

**DOCTORAL (PhD) DISSERTATION**

**XIANGYU CAI**

**KAPOSVÁR**

**2018**

**KAPOSVÁR UNIVERSITY**  
**DOCTORAL SCHOOL OF MANAGEMENT AND**  
**ORGANIZATIONAL SCIENCES**  
**FACULTY OF ECONOMICS**

Head of Doctoral School

**Prof. SÁNDOR KERÉKES DSc**

Correspondent Member of the Hungarian Academy of Sciences

Supervisor

**Dr. ARNOLD CSONKA**

Associate professor

**EVALUATION OF STRATEGIC COST DRIVERS IN**  
**THE CHINESE PETROLEUM SECTOR**

Written by

**XIANGYU CAI**

KAPOSVÁR

2018

## **Content**

1. Introduction .....	1
2. Literature review .....	9
2.1 Definition of cost.....	10
2.2 Definition of cost management .....	11
2.3 Theories and methods of cost management.....	13
2.3.1 Emergence and development of cost management.....	13
2.3.2 Methods of cost management .....	21
2.4 Definition of strategic cost management .....	25
2.4.1 Definition of strategy.....	25
2.4.2 Definition of enterprise strategy .....	25
2.4.3 Definition and features of strategic cost management.....	26
2.5 Framework of strategic cost management .....	29
2.5.1 Value chain analysis .....	29
2.5.2 Strategic positioning .....	33
2.5.3 Cost driver analysis .....	38
2.6 Step of strategic cost management .....	40
2.6.1 Strategic environmental analysis .....	40
2.6.2 Strategic planning.....	41
2.6.3 Strategy implementation.....	41
2.6.4 Strategic performance evaluation .....	42
2.7 Method comparison of cost management.....	42
2.7.1 The limitation of traditional cost management.....	43
2.7.2 Target costing management and activity-based costing management.....	43
2.7.3 Activity-based costing management and strategic cost management.....	44
2.8 Research on strategic cost management of petroleum enterprises ....	45
2.9 Conclusion from the literature.....	47

3. Aims of study .....	48
4. The status quo and problems of strategic cost management of China's petroleum enterprises .....	50
4.1 The characteristics of production and operation of petroleum enterprises .....	52
4.2 The status quo of cost management of China's petroleum enterprises .53	
4.2.1 Questionnaire.....	53
4.2.2 The method of cost management used by petroleum enterprises in China .....	58
4.3 Problems of cost management of China's petroleum enterprises.....	60
4.3.1 Integration of internal and external environment is not enough.	61
4.3.2 No systematic cost management.....	62
4.3.3 Budget management is not cover all cost .....	62
4.4 The causes of problems .....	63
4.4.1 The lack of strategic thinking .....	63
4.4.2 Cost management methods and techniques are obsolete.....	64
4.4.3 The scope of cost management is narrow.....	64
4.5 Brief summary of this chapter .....	65
5. Material and methods .....	67
5.1 The structure of strategic cost driver of petroleum enterprises .....	69
5.1.1 Structural cost drivers.....	71
5.1.2 Executional cost drivers .....	74
5.2 Model.....	76
5.3 Analyzing strategic cost drivers by using DEMATEL model.....	81
6. Result and discussion .....	82
6.1 Result.....	83
6.1.1 Creating direct relation matrix.....	83
6.1.2 Normalizing the direct relation matrix .....	85
6.1.3 Creating total relation matrix.....	86

6.1.4 Calculating the influence degree, the affected degree, the center degree and the cause degree .....	87
6.1.5 Creating visual diagram.....	89
6.2 Optimizing key cost drivers.....	92
6.2.1 Progress of technology .....	92
6.2.2 Cleaner production .....	93
6.2.3 Economies of scale .....	94
7. Conclusions .....	96
7.1 Conclusions .....	97
7.2 Limitations.....	98
8. New scientific result .....	100
9. Summary .....	102
10. Acknowledgement.....	105
11. References .....	107
12. The publications related to the topic.....	121
13. The publications not relate to the topic .....	123
14. Curriculum vitae.....	125
15. Abbreviations .....	127
16 Appendix .....	129

## Content of figure

Figure 1. 2010-2015 Consumption of crude oil and natural gas in China ....	5
Figure 2. 2010-2015 Foreign dependence of China's crude oil and natural gas.....	7
Figure 3. Interrelation of cost management.....	13
Figure 4. Cost management divided according to development process.....	14
Figure 5. Cost management divided according to time series .....	18
Figure 6. Cost management divided according to logical evolution .....	21
Figure 7. Model of activity-based costing .....	23
Figure 8. Internal value chain of activity in enterprise .....	24
Figure 9. Michael Porter's value chain.....	31
Figure 10. Part of the whole industry value chain.....	32
Figure 11. Porter's five forces model .....	34
Figure 12. PEST model .....	35
Figure 13. SWOT model .....	36
Figure 14. Framework of strategic cost management.....	40
Figure 15. Example map of influence network .....	79
Figure 16. Center degree of strategic cost drivers .....	89
Figure 17. Scatter plot of center degree and cause degree .....	90

## Content of table

Table 1. Scholars' researches of strategic cost management of petroleum enterprises.....	47
Table 2. The basic understanding of modern cost management.....	54
Table 3. Whether the enterprise uses the analysis of value chain activity chain and cost chain .....	54
Table 4. Whether the enterprise implements complete cost budget system and its effect of implementation .....	55
Table 5. Whether the enterprise apply at least one method of cost management and its effect .....	55
Table 6. Whether the enterprise implements at least one method of BPR ERP BSC .....	56
Table 7. Whether the enterprise implement cost assessment system and its effect.....	56
Table 8. The reason why the implementation of cost assessment system is not obvious .....	57
Table 9. Whether the enterprise has relative perfect cost management system and its implementation .....	57
Table 10. Whether the national macroeconomic policy is an important factor affecting cost of the enterprise .....	58
Table 11. Strategic cost drivers of petroleum enterprise .....	71
Table 12. List of experts for interview .....	84
Table 13. Direct relation matrix M.....	85
Table 14. Normalizing direct relation matrix N .....	86
Table 15. Total relation matrix T .....	87
Table 16. Influence degree, affected degree, center degree and cause degree of strategic cost drivers.....	88
Table 17. Oil and gas reserves and exploration workload of CNPC.....	95

## **1. Introduction**

How to strengthen the financial management and improve the level of administration to help a business grow, develop and make profit is a big issue in business management. With the development of the economy, enterprises start to focus on their level of cost management. In this increasingly competitive era, every enterprise wants to know how to maximize their benefits, they want to control their cost and do more things with the least money which is one of the ways to be successful. Cost management is one of the most important parts of business management. In today's society, cost management is critical to sustainable development of an enterprise, therefore, discussing the function and role of cost management in the field of business management becomes a popular topic.

Generally speaking, cost management is not an emerging field which existed as early as the period of rise industrial economy in 19<sup>th</sup> century (J. Wang, 2002). With the completion of the first industrial revolution, the socialization of larger-scale production has become an inevitable trend of economic development. Then the emergence and development of modern enterprises with certain scale led the role of cost management become more and more important. From the emergence of Taylorism in early 20<sup>th</sup> century to today's complex management theories and methods applied in multinational enterprises, science of management has gone through a long way for decades. In the development of management science, there is a trend that enterprises pay more and more attention to cost management. The reason why cost management is important is easy to understand. With the condition of market economy, the main purpose of enterprise is to earn profit and profit acquisition is achieved after the

cost of compensation. In the premise of certain market demand, reduce costs become the only way to pursue the maximal profit.

Cost management as an important part of business management, the main function and role is to provide accurate cost information for administrations to make decision (S. Wu, 2003). Since 1990s, with global economic integration and rapid development of high-tech, the internal and external environment changed tremendously. In order to cope with resource shortage and increasingly fierce competition, the traditional cost management needs to reform adaptively that strategic cost management has become the inevitable choice of enterprise to maintain long-term competitive advantage.

After two hundred years of development in management science, cost management in western countries formed a set of scientific and effective theories and methods. From product manufacturing cost to product life cycle cost, cost reduction to cost avoidance, production-based cost management to market-based cost management. All these theories and methods adapted to the internal and external changes of enterprises and provided enough information for the decision making of enterprises.

China's cost management learned and accumulated valuable experience after more than sixty years of development. It formed some methods such as team accounting, cost centralized management, cost accounting and market-oriented cost management etc. (X. Yu, 1999). After China became a member of the World Trade Organization in 2001, China's economy become more and more open, in the meantime business competition became much fiercer than ever. With the expansion of market access and reduction of tariffs, more

and more multinational enterprises came into Chinese market so that foreign products, services and investment swarm into the market compete with Chinese products and services. The traditional cost management model in China is not adapted to the economic development any more. These changes formed a complex internal and external environment of competition for Chinese enterprises, under this condition, Chinese enterprises need to learn and implement new methods of management to improve the competitiveness of enterprises so that enterprises can survive from fierce competition.

Petroleum is a product with character of commerce and national strategy (D. Chen, Wang, & Guo, 2009). The petroleum industry became international due to the regional differences in petroleum resources which are not renewable. The rapid development of world economic globalization has accelerated the pace of international petroleum industry in the world. Researches have shown that energy consumption of a country can boost GDP in the country and its growth rate is proportional to the growth rate of the national economy (Afgan, Gobaisi, & Carvalho, 1998). Petroleum and gas consumption accounted for more than 70% of primary consumption in developed countries (Z. Zhou & Tang, 2003). In China, petroleum and gas consumption only accounted for 25% of primary consumption, but the proportion continues to grow in recent years and petroleum and gas resources have become the main part of energy consumption which determines the direction of China's energy. It can be said that petroleum and gas resources are the basement of national sustainable development which also reflect comprehensive national strength of a country.

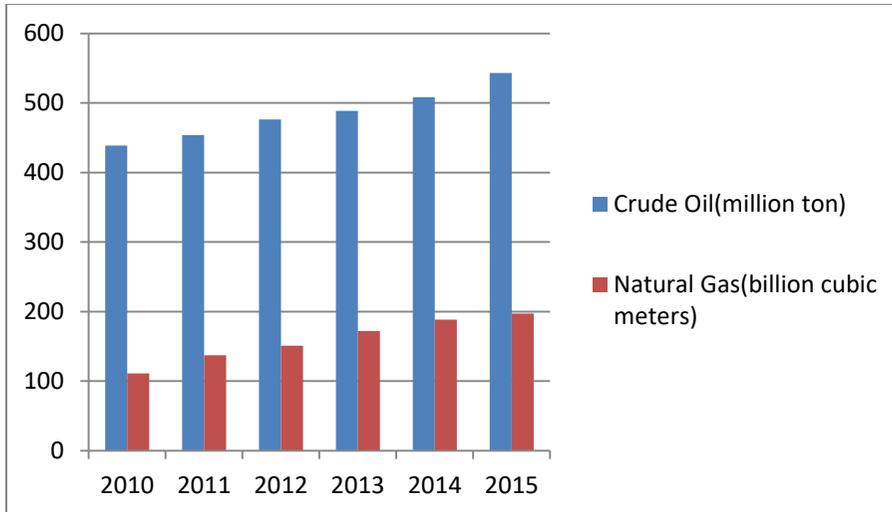


Figure 1. 2010-2015 Consumption of crude oil and natural gas in China Source: BP world energy statistics yearbook 2015

Over past three decades, China's annual growth rate of GDP is about 9.7% which is one of the fastest-growing countries in the world. The rapid development of the national economy has promoted the rapid growth of petroleum demand in China. In 2010, China's crude oil and natural gas consumption were 438.68 million tons and 111.2 billion cubic meters. China's crude oil and natural gas consumption were 543.20 million tons and 197.3 billion cubic meters in 2015 (China National Petroleum Corporation, 2016). Due to the rapid economic development, China's current energy demand is strong. Although China is the world's energy producer, energy production is still difficult to meet the huge energy needs. From 1949 to 1960, China's domestic demand for refined oil and demand for crude oil were all dependent on imports from abroad. In 1961-1979, oil was self-sufficient. During this period, part of the crude oil was also used for export. But in 1993, China became a net importer of oil (Cui, 2010).

As energy-based enterprise, petroleum enterprises play an important role in the national economy that makes great contribution to the development of national and regional economy. China's petroleum enterprises have made great progress over past 60 years. After decades of integration and adjustment, China National Petroleum Corporation (CNPC), Sinopec Group and China National Offshore Oil Corporation (CNOOC) have developed into large integrated energy enterprises and rank in Fortune Global 500. For example, China National Petroleum Corporation ranked third place in the Fortune Global 500 in 2016, revenue for the year is 299,270.6 million dollars and profit is 7,090.6 million dollars. However, there are still some problems in the development of China's petroleum enterprises. With the fluctuation of the international oil price, the situation of world economy became more complex that petroleum enterprises are facing unprecedented challenges. The gap of supply and demand is growing because of energy shortage in China. Research from Chinese academy of sciences reported that supply of crude oil and natural gas resources has been significantly lagging behind the growth of national economy (X. Liu, 2014). From 2010-2015, foreign dependence of China's crude oil and natural gas has been increasing and the dependence of crude oil reached 60.6% by 2015.

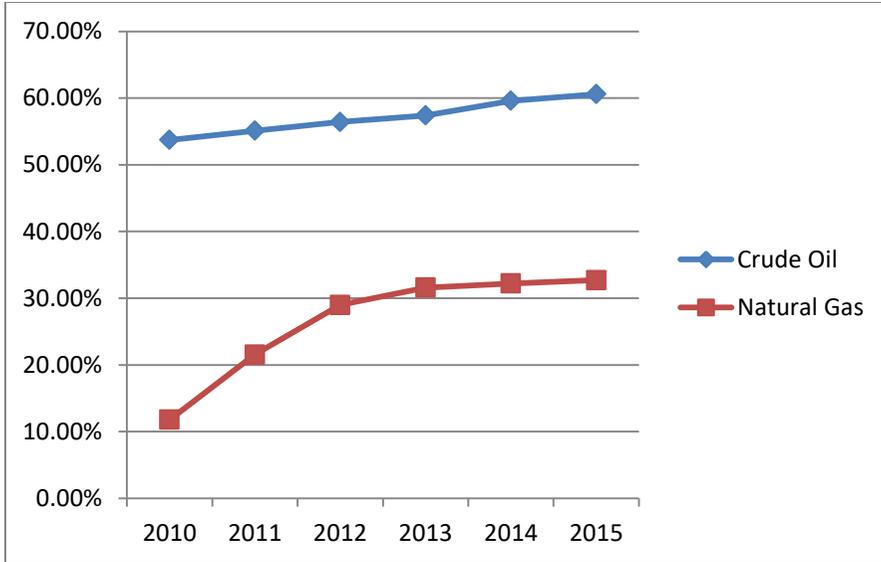


Figure 2. 2010-2015 Foreign dependence of China's crude oil and natural gas  
Source: Own creation based on Figure 1. Foreign dependence=Total imports / (domestic production + total imports)\*100%

The oil consumption of China is expected to reach 590 million tons by 2020 which lead the supply and demand gap of oil and gas resources will be further expanded. With the high growth of energy consumption, China's oil and gas production is obviously insufficient. Moreover, most of the oil fields have entered the late stage of development, especially the recoverable reserves of high quality has been decreasing. There are still many problems in the process of mining, such as indiscriminate mining and damage to the oil reservoir that resulted in a large number of oil and gas resources cannot be recovered(Z. Zhao, Huo, & Wang, 2011). At the same time, the level of technology in exploration is low that cannot meet the requirement of sustainable development of oil resources. Faced with all these bottleneck problems, petroleum enterprises of China should speed up the reformation and reorganization of their system and implement low-cost strategies of development in order to improve

competitiveness of enterprises in international market. To cope with fierce competition, we should find a suitable way of cost management for China's petroleum enterprises. In this thesis, I will try to learn and absorb the experiences of advanced cost management from western countries so that to contribute to theory of China's strategic cost management. In the meantime to improve the level of cost management of China's petroleum enterprises that to gain competitive advantage in market.

## **2. Literature review**

Cost is a product of economic development to a certain stage (C. Zhang, 2006). It came into being with the production of goods and promoted itself with the development of production. In business, cost is usually a monetary valuation of effort, material, resources, time and utilities consumed, risks incurred and opportunity forgone in production and delivery of a good or service. Cost is one of acquisition and this is the economic essence of cost.

## 2.1 Definition of cost

In 1978, the US Financial Accounting Standards Board noted cost in the conceptual framework for financial accounting and reporting that the cost is defined as sacrificed for economic activity and it is sacrificed for consumption, salvation, exchange production etc. (Financial Accounting Standards Board, 1992). The cost in the cost accounting that defined as a resource sacrificed or forgone to achieve a specific objective. A cost is usually measured as the monetary amount that must be paid to acquire goods or services by American cost management expert Charles T. Horngren (Horngren, 2014). This definition of cost is based on the definition noted in the conceptual framework for financial accounting and reporting which is the most general definition of cost in western countries. Accounting scholars in China generally believe that expense and cost are two parallel definitions. Expense incurred during a certain period of time and cost incurred for certain objects (Xu, 1994). It can be seen that the definition of cost in China is has limitation which belongs to financial cost, while the definition in western countries not only has financial cost but also includes management cost. On the basis of above, in this thesis cost described as it in order to achieve a certain purpose,

people sacrifice different resources for the purpose such as money, materials, time and opportunities etc. in economic activities.

## 2.2 Definition of cost management

There is no uniform definition of cost management that different scholars in different countries have different interpretations. Charles T. Horngren argued that cost management is the process of measuring, analyzing and reporting financial and nonfinancial information that helps managers make decisions to fulfill the goals of an organization (Ouyang, 1999). Japanese costing guideline defined cost management as the cost standard in Japan that compare actual amount of cost with the cost standard. Analyze the difference between them and report the data and result to managers in order to help managers to make decision to reduce cost (Y. Li, 1994). Chinese scholars defined as cost management is a series of scientific work of management include forecasting, decision-making, planning, controlling, accounting and analyzing for the cost incurred in the process of production and operation (Xu, 1994). Although the focus is different of these three definitions of cost management above, there is one thing in common that is to reduce cost. Cost management as a subsystem of enterprise management, it will be developed with the changes of enterprises' internal and external environment (Mao, 2002). The world is changing rapidly, with the world economic integration and rapid development of information technology, demand of customer for products or services is getting higher and higher. Under this circumstance, only focus on cost saving is not adapt to the economic development. Therefore, this thesis defined cost management as a series of scientific management activities such

as forecasting, decision-making, planning, accounting, controlling, analysis and evaluation, which are based on the cost information of competitive advantage. Its purpose is to obtain long-term competitive advantage to achieve the Cost management is a series of scientific management activities such as forecasting, decision making, planning, accounting, control, analysis and evaluation, which are based on the cost information of competitive advantage. Its purpose is to obtain long-term competitive advantage to achieve competitive strategy of enterprise. Accordingly, the object of cost management is expanded in time and space, referring to all the cost associated with business process that including not only the historical cost of financial accounting but also current and future cost. Cost management including both the cost of enterprise's internal value chain and the cost of industry value chain which involved customers and suppliers. The goal of cost management is to enable enterprises adapt to competitive market and maintain a competitive advantage to achieve competitive strategy.

According to the description of cost management above, cost management is divided in to seven parts which are cost forecasting, cost decision, cost planning, cost accounting, cost control, cost analysis and cost evaluation. These seven parts are interrelated to form the entire cycle of modern cost management.

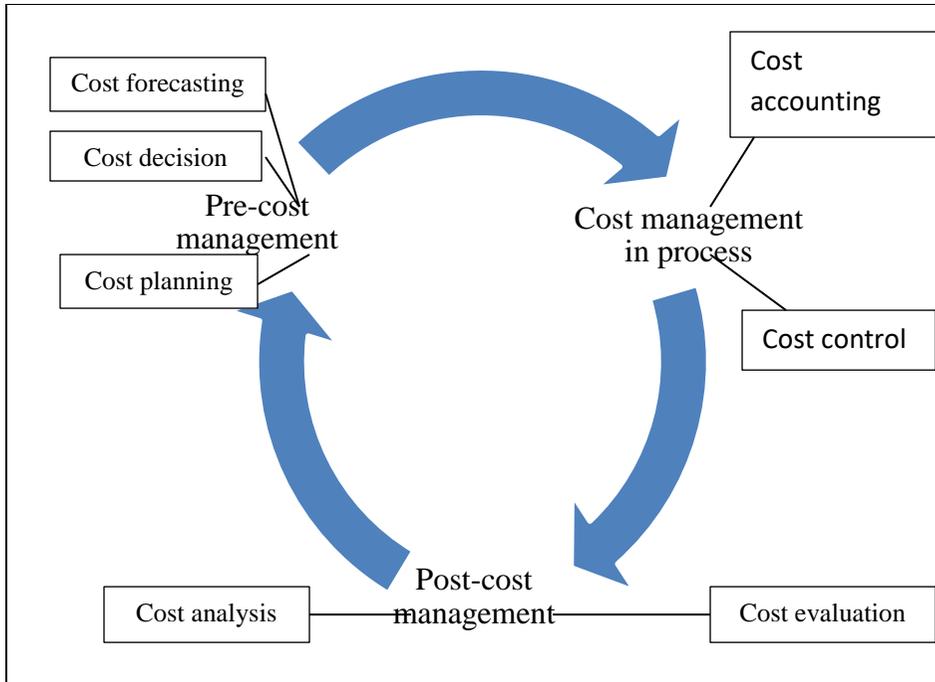


Figure 3. Interrelation of cost management Source: Own creation

The seven parts of cost management constitute pre, in process and post cost management. In the stage of designing before cost issues, cost forecasting, cost decision and cost planning should be considered. In the stage of implementation while cost issues, cost accounting and cost control should be carried out in this stage. In the stage of evaluation after cost produced, cost analysis and cost evaluation should be carried out.

## 2.3 Theories and methods of cost management

### 2.3.1 Emergence and development of cost management

The emergence and development of cost management is closely related to the development of economic and management theory. In Western countries, enterprise management has experienced four stages such as empirical management, scientific management,

modern management and strategic management (Giannantonio & Hurley-Hanson, 2011). Cost management as a subsystem of enterprise management that in accordance with the development process can be divided into traditional cost management and modern cost management. The cost management which occurred before ABC (Activity-Based Costing) was created by Robin Cooper and Robert Kaplan (Cooper & Kaplan, 1992) in 1984 was called the traditional cost management. With the emergence of ABC, it is known as the start of the era of modern cost management. The traditional cost management has experienced in a relatively long period that roughly can be divided into three stages. Stage one is the emergence of cost management after the industrial revolution after 19<sup>th</sup> century; stage two is period of standard cost management from the end of 19<sup>th</sup> century to 1930s; stage three is period of cost accounting management from the post-World War II to the early 1980s.

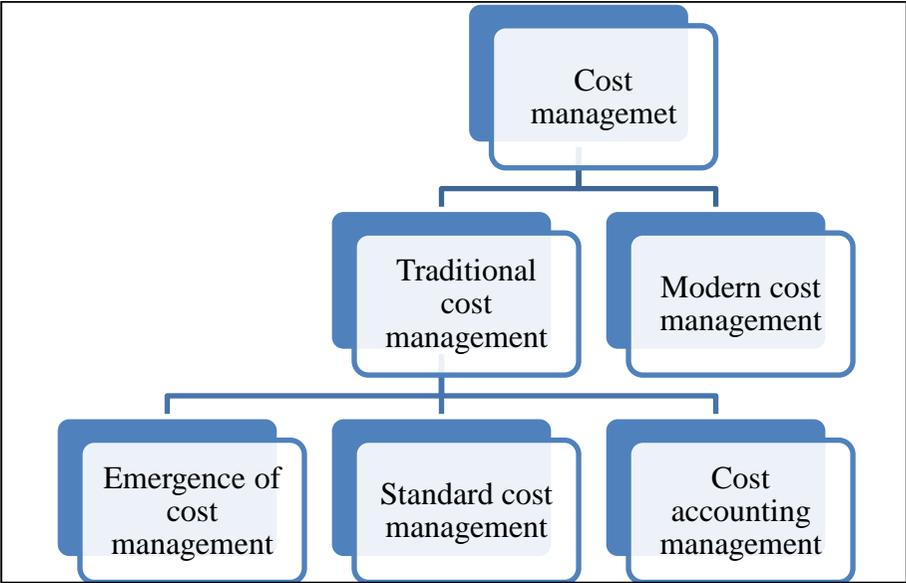


Figure 4. Cost management divided according to development process Source: Own creation

From the beginning of the 19<sup>th</sup> century to the early 20<sup>th</sup> century, measure of cost management is mainly analyzed the cost information after cost produced (Xie & Sun, 2010). Since the emergence of material production, human beings began the accounting and management of labor cost. But began to use money to calculate the production cost systematically of enterprise is after the industrial revolution. With the completion of the industrial revolution in the 19<sup>th</sup> century, machines factory replaced handicraft factory and the scale of enterprises gradually expanded which brought competition in market that enterprises have started to mention production cost. In order to reduce the cost of per unit of product, enterprises began to pay attention to the generation of cost information and combined the cost records with general accounting records together became cost accounting , which the emergence of cost management. Cost management mainly refers to cost calculation in this period which is use the principles of accounting to record all cost incurred in the process of production and sale and calculate the unit cost and total cost in the process. Managers make decisions based on the whole records. By the end of 19<sup>th</sup> century, managers realized that having a good system of cost management is very important to the development of enterprises. In this period, managers used cost information to manage large scale manufacturing enterprises. Managers set up the principles for the process of production so that every single department could provide cost information to managers. Then managers could use the cost information to assess the performance of workers and they could use the cost information for other aspects of management such as product pricing and check the quality of raw materials.

In accordance with the time series, the development of cost management can be divided into three stages (X. Shi, 2001). First stage is standard cost management; second stage is cost accounting management; third stage is modern cost management. Stage one is standard cost management from the end of 19th century to 1930s. In this period, the American engineer, Frederick Winslow Taylor known as the father of scientific management published the book “The Principles of Scientific Management” in 1911, which systematically expounded the methods for determining the standard of operating procedures and operating time. It established standard of accurate use of raw materials and labor force and determine the amount of work by scientific methods to pay the compensation for workers. Based on above, he invented a number of new cost measurement indicators such as materials standard cost and labor standard cost. The system introduced by Taylor known as Taylorism (Y. Zhang, 2009). The core of Taylorism is to emphasize the improvement of production and work efficiency through the so-called research of time and action to develop the standard which could achieve in the most efficient way under certain condition. Taylorism laid the theoretical basis of standard cost accounting. Cost management in this period is a comprehensive term used to describe the principle, practices and techniques of enterprises in terms of budget and control its resources, equipment and employees.

At this stage, cost management has developed its content in cost forecasting and cost control and methods of standard cost, budget cost and analysis of variance began to appear. The biggest feature of this period is that the standard cost system has fully developed. American accountant George Charter Harrison designed a complete

standard cost system in 1911. Since then, the standard cost began to apply in enterprises (Z. Wu, 2015). Cost accounting developed from simple cost accounting to management of cost accounting combine with cost control in order to get more potential to reduce cost. Standard cost system has some features such as set up the standard to limit the occurrence of cost; the purpose of standard cost is to achieve the cost criteria established in advance; standard cost is focus on current cost occurred in process and through the analysis of cost could reveal the level of cost management. Therefore, the biggest advantage of standard cost system is build a feedback system in the process of cost occurs which the feedback system could observe the difference in time that improves the effect of cost management.

Stage two is cost accounting management from the post –World War II to the early 1980s. After World War II, there was a new change in western countries. On the one hand, a large number of multinational enterprises emerged and scale of enterprises became bigger and bigger that led production and management increasingly complex; on the other hand, the science and technology developed in the war have been transferred to the civilian products that made new products emerged in market quickly resulted in a fierce competition. Under this condition, in order to avoid to be eliminated in the competition, enterprises focused on how to reduce cost while developed new technology. Managers began to realize that in order to reduce cost significantly, they should reform the product design, structure, technology etc. before the production process so that they select the best plan for different plans as the basis of decision-making. In this period, cost management not only control the cost in production process and account cost after production process, but also implement

cost forecasting and cost decision to set up target cost. Moreover, cost management in the period should set up the responsibility of employees for cost and optimize the process of cost to get the maximal economic benefits. Thus, on the one hand, many scientific methods of higher mathematics, operational research and mathematical statistics began to introduce into cost management; on the other hand, the rapid development of information technology basically satisfied the need of cost data processing. The application of natural science, technical science and social science in cost management in this period made cost management to a new stage. Since then, cost and management began to be integrated closely with advanced and scientific methods to influence on process of production.

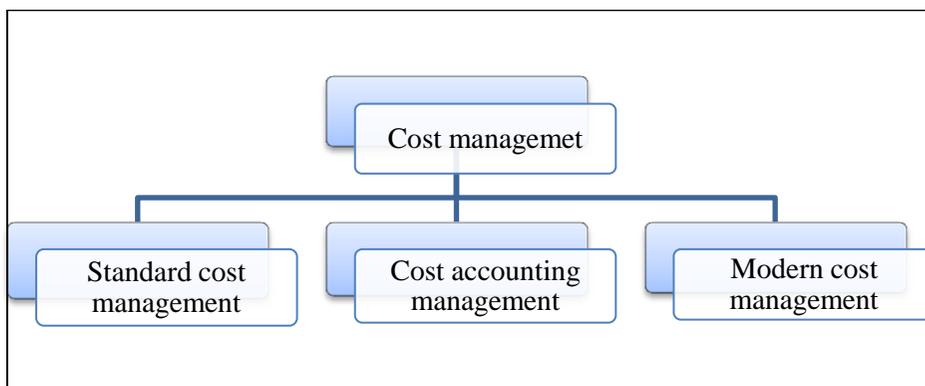


Figure 5. Cost management divided according to time series Source: Own creation

Stage three is modern cost management from the beginning of the 20<sup>th</sup> century to the present. Since 1990s, due to the fiercer competition of market managers expected that the emergence of new methods of cost management. Business circles and academia are also committed to create new theories and methods of cost management to adapt to global challenge and competition brought by the rapid

development of economy. From the end of 1980s, more and more scholars began to study leading enterprises that they found the sustainability of competitive advantage was the key to success of enterprises (X. Zhou & Chen, 2004). Because competitive advantage of enterprises was based on the unique resources allocated and owned by enterprises in specific environment, so to be ensured the sustainability of competitive advantage that enterprises need to obtain competitive resources and maintain effective management. Effective allocation of resources requires reasonable planning, control and evaluation of cost, traditional financial cost management cannot adapt to the requirements. Moreover, in order to obtain high return of strategic competition, enterprises not only need to research the internal environment of their own enterprises, but also need to research external environment of enterprises including competitors, customers, mar-kets and even government which the research can realize the information of changes of environment clearly. In order to provide this information based on external resources and long-term competitive advantage to enterprises, concept of strategic cost has been generated (Xia, 2000a). The concept of strategic cost management was put forward in 1980s, scholars and managers started to discuss and develop the theory and related methods that these theories and methods adopted by Europe, United States and Japan resulted in very good achievement.

The stages of cost management mentioned above are divided according to time series and did not fully consider the logical evolution of cost management. If we divide the stage of cost management according to logical evolution which are pre, in process, post and strategic that can be divided into four stages.

Stage one of cost management is that mainly used the post analysis of cost information. The focus of this stage is how to calculate the cost correctly and analyze the calculated cost information then provide the cost information to managers as the basis of cost control for next production circle. Stage two is mainly about cost control in process. Standard cost system emerged in this stage that led the focus of cost management from post analysis to cost control in process which is a breakthrough in the concept of cost management. It is great significance for the development of theory and method of cost management. Stage three is pre cost management. In this stage, the focus of cost management has shifted from how cost control in process and analyze calculated cost to cost forecasting, cost decision and cost planning that means from post and in process to pre control. In this stage, on the one hand, scholars focused on how to use modern forecasting theories and methods to establish quantitative management, which could estimate future trend of cost and based on estimate data to make optimal decision in order to achieve the maximal profit. On the other hand, scholars paid more attention to the actual situation of cost management in enterprises. They put forward method according to the actual situation that enriched the theories and methods of modern cost management. Stage four is strategic cost management. Strategic cost management is an important sign of modern cost management, which linked cost management with strategy of enterprise closely. It takes full account of changes in the environment that has changed cost management to three-dimensional cost management.

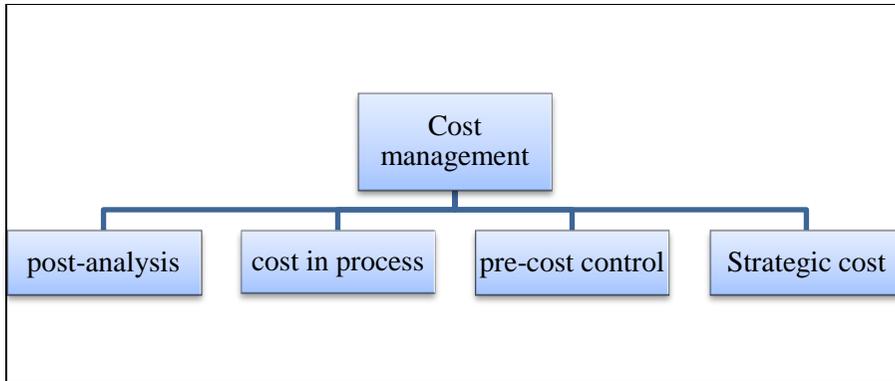


Figure 6. Cost management divided according to logical evolution Source: Own creation

### 2.3.2 Methods of cost management

#### Standard cost management

Standard cost management is based on cost accounting and the method is that control cost of product (Wei, 2006). Standard cost management means to establish a standard cost system that combine cost calculation of product with cost control. The system integrated set up cost standard, calculation and analysis of cost variance and deal with cost variance. To set up cost standard generally take into account future development and standard of feasibility. Including the development of direct materials and manufacturing costs, in the process of set up the standards that should be set up standard of price and quantity separately. The cost variance is the difference between the actual cost and the standard cost, which including calculation and analysis for cost of direct material, direct labor and manufacturing. After calculating the cost variance, at the end of each accounting period, the cost variance is the basis of modification for next production circle.

## **Target costing management**

Target costing is the core and essence of the Japanese cost management (Zheng, 2003). The earliest emergence of target costing is in the early 1960s. The Japanese accounting association defined target costing as a new field of management accounting in 1994, which created new model of cost management in Japan.

The essence of the target costing is pre-control of the cost and the method that is multiple cycles of set up, implement, accomplish, reset, re-implement, re-accomplish. Each cycle is a squeeze on the cost until the cost reached to the target. The target cost is determined by an acceptable selling price of market minus the expected profit. If the estimated cost is not bigger than the target cost, enterprises can implement next cycle. Otherwise, it is necessary to analyze the cost process to reduce the estimated cost until reach the target cost. The key factor of target costing is the target cost, which as a basis of product designing (Y. Liu, 2004). Through the cooperation of relevant departments in enterprise to optimize cost and reduce cost so that to achieve the target cost. Target costing means that cost management shifted from in process management of production to product planning and designing that its essence is strategic management for profit of enterprise.

## **Activity Based costing management**

Activity-based costing is a method which to calculate the cost of production by analyzing cost driver of activity to provide more accurate cost information for enterprise management. The basis of activity-based costing is the cost driver theory. The essence of the activity-based costing is to separate, summarize, and combine

between resource consumption and products through operations to form cost of product. This method provides more accurate and detailed information than information provided by the traditional costing method, which increases the usefulness of the cost information for decision-making (P. Wang, Yu, & Zhang, 2001). Specifically, the activity-based costing has undergone three stages of development.

Stage one emphasized product cost calculation. The cost drivers are divided into quantitative cost driver and transaction cost driver in this stage and for the first time that confirmed there are a variety of cost drivers in a business and use the method of analysis and management of cost drivers in cost management. Through modify the method to eliminate cost drivers and activity which not add value for enterprise. Activity-based costing is an internal management that focuses on the management of the internal activity chain and the improvement of internal efficiency in this stage. It has not extended cost management to the external environment and did not take into account the cost drivers of the enterprise's strategy. ABC in this stage mainly focused on post cost control and in process cost control.

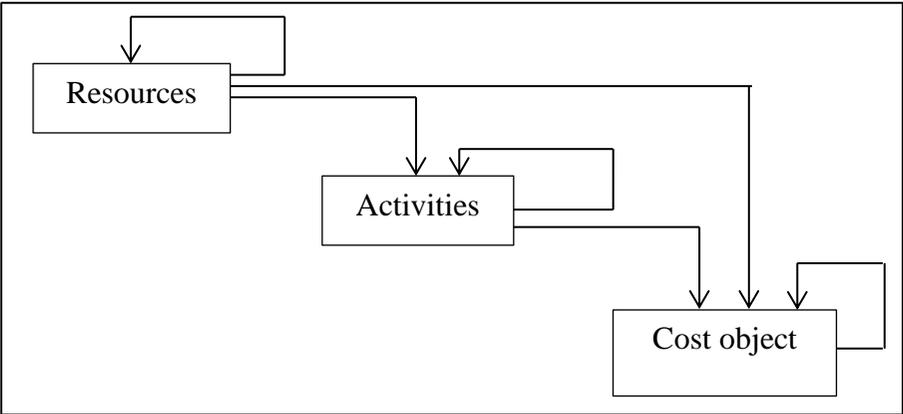


Figure 7. Model of activity-based costing Source: Own creation

Stage two is not only paid attention to product cost, but also focused on the process of cost formation. This stage was developed on the basis of the first stage, greatly widening the scope of internal activity of enterprise. ABC in stage one is to confirm the activity first then combined the activity with cost to determine the cost of product. But ABC in stage two is to confirm the process of cost formation first then linked the process with activity to determine the cost. But the limitation of stage two is to only analyzed internal activity and its cost driver of enterprise.

The focus of stage three is not a single activity or a specific process but the whole enterprise. ABC in this stage takes into account the whole activity chain of the enterprise and how to use the auxiliary activity to obtain the competitive advantage. Through the analysis of the value chain, the strategic goal of the enterprise is combined with the activity management, which applied for enterprises in the stage.

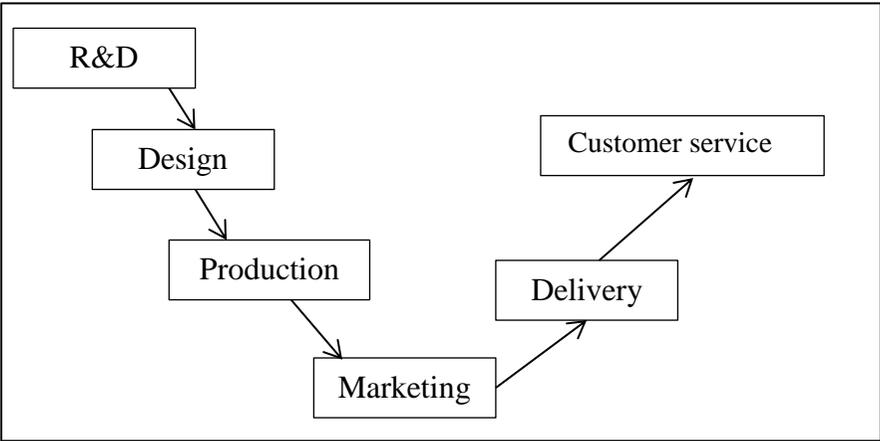


Figure 8. Internal value chain of activity in enterprise Source: Own creation

**Strategic cost management**

Strategic cost management was developed on the basis of traditional cost management in order to adapt to the change of enterprise

competitive environment and the need of strategic management. It is the product of strategic management integrated with cost management that is an effective way for enterprises to obtain long-term competitive advantage.

## 2.4 Definition of strategic cost management

### 2.4.1 Definition of strategy

Strategy defined as a term of “the science and art of employing the political, economic, psychological, and military forces of a nation or group of nations to afford the maximum support to adopted policies in peace or war; the science and art of military command exercised to meet the enemy in combat under advantageous conditions” by Merriam-Webster dictionary. And defined as a term of “a plan of action designed to achieve a long-term or overall aim; the art of planning and directing overall military operations and movements in a war or battle” by Oxford dictionary. Defined as a term of “the overall planning and guidance of war; the overall plan for the decision” by Chinese dictionary of Cihai.

### 2.4.2 Definition of enterprise strategy

Strategy defined as “the determination of the long-term goals and objectives of an enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out these goals” by Alfred D. Chandler who is the earliest proposed the common definition of enterprise strategy (Chandler, 1962). The definition of strategy defined by Chandler illustrated that strategy has characteristics of long-term and future-oriented. And another theme of strategy is competition is proposed by Michael E. Porter (Porter, 1980). He took account competitive strategy into enterprise could

create and sustain the competitive advantage in every area. Kenichi Ohmae (Ohmae, 1991) pointed out that enterprise strategy is for the competitive advantage, there is no need to develop a strategy without competitors. Definition defined by Michael J. Stahl and David W. Grigsby (Stahl & Grigsby, 1991) is focus on the importance of marketing and environment of enterprise strategy.

From the definitions above can be seen that enterprise strategy has the characteristics of long-term, future-oriented, competition and marketing. Therefore, the definition of enterprise strategy can be defined as a long-term plan that will have a significant impact on improvement of competitive advantage in the future.

### **2.4.3 Definition and features of strategic cost management**

#### **2.4.3.1 Definition of strategic cost management**

Research on strategic cost management began from 1990s, therefore, there is no uniform definition of strategic cost management. The understanding of Scholars on strategic cost management mainly as the following, Robin Cooper and Regine Slagmulder (Cooper & Slagmulder, 1998) pointed out that the purpose of strategic cost management refers to the use of a series of cost management methods to achieve lower costs and improve the strategic position. Anderson and Dekker argue that strategic cost management is the deliberate alignment of a firm's resources and associated cost structure with long-term strategy and short-term tactics (Anderson & Dekker, 2009). John Shank (Shank, 1989) defined it as cost information is directly used for one or more stages of the four stages of a strategic management. The representative definition of strategic cost management in China defined by Ke Chen, Kuanyun Xia, Wanxiang

Lin etc. Ke Chen argued that strategic cost management is a kind of management method that using the cost information for control and improvement of the cost structure and cost behavior of the enterprise to obtain long-term competitive advantage (K. Chen, 2003). Kuanyun Xia argued (Xia, 2000b) that strategic cost management refers to accounting department to provide the analysis of information of the enterprise and its competitors to help managers evaluate the enterprise strategy to create a competitive advantage in order to achieve the effective adaptation to the external changes of environment. Wanxiang Lin (Lin, 1999) argued that strategic cost management focus on the strategic environment, strategic planning, strategic implementation and strategic performance of cost management. The definition of strategic cost management can be expressed as how to organize cost management under different strategic options. Although the definition above are different, one thing in certain is that compared with the traditional cost management, strategic cost management is to obtain and maintain a lasting competitive advantage for enterprise in the meantime to maximize profit of enterprise and satisfy for needs of customer. Therefore, the strategic cost management is based on the development requirements of enterprise strategy to use the cost information for strategic choice and to organize different costs of strategic management so that to achieve competitive advantage and adapt to the changes of external environment effectively.

#### 2.4.3.2 Features of strategic cost management

Compared with the traditional cost management, the purpose of strategic cost management was changed. The purpose of strategic cost management is not only to reduce costs, but also to obtain and

maintain the long-term competitive advantage (Sun, 2015). Enterprise must explore ways to increase or at least not decrease its competitive position. It should be cut out if a reduction of cost undermines the strategic position of the enterprise. In other words, if the increase of certain cost contributes to the competitive position of the enterprise, the increase of certain cost should be encouraged. For example, enterprise needs to set up a special after-sales service for customers in certain market which increase the cost of the enterprise. But because of the after-sales services attracts more customers that maintain the competitive advantage of the enterprise, it is the advantages outweigh the disadvantages for the enterprise in the long run. Compared with the traditional cost management, the scope of cost management is more expanding in strategic cost management (Y. He, 2004). Due to the increase cost of pre-production and post-production in enterprise, cost management should not only focus on cost control of production in process, but also focus on cost control of product designing, material purchasing, product marketing and customer service etc. Thus, strategic cost management relates to the cost of interrelated of all sectors in enterprise such as department of R&D, supply, production, marketing and after-sales service. Moreover, the scope of strategic cost management is no longer confined to the internal environment of enterprise that goes beyond the enterprise boundary as a cross-organizational cost management, such as to establish system of electronic information exchange and transportation with suppliers and distributors together to improve cost management. The essence of the traditional cost management is cost saving, which save the cost of production in process through modify the way of working such as reduce waste losses, save energy, zero

inventory, analysis and improvement of activity etc. The essence of the strategic cost management is cost avoidance, which consider geographical location, market positioning, scale of operation and a series of cost drivers in the process of enterprise planning in order to control the cost from very beginning that means in the stage of product designing and development, the product designed by enterprise should be accorded with target cost while competitive in order to avoid the unnecessary cost. Compared with the traditional cost management which focused on cost reduction, strategic cost management focus on development of sustainable competitive advantage and the purpose of strategic cost management is to help enterprise to adapt to market, capture market and obtain competitive advantage.

## **2.5 Framework of strategic cost management**

The essence of strategic cost management is to focus on cost drivers, use analysis of value chain to clarify the functional positioning of cost management in enterprise strategy (Gan, 2001). The model of strategic cost management theory and practical application proposed by John Shank including three important management tools which are value chain analysis, strategic cost driver analysis and strategic positioning analysis (Shank & Govindarajan, 1993). Therefore, value chain analysis, cost driver analysis and strategic positioning analysis constitute the basic framework of strategic cost management.

### **2.5.1 Value chain analysis**

The concept of the value chain was first described by Michael Porter (Porter, 1985) in his book of "competitive advantage" that refers to a set of activities that a firm operating in a specific industry performs in

order to deliver a valuable product or service for the market. Later, the concept of the value chain further expanded by John Shank and Vijay Govindarajan (Shank & Govindarajan, 1993) argued that the value chain included the whole process of value production, not only including the internal value chain, but also including the external value chain of suppliers and distributors. With the development of information technology, Rayport (Rayport & Sviokla, 1995) and Bhat (Bhatt & Emdad, 2001) expanded the value chain as a virtual value chain. Walters, Lancaster (Walters & Lancaster, 2000) and Mclarty (Mclarty, 2000) studied on the implementation of strategic management and practical application based on value chain.

On the one hand, production and management activities consume the resources of enterprises cause the cost of business. On the other hand, production and management activities create value for the enterprise. When the enterprise takes production and management activities as a value activity, the cost management of the enterprise is transformed into the management of the value activity. Value chain analysis is the first step in the implementation of strategic cost management, including the internal value chain analysis, competitor value chain analysis and industry value chain analysis. The appropriate level for constructing a value chain is the business unit, not division or corporate level. Products pass through a chain of activities in order, and at each activity the product gains some value. The chain of activities gives the products more added value than the sum of added values of all activities (Porter, 1985).

The internal value chain of enterprise is the main activities and related support activities which are created by the enterprise for the

customer (Ren & Fan, 2007). It is divided into nine sectors including enterprise infrastructure management, human resource management, technology development, procurement, inbound logistics, operations, outbound logistics, marketing and after-sales service.

These activities interrelated together to create profits for the enterprise and forming value chain of the enterprise which from the raw material suppliers to consumers (Qi Zhang, 2005). The purpose of the internal value chain analysis is to find the basic value chain and decomposed the basic value chain into separate activity, then optimize value activity according to strategic objectives of enterprise in order to improve customer value while to reduce cost as much as possible and improve competitive advantage.

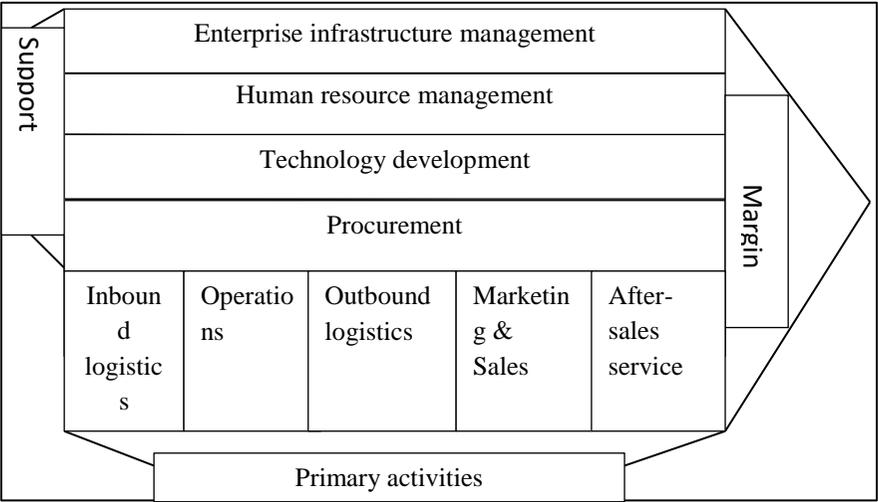


Figure 9. Michael Porter's value chain Source: (Porter, 1985)

After the 1980s, people gradually realized that customer value is the driving factor of enterprise value. Value chain extends from inside of the enterprise to the outside of the enterprise. The focus shifted from consumption cost of production in process and internal cost reduction to pay more attention to cost management of the related enterprise of

the upstream and downstream. From the customer's point of view, any enterprise is in a linking node in the value chain which has upstream suppliers and downstream distributor. The industry value chain is an extension of the internal value chain. Through the industry value chain analysis, enterprise can figure out its position in the industry value chain and analyze the upstream and downstream value chains as a basis of promoting the partnership between the enterprise with the supplier and the customers to obtain competitive advantage.

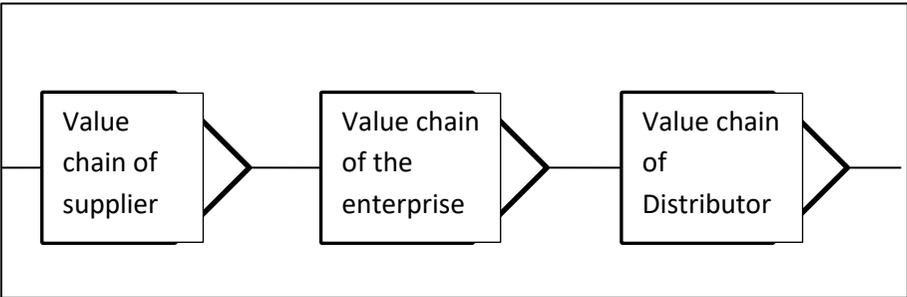


Figure 10. Part of the whole industry value chain Source: Own creation based on Figure 9

There are competitors who produce similar products in an industry. The competitive advantage of the enterprise is reflected in the comparison with the competitors, the so-called "know the enemy and know yourself, and you can fight a hundred battles without defeat" (Xi, 2006). If enterprise know nothing about competitors, it is difficult for enterprises to use a scientific and reasonable competitive strategy to compete with competitors that may cause enterprises to suffer from unexpected competitive pressure (F. Wang, Cheng, & Wang, 2006). On the contrary if enterprise could get the information of competitors and analyze the information to help the enterprise to know the current situation in market. Enterprise can set up appropriate strategies to eliminate the competitive disadvantage and

maintain competitive advantage in order to obtain a competitive position in the industry. The analysis of the competitor's value chain is mainly to measure the cost level, structure and behavior of the competitors, which compare with the cost status of the enterprise so that revealing the cost difference and establishing cost strategy to adapt competition. But this analysis is often difficult to achieve because mutual confidentiality of competitors and the cost of information difficult to obtain (Qi, 2015). Therefore, the analysis of the competitor's value chain mainly lies in the study of the relationship between the competitor's value activity and other activities, as well as the corresponding cost drivers and the comparative analysis of the corresponding activity in the enterprise which the reasons leading to competitive advantage or disadvantage that to help enterprises to improve the competitive position of cost.

### **2.5.2 Strategic positioning**

Strategic positioning refers to positioning the industry, market and product for enterprise based on a thorough investigation of internal and external environment of enterprise which to help the enterprise to determine the competitive strategy to obtain competitive advantage. When the enterprise determined which strategy should be taken that defined the direction of strategic cost management so that the enterprise can use appropriate procedures and tools adapt to strategic cost management of the enterprise. Strategic positioning analysis refers to the method how enterprise makes choice of strategy to compete with competitors in market. There are many methods of strategic positioning analysis such as Porter's five-force model, PEST model for the external environment analysis and SWOT model for analysis of internal and external environment.

## Five forces model

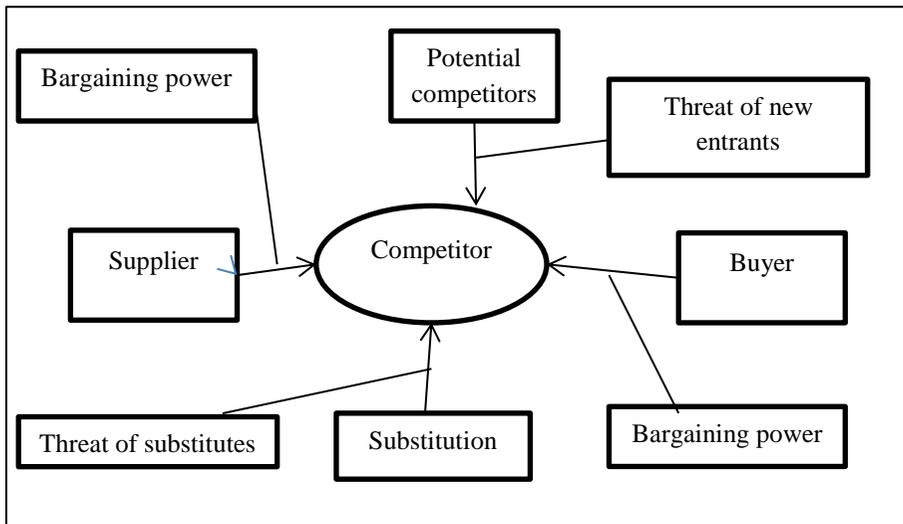


Figure 11. Porter's five forces model Source: (Porter, 1979)

Michael Porter proposed a model of industry structure analysis, which is the five forces analysis (Porter, 1979). The model pointed out that threat of new entrants, threat of substitutes, bargaining power of customers, bargaining power of suppliers and industry rivalry constitute the five forces which are competitive drivers to determine the profitability of the enterprise. According to the model, the core of the enterprise strategy is to choose the right industry, as well as the best position of industry competition. Therefore, the model has been always to be the basis of enterprise to carry out industry competition analysis and to develop competitive strategy.

## PEST model

PEST is a model of macroeconomic analysis which has four factors that P represents politics, E represents economy, S represents society and T represents Technology. The model is part of external environment analysis of enterprise. Generally the four factors are not

controlled by enterprise. Therefore, sometimes these factors are dubbed the pest which means harmful to enterprise.

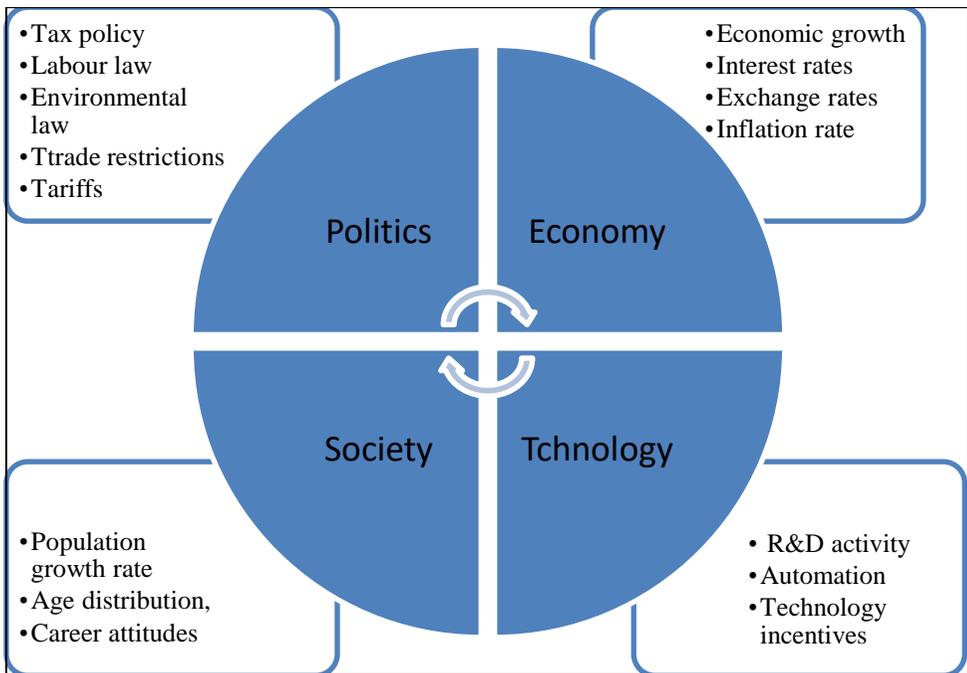


Figure 12. PEST model Source: Own creation based on definition

### SWOT model

SWOT is a model of analysis for internal and external environment of enterprise. S represents strengths, W represents weaknesses, O represents opportunities and T represents threats. S and W represent the internal factors; O and T represent the external factors. SWOT is a method based on the internal and external conditions of the enterprise, through the analysis of strengths, weaknesses, opportunities and threats of enterprises to figure out what are the strengths, weaknesses and core competitiveness of enterprise. This is strategy of enterprise to find out a way of using strengths and opportunities to avoid weaknesses threats for enterprise.

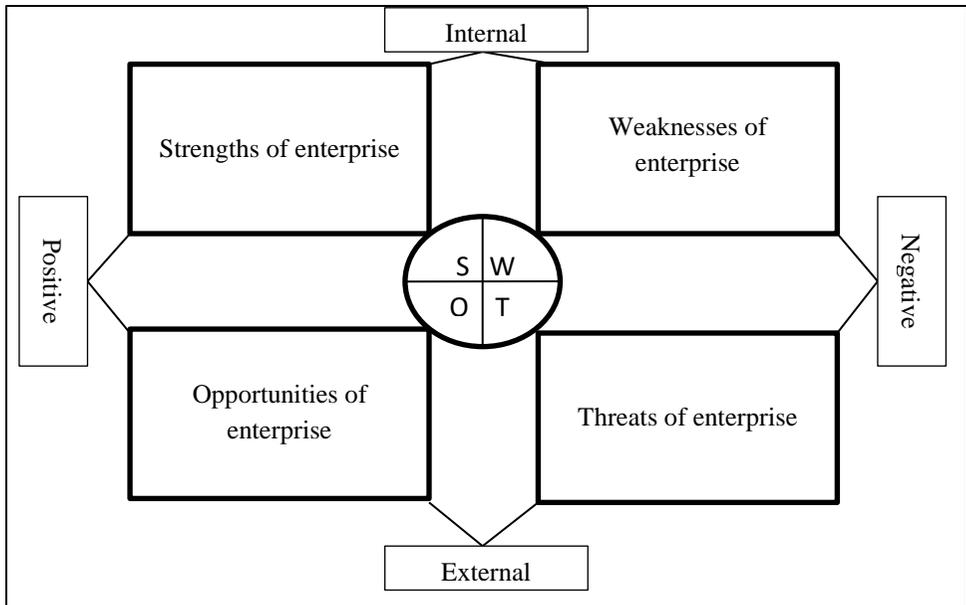


Figure 13. SWOT model Source: Own creation based on definition

Enterprise strategic positioning can be divided into cost leadership, differentiation strategy and market focus strategy. Different strategic positioning has different influence on competitive advantage of enterprise.

### **Cost leadership**

Cost leadership means lower the cost of products to maintain a leading position in the industry and use low-cost strategy to capture the market (T. Liu, 2008). Under the guidance of this strategy, the goal of the strategy is to obtain the lowest cost so that to perform better than competitors through large-scale production and strict cost control under the condition of product with the same quality. Using the strategy of cost leadership can take the market share from competitors by lowering prices and make it difficult for new competitors to enter the market. However, one of the major drawbacks of overall cost leadership is that managers focused on

prices of products while ignored the quality of products and services which is not conducive to the long-term development of enterprise.

### **Differentiation strategy**

Differentiation strategy is that enterprise provides unique products of the industry to attract consumers to pay for it which could improve consumers' surplus and increase brand loyalty (K. Yu, 2001). As long as the enterprise gains more profit than the cost caused by differentiation that means the strategy works for the enterprise. If enterprise implements differentiation strategy that means through the satisfaction for specific needs of certain consumers the enterprise could reduce customers' sensitivity to the price and to weaken the customer bargaining power. However, when the differentiation strategy is implemented, the product differences and the price differences should be accepted by the customers.

### **Market focus strategy**

The market focus strategy is for some certain group of customers that with a certain product in market to gain a competitive advantage (Y. Wang, 2007). This strategy requires enterprise to focus on certain customers with limited resources and perform more efficient than competitors. When enterprise implements market focus strategy that could not reach the industry standards. However, the enterprise should implement overall cost leadership or differentiation strategy based on a certain group of customers. So that enterprises can be more effective than a competitor to provide products and services for a certain group of customers in order to obtain competitive advantage. The risk is there is possibility that the certain group of customers may turn their preference to public preference and small-scale production is not conducive to cost management.

### **2.5.3 Cost driver analysis**

Enterprise can determine the cost management strategy on the basis of value chain analysis and strategic positioning analysis, but it is not enough for cost management to achieve the strategic objectives. Therefore, we must also find out the cost driver of business to control the main value chain activities and ensure the effectiveness of strategic cost management. According to ABC, activity affects cost and driver affects activity so that cost drivers are the causes of changes in cost. Cost drivers can be divided into two levels. First is the tactical level of cost drivers which exist in production and activities of the business process; second is the strategic level of cost drivers which have long-term impact on enterprise structure and cost behavior (Shank & Govindarajan, 1993). The latter one is the strategic cost drivers.

From a strategic point of view, the cost driver of business mainly come from the economic structure of enterprises and the executed procedures which divide the strategic cost driver into structural cost driver and executional cost driver. The analysis of structural cost driver including the selection of the scale, scope of business, experience, technology, diversity and place of the enterprise from the perspective of strategic cost management. It is aimed to obtain competitive advantage based on arranging the basic economic structure of the enterprise rationally (Porter & Millar, 1985). The analysis of executional cost including the improvement of labor force participation in enterprise, the overall quality control, the utilization of the production capacity, the efficiency of the factory layout, the appearance of the product etc. from the perspective of strategic cost

management. It is aimed at to provide efficiency assurance for the strategic cost management.

For structural cost driver, it is not the higher the better but there is a certain range. For example, the size of enterprise is not the bigger the better. But for the executional cost driver, generally speaking the level is the higher the better, such as overall quality system. These two types of cost driver have different meanings for enterprise. The purpose of structural cost driver is to optimize the strategic allocation of basic resources. The purpose of executional cost driver is to improve internal management and the strategic system. In sum that the strategic cost driver analysis is the way to change the position of cost and improve competitive advantage for enterprises. Enterprise cost is always controlled by a group of cost driver, to select the appropriate cost drivers as a breakthrough to obtain cost advantages is an important strategy for enterprise. According to introduction of value chain analysis, strategic positioning and cost driver analysis that we can know the basic framework of strategic cost management. These three analytical tools are interrelated to establish an analytical framework for strategic cost management that provides methods and ways implementing strategic cost management of enterprise.

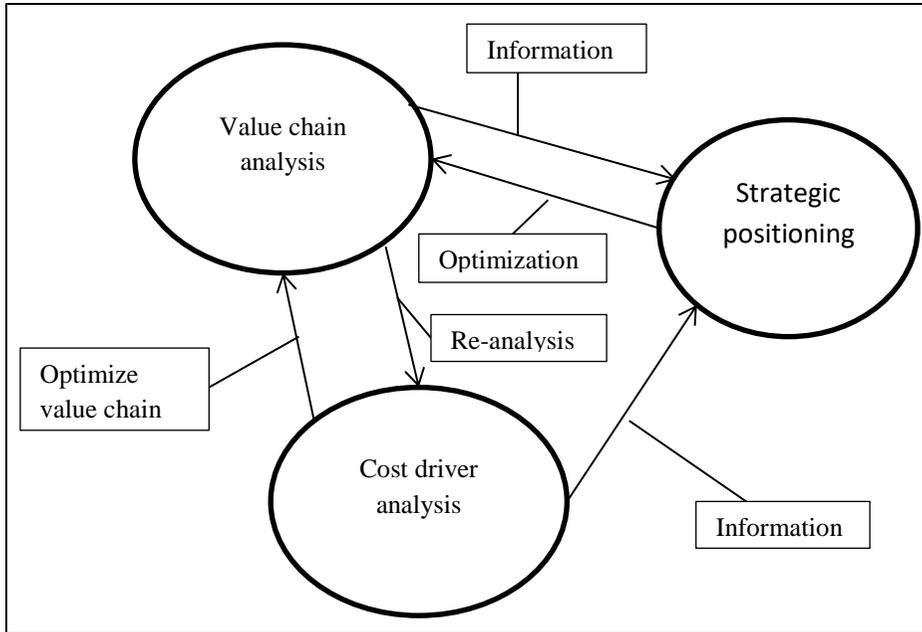


Figure 14. Framework of strategic cost management Source: Own creation

## 2.6 Step of strategic cost management

### 2.6.1 Strategic environmental analysis

Environmental analysis is the basis of strategic cost management and the method is value chain analysis (Du, 2004). Through the analysis of the industry value chain, enterprise can figure out the position of the enterprise in the industry value chain; through the internal analysis, enterprises can figure out the enterprise's value chain and through the analysis of competitors, enterprise can figure out the value chain of competitors so that based on all information from a series analysis to determine what kind of the strategy of cost management should be applied in the enterprise. Through environmental analysis, enterprise can fully aware of the opportunities and challenges, strengths and weaknesses of its own. To compare the analysis with the environment expected by the

enterprise, if the environmental condition of the analysis is better than or equal to the expected, the environment is accepted by the enterprise. Otherwise, enterprise should find out a way from other aspects to obtain competitive advantage.

### **2.6.2 Strategic planning**

On the basis of environmental analysis, the next step is to carry out strategic planning to determine how enterprise enter, develop or withdraw from a certain industry. Based on a certain type of strategic cost management, strategic planning needs to determine the objectives of strategic cost management which including the overall objectives and a series of specific objectives. Objectives must be constitutes a clear network that accurate network of objective is helpful to the development, implementation and control of strategies.

### **2.6.3 Strategy implementation**

In order to achieve the objectives, enterprise needs to set up basic strategy and plan of implementation according to the internal resources and external environment (B. Li, 2005). Due to changes of internal resources and external environment in the implementation process of strategy, it is necessary to carry out strategic control. Strategic control includes feedforward control and feedback control. The control process includes research of control factors, determination of control standard and transmission of control information etc. If the strategic objectives have been achieved or internal and external conditions have changed significantly over the capacity of strategic control, enterprise need adjust strategy which means to restart a strategic environmental analysis and strategic planning into a new round.

#### **2.6.4 Strategic performance evaluation**

Strategic performance evaluation is an important part of strategic cost management (Wan & Guo, 2009). The purpose of strategic performance evaluation is to measure the performance of strategic cost management activities, which the enterprise achieved the expectation or not. Then to provide further information for enterprise's decision-making. Performance evaluation usually includes indicators setting, assessment, evaluation, control, feedback, adjustment, incentives etc. The performance evaluation of strategic cost management should be carried out according to strategic objectives. Enterprise can use strategic performance evaluation to improve the strategic cost advantage.

#### **2.7 Method comparison of cost management**

The thesis introduced standard cost management, target costing management, activity-based costing management, objective cost management and strategic cost management previously. Standard cost management belongs to the traditional cost management with great limitations compared with the other methods. Target costing management and activity based costing management belong to the modern cost management, which two methods are the most representative of 20th century. There are some relationships and differences between target costing management and activity based costing management. Strategic cost management as a new cost management method due to the introduction of value chain analysis, compared with activity-based cost management they also have similarities as well as differences.

### **2.7.1 The limitation of traditional cost management**

Compared with modern cost management, traditional cost management has some limitations such as lack of adaptability to the new external environment, only focus on the internal production process and to ignore the necessary research on the cost of competitors etc. Since the 1980s, the business environment of enterprises changed tremendously, most products oversupply in markets led to very fierce competition in markets. New technology continues to emerge and spread quickly, such as computer-aided design (CAD) and flexible manufacturing system (FMS) which accelerated products upgrade and increased global competition (G. Liu, 2010). Traditional cost management could not adapt to the external environment changes. One limitation of traditional cost management that is only focus on internal production process of enterprise. It is less to consider product R&D, business management process, the supply and marketing services. It is also less concern about competitors. Traditional cost management also ignores the necessary research on the cost of competitors. For enterprises in a competitive environment, in order to maintain a lasting competitive advantage, they must to decide the competitive strategy through the analysis of competitive situation of the market, which requires enterprises to get the cost information of competitors.

### **2.7.2 Target costing management and activity-based costing management**

In view of shortcomings of the traditional cost management, Japan and the United States innovated methods of cost management based on their social economy and cultural background which are target costing management in Japan and activity-based costing management

in the US (J. Shi, 2000). Target costing management turned the focus of cost management from the product cost in process to the design, planning and development of product. The activity-based costing management mainly focused on every step of production activity which caused the cost. Control and improve the cost of product based on the analysis of production activities.

There are many advantages of the two cost management methods, but with the rapid development of economy and technology, their drawbacks are gradually revealed. Such as unpredictable future increased risk of target costing management and the application of target costing is only for technology-intensive industries. Activity-based cost management provide more accurate information than traditional cost management, but activity-based cost management also based on information of historical cost. The method increases workload lead to more information cost. In addition, the choice of cost driver is more difficult with activity-based costing management.

### **2.7.3 Activity-based costing management and strategic cost management**

The view of strategic cost management is from macro and overall perspective to the cost management of enterprises. The view of activity-based costing management is from micro and internal perspective, which pay more attention to solve the specific problems in activities and concerned about the operational level. Activity-based costing management focuses on the causes of cost, it control the cost based on the analysis of causes of cost. Strategic cost management focuses on the life cycle cost, at different stages to implement different method of cost management to achieve the minimum life

cycle cost. Although both methods use value chain analysis, the focus is different. The value chain analysis of activity-based cost management only refers to the internal value chain of enterprises. The value chain analysis of strategic cost management not only focuses on the internal value chain, but also focuses on the industry value chain and the competitor value chain to implement the strategic cost management and improve the sustainable competitive advantage of the enterprise.

Because the standard cost exposed many drawbacks that stimulated people to explore new methods of cost management to adapt the development of enterprises (Zhenyi Wang, 2003). Under this condition, two modern cost management methods, which are target costing management and activity-based costing management carried out by people. Then target costing management and activity-based costing management provided a research environment and possibility for strategic cost management. Therefore, strategic cost management not only absorbed the advantages of traditional cost management to improve the lack of other cost management but also a innovation based on other cost management, which a better cost management method than others.

## 2.8 Research on strategic cost management of petroleum enterprises

Faced with increasingly fierce competition in the oil market, many large petroleum enterprises around the world started to research on how to expanding the market while to reduce production costs in order to obtain cost advantage. The strategic cost management as rising star of cost management theory, its advantages gradually

highlighted and accepted by domestic petroleum enterprises. The environment of market changes rapidly nowadays, almost all petroleum enterprises follow the principles of best efficiency, lowest cost and the optimize selection of location to reorganize, replace, eliminate and remove non-competitive, non-core and low profit business in order to strengthen the competitive advantage of core business. Large petroleum enterprises expanded the scope of cost management and pay more attention to long-term cost management, which to strengthen the management of capital cost, opportunity cost and risk cost. Such as Chevron to reduce capital cost by using a large number of short-term funds to issue commercial paper and financing. Large petroleum enterprises pay more attention to value chain analysis. They integrate the internal value chain and optimize the external value chain of their enterprises. For example, large petroleum enterprises generally formed a strategic alliance with the upstream and downstream enterprises that they focus on the total cost of the value chain to achieve the win-win situation.

Scholars also launched some researches for strategic cost management of petroleum enterprises. The study of petroleum enterprises basically follows the research model of Shank, which from the aspects of the value chain analysis, cost driver analysis and strategic positioning analysis. Different scholars focus on different aspect. For example, Di Wang (D. Wang, 2008) and Shaoen He (S. He, 2010) focused on performance evaluation based on Shank's model. Zhenzhi Zhao and Jianglin Huo (Z. Zhao & Huo, 2010) made a quantitative research on the value chain of petroleum enterprise. Hui Li (H. Li, 2010) and Qiong Zhang (Qiong Zhang, 2009)

researched petroleum enterprises by using the activity-based costing method.

Table 1. Scholars' researches of strategic cost management of petroleum enterprises

Methods	Scholars	Objectives
Shank's model	Di Wang (D. Wang, 2008), Shaoen He (S. He, 2010)	Evaluate cost management performance of petroleum enterprises
Value Chain analysis	Zhenzhi Zhao & Jianglin Huo (Z. Zhao & Huo, 2010)	Find out the importance of value chain in cost management of petroleum enterprises
Activity-based costing (ABC)	Hui Li (H. Li, 2010), Qiong Zhang (Qiong Zhang, 2009)	Application of ABC in petroleum enterprises

Source: Own creation

## 2.9 Conclusion from the literature

This chapter mainly analyzed the theories and related literature of cost management, which include the definitions, theories and the development history of the cost management, especially the strategic cost management and relevant literature. Last but not the least, this chapter analyzed the relevant literatures on the strategic cost management of petroleum enterprises.

### **3. Aims of study**

The objective of my PhD work has twofold. The first objective is to research the current situation of cost management of petroleum enterprises in China. Investigating what kind of cost management and what kind of tools they applied in cost management of their business that will help researchers who interested in this field to find out the problems existing in petroleum enterprises. Petroleum enterprises have very important position and function in China, if I can find out some problems of enterprises, then we can try to fix the problems. The second objective is based on the first objective to optimize the cost management method and structure of Chinese petroleum enterprises by using strategic cost management that can make contribution to China's economy and make petroleum enterprises have better performance and competitive advantages in markets. I hope after finish the work of my PhD, my research could help Chinese petroleum enterprises to improve their ability of cost management so that to maintain competitive advantage in market.

#### **4. The status quo and problems of strategic cost management of China's petroleum enterprises**

As one of the energy pillar industries in China, petroleum enterprises are important for china's economy obviously (Zhu, 2010). Nowadays, along with a series of changes such as fluctuation of international oil price, oil resources drying up, standard of carbon emissions issued in China, the business environment of petroleum enterprise changed significantly. These changes put forward new requirements and challenges for the cost management of petroleum enterprises. The traditional cost management could not adapt to the development of petroleum enterprises. The traditional cost management pays more attention to the management of internal and production cost management to control and reduce cost. But according to modern enterprise management, enterprise is in fact an open system and the enterprise cost management is a systematic project. After introduced strategic concept, especially Michael Porter's the competitive advantage provided a theoretical basis for the strategic cost management of petroleum enterprises. Strategic cost management pays more attention to the external environment and source management, its essence is to create value for the enterprise and obtain the sustainable competitive advantage for the enterprise, not just the reduction of the production cost. Therefore, in order to solve the problems in the cost management of petroleum enterprises, it is necessary to investigate the status quo and problems existed in cost management of petroleum enterprise. Trying to analyze the causes of these problems, and then solve the problems.

#### 4.1 The characteristics of production and operation of petroleum enterprises

Oil and gas resources belong to non-renewable resources and the total amount is limited. With the oil and gas exploitation intensified, oil and gas reserves will gradually reduce lead to the mining process more and more difficult. With the continuous exploitation of oil and gas resources in China, the difficulty of exploration and development of petroleum enterprises is increasing, which lead the difficulty of cost control is increasing. Compared with the product cost of other industries, the main part of the production cost of petroleum enterprises is not material cost. The cost mainly from water injection, gas injection, downhole operation, oil and gas processing etc., there are also some uncertainties in the mining process. All these factors result in difficult to control the cost of petroleum enterprises. The total cost of oil and gas production is mainly affected by oil and gas reserves and production efficiency. On the one hand, with the exploitation of energy, the reserves are decreasing and the difficulty of discovering and mining is increasing, which lead the rise of total cost. On the other hand, due to the progress of science and technology, the productivity is improved continuously, so the cost of oil and gas exploitation is reduced gradually. Oil and gas exploration requires high technology support, while the cost is huge. So it is necessary to use new technology in exploration and development to increase the oil and gas production while decrease cost. At the same time the production site of petroleum enterprises mostly in the wild, may affect farmland, villages, caused pollution and destruction. Dealing the relationship with the local government and the local people has become a major problem in the production of petroleum

enterprises. The production of petroleum enterprises is different from the general manufacturing enterprises, which determines the specificity of the cost management of petroleum enterprises. Because there are a lot of unpredictability and uncontrollable factors in the production of petroleum enterprises, petroleum enterprises should increase the flexibility of cost management and change the cost management model of reduce cost simply.

## 4.2 The status quo of cost management of China's petroleum enterprises

### 4.2.1 Questionnaire

The questionnaire of this chapter is targeted at senior financial managers in China Petroleum and Sinopec of Xinjiang branch. The data collection on the cost management of petroleum enterprises are mainly investigated from the aspects of the concept and application of the strategic cost management, the application of cost management method of petroleum enterprises, the effect of the enterprises cost management and the external factors that affect the enterprise cost. The questionnaire was distributed to 20 petroleum enterprises and 20 were collected.

Table 2 reflects the understanding of Xinjiang's petroleum companies on modern cost management, 60% of which believe that modern cost management includes not only the cost of resource discovering, production activities, sales activities, but also includes the use of the consumer. 40% enterprises believe that modern cost management not only includes the cost of resource discovering and production activities, but also the cost of enterprise sales activities. No enterprise

believes that cost management is only in the production process. It shows that petroleum enterprise has basically acquired the concept of strategic cost management.

Table 2. The basic understanding of modern cost management

	No. of enterprise	Percentage
Cost management from resource discovering to customers	12	60%
Cost management from resource discovering	8	40%
Cost management in production process	0	

Source: Own creation based on questionnaire

Table 3 shows that 10% of the petroleum enterprises did not carry out the analysis of the value chain, the activity chain and the cost chain, only 10% of the enterprises that took the value chain and the activity chain and cost chain analysis, 80% of the enterprises that took partial analysis of the value chain the activity chain and cost chain. It shows that the analysis of the value chain, the activity chain and the cost chain is in the stage of research and application for petroleum enterprises.

Table 3. Whether the enterprise uses the analysis of value chain activity chain and cost chain

	Use	Partial use	Not use
No. of enterprise	2	16	2
Percentage	10%	80%	10%

Source: Own creation based on questionnaire

Table 4 shows that all petroleum enterprises have implemented a complete cost budget system, 70% of the enterprises have an obvious implementation effect, while another 30% of the enterprises cannot be judged.

Table 4. Whether the enterprise implements complete cost budget system and its effect of implementation

	No. of enterprise	Percentage
Implement and obvious effect	14	70%
Implement but cannot be judged	6	30%
Implement but no effect	0	0
No implement	0	0

Source: Own creation based on questionnaire

Table 5 shows that all petroleum enterprises have applied at least one method of cost management that 80% of the enterprises got a good effect, with only 20% of the enterprises showed no significant effect. It shows that the method of cost management has got a good result in petroleum enterprises. But there are a few enterprises have not obvious effect, which indicated some enterprises may have some problems in cost management that need to continue to optimize the cost management method.

Table 5. Whether the enterprise apply at least one method of cost management and its effect

	No. of enterprise	Percentage
Applied and good effect	16	80%
Applied and no significant effect	4	20%
Not apply	0	0

Source: Own creation based on questionnaire

Table 6 shows that 35% of the petroleum enterprises did not implement at least one method of BPR, ERP and BSC, indicating that there are obvious shortcomings in the use of advanced cost management methods and performance evaluation methods. It is

necessary to learn and promote the application of these methods for petroleum enterprises.

Table 6. Whether the enterprise implements at least one method of BPR ERP BSC

	No. of enterprise	Percentage
Implement	13	65%
No implement	7	35%

Source: Own creation based on questionnaire

Table 7 shows all the petroleum enterprises implemented cost assessment system, and 75% of enterprises believed that the implementation effect is obvious, which indicate that the implementation of cost assessment system has a good effect on enterprises' cost management , 25% of enterprises believed that the implementation effect is not obvious.

Table 7. Whether the enterprise implement cost assessment system and its effect

	No. of enterprise	Percentage
Implement and good effect	15	75%
Implement and no significant effect	5	25%
Implement and no effect	0	0
No implement	0	0

Source: Own creation based on questionnaire

Table 8 shows that 5 of the enterprises who believed that the implementation effect of cost assessment system is not obvious, 4 of them believe that the reason of not obvious, because they do not have effective implementation. Only 1 enterprise believes that the cost assessment system is unsuitable for the enterprise.

Table 8. The reason why the implementation of cost assessment system is not obvious

	No. of enterprise	Percentage
Ineffective implementation	4	80%
System not suitable	1	20%

Source: Own creation based on questionnaire

Table 9 shows that 45% of the petroleum enterprises have established a relative perfect cost management system, of which 35% considered to be well implemented, 10% considered not well implemented. 55% of the enterprises believe that the cost management system is not perfect. Indicating that most enterprises believe their cost management system needs to be further improved.

Table 9. Whether the enterprise has relative perfect cost management system and its implementation

	No. of enterprise	Percentage
Yes and well implement	7	35%
Yes but not well implement	2	10%
Not relative perfect	11	55%
No cost management system	0	0

Source: Own creation based on questionnaire

Table 10 shows that 95% of the petroleum enterprises believe that China's macroeconomic policy is an important factor affecting the cost of the enterprise, indicating that the macroeconomic environment has a huge impact on business cost, which is often beyond the control of enterprises but for all enterprises are fair. Because all enterprises in the same environment.

Table 10. Whether the national macroeconomic policy is an important factor affecting cost of the enterprise

	No. of enterprise	No. of enterprise
Yes	19	95%
No	1	5%

Source: Own creation based on questionnaire

#### **4.2.2 The method of cost management used by petroleum enterprises in China**

Foreign petroleum enterprises have recognized the competitive advantage of cost strategy, the focus of cost management shifted from cost control to strategic cost management to obtain the long-term competitive advantage of cost. Such as to obtain overseas exploration projects to increase profits through international strategy, which to spend the same cost to create greater value or pay more attention to the long-term cost management. Such as development of the life cycle cost management and optimization of strategic value chain to achieve the objectives of cost management. Based on literature review and questionnaire we can see that the current cost management methods and techniques of China's petroleum enterprises are mostly learned from foreign big petroleum enterprises.

##### **4.2.2.1 Target costing**

Enterprises determine the expected cost of the product based on the market price to obtain the expected profit (R. Wang, Zhang, & Cheng, 2010). China's petroleum enterprises used the method of target costing management method for a long time. They use market price of product minus the target profit to calculate the total target cost. According to the calculation, they allocate the total target cost to every department and ever employee to create the responsibility of the target cost, so that everyone has a responsible for cost. Then,

through the assessment system and incentive system to achieve the total target cost which means achievement of target profit.

#### 4.2.2.2 Cost budget management

China's petroleum enterprises generally used the method of incremental budget before the 21st century (J. Liu, 2013). They calculated the budget according to the combination of historical cost of each department and business volume in the budget period of enterprises.

After entering the 21st century, China's petroleum enterprises began to implement total budget management. Total budget management is an important way of internal management and control. It based on the sales forecast to predict the production, cost, ins and outs of cash flow. These predictions reflect the financial standing of enterprise in the future.

#### 4.2.2.3 Activity-based costing management

China's petroleum enterprises tried to use activity-based costing management in recent years (M. Zhang, 2012). For example, the application of activity-based costing management in the oil exploration industry. The cost problem of oil exploration can be solved effectively by allocating the resource to every single activity accurately after cost calculation.

Activity-based costing management is also used in cost budgeting of petroleum enterprises. For petroleum Enterprises, the expected production of oil and gas determines the quantity of activities. Therefore, petroleum enterprises should take full account of the geological conditions and explorative conditions etc. to allocate the

cost according to the total quantity of activities which could complete the expected production.

#### 4.2.2.4 Strategic value chain management

China's petroleum enterprises have fully realized the importance of strategy to cost management, and tried to study the cost from a strategic point of view. Through the use of strategic value chain analysis of the core value chain to recognize activities that can add value or reduce costs to increase efficiency in creating value and provide long-term competitive advantage. The value chain management of petroleum enterprises mainly includes the integration of internal value chain, analysis of industry value chain and identification of competitors' value chain.

### 4.3 Problems of cost management of China's petroleum enterprises

China's petroleum enterprises are faced with the difficulties of resource exhaustion, exploration and insufficient investment in the development of oil fields and decline of crude oil production. In the meantime, the market competition became more and more intense. Therefore, petroleum enterprises began to develop their business with the way of lower cost, which strengthen cost control and the awareness of cost management from the internal of enterprises. This way of cots management played an important role for reduction of cost. China's petroleum enterprises abide by the rule of budgeting first, decision-making based on budgeting, the rule that control the cost from source (X. Zhang, 2011). In order to improve the investment efficiency, petroleum enterprises determine the scale of investment based on the source of funds that solve the problem of

over scale investment which cause the cost. The application of the cost management method of petroleum enterprises has played an important role in the development process, which has restrained the rising trend of cost. However, due to the limitation and influence of various subjective and objective conditions, there are still many problems of cost management in petroleum enterprises.

#### **4.3.1 Integration of internal and external environment is not enough**

In order to obtain sustainable competitive advantage, the cost management of petroleum enterprise must be consistent with the enterprise's strategy. Although China's petroleum enterprises have already introduced part of the strategic cost management methods, the cost management model of petroleum enterprises still using the traditional model. For internal environment, in the process of cost management of petroleum enterprise, the management department plays a major role, while the technical department is rarely involved. For example, the geological exploration department is familiar with geological condition and technology in the process of oil exploration. But they do not familiar with the cost control method. Therefore, the exploration plan created by geological exploration department is lack of consideration of cost control. At the same time, once the plan is approved, the cost can be controlled only by management department through manage the behavior of operators. It is difficult to control the cost effectively due to the disjunction between the department of technology and the management. For external environment, most of the petroleum enterprises have not completed the integration of upstream and downstream enterprises, which easy to ignore the discovery cost before the oil and gas production. The cost

management of these enterprises is focused on the activity level, which not combined with enterprise's strategic objectives.

#### **4.3.2 No systematic cost management**

At present, the cost management information system of petroleum enterprises is still based on the cost accounting system of the finance department. The cost accounting only reports the total cost and unit cost of the oil production and it cannot provide the complete cost information of the oil reservoir. They focus on the short-term results of business and accounting data and ignore the long-term development strategies and non-financial data collection. There is no detailed analysis of cost driver, which leads to the lack of scientific basis for indirect cost allocation of petroleum enterprises.

#### **4.3.3 Budget management is not cover all cost**

The cost budget management system was not paid enough attention to the importance of improving the economic efficiency of the petroleum enterprise in a long period. Although petroleum enterprises implemented the total budget management, the focus of total budget management is still the cost budget and less consideration of other budget such as procurement budget, production budget and investment budget. In the implementation of budget, petroleum enterprises mainly use incremental budget. In fact, the incremental budget management admit that the unreasonable historical cost continue to exist in new period of budget, which over-reliance on historical data that reduce the scientific basis of budget management. Due to the unreasonable budget planning, the method of budget assessment cannot adjust the budget according to the change of

environment and production that result in budget overrun and the responsibility is unclear.

#### 4.4 The causes of problems

There are many problems in the cost management of petroleum enterprises, which are influenced by the changes of external competition environment of petroleum enterprises and the imperfect incentive system of petroleum enterprises. The causes of these problems are different such as lack of strategic thinking, cost management methods and techniques are obsolete and scope of cost management is narrow etc.

##### **4.4.1 The lack of strategic thinking**

Petroleum enterprises are faced with tremendous changes of business environment and the competition in the international market become fiercer than ever. In order to control the cost of petroleum enterprises, enterprises need to get detailed cost information. But most of petroleum enterprises only focus on the cost information of production lead to the lack of strategic information which could help enterprises to achieve their objectives of strategy.

Petroleum enterprises of China have not implemented full strategic cost management yet. In order to establish a scientific cost management system, they need to learn advanced methods of cost management, such as to obtain cost information of enterprise and oil industry through value chain analysis; identify the key drive of oil cost through the analysis of strategic cost driver. With the rapid development of the world oil market, petroleum enterprises of China should learn from the practical experience of foreign large petroleum

enterprises in strategic cost management. Introduce the strategic cost management theory and advanced methods such as strategic value chain analysis and strategic cost drivers analysis to improve and innovate cost management methods of china's petroleum enterprises, which could to improve the strength of petroleum enterprises to participate in international competition.

#### **4.4.2 Cost management methods and techniques are obsolete**

Scientific and technological progress has completely changed the production organization and competitive environment of business. The competition of petroleum enterprises is no longer focused on the technology and quality of oil production and it expanded to management and service while from domestic market competition to international market competition. Therefore, China's petroleum enterprises must speed up the technological innovation, increase the intensity of research and development, such as cooperate with first-class research institutions and universities the to research a suitable method of cost management instead of obsolete methods and techniques, which could improve the level of enterprise cost management and international competitiveness of enterprises.

#### **4.4.3 The scope of cost management is narrow**

China's petroleum enterprises always focus on the research of production of oil and gas, ignoring the various activities linked inside the enterprise, which influence on the business performance. Most of enterprises only focus on the cost management in production process and they rarely control the cost of pre-production development, supplement, post-production and marketing. Moreover, enterprises only concerned about the tangible cost driver, while ignored the

enterprise strategy is closely related to the intangible cost driver. Even they applied value chain analysis in their enterprises, they only focus on internal value chain analysis while ignore the industry value chain and competitor value chain. With the development of economy and technology, the traditional cost management was unable to satisfy the needs of enterprise cost management.

#### 4.5 Brief summary of this chapter

This chapter studied the status quo of strategic cost management in China's petroleum enterprises. First, through the questionnaire we can sum up that the managers of petroleum enterprises have a sense of modern cost management of enterprise, but they need to strengthen it in details; petroleum enterprises have a complete system of cost budget and the majority of implementation in good condition. Most of enterprises have adopted a target costing management, but with the development of petroleum enterprises they need to use more strategic method to control their cost; In this questionnaire, all the petroleum enterprises have a cost management system, but more than half of the enterprises think that their cost management system is not perfect, which indicate that petroleum enterprises focus on cost management, but there are some problems that they need to improve the cost management system by learning advanced methods; macroeconomic policies have a huge impact on the cost management of oil companies, such as monetary policy, tax policy, industry management policy etc. Although these policies are fair to all enterprises in the industry, the impact of the policy on the business is different. Enterprise strategy must be formulated based on macroeconomic policy which could help enterprises to control their

cost. Second, this chapter showed the methods of cost management used by petroleum enterprises currently. On this basis, it studied the problems existed in cost management of petroleum enterprises and pointed out that China's petroleum enterprises are facing fierce competition. By learning advanced cost management techniques and methods from foreign petroleum enterprises, China's petroleum enterprises have restrained the rising cost somehow. Last but not the least, this chapter analyzed the causes of the problems and pointed out that the problems caused by lack of strategic thinking, cost management methods and techniques are obsolete and the scope of cost management is narrow.

## **5. Material and methods**

The goal of strategic cost management is to provide prompt, reliable and useful information for business decision-making. The basis for obtaining high quality cost information is to find out the cost driver (J. Li, 2009). The cost strategy of enterprise cost strategy not only consider the cost reduction, but also consider the essential factors which restrict the cost of enterprise from the perspective of long-term strategy and competitive advantage. In the premise of certain strategy of enterprise, analyzing the cost driver is the basis of cost reduction and control through the macro level.

The strategic cost management of petroleum enterprises is a systematic process of management. The cost is driven by many cost drivers, which determine the production cost of petroleum enterprises (Deng, 2010). Most of the cost drivers are tangible such as working hours, output, number of workers etc. But part of the cost has been decided before the production such as the scale of enterprises and organizational structure determines the cost of labor force and the size of asset determines the depreciation. Most of these cost drivers are difficult to quantify and not independent of the cost. Cost drivers are interacting with each other that the effect is reflected in the cost. In order to improve the effect of strategic cost management for petroleum enterprises, we need to figure out the relations between these strategic cost drivers and how these strategic cost drivers influence on the cost management of petroleum enterprises.

This chapter will study the strategic cost drivers of petroleum enterprises systematically with Decision Making Trial and Evaluation Laboratory (DEMATEL) in order to find out which cost driver could

influence on the strategic cost management of petroleum enterprises significantly.

### 5.1 The structure of strategic cost driver of petroleum enterprises

Cost drivers are the structural determinants of the cost of an activity, reflecting any linkages or interrelationships that affect it (Porter, 1985). Traditional cost management usually taking output as the only cost driver. However, research shows that cost driver which are widely accepted in traditional cost management only account for around 15% of the total cost drivers. The other 85% of cost drivers has been influenced on the cost before production activities (Xuemei Yang & Tang, 2003). Such as the size of enterprise, investment, organizational structure, geographical location etc. which defined as the strategic cost drivers. By studying strategic cost drivers, enterprises could find out the cause of the cost and the way of cost reduction.

Strategic cost drivers are basic factors that lead to business costs, and are related to long-term business strategies. According to Michael Porter (Porter, 1988), strategic cost drivers can be identified as economies of scale, learning and spillovers, capacity utilization, linkages among activities, interrelationships among business units, vertical integration, timing of market entry, firm's policy of cost or differentiation, geographic location and institutional factors etc. John Shank and Vijay Govindarajan list cost drivers into two categories which are structural cost drivers and executional cost drivers (Shank & Govindarajan, 1993). Structural cost drivers determine the enterprise's economic structure. The formation of structural cost

drivers usually before production activities such as size of enterprise that requires a long period process of decision-making and is difficult to change after decided. Structural cost drivers not only influence on the cost, but also influence on other cost drivers such as product quality, human resources etc. Executional cost drivers are related to the execution of the business activities. Executional cost drivers generated after the structural cost drivers are decided. Executional cost drivers reflect the enterprise's utilization of resources and the execution effect of the activities, such as capacity utilization.

There are a lot of experts and scholars who did research of strategic cost drivers for enterprises. For petroleum enterprises, most of enterprises reduce cost through the way of improve labor productivity and improve the quality of assets. This paper analyzes the cost management of petroleum enterprises based on the analysis of strategic cost drivers. In the designing framework of strategic cost drivers, this paper takes into account the characteristics of petroleum enterprises such as cleaner production under the classic framework of Porter's.

In this paper, strategic cost drivers of petroleum enterprise are economies of scale, learning ability, vertical integration, geographic location, progress of technology, cleaner production, level of resources, capacity utilization, interrelationship of value chain, total quality management, involvement of employees.

Table 11. Strategic cost drivers of petroleum enterprise

Type of strategic cost drivers	Strategic cost drivers	Number
Structural cost drivers	Economies of scale	D1
	Learning ability	D2
	Vertical integration	D3
	Geographic location	D4
	Progress of technology	D5
	Cleaner production	D6
	Level of resources	D7
Executional cost drivers	Capacity utilization	D8
	Interrelationship of value chain	D9
	Total quality management	D10
	Involvement of employees	D11

Source: Own creation

### 5.1.1 Structural cost drivers

The economies of scale of petroleum enterprises are different from manufacturing enterprises. Sometimes the scale of investment and production efficiency is not proportional. The cost of production is not lower with the expansion of business scale and the increase of business volume, which cannot reduce the fixed cost of per unit. For example, Karamay oilfield in Xinjiang province started to exploit in 1955, after over 60 years exploitation, Karamay oilfield is in the late development stage now, the facilities of exploitation is becoming old.

With the further development, increased difficulty in exploitation will lead to an increase in investment. Under this circumstance, strategic cost management is becoming more and more important for petroleum enterprises.

The contribution of learning ability to cost mainly comes from two aspects which are internal accumulation and external learning. Internal accumulation is that through practice and learning, employees have full knowledge of new technology and effective method to complete the work. External learning is enterprises try to find out resources that are conducive to improve the value of enterprises in external environment. Such as learning from other enterprises in the same industry, buying or using advanced experience and methods of competitors.

In order to improve the competitive advantage, enterprises may expand the scale of business continuously which to expand the value chain to upstream and downstream enterprises. Vertical integration is the degree to which an enterprise owns upstream and downstream enterprises. Vertical integration of petroleum enterprises can be divided to direction that forward vertical integrate exploration of oil and backward vertical integrate oil refining and oil retailing. Through the integration of upstream and downstream enterprises, petroleum enterprises could optimize the allocation of resources and reduce cost to obtain competitive advantage.

The influence of geographic location on the cost of petroleum enterprises is mainly the difficulty degree of oil and gas exploitation and the cost of crude oil transportation. Located in different oil fields, traffic conditions and economic conditions are not the same. The

location of the oil field not only influences on oil and gas exploration but also influence on pipeline transportation, oil refining transportation and retailing. The most significant effect is to increase the cost of each node in the value chain of the petroleum enterprise.

Due to the decline of oil and gas resources, exploitation became more and more difficult in recent years for petroleum enterprises. Petroleum enterprises can no longer only rely on current technology of exploitation. In order to compete with big petroleum enterprises they must develop new technology. For example, the application of three-dimensional seismic technology improved the observation accuracy of geological structure which increased the success rate of exploration, reduce the cost of exploration.

Environmental issues have become the focus of the whole world. Most countries take the ecological security as a major strategy for economic development. As a developing country, China has the problem of energy shortage, low resources for per capital and serious environmental pollution. To develop cleaner production is conducive to improve energy efficiency and the energy structure (Xiaolong Yang, 2013). The proportion of environmental cost is increasing in the production cost of petroleum enterprises. Because the current methods of pollution control are not effective, to establish cost management on the basis of cleaner production is conducive to control the environmental cost and improve the competitiveness of enterprises. But in the process of improving the environment or avoiding pollution, petroleum enterprises could increase cost because of equipment of cleaner production and acquisition of cleaner

production technology, which is an important structural cost driver influence on the cost of petroleum enterprises.

The level of oil resources mainly refers to the potentiality of oil and gas and geographical features of the area, which reflects the probability of oil and gas exploration and the difficulty degree of exploration and development. The characteristics of oil resources determine the development mode and production cost of petroleum enterprises. Different stage of oilfield has different level of resources, which makes the cost of production increase year by year. At the same time, the economic benefits are decreasing year by year. In the early stages of development, due to high strata pressure single well production increasing lead to total production increasing. After the peak period, strata pressure becomes lower and lower will lead to decreased capacity of production. Petroleum enterprises need to invest more money to fix this. Therefore, in the process of exploration, the level of resources has a very important impact on the cost of petroleum enterprises.

### **5.1.2 Executional cost drivers**

Capacity utilization is in the premise of certain scale of investment to improve the efficiency of the use of assets, such as through the reformation of the production process or technical improvements to improve production efficiency. Usually, the higher the utilization of production capacity, the lower fixed cost of unit product that means high capacity utilization will help enterprise to reduce the cost per unit of product. The type of petroleum enterprises is capital intensive enterprise. Petroleum enterprises require a lot of investment and most of assets are fixed assets that lead to huge fixed cost in the production

process such as depreciation and cost of labor force. Therefore, capacity utilization is a very important executional cost driver for petroleum enterprises.

The value chain of petroleum enterprises can be divided into internal value chain and external value chain. The interrelationship of internal value chain mainly related to every production activities of petroleum enterprises. The interrelationship of external value chain involves the value chain of whole oil industry, including exploration, exploitation, oil refining and sales etc. Internal value chain can be improved by modifying the relationships among every department in the enterprise or by reorganizing the organizational structure to coordinate the activities which could improve the activity efficiency. External value chain reflects the dependency of petroleum enterprises with upstream and downstream enterprises. External value chain can affect the cost structure of petroleum enterprises such as cost of transportation and cost of assets.

Total quality management (TQM) consists of organization-wide efforts to install and make permanent a climate in which an organization continuously improves its ability to deliver high-quality products and services to customers (Lorente, Dewhurst, & Dale, 1998). For petroleum enterprises, total quality management means that controlling the defect in the production process. The purpose of total quality management is to reduce unnecessary loss and cost to improve the competitiveness of petroleum enterprises. The production of petroleum enterprises is different from manufacturing industry (H. Zhao, 2014). Usually a petroleum enterprise has many production areas and the location is far away from cities lead to

complex working conditions. Because of these factors, total quality management is one of the effective ways to reduce cost.

People are the most important resources in enterprise. Every employee's behavior is related to the implementation of enterprise strategy and enterprise cost. The participation and responsibility of employees directly affect the total cost of enterprise. As large state-owned enterprises in China, the central planning economy has a deep impact on petroleum enterprises. Many ordinary employees in petroleum enterprises generally believe that the implementation of the strategy is the task of management department, the cost reduction is the responsibility of the financial department and ordinary employees have nothing to do with this. However, the production of petroleum enterprises is complex and the management is much more difficult than other type of enterprises. Only depend on managers or financial department cannot achieve the goal of cost control. Therefore, petroleum enterprises should encourage all employees to participate in strategic cost management of enterprises through incentive system, so that to reduce cost and improve the competitive advantage.

## 5.2 Model

There are two categories to classify the strategic cost drivers. One is divided into structural cost driver and executional cost driver. The other one is divided strategic cost drivers into three levels which strategic, tactical and operational cost drivers. The regardless of which category, most of the researches are qualitative analysis. There are a few researches of quantitative analysis based on cost drivers selection or combination. Such as Schniederjans and Garvin used

analytic hierarchy process to select cost driver which made contribution to quantization of strategic cost driver (Schniederjans & Garvin, 1997). According to the problem of lack quantitative analysis, this thesis will combine qualitative with quantitative analysis of strategic cost drivers of petroleum enterprises by using Decision Making Trial and Evaluation Laboratory (DEMATEL). Hoping the result of DEMATEL could be the guidance of cost management of petroleum enterprises with good effect. There are a lot of strategic cost drivers of petroleum enterprises. Enterprises cannot take care of all cost drivers in the same time. Therefore, enterprises need to find out and control the key cost drivers which have the greatest impact on cost. If enterprises could control key cost drivers means they controlled most part of cost of enterprises.

Decision Making Trial and Evaluation Laboratory methodology is proposed to for researching and solving complex and intertwined problem groups because of its capability in verifying interdependence between variables and try to improve them by offering a specific chart to reflect interrelationships between variables (Falatoonitoosi, Leman, Sorooshian, & Salimi, 2013). The Decision Making Trial and Evaluation Laboratory method developed by the Geneva Research Centre of the Battelle Memorial Institute, which was developed to study the structural relationships in a complicated cluster of problems (Lu, Rau, Liou, & Yang, 2014). Because DEMATEL can develop the structural relationships in a complicated cluster of problems and describe the interrelationships among the factors to reveal key factors, the method is widely used in various fields. Such as analyzing green supply chain (Zhigang Wang, Mathiyazhagan, Xu, & Diabat, 2016), DEMATEL method used in the multi-criteria decision making (C.-W.

Li & Tzeng, 2009), analyzing key factor of hospital service (Shieh, Wu, & Huang, 2010), personnel estimation (Roy & Misra, 2012), modelling for causal interrelationships (Siti Aissah Mad Ali & Sorooshian, 2016), for medical tourism development (C.-A. Chen, 2012) etc. DEMATEL method is to use the degree of mutual influence between the factors to calculate the degree of center and the degree of cause, so as to determine the importance and value of each factor. The method combines qualitative with quantitative methods to research on complex system problems.

The DEMATEL method is described as the following,

Step 1, identify the factors that influence the problem, set the number of factor as  $D_1, D_2 \dots D_n$ .

Step 2, find out the direct-relation matrix. The matrix determine by relationship between factors according to a number of experts' opinion. The influence scale set 0 as no influence, 1 as low influence, 2 as medium influence, 3 as high influence and 4 as very high influence (0= no influence, 1= low influence, 2= medium influence, 3= high influence, 4=very high influence) for comparison of factor influence. If there are  $Z$  experts compare  $n$  factors, the result of each expert can be described as direct relation matrix of  $n \times n$ , which includes factor  $D_{ij}^k$  illustrate that influence between factor  $D_i$  and  $D_j$  given by  $k^{\text{th}}$  expert,  $ij$  means factor  $D_i$  has influence on factor  $D_j$ . The diagonal of the matrix is zero because factor has no influence on itself in DEMATEL.

$$D = \begin{bmatrix} 0 & D_{12} & \cdots & D_{1n} \\ D_{21} & 0 & \cdots & D_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ D_{n1} & D_{n2} & \cdots & 0 \end{bmatrix}$$

To collect all experts' opinion to calculate the average direct relation matrix of  $X = [A_{ij}]$ , which can be calculated by using equation as the following,

$$A_{ij} = \frac{1}{Z} \sum_{k=1}^Z D_{ij}^k \quad (1)$$

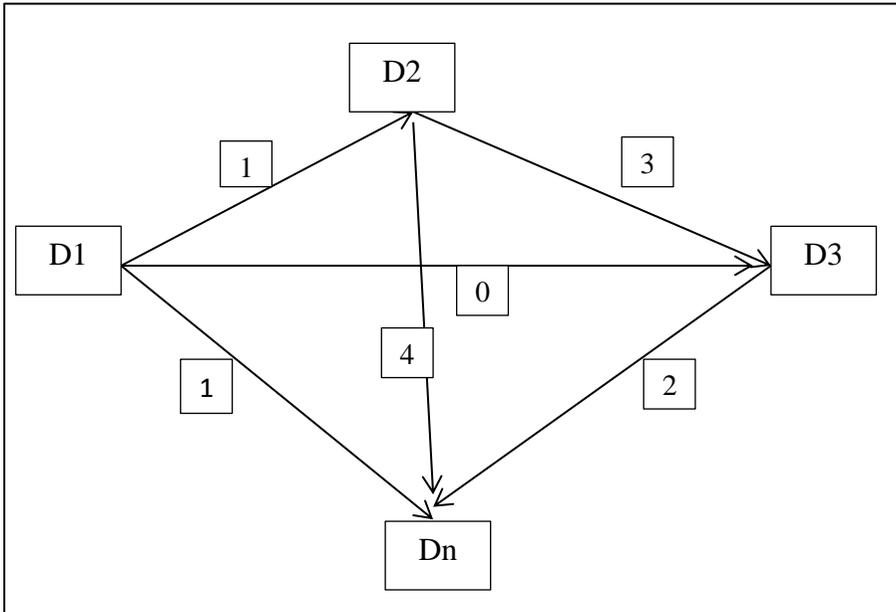


Figure 15. Example map of influence network Source: Own creation

Step 3, to normalize the direct relation matrix  $X$  to the matrix  $Y$ . Matrix  $Y$  presents the relative intensities of the direct relations.

$$S = \max\{\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij}\} \quad (2)$$

$$Y = \frac{X}{S} \quad (3)$$

According to equation 2 and equation 3 we can calculate the normalizing matrix. S means sum each row and each column to find out the max number, this number is S.

Step 4, to calculate total relation matrix T.

$$T = Y^1 + Y^2 + \dots + Y^n = Y(I - Y)^{-1} \quad (4)$$

Total relation matrix is sum of normalizing matrix, when n is large enough the equation can be described as equation 4. I represent identity matrix in equation 4.  $T_{ij}$  indicate that the relationship between  $D_i$  and  $D_j$  including direct and indirect influence. Through analysis of  $T_{ij}$ , we can find out the result of each factor  $D_1, D_2 \dots D_n$ 's influence degree, affected degree, center degree and cause degree.

Step 5, influence degree can be calculated as sum of  $T_{ij}$  in each row, we set it as  $e_i$ ,  $e_i$  is the influence degree of  $D_i$  in the row to other factors in the row, the equation as following,

$$e_i = \sum_{j=1}^n T_{ij} \quad (5)$$

Affected degree can be calculated as sum of  $T_{ij}$  in each column, we set it as  $a_j$ ,  $a_j$  is the affected degree of  $D_j$  in the column to other factors in the column, the equation as following,

$$a_j = \sum_{i=1}^n T_{ij} \quad (6)$$

The sum of influence degree and affected degree call center degree of factors. This index represents factor's position and importance in the system, the bigger number of center degree, the more important in the system. Center degree of  $D_i$  can be calculated as following,

$$c_i = e_i + a_j \quad (7)$$

Because  $e_i$  and  $a_j$  corresponding the same factor, so  $i=j$ .

The cause degree can be calculate as subtraction of influence degree and affected degree, which influence degree minus affected degree. The equation of cause degree as the following,

$$u_i = e_i - a_j \quad (8)$$

It is same as equation 7 that  $i=j$ . If cause degree  $u_i > 0$  that means influence degree is bigger than affected degree, the factor influences other factors. If  $u_i < 0$  that means influence degree is smaller than affected degree the factor affected by other factors.

Step 6, creating visual diagram and reorder factors according to the calculated degree to find out key factors.

### 5.3 Analyzing strategic cost drivers by using DEMATEL model

In this thesis, I will use DEMATEL model to analyze strategic cost drivers of petroleum enterprises. First, creating direct relation matrix based on experts' opinion. Second, creating total relation matrix after created direct relation matrix. Third, to calculate the influence degree, the affected degree, the center degree and the cause degree among each cost driver. Last, according to the result to determine the key strategic cost drivers.

## **6. Result and discussion**

## 6.1 Result

### 6.1.1 Creating direct relation matrix

I used the method of combining interview and scoring sheet to determine the influence relationship among each cost driver in the thesis. First of all, I interviewed relevant experts and scholars from Karamay Oilfield, Tarim Oilfield, China University of Petroleum, Xinjiang College of Petroleum and China National Petroleum Corporation at Xinjiang branch. The list of experts can be seen from table 12.

I determined the strategic cost drivers of petroleum enterprises in China on the basis of experts' opinion. Then, designed scoring sheet of strategic cost drivers and invited the ten experts to give the mark to the influence among strategic cost drivers. After experts' scored, I collected all data and analyzed the data, then decided to use mode of this data set as the basis to construct the direct relation matrix  $M$  of strategic cost drivers of petroleum enterprises.

Table 12. List of experts for interview

Name	Position	Institution
Zhenquan Wang	Professor	China University of Petroleum(Karamay branch)
Hongkui Ge	Professor	China University of Petroleum(Karamay branch)
Zongjie Mu	Senior engineer	China University of Petroleum(Karamay branch)
Luguang Li	General manager	Tarim Oilfield of China National Petroleum Corporation
Jiangchuan He	Deputy general manager	Tarim Oilfield of China National Petroleum Corporation
Zhaoji Liang	Professor	Xinjiang College of Petroleum
Pingzheng Cui	Professor	Xinjiang College of Petroleum
Ganying Zhang	Professor	Xinjiang College of Petroleum
Yufen Cai	Professor	Xinjiang College of Petroleum
Youlin Zhang	General manager	Sinopec (Karamay branch)

Source: Own creation

Table 13. Direct relation matrix M

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
D1	0	0	0	3	3	4	0	3	2	2	2
D2	1	0	0	0	4	0	0	3	0	4	3
D3	4	1	0	4	1	0	0	0	4	0	0
D4	2	1	4	0	1	0	1	0	3	0	0
D5	3	3	2	1	0	4	3	4	2	0	2
D6	4	1	2	1	4	0	1	2	2	4	3
D7	4	2	2	2	3	3	0	2	4	3	0
D8	2	2	0	0	2	1	0	0	0	3	2
D9	0	1	4	2	0	0	0	0	0	1	0
D10	1	3	0	0	1	2	0	2	1	0	4
D11	0	3	0	0	0	3	0	1	0	3	0

D1, D2 ... D11 represent strategic cost drivers of petroleum enterprise. The name of factors see from table 11. Source: Own creation

### 6.1.2 Normalizing the direct relation matrix

Normalizing the direct relation matrix M according to equation (2) and (3) by using MATLAB software, the normalizing direct relation matrix N as the following,

Table 14. Normalizing direct relation matrix N

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
D1	0	0	0	0.12	0.12	0.16	0	0.12	0.08	0.08	0.08
D2	0.04	0	0	0	0.16	0	0	0.12	0	0.16	0.12
D3	0.16	0.04	0	0.16	0.04	0	0	0	0.16	0	0
D4	0.08	0.04	0.16	0	0.04	0	0.04	0	0.12	0	0
D5	0.12	0.12	0.08	0.04	0	0.16	0.12	0.16	0.08	0	0.08
D6	0.16	0.04	0.08	0.04	0.16	0	0.04	0.08	0.08	0.16	0.12
D7	0.16	0.08	0.08	0.08	0.12	0.12	0	0.08	0.16	0.12	0
D8	0.08	0.08	0	0	0.08	0.04	0	0	0	0.12	0.08
D9	0	0.04	0.16	0.08	0	0	0	0	0	0.04	0
D10	0.04	0.12	0	0	0.04	0.08	0	0.08	0.04	0	0.16
D11	0	0.12	0	0	0	0.12	0	0.04	0	0.12	0

The number is accurate to two decimal places Source: Own calculation

### 6.1.3 Creating total relation matrix

After normalized the direct relation matrix, we can create total relation matrix T based on Table 14 and equation (4) by using MATLAB.

Table 15. Total relation matrix T

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11
D1	0.15	0.14	0.11	0.20	0.25	0.29	0.05	0.25	0.20	0.23	0.22
D2	0.15	0.13	0.05	0.05	0.26	0.13	0.04	0.24	0.08	0.28	0.25
D3	0.24	0.11	0.10	0.23	0.13	0.08	0.03	0.08	0.25	0.08	0.07
D4	0.17	0.10	0.23	0.09	0.12	0.07	0.06	0.07	0.21	0.07	0.06
D5	0.31	0.28	0.20	0.16	0.20	0.32	0.16	0.33	0.23	0.22	0.26
D6	0.33	0.21	0.19	0.16	0.32	0.19	0.09	0.26	0.22	0.34	0.29
D7	0.34	0.24	0.22	0.21	0.30	0.29	0.06	0.26	0.32	0.30	0.18
D8	0.16	0.17	0.05	0.05	0.18	0.14	0.03	0.11	0.07	0.23	0.19
D9	0.06	0.08	0.20	0.13	0.05	0.03	0.01	0.04	0.06	0.08	0.04
D10	0.13	0.22	0.05	0.05	0.15	0.18	0.03	0.18	0.10	0.13	0.27
D11	0.08	0.19	0.04	0.03	0.09	0.19	0.02	0.13	0.05	0.22	0.10

The number is accurate to two decimal places Source: Own calculation

#### **6.1.4 Calculating the influence degree, the affected degree, the center degree and the cause degree**

After created total relation matrix T, we can calculate the influence degree, the affected degree, the center degree and the cause degree of strategic cost drivers based on equation (5), (6), (7), (8).

Table 16. Influence degree, affected degree, center degree and cause degree of strategic cost drivers

	$e_i$	$a_j$	$c_i$	$u_i$
D1	2.0825	2.1338	4.2163	-0.0513
D2	1.6505	1.8772	3.5277	-0.2267
D3	1.3880	1.4212	2.8092	-0.0332
D4	1.2427	1.3492	2.5919	-0.1065
D5	2.6827	2.0426	4.7253	0.6401
D6	2.6025	1.9008	4.5033	0.7017
D7	2.7195	0.5751	3.2946	2.1444
D8	1.3663	1.9380	3.3043	-0.5717
D9	0.7666	1.7747	2.5413	-1.0081
D10	1.2404	2.1794	3.4198	-0.9390
D11	1.1424	1.6921	2.8345	-0.5497

$e_i$  is the influence degree of each strategic cost driver,  $a_j$  is the affected degree of each strategic cost driver,  $c_i$  is the center degree of each strategic cost driver and  $u_i$  is the cause degree of each strategic cost driver. Source: Own calculation

### 6.1.5 Creating visual diagram

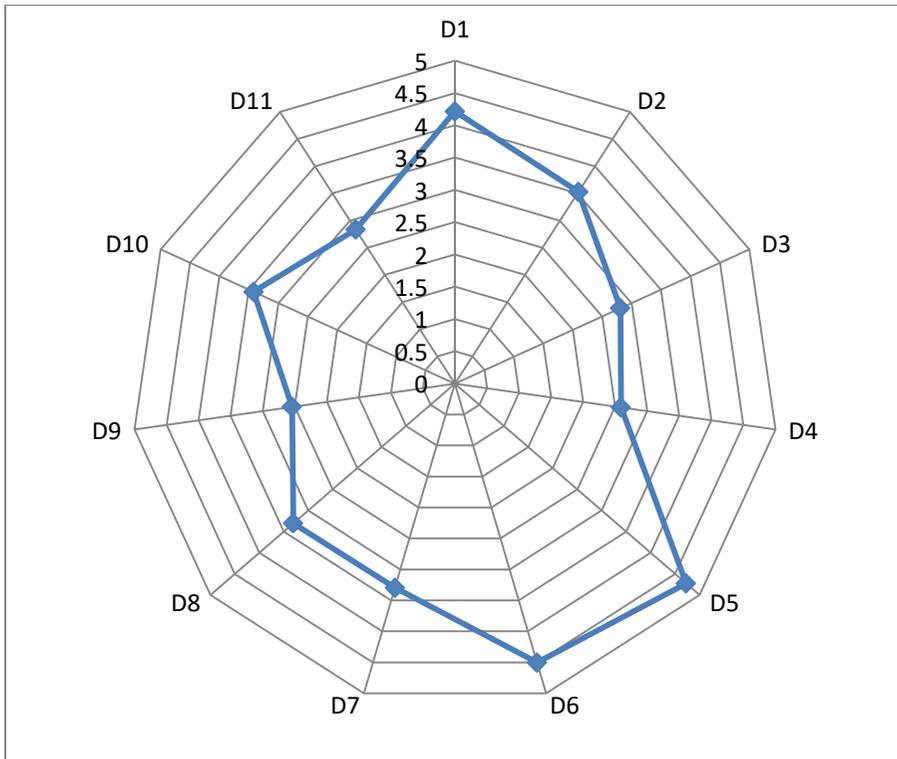


Figure 16. Center degree of strategic cost drivers Source: Own creation based on Table 16

After created visual diagram, we can see that order of center degree follow the order as D5, D6, D1, D2, D10, D8, D7, D11, D3, D4, D9. The center degree indicates that the importance of cost drivers in the cost driver system. Therefore, based on the result, progress of technology, cleaner production, economies of scale, learning ability and total quality management have bigger center degree that means petroleum enterprises in China should pay more attention to these cost drives in process of strategic cost management. From figure 17 we can see that D5, D6, D7 are bigger than zero, and D1, D2, D3, D4, D8, D9, D10, D11 are smaller than zero. As mentioned before, when cause degree bigger than zero, the factor influence other factors thus

D5, D6, D7 which progress of technology, cleaner production, level of resources are the factors influence on other factors.

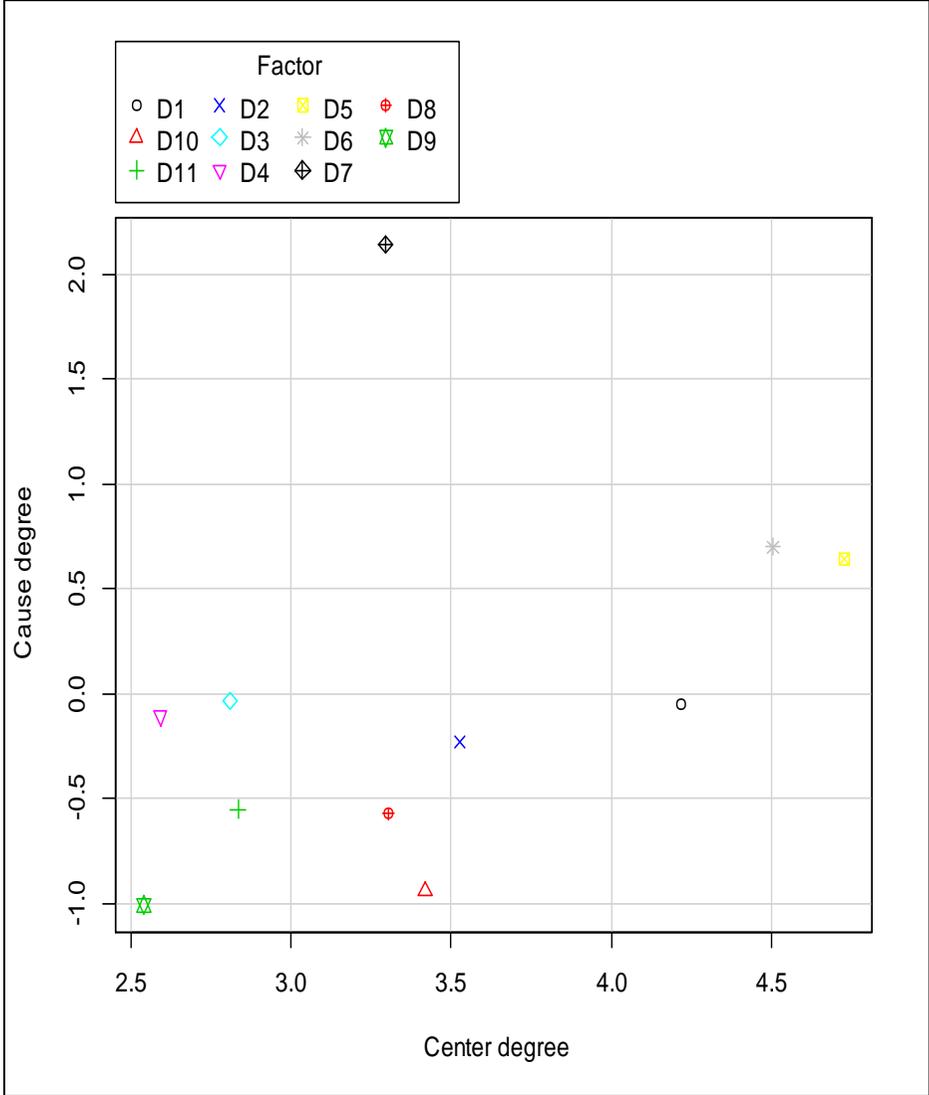


Figure 17. Scatter plot of center degree and cause degree

After analyzed strategic cost drivers of petroleum enterprises in China by using DEMATEL model, we can find out key cost drivers of the eleven strategic cost drivers. Center degree of progress of technology, cleaner production, economies of scale bigger than 4;

center degree of learning ability, total quality management, capacity utilization, and level of resources bigger than 3, which also have important position in the system of strategic cost management. Thus, the result of analysis of strategic cost drivers shows that progress of technology, cleaner production, economies of scale are key cost drivers for petroleum enterprises in China. Although, the center degree of level of resources is not high enough, but the cause degree of the level of resources is very high that means level of resources has very big impact on other cost drivers.

Although result shows that progress of technology, cleaner production, economies of scale are key cost drivers, it does not mean that other cost drivers are not important. Involvement of employees, vertical integration, geographic location and interrelationship of value chain are also main cost drivers in the strategic cost management system. The reason of the result is because since the 1990s, a large number of cost management theories and research methods were introduced into China which applied for petroleum enterprises. After several years, the development of petroleum enterprises is getting better and they have relative mature management system. Cost drivers like involvement of employees, vertical integration and geographic location will not have a big change and challenge for petroleum enterprises in short term. Therefore, they are main cost drivers but not the key cost drivers.

Another reason is people started to concern about the ecological environment and social problems in recent years. The Chinese government also focused on the environmental issues that restricted the carbon emissions of petroleum enterprises through legislation of

laws and regulations to push petroleum enterprises to improve their cleaner production and corporate social responsibility. Due to the particularity of production, which have negative influence on ecological environment, in order to implement cleaner production to reduce carbon emissions, petroleum enterprises continuous to increase the investment in equipment of cleaner production and advanced technology. Therefore, cost drivers like cleaner production, progress of technology will be the key cost drivers for the cost of petroleum enterprises in next few years.

## 6.2 Optimizing key cost drivers

### 6.2.1 Progress of technology

In recent years, China's petroleum enterprises continue to increase the investment in scientific and technological innovation. In exploration process, three-dimensional seismic exploration, remote sensing technology and computer data and image processing technology were applied for petroleum enterprises as well as advanced deep water exploration technology accelerated the exploration of oil and gas. These technologies improved the production efficiency and increased oil and gas reserves of petroleum enterprises (Xiao, 2013).

China has a very high percentage of low permeability reservoirs, ultra-low permeability reservoirs and heavy oil of oil resources. According to the characteristic, petroleum enterprises should improve the technology of forecasting the distribution of remaining oil and gas resources, heavy oil steaming, solvent extraction, in-situ combustion and other advanced technology such as technology of low-cost for low permeability reservoirs. The difficulty of innovation is lack of

talent. If petroleum enterprises want to obtain more advanced technology for the development, they need to improve the cooperation with scientific research institutions and first-class universities. Petroleum enterprises cooperate with scientific research institutions and first-class universities is conducive to mutual knowledge acquisition and promote the development of technological innovation to reduce innovation cost and shorten the innovation cycle, which improve the performance of technological innovation while reduce the total cost of petroleum enterprises. Petroleum enterprises also need to set up appropriate strategies to improve the level of technological innovation. The strategy will push the enterprise to obtain more advanced technology, the more advanced technology petroleum enterprises owned, the more profit they will earn.

### **6.2.2 Cleaner production**

Oil and gas resources are an important part of the ecological environment, petroleum enterprises need to consider the sustainability while they exploit the resources. Therefore, it is necessary to establish a system to evaluate the bearing capacity of ecological environment where the oil and gas resources located. Then, petroleum enterprises need to prevent and reduce the geological disasters in the process of exploitation and exploit the resources in a scientific way. It is estimated that the cost of traditional mode of production and the damage to the environment is much higher than the cost of using cleaner production (Hong, 2016). Therefore, implementation of cleaner production is necessary for petroleum enterprises.

Strategic cost management under the condition of cleaner production should focus on efficiency, which to produce more products or provide more services with the most economical way. On the one hand, assuming that output is invariant, calculating the cost of total life-cycle environmental costs of cleaner production technology, combined with the accounting cost of the cleaner production technology to make the cost as low as possible; on the other hand, comparing the total benefits of all cleaner production technologies, including economic benefits, social benefits and environmental benefits, then choose the most efficient cleaner production technology. Petroleum enterprises can design the cost management system from the perspective of cleaner production, which is a breakthrough in traditional cost management.

### **6.2.3 Economies of scale**

The main purpose of the expansion of the scale of investment in oil production is to stabilize production. If petroleum enterprises want to reduce cost of production in essence, they need to continuous increase investment in exploration and optimizing the structure of assets. At the same time, they need to find high-quality reserves to increase the level of oil and gas resources they owned. If they have high-quality reserves that can reduce oil and gas costs from the source.

For example, China National Petroleum Corporation implemented multi-layer fracturing, horizontal well drilling and deep well drilling in key exploration areas such as low permeability, carbonate rock and volcanic rock in 2015. Those actions obtained an important strategic discovery in main exploration area, which improved the level of oil

and gas resources CNPC owned. Through a series of exploration, CNPC found a large number of oil and gas resources.

Table 17. Oil and gas reserves and exploration workload of CNPC

	2014	2015	2016
Newly discovered petroleum reserves (million ton)	689.80	728.17	649.29
Newly discovered natural gas reserves (billion square meter)	484.0	570.2	541.9
2D seismic (kilometer)	19170	15909	24885
3D seismic (square kilometer)	11739	9095	8764
Exploratory well (unit)	1584	1588	1656
Preliminary prospecting well (unit)	910	924	865
Test well (unit)	674	664	791

Source: [http://www.cnpc.com.cn/cnpc/ktysc/ktysc\\_index.shtml](http://www.cnpc.com.cn/cnpc/ktysc/ktysc_index.shtml)

Through increasing investment in exploration to obtain more high-quality resources, petroleum enterprises could reduce the follow-up cost of development and production.

## **7. Conclusions**

## 7.1 Conclusions

Based on the previous analysis the following conclusions can be drawn.

There are some problems of cost management in China's petroleum enterprises. Cost management of petroleum enterprises become more and more difficult with the lack of resources, increasing difficulties in exploration that lead to cost of oil and gas continue to rise etc. in China. Although China's petroleum enterprises have taken a variety of cost management tools and methods such as target costing and budget management, there are still many problems existed. Therefore, petroleum enterprises should implement strategic cost management and innovate the cost management method, expand the scope of cost management to reduce cost that to obtain competitive advantage.

This research analyzed strategic cost drivers by using Decision Making Trial and Evaluation Laboratory (DEMATEL) in order to find out which cost driver could influence on the cost management of petroleum enterprises in China.

There are eleven strategic cost drivers of petroleum enterprises in China based on the experts' opinion that including economies of scale, learning ability, vertical integration, geographic location, progress of technology, cleaner production, level of resources, capacity utilization, interrelationship of value chain, total quality management, involvement of employees

Among the eleven strategic cost drivers, three strategic cost drivers are selected to be key cost drivers which are progress of technology,

cleaner production and economies of scale by using DEMATEL model.

Although other eight strategic cost drivers are not key strategic cost drivers, cost drivers of learning ability, vertical integration, geographic location, level of resources, capacity utilization, interrelationship of value chain, total quality management, involvement of employees are also very important strategic cost driver in the cost management system of petroleum enterprises in China.

After calculated all these cost drivers, we can clearly know the importance of strategic cost driver to cost management system. We can optimize key strategic cost drivers to help petroleum enterprises reduce cost and obtain competitive advantage, in the meantime also pay attention to other strategic cost drivers.

Through strategic cost driver analysis, enterprises could know exactly which cost driver is important and modify the cost management methods based on the analysis.

## 7.2 Limitations

In this dissertation, only the petroleum enterprises from Xinjiang province were selected for field research. However, because the production of petroleum enterprises is affected by various factors such as the condition of crude oil, geological conditions and social environment that lead to the difference of cost of oil and gas production. To some extent, it affects the general applicability of the research.

The occurrence of cost is the common result of many cost drivers, and different cost driver has different contribution to the total cost. Therefore, it is necessary to establish a quantitative model to analyze the relationship between cost drivers and cost to determine the relative importance of each cost driver and provide strategic information for the implementation of strategic cost management. However, because most of the strategic cost drivers are difficult to quantify accurately that make it difficult to establish an accurate model to describe these complex relationships. This is also a question that needs further research in this dissertation.

## **8. New scientific result**

1. Identification of cost management problems of Chinese petroleum enterprises (integration of internal and external environment is not enough; there is no systematic cost management; the budget management does not cover all costs) and the main causes of problems (the lack of strategic thinking, cost management methods and techniques are obsolete, the scope of cost management is narrow)
2. Introduced the Decision Making Trial and the Evaluation Laboratory (DEMATEL) model to quantify the strategic cost drivers.
3. Identification of eleven strategic cost drivers which have influence on cost management of petroleum enterprises. Find out three key cost drivers by using DEMATEL model. The three key cost drivers are the progress of technology, cleaner production and economies of scale.
4. Although the center degree of level of resources is not higher than three key cost drivers, the cause degree of level of resources is very high in this case that means level of resources has big impact on other cost drivers.

## **9. Summary**

First of all, this thesis reviewed literature about cost management and strategic cost management applied in petroleum enterprises. There are a lot of methods and tools of cost management such as budget management, standard cost management, target costing management, activity-based costing management and strategic cost management etc.

Secondly, this thesis analyzed the status quo and problems existed in the cost management of China's petroleum enterprises. Although China's petroleum enterprises have adopted various methods and techniques of cost management and achieved certain effect, there are still some shortcomings in their cost management system and they need to implement strategic cost management for petroleum enterprises. Innovating cost management methods, expanding the scope of cost management and improving the cost management system.

Thirdly, this thesis analyzed the strategic cost drivers of petroleum enterprises by using DEMATEL model to makes a quantitative evaluation of the strategic cost drivers, confirmed three key cost drivers from eleven main strategic cost drivers. The eleven main strategic cost drivers are economies of scale, learning ability, vertical integration, geographic location, progress of technology, cleaner production, level of resources, capacity utilization, interrelationship of value chain, total quality management, involvement of employees which are confirmed through the interview with ten experts and scholars in China with the professional background. Then quantized these eleven strategic cost drivers and calculated them by using DEMATEL, confirmed three key cost drivers based on the result

which are progress of technology, cleaner production and economies of scale.

Last but not the least is the conclusion that petroleum enterprises should implement strategic cost management and innovate the cost management method, expand the scope of cost management to reduce cost that to obtain competitive advantage. Although other eight strategic cost drivers are not key strategic cost drivers, cost drivers of learning ability, vertical integration, geographic location, level of resources, capacity utilization, interrelationship of value chain, total quality management, involvement of employees are also very important strategic cost driver in the cost management system of petroleum enterprises in China. We can optimize key strategic cost drivers to help petroleum enterprises reduce cost and obtain competitive advantage, in the meantime also pay attention to other strategic cost drivers. Through strategic cost driver analysis, enterprises could know exactly which cost driver is important and modify the way of implementation cost management based on the analysis.

## **10. Acknowledgement**

First and foremost I want to thank my supervisor Dr. Arnold Csonka. I really appreciate all his help and contributions of time, ideas and experience which help me a lot. For me, he is a good supervisor and helpful friend. His enthusiastic for researches was motivational for me and stimulating me to learn from him. When I went through tough time in my pursuit of Ph.D., I really rejoice that I have a supervisor and friend like him.

Prof. Sándor Kerekes DSc, Prof. Dr. Zoltán Gál, Dr. György Kövér, Dr. Bernadett Kovács, Ms. Katalin Laczkó and all teachers in Kaposvár University have contributed immensely to my personal and professional time at Hungary. I really appreciated their willingness to teach me and give me a lot of advises during my time at Hungary.

I want to thank the Stipendium Hungaricum scholarship and China Scholarship Council to give me chance to study at Kaposvár University they made my Ph.D. work possible.

I want to thank Ms. Dóra Takács, Ms. Lilla Barics and Mr. Endre Drégelyi-Kiss, they really help me a lot to adapt to life outside my home country.

I really enjoy my time stay at Kaposvár, my friends here they made me feel I am not alone and here it is my second home. I am grateful for time spent with all my friends here

.Lastly, I would like to thank my girlfriend Jie Ding and my family for all their love, patience and encouragement. My family raised me with a love and they always supported me and got my back, because of them I can pursuit my Ph.D. career without any hesitation.

## **11. References**

- Afgan, N. H., Gobaisi, D., & Carvalho, M. G. (1998). Sustainable Energy Development. *Renewable and Sustainable Energy Reviews*, (2), 235–286.
- Anderson, S. W., & Dekker, H. C. (2009). Strategic Cost Management in Supply Chains, Part 1: Structural Cost Management. *Accounting Horizons*, 23(2), 201–220.
- Bhatt, G., & Emdad, A. (2001). An Analysis of the Virtual Value Chain in Electronic Commerce. *Logistics Information Management*, 14(1/2), 78–84.
- Chandler, A. D. (1962). *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. Cambridge MA: MIT Press.
- Chen, C.-A. (2012). Using DEMATEL Method for Medical Tourism Development in Taiwan. *American Journal of Tourism Research*, 1(1), 26–32.
- Chen, D., Wang, Z., & Guo, Q. (2009). *Research on the Sustainable Development Strategy of Oil and Gas in China*. Beijing: Petroleum Industry Press.
- Chen, K. (2003). Theoretical Analysis of the Connotation of Strategic Cost Management. *Sichuan Accounting*, (3), 20–23.

- China National Petroleum Corporation. (2016). *Annual Bulletin of China National Petroleum Corporation 2015* (Annual Bulletin) (pp. 10–12). Beijing.
- Cooper, R., & Kaplan, R. (1992). Activity-Based Systems: Measuring the Costs of Resource Usage. *Accounting Horizons*, 1–13.
- Cooper, R., & Slagmulder, R. (1998). The Scope of Strategic Cost Management. *Management Accounting*, 79(8), 15–16.
- Cui, M. (2010). *China Energy Development Report*. Beijing: Social Sciences Academic Press.
- Deng, H. (2010). Research on Optimized Control Mode of Strategic Cost Driver. *Journal of North China Electric Power University*, (4), 40–47.
- Du, Y. (2004). *Research on Implementing Steps of Strategic Cost Management* (Master Dissertation). Wuhan University of Science and Technology, Wuhan.
- Falatoonitoosi, E., Leman, Z., Sorooshian, S., & Salimi, M. (2013). Decision-Making Trial and Evaluation Laboratory. *Research Journal of Applied Sciences, Engineering and Technology*, 5(13), 3476–3480.

- Financial Accounting Standards Board. (1992). *Conceptual Framework for Financial Accounting and Reporting*. Beijing: Chinese Financial&Economic Publishing House.
- Gan, Y. (2001). Study on the Methods of Strategic Cost Management. *Finance & Accounting for Communications*, (10), 35–37.
- Giannantonio, C. M., & Hurley-Hanson, A. E. (2011). Frederick Winslow Taylor: Reflections on the Relevance of The Principles of Scientific Management 100 Years Later. *Journal of Business and Management*, 17(1), 7–10.
- He, S. (2010). *The Study of Strategic Cost Management for Oil-gas Enterprises Based on Reservoir Operation* (PhD Dissertation). Beijing Jiaotong University, Beijing.
- He, Y. (2004). Literature Review of Strategic Cost Management. *Journal of Beijing Technology and Business Univeristy*, 19(1), 37–40.
- Hong, W. (2016). Research on Cleaner Production Mode of Petroleum Enterprises. *Modern Enterprise Culture*, (21), 110–111.
- Horngrén, C. T. (2014). *Cost Accounting*. Cambridge: Pearson.

- Li, B. (2005). Discussion on Enterprise 's Implementing Strategic Cost Management. *Research on Economics and Management*, (1), 36–40.
- Li, C.-W., & Tzeng, G.-H. (2009). Identification of a Threshold Value for the DEMATEL Method Using the Maximum Mean De-entropy Algorithm to Find Critical Services Provided by a Semiconductor Intellectual Property Mall. *Expert Systems with Applications*, 36(6), 9891–9898.
- Li, H. (2010). Discussion on Application of Activity-Based Costing in Oil and Gas Exploitation of Petroleum Enterprises. *Oil-Gas Field Surface Engineering*, 29(10), 80–81.
- Li, J. (2009). Analysis of Strategic Cost Drivers. *Modern Business Trade Industry*, 21(6), 189–190.
- Li, Y. (Trans.). (1994). *Japanese Accounting Regulations*. Beijing: Chinese Financial&Economic Publishing House.
- Lin, W. (1999). Study on the Social Economic Background and Practical Significance of Strategic Cost Management. *Sichuan Accounting*, (5), 3–7.
- Liu, G. (2010). Modern cost management. *Management Observer*, (27), 182–184.

- Liu, J. (2013). Discussion on the Application of Total Budget Management in the Cost Control of Oil Companies. *Modern Economic Information*, (16), 243–244.
- Liu, T. (2008). Cost leadership strategy. *Finance & Accounting for Communications*, (2), 10–11.
- Liu, X. (2014). *Research on Energy Problems and Environmental Development Strategy in China* (Master Dissertation). Nanjing University Of Information Science & technology, Nanjing.
- Liu, Y. (2004). The Influence of Target Costing on China's Enterprise Cost Management. *Contemporary Economy of Japan*, (5), 49–52.
- Lorente, M., Dewhurst, F., & Dale, B. (1998). Total Quality Management: Origins and Evolution of the Term. *The TQM Magazine*, 10(5), 378–386.
- Lu, T.-P., Rau, P.-L. P., Liou, T.-Z., & Yang, Y.-H. (2014). A Fuzzy Decision Making Trial and Evaluation Laboratory Analysis of SCM System Implementation. *Applied Mathematics & Information Sciences*, 8(3), 1331–1341.
- Mao, F. (2002). *Management Accounting*. Beijing: Higher Education Press.

- Mclarty, R. (2000). Evaluating Graduate Skills in SMEs: the Value Chain Impact. *Journal of Management Development*, 19(7), 615–628.
- Ohmae, K. (1991). *The Mind Of The Strategist: The Art of Japanese Business*. New York: McGraw-Hill.
- Ouyang, Q. (1999). *Accounting*. Beijing: Chinese Financial&Economic Publishing House.
- Porter, M. (1979). How Competitive Forces Shape Strategy. *Harvard Business Review*, 57(2), 137–145.
- Porter, M. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: Free Press.
- Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Porter, M. (1988). *Michael Porter on Competitive Strategy*. Boston: President and Fellowes of Harvard College.
- Porter, M., & Millar, V. E. (1985). How Information Gives You Competitive Advantage. *Harvard Business Review*, 63(4), 149–160.
- Qi, Y. (2015). Study on Value Chain of Strategic Cost Management Applied in Enterprises. *China Journal of Commerce*, (36), 43–45.

- Rayport, J., & Sviokla, J. (1995). Exploiting the Virtual Value Chain. *Harvard Business Review*, 73(6), 75–78.
- Ren, Z., & Fan, Y. (2007). Study on the Application of Value Chain Analysis in Strategic Cost Management. *Value Engineering*, 26(7), 62–64.
- Roy, B., & Misra, S. K. (2012). An Integrated DEMATEL and AHP Approach for Personnel Estimation. *International Journal of Computer Science and Information Technology & Security*, 2(6), 1206–1212.
- Schniederjans, M. J., & Garvin, T. (1997). Using the Analytic Hierarchy Process and Multi-Objective Programming for the Selection of Cost Drivers in Activity-Based Costing. *European Journal of Operational Research*, 100(1), 72–80.
- Shank, J. (1989). Strategic Cost Management: New Wine or Just New Bottles. *Journal of Management Accounting Research*, (1), 47–65.
- Shank, J., & Govindarajan, V. (1993). *Strategic Cost Management: The New Tool for Competitive Advantage*. New York: Simon & Schuster.
- Shi, J. (2000). Comparison of the US and Japan Cost Management Models. *Public Enterprise Management*, (8), 47–48.

- Shi, X. (2001). *Model of Modern Cost Management*. Beijing: Economic Science Press.
- Shieh, J.-I., Wu, H.-H., & Huang, K.-K. (2010). A DEMATEL Method in Identifying Key Success Factors of Hospital Service Quality. *Knowledge-Based Systems*, 23(3), 277–282.
- Siti Aissah Mad Ali, & Sorooshian, S. (2016). Modelling for Causal Interrelationships by DEMATEL. *Contemporary Engineering Sciences*, 9(9), 403–412.
- Stahl, M. J., & Grigsby, D. W. (1991). *Strategic Management for Decision Making*. Boston: PWS-KENT Publishing Company.
- Sun, W. (2015). Study on the Basic Ideas and Methods of Strategic Cost Management. *Economic Research Guide*, (24), 150–151.
- Walters, D., & Lancaster, G. (2000). Implementing Value Strategy Through the Value Chain. *Management Decision*, 38(3), 160–178.
- Wan, S., & Guo, J. (2009). Study on the Construction of Strategic Cost Management Performance Evaluation System. *Journal of Guizhou University of Finance and Economics*, (3), 32–38.
- Wang, D. (2008). *Research on Strategic Cost Management Mode of Oilfield Enterprises* (Master Dissertation). China University of Petroleum, Qingdao.

- Wang, F., Cheng, J., & Wang, J. (2006). Analysis of Competitor's Value Chain. *Special Zone Economy*, (4), 375–376.
- Wang, J. (2002). Challenges for Traditioanl Cost Management. *Journal of Beijing Technology and Business Univeristy*, 17(2), 37–38.
- Wang, P., Yu, H., & Zhang, F. (2001). The Emergence and Development of Activity-Based Costing. *Journal of Xi'an Jiaotong University*, 21(1), 30–34.
- Wang, R., Zhang, B., & Cheng, D. (2010). The Application of Detailed Cost Management in Petroleum Enterprises. *Communication of Finance and Accounting*, (29), 123–124.
- Wang, Y. (2007). The Application of Market Focus Strategy. *Market Modernization*, (3), 43–44.
- Wang, Zhenyi. (2003). Innovation of Cost Management. *Journal of Wuhan Commercial Service College*, 17(4), 49–52.
- Wang, Zhigang, Mathiyazhagan, K., Xu, L., & Diabat, A. (2016). A Decision Making Trial and Evaluation Laboratory Approach to Analyze the Barriers to Green Supply Chain Management Adoption in a Food Packaging Company. *Journal of Cleaner Production*, 117, 19–28.

- Wei, G. (2006). Study on Standard Cost Management. *Contemporary Economics*, (8), 50–51.
- Wu, S. (2003). Study on the Challenge of Environment Change to Traditional Cost Management. *Inner Mongolia Science Technology & Economy*, (10), 11–12.
- Wu, Z. (2015). Application of Standard Cost System in Cost Management. *Commercial Accounting*, (2), 72–74.
- Xi, M. (2006). Analysis of Value Chain in Strategic Cost Management. *Co-Operative Economy & Science*, (22), 33–34.
- Xia, K. (2000a). Model and method of Strategic Cost Management. *Foreign Economics & Management*, 22(2), 43–48.
- Xia, K. (2000b). *Strategic Cost Management*. Shanghai: Lixin Accounting Press.
- Xiao, M. (2013). *Research on Knowledge Management of Oil Exploration Enterprises Based on Technological Innovation* (Master Dissertation). Chengdu University of Technology, Chengdu.
- Xie, Y., & Sun, S. (2010). A Comparative Study of Traditional Cost Management and Strategic Cost Management. *Accountant*, 114(3), 33–34.

- Xu, Y. (1994). *New Cost Management Dictionary*. Beijing: China Price Publishing House.
- Yang, Xiaolong. (2013). Analysis on the Sustainable Development of Traditional Energy Enterprises and the Development Path of Low-Carbon Technology - A Case Study of Low Carbon Transformation in Petroleum Enterprises. *Science & Technology Progress and Policy*, 30(10), 98–102.
- Yang, Xuemei, & Tang, Y. (2003). The Application of Strategic Cost Driver Analysis in Strategic Cost Management. *Finance and Accounting Monthly*, (4b), 19–20.
- Yu, K. (2001). Study on the Strategy of Enterprise Differentiation. *The Theory and Practice of Finance and Economics*, 22(2), 18–20.
- Yu, X. (1999). *Operational Accounting*. Beijing: China Renmin University Press.
- Zhang, C. (2006). *Contemporary Management Accounting Research*. Beijing: Peking University Press.
- Zhang, M. (2012). The Application of Activity-based Costing in Cost Management of Petroleum Enterprises. *Modern Business Trade Industry*, 24(8), 143–144.

- Zhang, Qi. (2005). *Value Chain Analysis of Strategic Cost Management* (Master Dissertation). Tianjin University, Tianjin.
- Zhang, Qiong. (2009). Research on the Application of Activity - based Costing in Petroleum Enterprises. *Communication of Finance and Accounting*, (20), 50–51.
- Zhang, X. (2011). Discussion on the Current Situation and Improvement Measures of Cost Management in Petroleum Enterprises. *Money China*, (8), 93–94.
- Zhang, Y. (2009). Taylorism and Modern Enterprise Management. *Social Sciences Review*, 24(5), 58–59.
- Zhao, H. (2014). The Application of Total Quality Management in Petroleum Enterprises. *Science and Technology Innovation Herald*, (27), 179–180.
- Zhao, Z., & Huo, J. (2010). Analysis on the Behavior of Cost Driver of Oilfield Enterprise. *Finance and Accounting*, (6), 55–56.
- Zhao, Z., Huo, J., & Wang, C. (2011). Supply Chain Construction of Oil and Gas Field Based on Sustainable Development. *Shandong Social Sciences*, (11), 143–145.
- Zheng, D. (2003). The Origin, Characteristics and Application of Target Costing. *Modern Accounting*, (7), 46–47.

- Zhou, X., & Chen, C. (2004). Social Capital and Sustainable Competitive Advantage of Enterprise. *China Industrial Economics*, (5), 90–96.
- Zhou, Z., & Tang, Y. (2003). Discussion on Future Energy Development Strategy in China Judged by Oil & Gas Resources Status. *Journal of Natural Resources*, 18(2), 210–214.
- Zhu, Y. (2010). *Evaluation and Prediction of Sustainable Development of China's Petroleum Industry* (PhD Dissertation). China University of Petroleum, Qingdao.

## **12. The publications related to the topic**

CAI XIANGYU, DING JIE. (2017): Research on the problems and countermeasures of enterprise cost management [企业成本管理存在的问题及对策研究]. Logistics Engineering and Management, 39(10): 124-125.

CAI XIANGYU, DING JIE, CSONKA ARNOLD. (2017): Research on cost management of small and medium-sized enterprises in China-case study of Xinjiang province. Technology and Economic Guide, 26(3): 152-153.

CAI XIANGYU. (2018): Analysis of Strategic Cost Drivers of Chinese Petroleum Enterprises by Using DEMATEL. Regional and Business Studies. (In Press)

### **13. The publications not relate to the topic**

LIU XIANGHUI, ABULIZ OSMAN, CAI XIANGYU. (2014): Research on the classification and training of talents in Agricultural and Forestry University. *Journal of Agricultural University of Hebei (Agriculture and Forestry Education Edition)*, (4):12-16.

CAI XIANGYU. (2017): Influence of financial regulatory system on European sovereign debt crisis. *Regional and Business Studies (Under review)*.

DING JIE, CAI XIANGYU. (2017): Comparative study on human resource management in China and Europe [中国与欧洲企业人力资管理比较研究]. *Finance & Economy*, (24): 116-117.

DING JIE, CAI XIANGYU. (2018): Study on the Impact of Strategic Human Resource Management on Enterprise Performance. *International Journal of Human Resource Studies*, 8(3): 60-68.

## **14. Curriculum vitae**

Xiangyu Cai was born on 3rd of October in 1988 in Atushi, China. He graduated from Dalian University of Foreign Languages in 2011 major in International Trade (English BA). After completed his BA, he continued his study in Xinjiang Agricultural University and he received his degree majoring in Management MSc in 2014, his research topic during master is Status Quo and Evaluation of New Round Aid Policy of Xinjiang in South of Xinjiang—Case study of Kizilsu Kirghiz Autonomous Prefecture. During his mater period, he also worked as an intern in the Institute of Economic Research of Xinjiang Development and Reform. He accomplished some research projects with the team from the institute. From 2014 up to now, he is a PhD student of Kaposvar University, and he taught Globalization Challenges in one semester for international bachelor students.

## **15. Abbreviations**

ABC: Activity-based costing

ABCM: Activity-based costing

CNPC: China National Petroleum Corporation

DEMATEL: Decision Making Trial and Evaluation Laboratory

PEST: Politics, Economy, Society, Technology

SCM: Strategic cost management

SWOT: Strengths Weaknesses Opportunities Threats

TC: Target costing

## **16 Appendix**

<b>Questionnaire of cost management of petroleum enterprises</b>	
<b>Name of Enterprise:</b>	
<b>Department:</b>	
<b>Position:</b>	
<b>Name:</b>	
<b>Age:</b>	
Please complete the following questionnaire by placing a CROSS in the appropriate box	
1. What do you think about cost management? Cost management from resource discovering to customers Cost management from resource discovering Cost management in production process	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
2. Does your enterprise use analysis of value chain ,activity chain and cost chain? Fully used Partial used No used	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
3. Does your enterprise implement complete cost budget system and what its effect of implementation? Implement and obvious effect Implement but cannot be judged Implement but no effect No implement	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4. Does your enterprise apply at least one method of cost management and its effect? Applied and good effect Applied and no significant effect No application	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5. Does your enterprise implement at least one method of BPR ERP BSC? Implement No implement	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
6. Does your enterprise implement cost assessment system and its effect? Implement and good effect Implement and no significant effect Implement and no significant effect No implement	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
7. Do you know why the effect of implementation of cost assessment system is not obvious? Ineffective implementation System not suitable	<input type="checkbox"/> <input type="checkbox"/>

Others(please list):	
8. Does your enterprise have relative perfect cost management system and its implementation?	
Yes and well implement	<input type="checkbox"/>
Yes but not well implement	<input type="checkbox"/>
Not relative perfect	<input type="checkbox"/>
No cost management system	<input type="checkbox"/>
9. Do you think the national macroeconomic policy is an important factor affecting cost of the enterprise?	
Yes <input type="checkbox"/> No <input type="checkbox"/>	
10. Do you find any problme of cost management while its working in your enterprise? Please list:	
11. What reason causes the problem? Please list:	
12. Do you have any experience want to share about cost management in your enterprise? Please list:	
<p>This questionnaire is intended to provide information for a study that leads to award of the Degree of PhD of Kaposvar University. You have been selected to participate in this research study by providing information and are kindly requested to complete the questionnaire, as honestly as possible.</p> <p>NOTE: the information that you'll provide is only for the purpose of this study and will be treated as confidential</p> <p>Thank you for your cooperation!</p>	