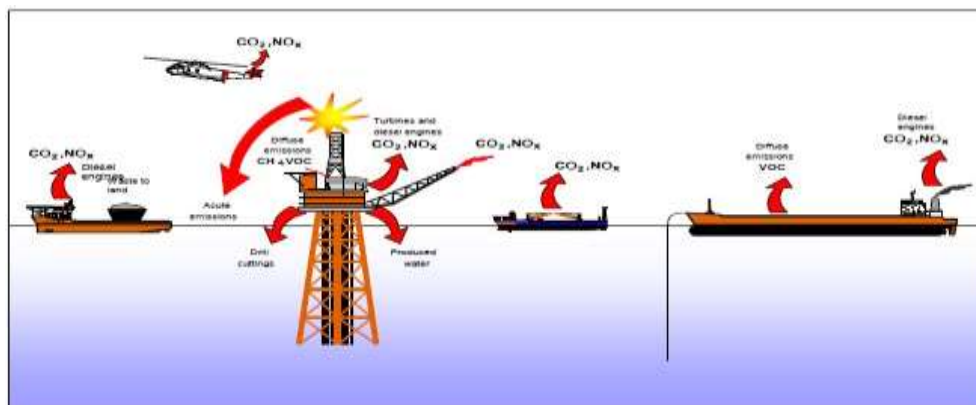


Figure 3.1 Emissions to Atmosphere and Discharges into sea (OFD, 2011)

In Europe, there are the strict emission and discharge standards from the environmental protection authorities; we can see applicable legislation and regulations for Norway on the website of the Petroleum Safety Authority (<http://www.ptil.no/>). According to the most important legislation for the environmental aspects of the Norwegian is the following:

- The Petroleum Act;
- The Pollution and Waste Act;
- The Product Control Act;
- The CO₂ Tax Act.

Besides, in Europe, there are the emergency planning authorities which are employed to deal with each potential emergency.

3.2 The common project management models

There are many different kinds of project management model which adapt to special situation with the development of the project. The followings are the traditional and some new project management models which have been applied in recent years.

3.2.1 Traditional project management model

Traditional project management model is the most common and popular type in the world. The definition of the traditional project management is that the client will sign the contract with the main contractors, the main contractors will sign the contract with the subcontractors/vendors related to the equipment and materials. Normally, there will be a representative from the client who will supervise and discuss with the contractors in order to get the work down efficiently and effectively.

The advantages and disadvantages of traditional project management are listed in following Table 3.1

Table 3.1 Advantages and Disadvantages of traditional model

Advantages	Disadvantages
Mature management methods	The project has longer life period
Clients and contractors are familiar with the procedure, they can choose designer freely and control the designing	The initial project cost is high, and changes in the project are costly
They can choose supervisor freely for the project	The feasibility of the project is low because the contractor can't join the initial designing
The client has a understanding on the project cost before bidding	The disputes between the contractors and designer result in damage the benefits of the clients

3.2.2 CM (Construction Management) model

What is the CM model? It means at the initial designing phase of the project, the clients will employ some experienced and qualified project managers to join in the project, so that the experienced project managers could provide some suggestions for the designers so that the designing of the project is more feasible. The advantages here are that the designing and executions of the project are regarded as a whole process, which means we have to consider

the latter executives when we do some designing. Finally, the project should be completed within the cost and period, with high quality.

There are two kinds of Construction management

- The first one is called “agency construction management”, regarding this type of management; the construction management manager is the representative of the client, who will sign the service contract with the client on some management. Besides, the client will also sign an operation contract with the operation contractor at the beginning of each phase of the project.
- The second one is called Non-agency construction management, the difference between Agency CM and Non agency CM is that the latter will play the role of main contractor in the project, so the Non agency CM will take more risk to execute the project. Generally speaking, the client will request a Non-agency CM to give a guaranteed maximum price to complete the project. At the end of the project, the Non-agency CM will pay the extra fee compared with the guaranteed maximum price. Conversely, the Non-agency CM will receive more profit due to undertaking more risk in the project.

Advantages of CM compared with traditional management:

- The design is more possible to be executed compared with the traditional management, because an experienced CM has already joined in the project in the designing phase, integrating with his experience and management technique to make the design more reasonable.
- The project can save time and cost due to the smooth connection between design and operation.
- The operation could be launched once one gets the permission from the client and government.
- The operation efficiency has been improved due to a harmonious relationship between designer and CM managers.

Disadvantages of CM compared with traditional management:

- The project is more risky, the budget is not so accurate, the client can't control the budget during the executive of project
- The designer has the various pressures from the client and contractor, the design will be affected if the designer can't coordinate the relationship between the client and contractor

3.2.3 Design-Build Model

Design-build model is the one in which the contractor is in charge of the whole process including design, installation and operation etc.

We can take oilfield cementing as an example, the client requests the cementing company to conduct cementing job for the oil well. What the cementing company needs to do is searching some information relevant to the cementing job, such as formation pressure and temperature which is used to do the slurry tests in the Lab, next the company has to install a suitable cementing unit on the rig site, then the qualified cementing engineers will be assigned to work site, meanwhile, the experts will have a meeting in the office to discuss the detailed procedure for cementing so that the cementing job can be conducted successfully. One main contractor can avoid the conflicts between the designer and operations. From the case stated above, we can summarize some characteristics as followings:

- The main contractor is the only responsible party if some problems happen in the project. It is easily to communicate and analyze with the main contractor without discussion between contractors. There are always some confused responsibilities between the contractors, we can take the drilling as an example, we have to analyze why we got stuck in the drilling, it is difficult to locate the responsibility between drilling party and drilling fluids company. The responsibilities will be clear if we have only one contractor. Then the interests of the client will be assured.
- The budget of the project can be estimated at the beginning of the launch if the scope of the work is the same as the plan.
- The communication efficiency improves a lot because of the direct contact between the client and the main contractor. The client can discuss directly with the main contractor with respect to the operation schedule and cost etc.

3.2.4 BOT model (Build---Operate--- Transfer)

Build—operate—transfer is a kind of project model which appeared in the 1980s in Southeast Asia, when the private participation was allowed in some major public investments, especially for some large infrastructure projects, which were constructed or operated by private firms under the system of BOT (Build—operate--transfer). In other words, the government were willing accept the funds from the private, meanwhile, the private contractor can have more authority to plan and operate the project.

Obviously, the build—operate—transfer model has some characteristics, BOT projects require a feasible project, a receptive host government, private sponsors, local partners etc.

The host government

The host government should be fully committed to the project. The host government should provide the support related to judicature for the BOT project. The government negotiators should possess the necessary skills and involve a contractor who has the comprehensive technique to analyze and evaluate the project. In some cases, the government is the only one purchaser of the service provided by the BOT association so the government should have a long term contract with the BOT association, besides, for some public infrastructure, such as a toll bridge, therefore, the government should have ample resources to take over the project in case of default.

Private sponsors

We can conclude from the history; that most private sponsorships of large BOT projects are carried out by famous international construction companies or the integrations of several these types of firms that are specialized in construction, resource etc. such as General Electrics, Asea Brown Boveri.

Local partners

Most of the countries require the BOT projects to use local labor, local contractors and local materials when they discuss and sign the contract. In return, the BOT sponsor also recognizes the value of using the local labor or local materials in the project. The human resource manager will then always consider the local labor or localize the human resource and materials once the project has started. The biggest benefit for the project is saving cost due to localization. All of these can be approved in the service company COSL (China Oilfield Service Limited).

Financing

In the BOT model, the government will not worry about financing any more, compared with the traditional model. Regarding financing, there are the following advantages and disadvantages:

Advantages:

- Project risk will be transferred and distributed, it is risky for government if it employs bond to finance, especially for developing countries like China.
- It can reduce finance burden for the government, the government can take advantage of its authority in project decision-making, tax and land development to settle the problems in the form of tender.
- The advanced management technology can be a useful reference for us in project management.

-
- The infrastructure can be improved, the government will select a capable and reasonable contractor to plan and operate the project. It can be demonstrated in many cases this kind of method can shorten the project period, lower the project cost, as a result, the construction efficiency can be improved.

Disadvantages:

- The policies and regulations are not perfect yet, which hampered the BOT model going into China.
- BOT model only can be applied in some small project as a test, then, can be employed widely in China.

3.3 New models

3.3.1 Engineering-Procurement-Construction model

EPC is the short for “Engineering-Procurement-Construction”, which appeared in 1980s in America, the exact meaning of EPC can be explained in the following paragraph.

Engineering is not only about design in the project; on the contrary, what are including is project planning, project design, project construction and project management. EPC model expands the scope work of the contractor compared with the traditional management model. All the preparation work and construction can be conducted by the contractor.

More often, the EPC model is suitable for power plant construction, infrastructure construction and oil gas development projects.

Procurement is engineering procurement, service procurement and material procurement as we think. However, the procurement in the EPC model is meaning equipment and materials, which indicate that the contractor will be in charge of equipment and materials procurement in EPC model.

The characteristics of the EPC model:

- The contractor will undertake most of the risk. In the EPC model, the contractor will take more risk due to the larger scope of work compared with before. We can take oilfield cementing as an example, the cementing contractor will prepare the cementing program in the first phase, the following job is installing cementing equipment on the platform, delivering material such as dry cement, chemicals and casing attachments, the last phase is conducting the cementing operation. Each step of cementing is illustrated in Figure 3.1

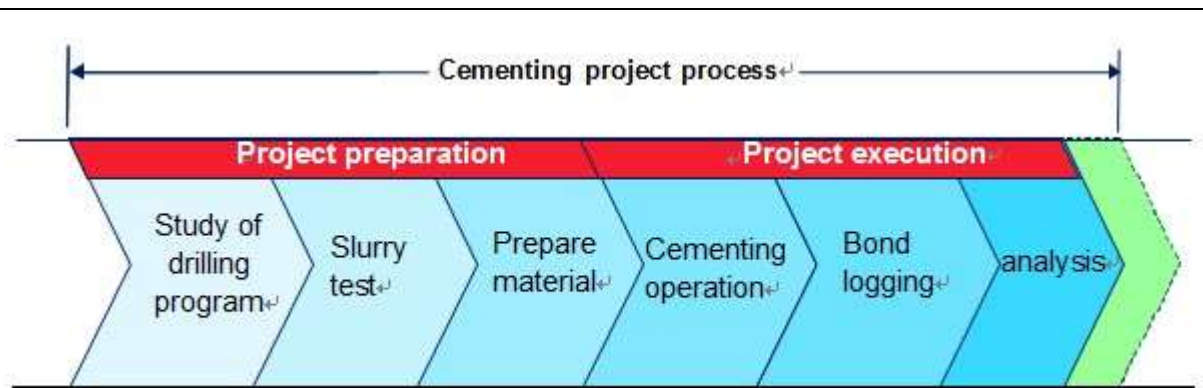


Figure 3.1 Process of Cementing

It is demonstrated in the above figure, that in each step of the cementing process, including study of the drilling program, slurry test in Lab, preparation of material, cementing operation, bond logging and cementing quality analysis, the cementing contractor have to take all the risk in each step in the project.

- The second characteristic is that client or the assigned representative will supervise the engineering or the project. Besides, the assigned representative or the client only inspect the performance at the end of the project rather than supervise details during the project because the contractor takes the most risks related to the project.
- The cost of the EPC project is only the cost which is similar to the factual expenditures compared with other project model. Also, the contractor is not permitted to change the budget due to the variety of the material price.

EPC model is suitable for the following situations based on the above characteristics:

- The contractor take the most risk in the project, so the client will provide sufficient information and time so that the contractor can study the contents of the invitation given in the bidding documents, then could submit a bid with reasonable cost and project period.
- Secondly, the clients don't have to be involved in the process of the project too much although they have the authority to monitor the job of the contractor. Because the contractor will manage the whole process, including design, procurement and construction, according to the contract. What the client only need to do is inspecting the performance at the end of the project, as the client has to make an investigation on the completed performance by the contractor. This is conducted according to the form of EPC model in order to assure the quality control in the ongoing project.
- Lastly, the clients have to pay the contractor according to the initial contract since the total budget is an exact amount which is decided in signing the contract. On the contrary, in other models, the client will make the payments after the engineers have checked the operation quality.

3.3.2 Project Management Contractor

PMC is short for “Project management contractor”, what is a project management contractor? The client will select a quite capable contractor which will manage the project thoroughly such as choosing the subcontractors in design and procurement, but the project management contractor will not interfere with the details in the process of design, procurement and operation.

Generally speaking, PMC is classified into the following two types according to the scope work:

- Firstly, PMC is the representative of the clients in managing the project, especially managing the EPC (engineering procurement construction) contractor but not being involved in the detailed work in the project.
- Secondly, PMC is the consultant for the clients which is monitoring the process of the project as well as reporting the simultaneous information to the clients.

As we know, project management can be classified into two phases, during the first phase, what the PMC need to do is manage the project in optimizing the project plan, optimizing risk management, making basic design, and deciding the final major contractor.

In the second phase, PMC is responsible for supervising and monitoring the process of the construction by the major contractor until the completion of the project, simultaneously, reporting the operation performance to the client at times. What the contractors need to do is making the detailed design, executing the procurement plan and carrying out the factual operation.

PMC has following advantages compared with other project models:

- Generally speaking, the PMC the clients selected are all famous and capable contractors which possess ample project management experiences, which are contributing to improve the project management for the whole project.
- There are some contract terms about awarding the PMC contractor which is employed to save cost in the agreement between the clients and contractor. Thus, the PMC will try to save budget on condition that the project is completed within the project cost and period.
- It is helpful for simplifying the organization; generally speaking, the client will establish a huge and complicated human organization to support the project once it is launched. However, how to arrange the human resource after the completion of the project is always a problem for the clients. Fortunately, the PMC solved the problem, why? PMC is familiar with the establishment and operation process of the project; the management staff of the PMC is clear about the amount of people which can be used to assist the client to manage the project instead of huge number of

people. Consequently, the staff organization are simplified on one hand, on another, the management quality is improved too.

3.3.3 Partnering Model

3.3.3.1 Definition of Partnering

A win-win situation is always created by the companies and contractors which cooperate with each other to reach the mutual objective. That is a partnering model. Partnering model appeared in the 1980s in America characterized by the partnering agreement between Shell oil companies and SIP companies which were certificated by CII (Construction Industry Institute). Successful applications of partnering have been reported in United Kingdom, the United States and Austria and so on, which showed that a partnering model was an essential qualification for the companies.

According to (Naoum,2003), "Partnering is a concept which provides a framework for the establishment of mutual objectives among the building team with an attempt to reach an agreed dispute resolution procedure as well as encouraging the principle of continuous improvement. This framework encourages trust, co-operation and teamwork into a fragmented process which enables the combined effort of the participants of the industry to focus upon project objectives."

It is highlighted that the partnering agreement should be signed among the clients, major contractor, designer and material suppliers instead of only between client and contractors.

The following aspects should be emphasized in terms of the partnering model:

- The clients are the one to decide when to sign the partnering agreement among the clients, contractors, materials suppliers, perhaps it is signed either in the design phase or operation phase.
- Generally speaking, the contract for other types of project model are drafted by the client, however, the contract in the partnering model is drafted by all the participants

The major characteristics of a partnering model:

- All the operations and services should be conducted for the benefit of the clients in terms of the traditional project model, however, the mutual profit are considered in the partnering model, which adjust the relationship between the clients and contractors.
- The traditional model only relies on the contract; the client will refer to the contract so as to find the solution for a dispute between the client and the contractors. But in the partnering model, there is an extra agreement which is mainly on solving the dispute

-
- Sharing information is a basic characteristic for the partnering model, all the participants should share the information with each other in times so that the operation is effective and efficient without repetition.

3.3.4 Project Controlling

3.3.4.1 Background of project controlling

As we know, the traditional project management model which is only composed of the clients and engineering supervisor is widely applied in China and other countries. One of the disadvantages is that the client can't manage and control the project efficiently and effectively. That is why we discussed the new project management model---- project control here. Some cases of project controlling are presented in the followings. Figure 3.3, Figure 3.4, Figure 3.5 are from website

<http://wenku.baidu.com/view/fa7f5b3667ec102de2bd8923.html>

Xia Men international conference center

Total investment: 1.17 billion RMB

Covering area: 47 hectare

First phase construction period: 2 years

See Figure3.3 (<http://wenku.baidu.com/view/fa7f5b3667ec102de2bd8923.html>)



Figure 3.3 Xia Men conference center

Nanning international conference center

Total investment: 655 million RMB

Covering area: 735 units of area

Building area: 0.2 million square meters

See Figure 3.4 in below

(<http://wenku.baidu.com/view/fa7f5b3667ec102de2bd8923.html>)



Figure 3.4 Nanning conference center

Germany railway construction

Total investment: 25.5billion Deutsche Mark

Project period: 18years

New construction railway: 1650KM

Tunneling: 41

Signal tower: 19

See below Figure 3-5



Figure 3.5 Construction of Germany railway

(<http://wenku.baidu.com/view/fa7f5b3667ec102de2bd8923.html>)

3.3.4.2 Definition of project controlling

Project control is a process of collecting, processing and transmitting information which is needed to support making decisions; all the processes of collecting and transmitting are based on modern information technology.

3.3.4.3 Characteristics of project control compared with project management

There are some similarities because project control is based on project management:

- They are both engineering consulting service limited
- Controlling objectives are the same: control the quality, cost and time of the engineering
- They are both belonging to dynamic control

Differences between project management consulting and project control

- Project management consulting can serve the clients, design companies or operation companies, but the project control only serves the clients.
- They have the different position for the clients. The clients can assign project management consulting to govern the project, in other words, project management consulting have the factual authority to assign the contractor to conduct the operation, on the contrary, project controlling only tries to obtain the information and analyze , then provides some reasonable advices for the decision-makers.
- Project management consulting serves the client only in the designing phase, or in the whole process of the project, but the project controlling serves the clients in the whole process.
- The contents of the work are different. Project management consulting will be involved in the detailed work, such as inspecting the design, monitoring the operation, evaluating the performance at the end of the project, but the project control will not interfere with the exact work in the project, it only is gathering and processing information, then providing suggestions for the clients when making decisions.
- They have different authorities. Project management consulting has more authorities due to the direct contact with the operation company or the contractor in conducting the operation, but the project controlling only contacts with the clients.

3.4 Discussions regarding Common Project Management models

The comparison between the design-build model and the PMC and CM project models are presented in the following paragraph.

3.4.1 Client interfering with the project or not

- In traditional project management, the client will not directly interfere with the project, as the consulting engineers and budget engineers are employed to manage the project instead of the clients themselves.
- In the design–build project model, the client has to govern the project directly due to the deficiency of the project management personnel.
- There isn't a major contractor in the CM project model, the client have to sign the contract with several contractors directly. In other words, the client has to participate in the project themselves directly.
- In PMC model, the client will invite a project management contractor as the representatives to conduct the orders from the client in cooperation with the clients.

3.4.2 Designer involved in the project

- In the traditional project management, the designer play an essential role in operating the project, other management layers even including the clients have to follow the suggestions from the designer when to make a decision.
- Operation management is the much more important part in terms of the CM model compared with designer although the designer still is an essential participant in the project. The designer is only required to supply the necessary documents to support the contractor to complete the project.
- In PMC model, generally speaking, the PMC will not be involved in the design even though the PMC has to do some work related to design. Strictly, even if the design will be finalized under the arrangement of the PMC, the detailed work is conducted by the major design contractor the client assigned.

3.4.3 Responsibility distribution

- In the traditional project management model, the contractor will investigate the problem from the design to operation if some undesired things happen. The responsibility will be more complicated if some more subcontractors are participating in the project.
- In the design-building model, the contractor will take the responsibility for all the operation, even take the responsibility for some natural disasters.
- The responsibility is clear in the CM model because there is a formal contract between the client and contractor.
- In PMC model, the PMC is the representative of the client in the work field, so the PMC will take all the responsibility during the project.

3.4.4 Adaptability of the project model

- The traditional management model is more complicated compared with other model, so it is not suitable for the simple project.
- The management responsibility distribution in the design-building model is clear, which is more suitable for simple projects, the design-building model contractor is not having the ability of coordination if the project is quite complicated.
- The CM model is more suitable for the complicated project relatively.
- The PMC model is fit for large complicated projects, especially for the project which the clients don't possess the ability to manage unless assigning a professional PMC to manage.

3.4.5 The progress rate of the project

- For the traditional management model, the clients always assign the contractors it is possible to ask the bidders to do some preparations before confirmation. However, some undesired problems could happen due to the pre-job.
- In the design-build model, the designer and operation contractor are clear with their jobs, thus, the job can be launched in the early phase.
- The CM model is having the highest progress rate of all the project models, in which the designer can connect with the operation smoothly.
- In PMC model, most of the operations or works are conducted by the contractor assigned by the clients. The PMC as the representatives of the client, is assisting the client to control the progress rate in design, executing and operating the project.

3.4.6 Initial cost of the project

Project cost is not exact due to latent risks, variety of the material prices and other unstable factors appearing in the project although the cost of the project is quite essential for the clients.

- The project cost for the traditional management model are clear because of the exact quantity of operations, if the operation quantity are changing all the time, this will result in the inaccurate project cost.
- The contract price cost, which contained all the operations, materials and equipment cost, is included in the design-build model. The contractor will take the full responsibility for the variety of the operations and materials prices in the project. Anyway, the initial cost for the design-build model is most clear among all the management models.

- We only can ascertain the project cost at the completion of the project because several contracts are contained in the project. The project cost is gradually clear with the developing of the project.

3.5 Discussions on project portfolio model

There are so many participants in a complicated project, including clients, consulting engineer, project management, designer, operation companies and the materials suppliers, all of whom form a complicated project system.

The participants will cooperate together with an attempt to achieve the mutual objective; the core task of the project management is to control the quality objectives. The comparison are conducted in the below Table 3.2

Table 3.2 Comparison between Traditional Model and Portfolio Model (Lei, 2007)

Item	Aspects	Traditional model	PMC + Partnering model
1	objective	Complete the project according to the initial investment, period and quality	Integrating all the participants to achieve the project objectives
2	Mutual relationship	Always having contradiction between clients and contractor	Honest, communication, solving the factual problems
3	Duration	The initial project duration	One project or many projects
4	Evaluation system	Periodically investigate and control	Evaluation system
5	Return	Getting extra bonus according to the performance	Benefiting from the project respectively
6	Contract	Traditional contract relevant to law	Traditional contract plus agreement

The above figure is illustrating that the PMC + Partnering model is based on the communication between the project members and is more human-orientated compared with the traditional management model, which enables the members to work more efficiently and effectively for the project. The following Table 3.3 presents the difference in application between the PMC + Partnering and the traditional model.

Table 3.3 Applications Comparison (Lei, 2007)

NO	Traditional model	PMC + Partnering model
1	The participants are doubtful with each other	Trust each other, can cooperate easily
2	Focus on their own objectives and maximum own profit	Possessing the common goal, sharing the success
3	Communication is limited	Communication and establishing good relationship
4	Single project engineering	Long term cooperation resulting in promoting in project management

5	The contractor consider own profit first	Considering the common profit
6	Only the management are involved	From the top level down to bottom
7	Different goal and distrusting resulting in not sharing information resource	Sharing project plan and resource
8	Opposing relationship	Eliminate or reduce the term in the contract which result in opposing relationship

3.6 Hints from international management

As we know, an excellent project should maximize the project within the project cost and duration; however, project durations are changing because of unstable factors such as the natural disasters. We can summarize the characteristics of project management in the developed countries firstly:

- An engineering project is a complicated system. The first stage for the project management is that a suitable project management model is, following that, the objective of the project are attained under the cooperation of the clients, contractors, subcontractors and vendors.
- What should we select with respect to the contractors and the control process when we conduct the project? The professional contractors and the standard control processes are the ones we need. We can analyze and conclude from the traditional project model, CM model, design-build model and EPC model that they are all composed of the professional contractors, subcontractors and consulting companies.
- All processes of the project are controlled rather than controlling a certain phase of the project.

What we should learn from the foreign countries about project management?

- Project management model organization is simplified and effectively and efficiently in foreign countries, we should combine the Chinese project model with modern project management models, studying and obtaining a factual and feasible project management model which is suitable for the situation in China.
- When the client is the government according to the Chinese situation, the government should assign the job according to the results of the bidding process.
- The advantages of project management, such as integration and standardization, should be fully utilized to improve the project management level in China.

4. Discussion on project management between international and Chinese oil service companies

4.1 Features:

4.1.1 Features of International project management model

Basically speaking, there are three phases in the project management in which the characteristics are discussed:

a) Investment decision making

A project is an investment, and we have to evaluate the feasibility of the investment on the project whether we can benefit or how much we can benefit from this investment. According to (Gardiner, 2001) Feasibility studies should be performed before project initiation in support of the proposed business case, but can be also carried out at any of the key stage gates of a project. The purpose of a feasibility study is to (Gardiner, 2001):

- Determine if a business opportunity is possible, practical and viable
- Provide structured method (focus on problems, identify objectives, evaluate alternatives along with associated benefits and costs, aid in the selection of the best solution)
- Improve confidence that the recommended action is the most viable solution to the problem
- Assure the sponsors that projects requiring significant resources can, should and will be done.

A typical feasibility study checklist might include:

- Detailed determination of the problem and underlying business needs
- Evaluation of (alternatives, market potential, cost-effectiveness, technical feasibility and implementation feasibility)
- Analysis of technology requirements
- Assessment of internal capabilities
- Identification and assessment of risks
- Trade-off analysis (scope, time and cost)
- Identification of critical success factors, goals and objectives
- Preliminary cost and time estimates. (Gardiner, 2001)

Some definitions related to investments:

Capital budgeting: according to (Gardiner, 2001) a financial manager must be able to decide whether an investment is worth undertaking and be able to choose intelligently between two or more alternatives. To do this, a sound procedure to evaluate, compare and select projects is needed. This procedure is called “capital budgeting”

Generally speaking, the investment should be profitable unless a project for social reasons only, an analysis will be conducted on the money should be put in the bank for the interests or investing it in an alternative project.

Thus, the organization always spends efforts selecting projects in which to invest by performing project appraisals, usually as part of a wider feasibility study.

Financial analysis

Some indicators can be employed to conduct financial analysis according to the profit to the firm, such as net present value (NPV), internal rate of return (IRR), payback period, discounted payback period and the profitability index (PI). Most of the companies use one or more of the measures to analyze the project. The indicators are explained as followings:

Net present value (NPV)

The Net Present Value (NPV) of an investment is the present value of the expected cash flows, less the cost of the investment. The decision rule of the NPV technique is: if the investment opportunity has a return which is equal to or above the required rate of return (that is, the discounted rate used), the opportunity is financially accepted to the decision maker.

The formula for calculating the NPV technique is:

$$PV = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \dots + \frac{C_n}{(1+r)^n}$$

Where:

C_0 = the initial investment

C_n = the total cash flows received or paid in period n

r = the appropriate discount rate for the capital investment opportunity

An example is given below:

The oilfield service company considered purchasing some more sets of equipment to meet the operations, the initial investment and the present value at each period is given below as Table 4-1

Table 4-1 Purchasing equipment, example cash flows and NPV

Period(years)	0	1	2	3	4	5	Total
Net cash flow	-56,000	17,500	26,250	39,688	27,891	30,672	
Present values	-56,000	15,625	20,926	28,249	17,725	17,404	
NPV at 12%							43,929

Applying the NPV decision rule, the purchase can be accepted due to the positive NPV value.

Internal rate of return (IRR)

According to the NPV calculating formula on investments, IRR means the discounted rate which produced an NPV of zero.

$$0 = C_0 + \frac{C_1}{(1+IRR)^1} + \frac{C_2}{(1+IRR)^2} + \dots + \frac{C_n}{(1+IRR)^n}$$

Where:

C_0 = the initial cash investment

IRR=the discounted rate for the capital investment opportunity with NPV of zero

Payback period

It is the length to recover the project initial costs or expenses.

All the above stated technique can be employed to decide whether the project will go or terminate in financial aspect.

b) Organization

Four kinds of organization structures are explained here, they are functional structure, product structure, matrix structure and virtual organizations, we only explain the functional structure here. Functional structure is the most common and simple organizational form from which we have a clear responsibility of each employee and relationship between each other. Of course, each project, or a company has a functional structure. The below Figure 4.1 is a simple example of functional structure in a company.

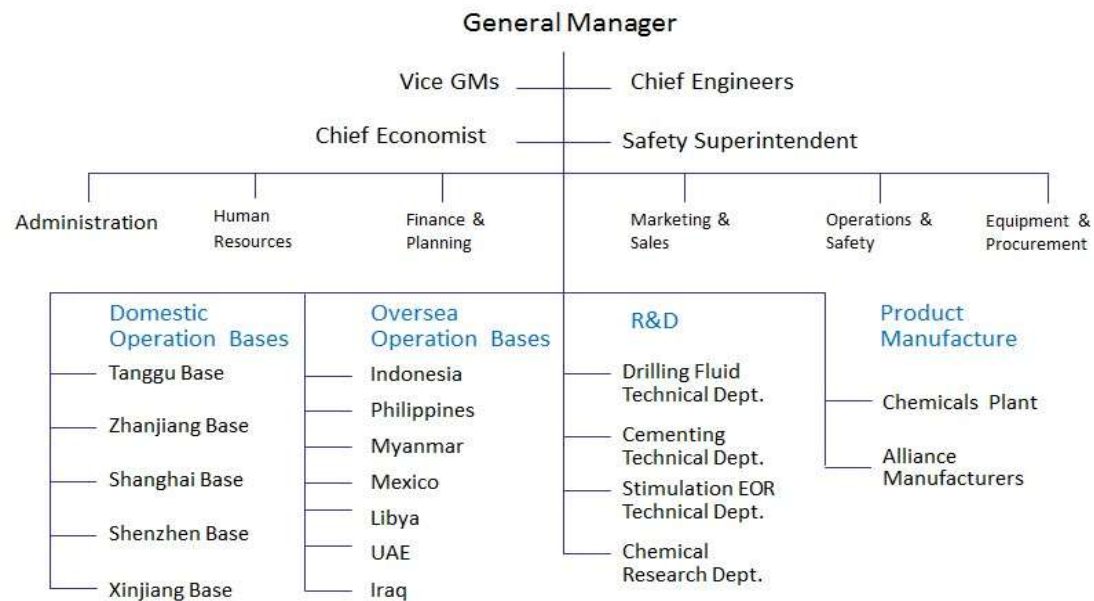


Figure 4.1 Functional structure in a company

From the above figure, there are vertical communication channels from the top level to down. The general manager has the control power for the whole company according to the figure. The below level (such as the base, oversea bases, R&D) are clear whom they should reported to.

c) Supply chain management

Procurement department, which is employed to support and assure the project, is an indispensable part in each company. It is impossible for the company to possess all the material resource or the equipment a huge and complex project. The supply chain management integrates strategy, purchasing and quality management into a process, which is also a fully integrated process extending from the supplier's supplier to the customer's customer (Gardiner, 2001).

There are four phases to procurement according to (Gardiner, 2001).

- Requirements planning—which means in the early stage of the project, that the project management should decide what parts or material should be bought as well as considering the maintenance parts during conducting the project.
- Solicitation-- this is the second step for the procurement which is identifying a supplier to providing materials or services required. The project management will consider the value of purchase and the nature of the requirement when they are selecting the vendors.

There are two ways in solicitation, they are public advertising and use of supplier list, public advertising is the most common and professional method to obtain the best possible price, another way for solicitation is to find the vendors in the official supplier list.

-
- Awarding—normally, the awarding will go to the lowest price contractor of the qualified contractors, however, the client has to consider the nature of the material and service needed to obtain a low risk.
 - Contract administration--- it is the process of managing the contract until completion the contract. Going a step further, the main contract administration functions include:
 - Contract change management
 - Specification interpretation
 - Adherence to quality
 - Warranties
 - Subcontractor management
 - Monitoring the work
 - Contract break and resolution of disputes
 - Project termination, payment schedules and contract closeout

After the completion of the project, managing risk and quality is the most important indicators to evaluate the performance of the project in the end. In other words, the project is successful only when managing risk and quality is in a reasonable range. The next paragraph is discussing managing risk and quality.

d) Managing risk and quality

Risk and quality control is a vital aspect in evaluating a project or a performance as we know. The following paragraphs are mainly discussing the risk and quality control.

Risk and risk management

The project risk is described as: any event with an undesirable outcome for the project that may happen sometime in the future (Gardiner, 2001)

Also there are essentially two kinds of risk:

Speculative risk: meaning a chance of a loss or chance of a profit, the second one is pure risk, which is meaning only a chance of a loss, for instance, driving a car involves only the chance of an accident.

According to the definition, risk is an undesirable outcome for the project or even can cause the death, how can we manage risk? Risk management is defined as all the measures and activities carried out to manage risk. As the statement in chapter 2, risk management is composed of risk planning, risk assessment, and risk control. Risk assessment is the process to introduce the technique to identify the risk and analyze the risk. For the clear understanding of the risk management, we have to refer to Figure 2.8

Risk assessment methods are listed in the Table 4.2

Table 4.2 Overview of risk assessment methods (1)

Risk assessment methods			
Risk identification methods	Risk analysis methods		Risk evaluation methods
	Frequency assessment methods	Consequence assessment methods	
Brainstorming	Fault tree analysis	Computational fluid dynamics	Risk matrix
Checklist	Event tree analysis	Source term models	F-N curve
HAZOP	Historical records	Atmospheric dispersion models	Risk profile
HAZID	Human reliability analysis	Blast and thermal radiation models	Risk density curve
FMEA	Common cause failure analysis	Aquatic transport models	Risk index
Safety audit		Effect models	
What-if review		Mitigation models	
Literature search			
Walk-through			

The main categories of risk analysis methods are available in Table 4.3

Table 4.3 Main categories of risk analysis (3)

Main category	Type of analysis	Description
Simplified risk analysis	Qualitative	Simplified risk analysis is an informal procedure that establishes the risk picture using brainstorming sessions and group discussions. The risk might be presented on a coarse scale, e.g. low, moderate or large, making no use of formalised risk analysis methods.
Standard risk analysis	Qualitative or quantitative	Standard risk analysis is a more formalised procedure in which recognised risk analysis methods are used, such as HAZOP and coarse risk analysis, to name a few. Risk matrices are often used to present the results.
Model-based risk analysis	Primarily quantitative	Model-based risk analysis makes use of techniques such as event tree analysis and fault tree analysis to calculate risk

According to the risk exposure equation:

$$\text{Risk exposure} = \text{probability} \times \text{impact of risk}$$

Risk exposure can be calculated once these two variables are determined. A risk assessment matrix is shown in Table 4.4, which is a convenient way to calculate the probability of project failure.

Table 4.4 Risk Assessment Matrix (Aven, 2008)

Probability		Impact		
		Low 1	Medium 2	High 3
Low	1	1	2	3
Medium	2	2	4	6
High	3	3	6	9

Quality management

Any organization or service company is always mentioning the term “quality control or quality management”, which is an indicator to evaluate the performance of the organization. Here, the quality means product quality and service quality.

Product quality

According to the early definition of the manufacturing organization, product quality means if the product meets the specification, then the product is good, on the contrary, it is not good. There are some requirements from International Organization for Standardization for every industry. A project can't be evaluated as a successful one without better product quality and risk control.

4.1.2 Features/processes of the Chinese project management

a) Information related to marketing

The information related to marketing or a bidder should have been collected by the oversea base or the other bases under the headquarters, then the information will be reported to the marketing division.

b) Evaluating the tender documents

The second stage is about the meeting which will be launched to discuss and evaluate feasibility and possibilities, focusing on if it is profitable or valuable to submit the bid and, the probability to win the bid based on the understanding and the information from other competitive bidders.

c) Making and designing the bid

Once it is decided that the company will try to get the bid, the bid documents will be ready to send according to the tender documents, which are usually composed of a technique part and a commercial part.

d) Establishing the organization (team)

The organization or the project team should be established immediately once the company wins the bidding. What the project team leader should do is to select some employees with professional technique and management experiences, then establish the work break down (WBS) system, so that the work can be assigned to them. The executive members should prepare equipment and material needed in the project.

e) Conducting the project

Conducting the project is a process from the project initialization to project closure; the performance should be completed according to the quality requirements from the client or according to the relevant ISO Standard without delay or failure.

f) Closing the project

The following activities are part of the closing project:

- Project reviews
- Communication with the client
- Demobilization

Project reviews aims to improve the management and professional technique, it is essential to communicate with the client, so that the project members can obtain some constructive suggestions which are helpful for the next operation. What is more, it is a rare chance to communicate and inquire some marketing information with the client.

4.1.3 Case study

A real case is discussed in the following paragraph in which a cementing service contract is signed between Philippine National Oilfield Corporation—Energy Developed Corporation (PNOC-EDC) and China Oilfield Service Limited (COSL) in 2006.

a) Marketing information

How can obtain the information from the client? The location of the “agent” is essential in the project, who is the one to pass the information to us, certainly, he is benefiting from the project too. All in all, the “agent” is a critical position for us to obtain the tender documents.

b) Project preparation

According to the content of the contract, COSL will provide 30 wells cementing services for the client PNOC-EDC in four years until 2010. The cementing services are including project management, operation team, equipment, materials and so on.

After a meeting with the leaders in headquarters, the project team is established which is illustrated in Figure 4.3

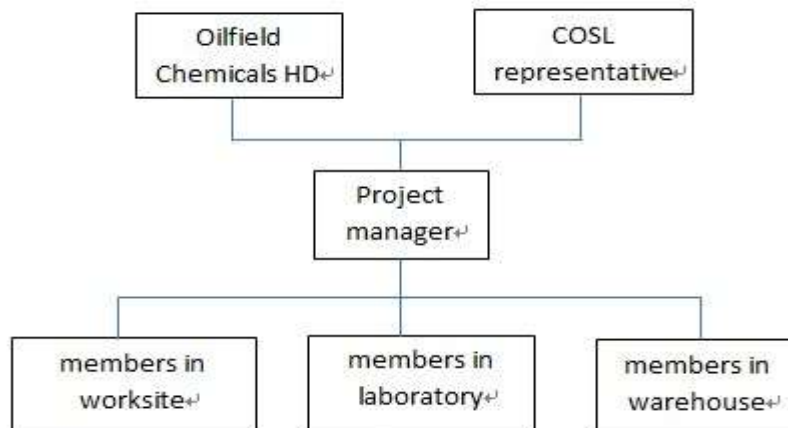


Figure 4.3 Project Team Work Breakdown Structure

From above structure, the task can be clearly assigned to the different members; each member of the project will have an exact task and responsibility. The project manager is the first responsible member for the project under the leadership of the Oilfield Chemicals Headquarters. In this project, we can see that the project manager is the one to manage the cost, profit, safety, risk, marketing, equipment and procurement which is different compared in international project as compared to Chinese projects.

c) Project preparation/execution

- In order to provide better service to the client, the experts made a study on the documents regarding the formation and considered the existing operation report in the Philippine. Then an advanced program which produced good compatible cementing slurry was initiated.
- According to the contract, COSL- Oilfield Chemicals already purchased six sets of cementing units together with the attachments from the manufacture.
- The new cementing chemicals related to the slurry system are in production.
- Some experienced cementing engineers and operators are selected from other bases to support this project.
- The formal execute contract time is March in 2006

d) Technical support

The service contract can't go without service quality. COSL has a technical support center in the Oilfield Chemicals Headquarters which is composed of the experts in each major area, such as drilling fluids and cementing. They can provide the best and reasonable solutions for the worksite anytime.

e) Project closure

- In the end of the project, some technical documents and reports are collected and technical papers are produced aiming to provide reference for future operations.
- The project manager conducted a cost effective analysis on this project which also is a reference for future project.
- The equipment is demobilized, but we have a new contract in Philippines due to the frequent communication with the clients.
- Most importantly, the project or the marketing division should always keep communication with the clients so that we can obtain the continual contracts without interruption.

5. Conclusions and Recommendations

As we discussed and compared in above chapter three, there are so many kinds of project management models, such as the common models: traditional project management model, Construction model, Design-build model and BOT model as well as the new models including Engineering-procurement constructions, project management contractor, partnering model and project controlling model.

Integrating with the case stated in Chapter four as well as the reality in China. What kind of project management model should we select in China? The author has the following recommendations.

5.1 PMC model

PMC model has been widely used in international companies; most of the operations and management are being executed by major contractor except for the decision-making authority for PMC model. What the project management contractor should do is assisting the client to conduct the feasibility, make the planning, control the quality in operation, procurement and commissioning. Due to the integration of the planning, operation and procurement for the PMC model, the project management contractor could conveniently organize the operation without necessity to communicate with outside parties. That is why PMC model is more popular nowadays. According to the reality in China, why we have to select this kind of model:

- The traditional model is the one which has been applied in China for a long time. But the disadvantages for traditional model are: the longer project duration; the high investment in the initial phase; the ambiguous responsibility between designer and operator etc.
- It is a necessity if we want to be in line with the international practice, and internationalize the project management mode.
- We should put more emphasis on the designing phase than operation phase. According to the survey (Lei, 2007), the possibility of designing phase affecting the investment is 35%-70%, but the operation phase only can be 5%-25%, thus, the designing phase is an essential part in the whole process of the project. PMC possesses the requirements stated above.
- We have the contradiction when Chinese companies are cooperating with foreign companies due to the different attitude in managing the project. The Chinese prefer to the traditional management model, however, the foreign companies would like to invite professional project management companies to manage the project. Selecting PMC is a way to solve the problem.

5.2 PMC + Partnering

PMC model is not the perfect one due to the following disadvantages: the poor organization and management ability for PMC; the bad engineering quality due to unregulated way to distribute task and so on.

We have suggested a new model due to above disadvantages of PMC, which is PMC + Partnering model. As we mentioned in chapter three, partnering model is the one in which all the participants, including clients, major contractor, subcontractor, designing companies, operating companies, should sign an agreement to attain the goal with an endeavor.

The portfolio model “PMC + Partnering” has the following characteristics:

- Can contribute to improve the management level during the whole process of the project
- Can be helpful in saving cost for the client
- The project duration can be shorter due to optimization of the project procedure
- Can contribute to shorten project duration on condition that we assure quality, at the end of the project, the project contractor can have some profit sharing, that is why the project contractor is the loyal one in the project process.

We can summarize the characteristic of portfolio model as one sentence, the client having partner relationship with the contractor based on loyalty will attain the “win-win” goal, which can also saving cost and shortening project duration. Consequently, the portfolio model “PMC + Partnering” is a new model which is suitable for the Chinese companies.

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